[5925]-201

S.Y. (Civil Engineering)

BUILDING TECHNOLOGY AND ARCHITECTURAL PLANNING

(2019 Pattern) (Semester - III) (201001)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Draw neat figures wherever necessary.*
4) *Assume necessary data.*
5) *Use of scientific calculator is allowed.*

Q1) a) Enlist various types of fixtures for doors and explain anyone with a neat sketch. **[6]**

b) State the types of flat terraced roofing and explain any one of them.**[6]**

c) Explain in brief, the following: **[6]**
   i) Timber Linter
   ii) Stone lintel

OR

Q2) a) Draw a neat labeled sketch of semicircular - arch and show: **[6]**
   i) Key stone
   ii) Crown
   iii) Springing line

b) Enlist any four types of floor finishes and explain mosaic flooring.**[6]**

c) Explain swing door with the help of a sketch. **[6]**

Q3) a) Enlist various types of residential buildings and explain any one in detail. **[6]**

b) Explain steps for design of dog legged staircase. **[6]**

c) Write a short note on rating system for green building. **[5]**

OR

Q4) a)   What are the fundamental requirements of residential building?   **[6]**

b)   What do you understand by Leadership in Energy and Environmental desing (LEED)?   **[6]**

c)   What are the salient features of Green Building?   **[5]**

Q5) a)   A hospital is to serve a population of 20000 and is to be designed on a site measuring 100m × 150m. Separate ward for men and women, W.C.s, nurses' rooms, etc are to be provided and details have to be worked out. Draw a line plan to a suitable scale.   **[12]**

b)   What are the salient features of engineering student's hostel building?   **[6]**

<center>OR</center>

Q6) a)   Design a single storeyed restaurant building on a highway. The following units are to be provided: **[12]**

Entrance and general stationery shop	45 sqm
Dining Hall	300 sqm
Service	35 sqm
Kitchen	45 sqm
Store room	18 sqm
Cloak room for keeping baggage	15sqm
W.C For gents	2 nos
W.C for ladies	2 nos

Draw to a scale 1 : 50 or suitable

i)   Line plan showing locations of doors and windows.

b)   What are the salient features of vegetable market building.   **[6]**

Q7) a)   Write a short note on land use zoning and mention the requirements of each.   **[6]**

b)   Compare fire resisting properties of concrete and stone.   **[6]**

c)   Explain with sketches, wind and stack effect.   **[5]**

<center>OR</center>

Q8) a)   What do you understand by RERA Act?   **[6]**

b)   What are the considerations for natural lighting in a residential building?   **[6]**

c)   Explain with a neat diagram winter air conditioning.   **[5]**

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SEAT No. :

[Total No. of Pages : 3

[5925]-202

S.E. (Civil Engineering)
MECHANICS OF STRUCTURES (MOS)
(2019 Pattern) (Semester - III) (201002)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

  1)   Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
  2)   Use of non-programable calculator is allowed.
  3)   Assume any data, if required.

Q1) a) A symmetric I section is having two flanges, each of 300 mm × 20 mm and vertical web of 20 mm thickness and 160 mm depth. The beam is subjected to shear force 200 kN. Draw Shear Force Distribution diagram. **[9]**

   b) A rectangular simply supported beam of 5m span is subjected to a central point load of 100 kN. The given beam is 300 mm wide and 500 mm deep. Determine maximum bending stress induced in the section. Draw Bending Stress Distribution diagram. **[9]**

OR

Q2) a) A 'T' beam, subjected to shear force of 200 kN. The flange is 200 mm × 30 mm and the web is 30 mm thick and 180 mm deep. Draw shear stress distribution diagram. **[9]**

   b) A symmetric I section of flanges 120 mm × 20 mm and web of thickness 20 mm and 100 mm depth, carrying uniformly distributed load of magnitude 80 kN/m over 4 m span. Calculate the maximum bending compressive stress. **[9]**

Q3) a) A solid circular shaft of diameter 90 mm rotates at 130 rpm. The twist is observed as 3° over 6 m span. **[9]**

Determine power transmitted.

Take G = 80 GPa.

b) Determine normal, tangential and resultant stresses on a plane at 25° with major principal plane. The principal stresses of 120 MPa tensile on major principal plane and 50 MPa compressive on minor principal plane are acting at a point on the member. **[8]**

OR

Q4) a) A solid circular shaft transmits 220 kW at 160 rpm. The maximum allowable shear stress is 60 MPa and angle of twist permitted is 2° in 3m length. Design suitable shaft. Take G = 78 GPa. **[9]**

b) A circular bar of diameter 80 mm diameter is subjected to axial compression force of 200 kN. Determine shear stress on a plane, on which the normal stress is 100 MPa. **[8]**

Q5) a) Compare the crippling loads given by Euler's and Rankine's formulae for a steel strut 2.5 m long having outer & inner diameter as 40 mm and 30 mm respectively loaded through pin jointed at the ends. Take yield stress as 320 N/mm² the Rankine's constant $\dfrac{1}{7500}$, E = 2 × 10⁵ MPa.

[9]

b) Explain 'Core of the Section' and obtain a core section for a hollow circular column of external and internal diameter 'D' and 'd' respectively. **[9]**

OR

Q6) a) A steel rod 6m long and 30 mm diameter is used as a column. One end is fixed and other is free. Determine the crippling load by Euler's formula. Take E = 200 GPa. **[9]**

b) A rectangular column of 240 mm × 150 mm is subjected to a vertical load of 110 kN, acting at an eccentricity of 60 mm in a plane bisecting 150 mm side. Determine the maximum and minimum stresses. **[9]**

Q7) a) The beam is supported and loaded as shown in figure. Determine the position and value of Maximum deflection $EI = 1.4 \times 10^{11}$ kN-mm². Use Macauly's method. **[9]**
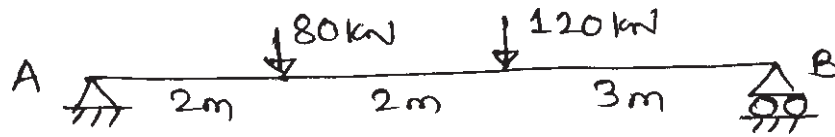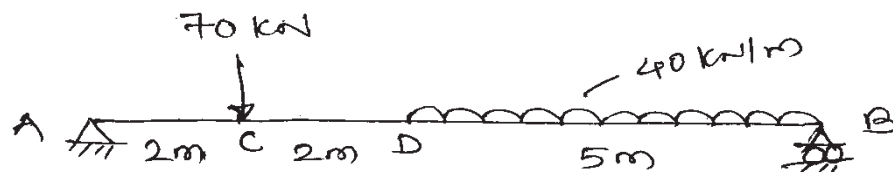

b) Determine the vertical and horizontal deflection at point 'C' for the truss shown below. **[8]**

$E = 200$ GPa $A = 2 \times 10^{-4}$ m² for all members.
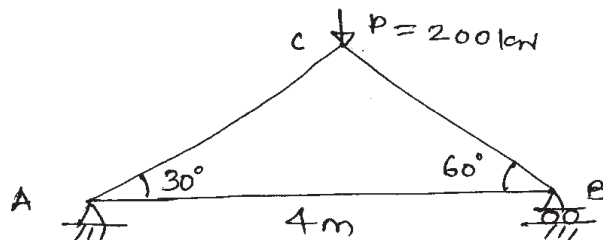
OR

Q8) a) Find slope at supports and at point 'C', deflection at 'C' and 'D' for the given beam using Macaulay's method. **[9]**

b) Determine the deflection and slope at the free end of cantilever beam of span '*l*' m, loaded with central point load 'w' kN. **[8]**

E 1 is constant.

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[5925]-203

S.E. (Civil)

FLUID MECHANICS

(2019 Pattern) (Semester-III) (201003)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Answer to the all questions should be written in single answer-book.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator (non programmable) and steam tables is allowed.*
6) *Assume suitable data, if necessary.*

Q1) a) A 1:15 model of a flying boat is towed though water. The prototype is moving in seawater of density 1025kg/m^3 at velocity of 21 m/s. Find the corresponding speed of the model. Also, determine the resistance due to waves on model if the resistance due to waves of the prototype is 610N. **[9]**

b) Explain the phenomenon of Boundary Layer Separation and Methods to control to it. **[8]**

<div align="center">OR</div>

Q2) a) The resisting force R of a supersonic plane during the flight can be considered as dependent upon the length of the aircaft *l*, velocity V, air viscosity μ, air density ρ, and bulk modulus of air K. Express the functional relationship between these variables and the resisting force. Use Buckingham's Π Method **[9]**

b) Explain with the help of neat sketch **[8]**

     i) Laminar boundary layer

     ii) Turbulent boundary layer

     iii) Laminar Sub-layer.

Q3) a) A pipe of 110 mm diameter is carrying water. If the velocities at the pipe center and 30 mm from the pipe centre are 2.1 m/s and 1.6 m/s respectively and flow in the pipe is turbulent. Calculate the shear friction velocity and wall shearing stress. **[9]**

b) Derive with usual notations the following Darcy-Weisbach equation for the loss of energy due to friction. **[8]**

$$h_f = \frac{4.f.LV^2}{2.g.D}$$

OR

Q4) a) A fluid of viscosity 8 poise and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is 211 N/m². Find: **[9]**

i) The pressure gradient,

ii) The average velocity, and

iii) Reynolds number of the flow

b) Explain the procedure of Hardy Cross method for the analysis of pipe network. **[8]**

Q5) a) The discharge of water through a rectangular channel of width 8 m, is 15.5 m³/s when the depth of flow of water is 1.25 m. Calculate: **[10]**

i) Discharge per unit width

ii) Velocity of flow

iii) Specific energy of the flowing water

iv) Critical depth

v) Critical velocity and

vi) Value of minimum specific energy.

b) Derive with usual notations the basic governing "energy equation" of channel flow. **[8]**

OR

Q6) a) A trapezoidal channel has side slope of 3 horizontal to 4 vertical and slope of its bed is 1 in 2000. Determine the optimum dimensions for the channel sections and show it with neat sketch, if it is carry water at 0.55 m³/s. Take Chezy's constant as 80. **[9]**

b)   i)   Explain the Specific energy curve with neat sketch.   **[5]**

       ii)   Find the rate of flow of water through a V-shaped channel as shown in Figure 6 b. Take the value of C=56 and slope of the bed 1 in 2000.   **[4]**
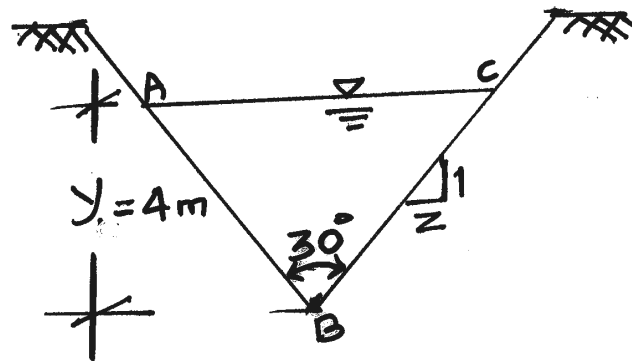

Fig:- 6 b

(NOT TO SCALE)

Q7) a)   A metallic ball of diameter 2×10^{-3} m drops in a fluid of sp. gr. 0.96 and viscosity 15 poise. The density of the metallic ball is 12000 kg/m^3. Find: **[10]**

       i)   The drag force exerted by fluid on metallic ball,

       ii)   The pressure drag and skin friction drag, and

       iii)   The terminal velocity of ball in fluid.

   b)   Explain Classification of channel bottom slopes with neat sketches.   **[8]**

<div align="center">OR</div>

Q8) a)   A rectangular channel is 20 m wide and carries a discharge of 65 m^3/s. It is laid at a slope of 0.0001. At a certain section along the channel length, the depth of flow is 2m. How far U/S or D/S will the depth be 2.6m? Take n=0.02. Use direct step method with three steps. Consider the depth increment in the interval of 0.1m. Classify and sketch the profile.   **[10]**

   b)   A flat plate 1.5 m×1.5 m moves at 51 m/hr in stationary air of density 1.16 kg/m^3. If the co-efficient of drag and lift are 0.16 and 0.76 respectively, determine: **[8]**

       i)   The lift force,

       ii)   The drag force

       iii)   The resultant force, and

       iv)   The power required to keep the plate in motion.

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[5925]-204

S.E. (Civil)

ENGINEERING MATHEMATICS - III

(2019 Pattern) (Semester - III) (207001)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Question No. 1 is compulsory.*
2) *Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.*
3) *Assume suitable data, if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*
5) *Figures to the right indicates full marks.*
6) *Use of electronic pocket calculator is allowed.*

Q1) a)   The pair of regression Linens are L1 : $8x - 10y + 66 = 0$ and

        L2 : $40x - 18y = 214$ **[1]**

        i)   L1 is the regression Line y on x.

        ii)   L1 is the regression line x on y.

        iii)   L2 is regression line y or x.

        iv)   L1 and L2 is regression line x on y.

   b)   Vector along the direction of the line.   **[1]**

      $\dfrac{x-1}{2} = \dfrac{y+2}{1} = \dfrac{z-3}{5}$ is

        i) $\dfrac{\hat{i} - 2\hat{j} - 3\hat{k}}{\sqrt{14}}$ ii) $\dfrac{\hat{i} + 2\hat{j} + 5\hat{k}}{\sqrt{30}}$

        iii) $\dfrac{2\hat{i} + \hat{j} - 5\hat{k}}{\sqrt{30}}$ iv) $\dfrac{2\hat{i} + \hat{j} + 5\hat{k}}{\sqrt{30}}$

c) Let $X = B(7,1/3)$ be the Binomial distribution with parameters $n = 7$ and $p = 1/3$. Then $p(x=2) + p(x=5)$ is **[2]**

i) 81/28

ii) 28/81

iii) 7/81

iv) 10/81

d) If vector field $\vec{F} = (x+3y)\hat{i} + (y-2z)\hat{j} + (x+mz)\hat{k}$ is solenoidal the value of m is **[2]**

i) −2

ii) 3

iii) 2

iv) 0

e) Using Stoke's theorem $\oint_c \vec{F} \cdot d\vec{r}$ where $\vec{F} = xy\hat{i} + yz\hat{j} + z\hat{k}$ over the cube whose side is a and it's face in XOY - plane is missing is equal to **[2]**

i) 0

ii) $\iint_R y\, dxdy$

iii) $\iint_R 2x\, dxdy$

iv) $\iint_R -x\, dxdy$

f) Most general solution of $\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}$ is **[2]**

i) $u(x,t) = (c_1 \cos mx + c_2 \sin mx)(c_3 \cos cmt + c_4 \sin cm)$

ii) $u(x,t) = (c_4 \cos mx + c_5 \sin mx)e^{-m^2 t}$

iii) $u(x,t) = (c_1 e^{-mx} + c_2 e^{mx})(c_1 \cos my + c_2 \sin my)$

iv) $u(x,t) = (c_1 \cos mx + c_2 \sin mx)(c_3 e^{-my} + c_4 e^{my})$

Q2) a) A computer while calculating carrelation coefficient between two variables X and Y from 25 pairs of observations obtained the following results :

$n = 25, \; \Sigma X = 125, \; \Sigma X^2 = 650, \; \Sigma Y = 100, \; \Sigma Y^2 = 460, \; \Sigma XY = 508.$

Later it was discovered that the values (X, Y) = (8, 12) was copied as (6, 14) and the value (8, 6) was copied as (6, 8). Obtain the correct value of the correlation coefficient. **[5]**

b) In a normal distribution 31% of the items are under 45 and 8% are above 64. Find the mean and standard deviation of the distribution. Take Area $(0 < z < 1.4) = 0.42$ and Area $(0 < z < 0.5) = 0.19$ where z is the standard normal variate. **[5]**

c) Verify at 5% level of significance and 4 degrees of freedom if the distribution can be assumed to be poisson given:

# defects :	0	1	2	3	4	5
Frequency :	6	13	13	8	4	3

Take $e^{-2} = 0.135$. in the calculations round off the frequencies to the immediate higher integral value. Take $\chi^2_{5,0.05} = 11.07$ **[5]**

OR

Q3) a) Two examiners A and B award marks to seven students as follows:

Roll No. :	R_1	R_2	R_3	R_4	R_5	R_6	R_7
Marks (A) :	40	44	28	30	44	36	30
Marks (B) :	32	39	26	30	28	34	28

Find the coefficient of correlation. **[5]**

b) Assume the mean height of soldiers to be 68.22 inches with a variance of 10.8 inches square. How many soldiers in a regiment of 10,000 would you expect to be over 6 feet? Assume area $(0 < z < 1.15) = 0.3749$ where z is the standard normal variate. **[5]**

c) Among 64 off springs of a certain cross between European horses 34 were red, 10 were black and 20 were white. According to a genetic model these numbers should be in the ratio 9:3:4. Is the data consistent with the model at 5% level of significance? Take $\chi^2_{2;0.05} = 5.991$ **[5]**

Q4) a) Find the angle between the tangents to the curve **[5]**
$x = t,\ y = t^2,\ z = t^3 \neq$ at $t = 1$ and $t = -1$

b) If $\vec{F}_1 = (y+z)\hat{i} + (z+x)\hat{j} + (x+y)\hat{k}$ and $\vec{F}_2 = (x^2 - yz)\hat{i} + (y^2 - zx)\hat{j} + (z^2 - xy)\hat{k}$ then show that $\vec{F}_1 \times \vec{F}_2$ is solenoidal. **[5]**

c) If the directional derivative of $\phi = axy + byz + czx$ at $(1, 1, 1)$ has maximum magnitude 4 in a direction of *x-axis*. Find *a*, *b* and *c*. **[5]**

OR

Q5) a) Find the directional derivative of $\phi = xy + yz^2$ at the point $(1, -1, 1)$ to wards point $(2, 1, 2)$. **[5]**

b) Prove the following identities (any one) **[5]**

i) $\nabla \times (\vec{a} \times \vec{r}) = 2\vec{a}$

ii) $\nabla (\vec{a}.\vec{r}) = \vec{a}$

c) Show that $\vec{F} = (xy^2 + xz^2)\hat{i} + (yx^2 + yz^2)\hat{j} + (zx^2 + zy^2)\hat{k}$ is irrotational. Find scalar ϕ such that $\vec{F} = \nabla\phi$. **[5]**

Q6) a) Evaluate $\int_c \vec{F} \cdot d\vec{r}$ along the straight line joining points $(0, 0, 0)$ and $(2, 1, 3)$ where $=\vec{F} = 3x^2\vec{i} + (2xz - y)\vec{j} + z\vec{k}$ **[5]**

b) Evaluate $\iint_S (x\vec{i} + y\vec{j} + z\vec{k}) \cdot d\vec{s}$ over the surface of sphere $x^2 + y^2 + z^2 = 1$ **[5]**

c) Evaluate using Stoke's theorem $\iint_S (\nabla \times \vec{F}) \cdot d\vec{s}$ where $\vec{F} = y^2\vec{i} + z\vec{j} + xy\vec{k}$ and S is surface of paraboloid $z = 4 - x^2 - y^2 (z \geq 0)$. **[5]**

OR

Q7) a) Use Green's theorem to evaluate $\int_c (2x^2 - y^2) dx + (x^2 + y^2) dy$ where 'C' is boundary of area enclosed by the axis and circle $x^2 + y^2 = 16, z = 0$. **[5]**

b) Apply Stoke's theorem to evaluate $\int_c \overline{F} \cdot d\overline{r}$ where $\overline{F} = yz\overline{i} + zx\overline{j} + xy\overline{k}$ and S is upper part of sphere $x^2 + y^2 + z^2 = 1$ above XOY plane. **[5]**

c) Evaluate $\iint_s (x\overline{i} + y\overline{j} + z^2\overline{k}) \cdot d\overline{s}$. Where S is the surface of cylinder $x^2 + y^2 = 4$ bounded by planes $z = 0$ and $z = 2$. **[5]**

Q8) a) A string stretched and fastened between two points L a part. Motion is started by displacing the string in the form $y = a \sin \dfrac{\pi x}{L}$ from which it is released at time $t = 0$. Find the displacement $y(x,t)$. **[8]**

b) Solve the one dimensional heat equation $\dfrac{\partial y}{\partial t} = k \dfrac{\partial^2 u}{\partial x^2}$ subject to conditions.

    i)   u is finite $\forall t$.

    ii)   u (0, t) = 0,

    iii) u(π, t) = 0,

    iv) u(x, 0) = $\pi x - x^2$ $0 \leq x \leq \pi$. **[7]**

OR

Q9) a) A tightly stretched string with fixed ends $x = 0$ and $x = l$ is initially at rest in its equilibrium position is set to vibration by giving each point a velocity $3x(l - x)$ for $0 < x < l$. Find the displacement $y(x, t)$ at any time t. **[8]**

b) An infinitely long uniform metal plate is enclosed between lines $y = 0$, and $y = l$ for $x > 0$. The temperature is zero along the edges $y = 0$, $y = l$, and at infinity. If edge $x = 0$ is kept at a constant temperature v_0, Find the temperature distribution $v(x, y)$. **[7]**

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[5925]-205

S.E. (Civil Engineering)
ENGINEERING GEOLOGY
(2019 Pattern) (Semester-III) (207009)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:
1) *All questions are compulsory.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams muist be drawn wherever necessary.*

Q1) a) Describe various types of unconformities with neat sketches. **[6]**

b) Explain sill and Dyke as igneous intrusions. **[5]**

c) Write short notes on: **[6]**

i) Symmetrical and asymmetrical folds.

ii) Strike and dip of rocks.

OR

Q2) a) Explain various parts Fold and any three types of fold with neat sketches.**[6]**

b) Write short note on plate tectonic. **[5]**

c) Describe the classification of fault and their engineering significance.**[6]**

Q3) a) What is the effects of faulting and their significance in civil engineering.**[6]**

b) Describe the application of remote sensing in civil engg. **[6]**

c) Describe photo interpretation elements of aerial photographs. **[6]**

OR

Q4) a) Explain in detail the importance of preliminary geological exploration in civil engineering projects. **[6]**

b) Write an applications of GIS in civil engg. **[6]**

c) Explain any three methods of subsurface investigation. **[6]**

Q5) a) Discuss in detail preliminary geological investigations of tunneling. **[6]**

b) What are the geological requirement for the foundation of dam? **[6]**

c) Discuss the feasibility of dam site, with dipping and horizontal strata.**[6]**

OR

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Q6) a) A site is proposed for excavation of tunnel is A-B and M-N, which is passing through axis and limb region of fold respectively. Justify the suitability of tunnel is such conditions. **[6]**

b) Explain with appropriate example the feasibility of dam alignment which is crossing DYKE. **[6]**

c) Write a note on the dam located on folded geological structure. **[6]**

Q7) a) Describe different types of seismic waves in detail. **[6]**

b) What is landslides? What are the causes of it? **[5]**

c) Define Aquifers. Explain in short the types of aquifers. **[6]**

OR

Q8) a) Write a note on building stones. **[6]**

b) What are the causes of an earthquakes. **[5]**

c) Explain the Geological conditions favorable for natural springs and artesian wells. **[6]**

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[5925]-206

S.E. (Civil)

GEOTECHNICAL ENGINEERING

(2019 Pattern) (Semester - IV) (201008)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1)   *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

2)   *Figures to the right indicate full marks.*

3)   *Neat figures must be drawn wherever necessary.*

4)   *Assume suitable data if required.*

5)   *Use of non programmable scientjfic calculator is allowed.*

Q1) a)   Discuss in detail Proctor needle in field compaction control.   **[6]**

b)   State any four assumptions in Boussinesq's theory. Mention the formula for calculation of stress in soil by point load and circular load by Boussinesq's theory, with description of each term.   **[6]**

c)   Describe the effect of compaction on properties of soil.   **[6]**

OR

Q2) a)   Differentiate between Standard Proctor Test and Modified Proctor Test. Draw typical compaction curve for both the tests.   **[6]**

b)   What is pressure bulb? Explain its significance and draw a neat sketch of pressure bulb for concentrated point load.   **[6]**

c)   A concentrated load of 25 kN acts on the surface of homogenous soil mass of large extent. Find the stress intensity at a depth of 8 m by using Boussinesq's theory at a horizontal distance of 2.5 m.   **[6]**

Q3) a)   Explain briefly the procedure of conducting Unconfined Compression Test on clayey soil sample. Draw Mohr's circle for the test.   **[6]**

b)   State and explain factors affecting shear strength of cohesive and cohesionless soil.   **[5]**

c) Two identical soil specimens were tested in a triaxial apparatus. First specimen was failed at a deviator stress of 700 kN/m² when the cell pressure was 200 kN/m². Second specimen was failed at a deviator stress of 1300 kN/m² when the cell pressure was 400 kN/m². Determine cohesion of soil and angle of internal friction of soil analytically. **[6]**

OR

Q4) a) Determine the shear strength in terms of effective stress on a plane within a saturated soil mass at a point where the total normal stress is 200 kN/m² and pore water pressure is 80 kN/m². The shear strength parameters in terms of effective stress are, c' = 16 kN/m² and Φ' = 39⁰. **[6]**

b) Explain how shear tests are conducted with different drainage conditions? **[5]**

c) Describe the procedure for Vane Shear Test. **[6]**

Q5) a) Explain earth pressure at rest, active earth pressure and passive earth pressure w.r.t. wall movement with sketches. **[6]**

b) Compute the intensity of active earth pressure at a depth of 8 m in dry cohesionless sand with an angle of internal friction 30⁰ and unit weight of 18 kN/m³. **[6]**

c) Derive the equation for lateral earth pressure in active state for dry cohesionless backfill with uniform surcharge. **[6]**

OR

Q6) a) A wall with a smooth vertical back, 10 m high, supports a purely cohesive soil with c = 9.81 kN/m² and γ = 17.66 kN/m³. Determine total active earth pressure against the wall and position of zero pressure before formation of tension crack. **[6]**

b) Explain Rebhann's graphical method for determination of earth pressure on retaining wall. **[6]**

c) Derive the expression for the active state of pressure at any point for a submerged cohesionless backfill along with pressure diagram. **[6]**

Q7) a) Explain with neat sketch different modes of slope failure. **[6]**

b) Discuss "Swedish Slip Circle Method" for stability analysis of finite slope. **[5]**

c) Derive the expression for F.O.S. for dry infinite slope in sandy soil. **[6]**

OR

Q8) a) Illustrates causes and remedial measures of landslide. **[6]**

b) Discuss "Taylor's Stability Number" for stability analysis of finite slope.

[5]

c) An infinite slope is made of clay with the following properties: **[6]**

γ_{sat} = 18 kN/m³, γ' = 9 kN/m³, c' = 25 kN/m² and Φ = 28°.

If the slope angle has an inclination of 350 and height equal to 12 m, determine stability of slope. When,

i) The slope is submerged

ii) There is steady seepage parallel to slope.

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[5925]- 207

S.E. (Civil)

SURVEY

(2019 Pattern) (Semester-IV)(201009)

Time :2½ Hours]   *[Maximum. Marks : 70*

Instruction to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat sketches must be drawn wherever necessary.*
3) *Figures to right indicate full marks.*
4) *Assume suitable data if necessary.*
5) *Use of electronic pocket calculator is allowed.*
6) *Use of cell phone is prohibited in examination hall.*

Q1) a) Explain with sketch the fixed hair method of tacheometry, when line of sight is inclined downward (depression) and staff is held vertical?   **[6]**

b) State the Characteristics of contour lines?   **[4]**

c) The following observations were made using a tacheometer fitted with an analytic lens, multiplying constant being 100.   **[8]**

Instr^n. Station	Instr^n. Height	Staff Station	Vertical Angle	Hair Reading	Remark
O	1.550	A	$+4°30'$	1.155,1.755,2.355	RL of O
	1.550	B	$+10°15'$	1.250,2.000,2.750	=150 m

Find R.L. of point A and B also find Distance AB.

OR

Q2) a) A tacheometer with analystic lens.Having the multiplying constant 100 was used and the following observations were made on staff held vertical. **[8]**

Instrument station	H.I. (m)	Vertical Angle	Staff at	Staff Reading
P	1.8	$+2°40'$	M	1.25,1.93,2.56
P	1.8	$-4°40'$	Q	1.45,1.85,2.30

R.L of station M is 50.00 m Calculate the R.L. of P&Q ,distance PQ and gradient?

b) State different uses of contour maps? **[4]**

c) Enlist different methods of contouring? Explain any one with detailed sketch? **[6]**

Q3) a) Write a note on necessity and types of transition curves. **[5]**

b) Two straights PI and QI meet at chainage of 1250 m. A right handed simple circular curve of 250 m radius joins them. The deflection angle between two straights is $30°$. Tabulate the necessary data to layout the curve by Offset from long chord. Take chord interval as 10 m. **[7]**

c) What are different types of curves, explain any one with sketch . **[5]**

OR

Q4) a) Two tangents intersects at a chain age of 150.5 m the intersection angle $150°$ calculate the following quantities for setting out all curves of radius 100m . **[7]**
Calculate.
Calculate.

i) Tangent length

ii) Length of long chord

iii) Length of the curve

iv) Chainage of Starting point and end point of curve

v) Apex Distance

vi) Versed sine of curve.

b) Enlist various linear methods of setting out curves and explain any one with sketch. **[5]**

c) Draw compound curve with its components. **[5]**

Q5) a) Enlist the limitations of the prevalent survey techniques and also give advantages of Space Based positioning System? **[6]**

b) Write a note on setting out a building? **[6]**

c) Explain how the verticality of tall building is checked? **[6]**

OR

Q6) a) State Different names of satellites and Write a note on GLONASS (Global Navigation and Surveying System). **[6]**

b) Write a short note on survey for drainage line work? **[6]**

c) Explain the how open traversing surveying work is conducted. **[6]**

Q7) a) What are different methods of sounding,State any one method in detail? **[5]**

b) State the working principle and applications of total station? **[6]**

c) Differentiate between Terrestrial photogrammetry and Aerial photogrammetry? **[6]**

OR

Q8) a) Describe the objective and classification of triangulation survey? **[6]**

b) State the classification and applications of Photogrammetry in surveying? **[5]**

c) What are the objectives of hydrographic survey? **[6]**

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[5925]-208
S.E. (Civil)
CONCRETE TECHNOLOGY
(2019 Pattern) (Semester - IV) (201010)

Time : 2½ Hours]   [*Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Use of non programmable calculator is allowed.*
5) *Your answers will be valued as a whole.*
6) *If necessary assume suitable data and indicate clearly.*
7) *Use of IS codes 10262, 456 is not allowed*

Q1) a) Explain the compressive strength of concrete. How it is determined in laboratory. **[6]**

   b) State the various types of non-destructive tests carried on hardened concrete. Explain ultrasonic pulse velocity test with its limitations. **[6]**

   c) Explain the relationship between compressive strength and tensile strength of concrete. **[6]**

OR

Q2) a) Explain rebound hammer test with its limitations. **[6]**

   b) Define creep of concrete. What are the factors affecting on creep of concrete? **[6]**

   c) Explain the stress-strain relationship of concrete with neat sketch. **[6]**

Q3) a) What do you mean by concrete mix design? What are the objectives in mix design? **[6]**

   b) Explain the factors affecting the concrete mix design. **[5]**

   c) Explain DOE method of concrete mix design. **[6]**

OR

Q4) a) Using IS code method design a concrete for grade M35 for following data : **[13]**

Parameter	:	Details
Grade designation	:	M35
Standard deviations	:	5.00
Factor based on the grade of concrete. X	:	6.50
Type of cement	:	OPC 53 grade conforming to Is 8112
Workability	:	75 mm(slump)
Exposure conditions		Very severe(for RCC)
Degree of supervision	:	Good
Maximum cement content	:	450 kg/m³
Type of aggregate	:	Angular coarse aggregate
Specific gravity of cement	:	3.15
Specific gravity of coarse aggregate and fine aggregate	:	2.70
Water absorption of coarse aggregate	:	0.50%
Water absorption of fine aggregate	:	1.00%
Free surface moisture for coarse aggregate	:	Nil
Free surface moisture for fine aggregate	:	Nil

Sieve Analysis :

Coarse aggregate

IS Sieve (mm)	Analysis of coarse aggregate fraction		Percentage of different fraction			Remarks
	I	II	I (50 %)	II (50%)	Combined (100%)	
20	100	100	50	50	100	Conforming
10	2.80	78.30	1.4	39.15	40.55	to table 7 of
4.75	0	8.70	0	4.35	4.35	IS 383

Fine aggregate : Conforming to grading Zone II of Table 9 of IS 383

Water content per m³ of concrete for 50mm slump :

Sr. No.	Nominal maximum size of aggregate (mm)	Maximum water content (kg/m³)
i)	10	208
ii)	20	186
iii)	40	165

Volume of coarse aggregate per unit volume of total aggregate for water cement/water-cementitious material ratio of 0.30 :

Sr. No.	Nominal maximum size of aggregate (mm)	Volume of coarse aggregate per unit volume of total aggregate for different zones of fine aggregate		
		Zone III	Zone II	Zone I
i)	10	0.56	0.54	0.52
ii)	12.5	0.58	0.56	0.54
iii)	20	0.68	0.66	0.64

Approximate air content

Sr. No.	Nominal maximum size of aggregate (mm)	Entrapped air, as % of volum of concrete
i)	10	1.0
ii)	12.5	0.8
iii)	20	0.5

Minimum cement content, maximum W/C and minimum grade of concrete for different exposures with normal weight aggregates of 20 mm nominal maximum size :

Sr. No.	Exposure	Minimum cement content (kg/m³)	Maximum W/C	Minimum grade of concrete
i)	Mild	300	0.55	M20
ii)	Moderate	300	0.50	M25
iii)	Severe	320	0.45	M30
iv)	Very severe	340	0.45	M35
v)	Extreme	360	0.40	M40

b) What do you mean by:　　　　　　　　　　　　　　　　　　　　**[4]**

i) Mean strength

ii) Variance

iii) Standard deviation

iv) Coefficient of variation

Q5) a) Describe the types of vibrators used for compaction of concrete. **[6]**

b) What is light weight concrete? How it can be achieved in practice? **[6]**

c) Describe the cold and hot weather concreting. **[6]**

OR

Q6) a) Write a short note on : [8]

      i) Fiber reinforced concrete

      ii) Geo-polymer concrete

  b) Enlist special concreting techniques? Explain under water concreting. [5]

  c) Explain the ferrocement technology with its applications. [5]

Q7) a) Explain the durability of concrete? What effect the water- cement ratio makes on durability? [5]

  b) Write short note on [12]

      i) Sulphate attack on concrete

      ii) Chloride attack on concrete

      iii) Carbonation of concrete

<div align="center">OR</div>

Q8) a) What are the symptoms and diagnosis of distress of concrete? [5]

  b) Explain in detail corrosion monitoring techniques of reinforcement and preventive measures against corrosion. [6]

  c) What do you meant by retrofitting of concrete and explain use of fiber reinforced polymer concrete for retrofitting. [6]

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[5925]-209

S.E. (Civil)

STRUCTURAL ANALYSIS

(2019 Pattern) (Semester - IV) (201011)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

   1)   *AnswerQ.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

   2)   *Neat sketches must be drawn wherever necessary.*

   3)   *Figures to the right indicate full marks.*

   4)   *Assume suitable data, f necessary.*

   5)   *Use of electronic pocket calculator allowed.*

   6)   *Use of cell phone is prohibited in the examination hall.*

Q1) a)   Analyze the beam shown in figure 1 by slope deflection method and draw BMD. Assume uniform flexural rigidity.   **[12]**
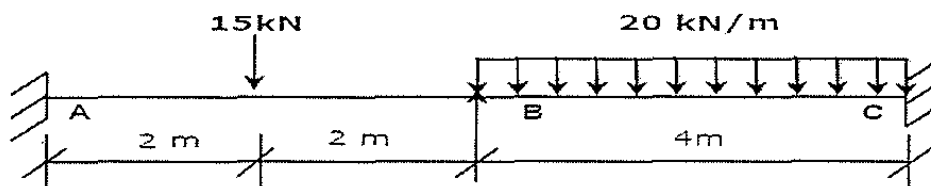

Figure 1

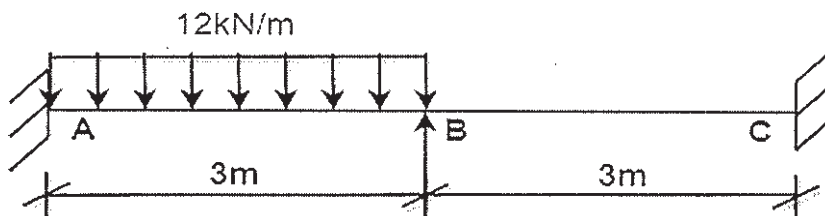b)   Find the rotation B (θ_B) for the beam with uniform flexural rigidity as shown in figure 2.   **[6]**

Figure 2

OR

Q2) a)   Analyse the frame shown in figure 3 by slope deflection method and draw BMD. Assume uniform flexural rigidity. **[12]**
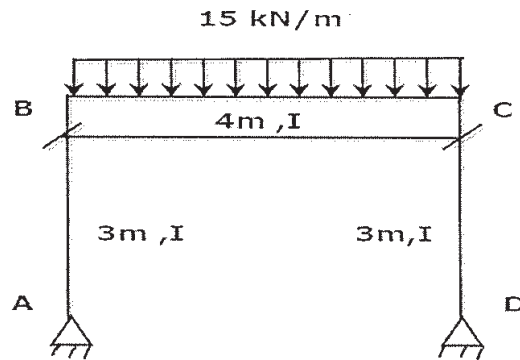
15 kN/m

B   4m ,I   C

3m ,I   3m,I

A   D

Figure 3

b)   Analyse the frame shown in figure 4 by slope deflection method. Assume uniform flexural rigidity. **[6]**

10kN/m   10 kN
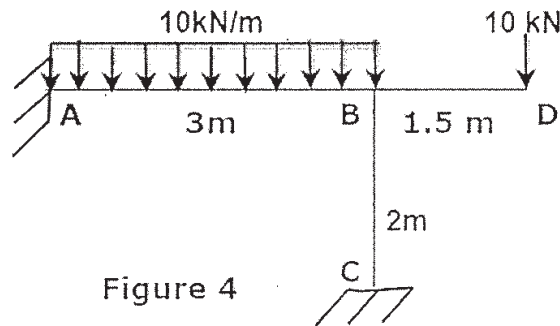
A   3m   B   1.5 m   D

2m

C

Figure 4

Q3) a)   Analyze the continuous beam ABCD shown in figure 5 by moment distribution method and draw BMD. Assume uniform flexural rigidity.**[12]**
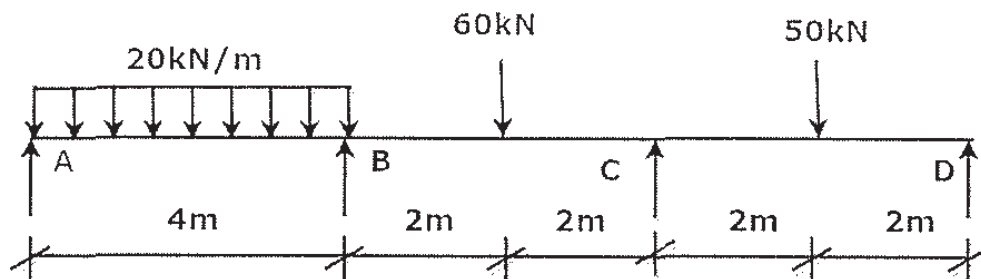
60kN   50kN

20kN/m

A   B   C   D

4m   2m   2m   2m   2m

Figure 5

b)   Define member stiffness; carry over moment and distribution factor.**[6]**

OR

Q4) a) Calculate final end moments for the frame shown in Fig. 6 by moment distribution method and draw BMD. **[12]**
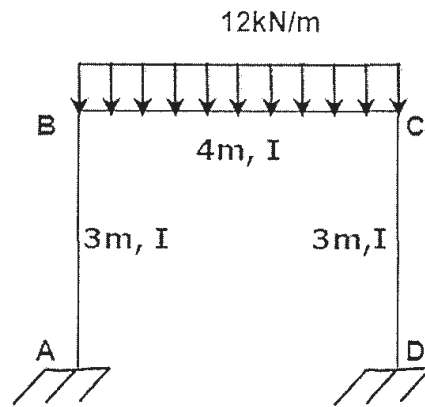
12kN/m

B   C

4m, I

3m, I   3m,I

A   D

Figure 6

b) Analyze bent ABC as shown in Fig. 7 by moment distribution method.**[6]**
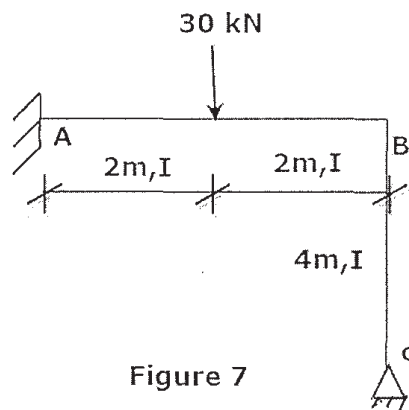
30 kN

A   B
2m,I   2m,I

4m,I

C

Figure 7

Q5) a) Write note on stiffness method and write elements of displacement matrix for following figure. **[6]**

12kN

B   C
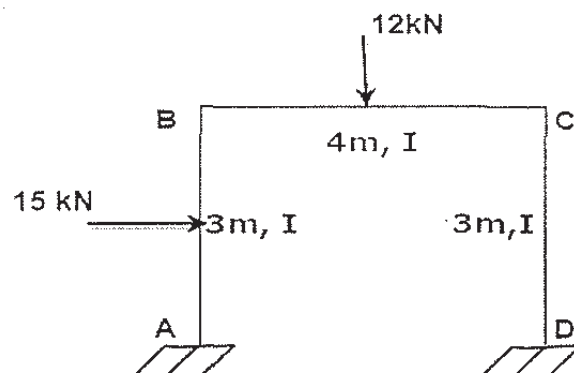
4m, I

15 kN
3m, I   3m,I

A   D

Figure 8

b) Analyse the continuous beam ABCD as shown in Fig. 9 by stiffness method and draw bending moment diagram. Assume uniform flexural rigidity. **[11]**
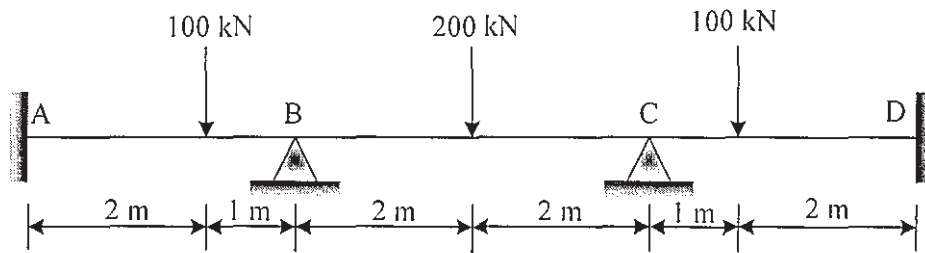
Fig. 9

OR

Q6) a) Explain degrees of freedom and stiffness. **[6]**

b) Analyse the bent shown in Fig.10 by stiffness method and draw bending moment diagram. **[11]**

Fig. 10

Q7) a) Define plastic hinge, load factor and shape factor. **[6]**

b) Calculate the collapse load W_u, for the beam shown in figure 11. **[11]**

Figure 11

OR

Q8) a) Explain different collapse mechanisms in plastic analysis with diagram.**[6]**

b) Determine shape factor for I section shown in figure 12. **[11]**

Figure 12

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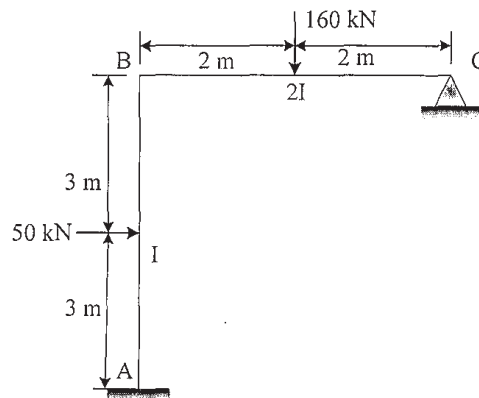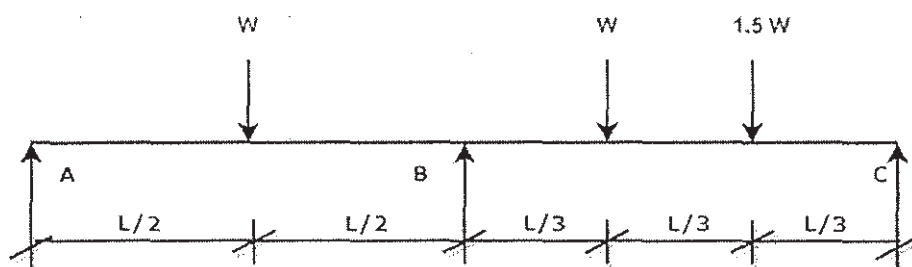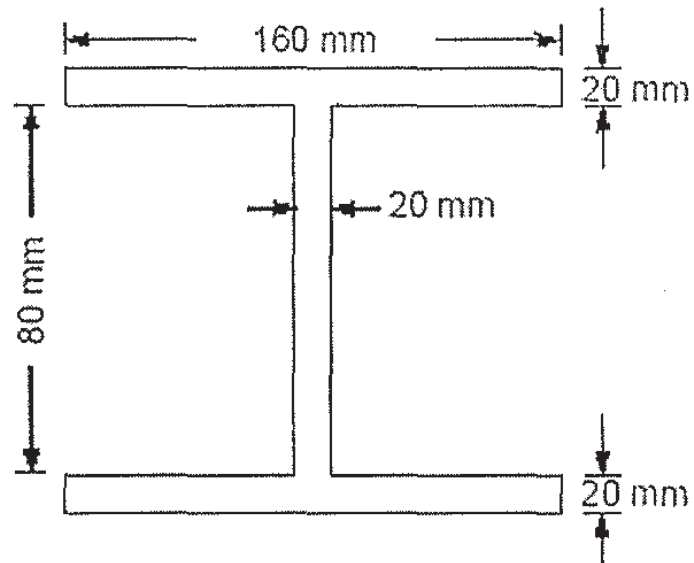
S.E. (Civil Engineering)
PROJECT MANAGEMENT
(2019 Pattern) (Semester-IV) (201012)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) State the primary and secondary objectives of material management. **[3+3]**

b) Explain the process of material procurement in construction project. **[2+4]**

c) The annual demand for the product is 22,000 units. The unit cost is Rs. 8/-. The annual inventory carrying cost per unit per annum is 20% of average iniventory cost. If the cost of procurement is Rs. 85/-.

  Determine **[2+2+2]**

  i) EOQ

  ii) No. of orders per annum

  iii) Total cost of purchasing

OR

Q2) a) Explain the meaning of **[3+3]**

  i) Raising of Indents

  ii) Delivery of Material

b) How do you inspect quality of material like sand and aggregate on your site? **[3+3]**

c) Explain why safety program have to be implemented at work site. what points should be considered while making a safety program for the following projects. **[2+2+2]**

  i) highway construction

  ii) Building construction

Q3) a) Explain resource allocation methods and their significance in manpower planning. **[2.5+2.5]**

b) Following table shows the data of small construction project. **[12]**

Activity	1-2	2-3	2-4	3-5	4-5	5-6	5-7	6-7
Duration (Days)	4	6	5	2	1	4	6	6

    i) Draw the network diagram and update the network by using the following conditions at the end of 8 days.

    ii) What is the change in the project duration?

    iii) What is remaining duration of project?

At the end of 8 days review was taken which indicates _____

    1) Activity 1-2 & 2-4 was completed as originally planned.

    2) Activity 2-3 & 3-5 delayed drastically and requires 5 & 6 more days respectively for their completion.

    3) Activity 4-5 & 5-6 is in progress and both require 10 more days for their completion.

    4) Activity 6-7 yet to start and the original time estimate still appear to be accurate.

    5) Activity 5-7 requires 8 days in place of 6 days for its completion.

OR

Q4) a) What do you mean by EVA? Explan any one method in detail **[2+2]**

b) The following is available information about various activities **[13]**

Activity	Normal duration (week)	Normal cost (Rs.)	Crash duration (week)	Crash cost (Rs.)
1-2	6	7000	3	14,500
1-3	8	4000	5	8,500
2-3	4	6000	1	9,000
2-4	5	8000	3	15,000
3-4	5	5000	3	11,000

Project overhead cost are Rs 3000/- per week.

Determine network diagram with CPM and optimum cost and duration.

Q5) a) Explain Demand and Supply curve. **[3+3]**

b) Explain the following terms: **[2+2+2]**

    i) Cost, Price and Value

    ii) Equilibrium price, Equilibrium quantity

    iii) Factors affecting Price Determination

c) Illustrate with example "Law of Diminishing Marginal Utility" **[2+4]**

OR

Q6) a) Explain Concept of Cost of Capital & Time Value of Money.   **[3+3]**

b) Mr. Vilas brough an air-conditioner for Rs. 20,000; he paid tax of Rs. 2,000 and Rs. 200 for trnsport. If he sold it to a customer for Rs. 22,500, what is the percentage profit or loss?   **[6]**

c) Explain the following laws with suitable diagram.   **[3+3]**
   i) Law of demand and supply
   ii) law of substitution

Q7) a) What are the different types of appraisals required to undertake any Project? Explain any one in detail.   **[2+4]**

b) Write a short note on: **[3+3]**
   i) Break even analysis,
   ii) Detailed project report (DPR).

c) Compare the project by NPV and B/C ratio method and state its feasibility if project cost is Rs. 2,80,000 and it has net cash flow of Rs. 90,000 for a peiod 4 years. Firm expect returns 10% per annum.   **[5]**

OR

Q8) a) Following are the details of Project A and B. Using NPV (i=8%), Comment on the following statements: **[6]**
   i) Whether both projects are feasible?
   ii) Whether both projects are not feasible?
   iii) Either of the A or B is feasible?

Years	Project A	Project B
Initial Investment	4,00,000	4,50,000
1	1,20,000	1,40,000
2	1,25,000	1,45,000
3	78,000	76,000
4	80,000	65,000
5	75,000	60,000
6	-	90,000

b) Explain the contents of Projet Feasibility report with example.   **[5]**

c) Explain the role of Project management Consultant in Pre-tender and Post-tender of a Project.   **[3+3]**

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[5925]-211

S.E. (Electronics/E&TC) (Electronics & Computer)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - III) (207005)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) Q.1 is compulsory.

2) Attempt Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.

3) Neat diagrams must be drawn wherever necessary.

4) Figures to the right indicate full marks.

5) Use of electronic pocket calculator is allowed.

6) Assume suitable data, if necessary.

7) Write numerical calculations correct upto four decimal places.

Q1) Write the correct option for the following multiple choice questions :

i) The divergence of vector field

$$\vec{F} = 3x^2\overline{i} + 3y^2\overline{j} + 2xz\overline{k}$$ at point (1,1,1) is   **[2]**

a) 14   b) 2

c) 12   d) 8

ii) If $f(x) = x^2$, $h = 1$, $\Delta\nabla f(x)$ is given by   **[2]**

a) –2   b) 1

c) 2   d) –1

iii) The value of $\int\limits_{C} \dfrac{z^2+1}{z-2} dz$ where C is $|z| = 1$,   **[2]**

a) 0   b) $2\pi i$

c) $4\pi i$ d) $\dfrac{\pi i}{2}$

iv) By Gauss - Divergence theorem $\iint_S \vec{r}_0 \hat{n} ds$ is equal to [2]

a) $3\iiint_v dv$ b) $\iiint_v \frac{1}{r^2} dv$

c) $\iiint_v dv$ d) 0

v) Inverse shifting operator is equivalent to. [1]
  a) $1 - \delta$ b) $1 + \delta^2$
  c) $1 + \delta$ d) $1 - \nabla$

vi) If $f(z)$ is analytic on and within a closed conter C then by Cauchy's Integral theorem $\oint_C f(z) dz$ is equal to [1]

  a) $2\pi i$ b) πi
  c) 0   d) 1

Q2) a) Using Newton's forward difference formula, find a polynomial passing through the points (0,1), (1,1), (2,7), (3,25), (4,61), (5,121). Hence find y and $\frac{dy}{dx}$ at $x = 0.5$. [5]

b) The speed (km/hr) of a train which starts from rest is given by the following table, the time being recorded in minutes. [5]

t (minutes)	0	2	4	6	8	10	12	14	16	18	20
v = ds/dt (km/hr)	0	10	18	25	29	32	20	11	5	2	0

Find approximately the total distance run in 20 minutes using Simpson's $\frac{1}{3}$ rd rule.

c) Determine using modified Euler's method the value of y at $x = 0.1$, given [5]

$\frac{dy}{dx} = x^2 + y, y(0) = 1.$

Take h = 0.1. (Two iterations only)

OR

Q3) a) Given the table of square roots, calculate the value of $\sqrt{155}$ by Newton's backward difference formula. **[5]**

x	150	152	154	156
$y = \sqrt{x}$	12.247	12.329	12.410	12.490

b) Evaluate $\int_{0}^{1} \dfrac{dx}{1+x^2}$ using Trapezoidal rule taking $h = \dfrac{1}{4}$. **[5]**

c) Using fourth order Range-Kutta method, solve $\dfrac{dy}{dx} = \sqrt{(x+y)}, \ y(0) = 1,$

to find y at $x = 0.2$ taking $h = 0.2$. **[5]**

Q4) a) Find angle between the normal to the surface $xy = z^2$ at (1,4,2) and (–3,–3,3). **[5]**

b) Find the directional derivative of $\varphi = x^2 - y^2 - 2z^2$ at the point p(2,–1,3), in the direction PQ where Q is (5,6,4). **[5]**

c) Show that the vector field $\bar{F} = (8xy + z^4)\,\bar{i}\ (4x^2 - 2)\bar{j} + (4xz^3 - y)\,\bar{k}$ is irrotational. Find scalar potential function φ. **[5]**

OR

Q5) a) Find directional derivative of $\varphi = e^{2x} \cos(yz)$ at the origin in the direction

tangent to the curve $\bar{r} = a \sin t + \bar{i} + a \cos t\ \bar{j} + at\ \bar{k}$ at $t = \dfrac{\pi}{4}$. **[5]**

b) Prove that $\bar{b} \times \nabla(\bar{a} \cdot \nabla \log r) = \dfrac{\bar{b} \times \bar{a}}{r^2} - \dfrac{2(\bar{a} \cdot \bar{r})}{r^4}(\bar{b} \times \bar{r})$. **[5]**

c) Find angle between the tangents to the curve $\bar{r} = t^2\bar{i} + 2t\bar{j} - t^3\bar{k}$ at the points $t = 1$ and $t = -1$. **[5]**

Q6) a)   Apply Green's theorem to evaluate :

$$\int_C (x^2 dx + xy dy)$$

Where C is the curve of region enclosed by $y = x^2$ and the line $y = x$.

[5]

b)   Using Gauss - Divergence theorem, evaluate :   **[5]**

$$\iint_S (x^3\overline{i} + y^3\overline{j} + z^3\overline{k}) \circ d\overline{s}$$

Over the surface of $x^2 + y^2 + z^2 = 1$.

c)   Using Stoke's theorem, evaluate :   **[5]**

$$\iint_s (\nabla \times \overline{F}) \circ \hat{n}\, ds$$

for $\overline{F} = (x^2 + y - 4)\overline{i} + 3xy\,\overline{j} + (2xz + z^2)\overline{k}$ over the surface of hemisphere $x^2 + y^2 + z^2 = 16$ above the XOY - plane.

OR

Q7) a)   Find the work done in moving a particle once around the ellipse $\dfrac{x^2}{25} + \dfrac{y^2}{16} = 1$, $z = 0$ under the field of force given by

$$\overline{F} = (2x - y + z)\overline{i} + (x + y - z^2)\overline{j} + (3x - 2y + 4z)\overline{k}.$$ **[5]**

b)   Using Gauss - Divergence Theorem, show that   **[5]**

$$\iiint_V \frac{1}{r^2}\, dV = \iint_S \frac{\overline{r}}{r^2} \circ \hat{n}\, ds$$

c)   Using stoke's theorem, evaluate   **[5]**

$$\iint_s (\nabla \times \overline{F}) \circ d\overline{s}$$

Where $\overline{F} = (x^3 - y^3)\overline{i} - xyz\overline{j} + y^3\overline{k}$ and S is the surface

$x^2 + 4y^2 + z^2 - 2x = 4$ above the plane $x = 0$.

Q8) a) If $u = \dfrac{1}{2} \log (x^2 + y^2)$, find V such that $f(z) = u + iv$ is analytic function. Express $f(z)$ in terms of z. **[5]**

b) Use Cachy's integral formula to evaluate $\oint_C \dfrac{e^z}{z+2} dz$ where C is the circle $|z + 2| = 2$. **[5]**

c) Find the bilinear transformation which maps the points 0,1,2 from z plane on to the points $1, \dfrac{1}{2}, \dfrac{1}{3}$ of the W - plane. **[5]**

OR

Q9) a) Show that the analytic function $f(z)$ with constant modulus is constant. **[5]**

b) Use residue theorem to evaluate $\oint_C \dfrac{e^z}{(z+1)(z+2)} dz$ where C is the contour $|z + 1| = \dfrac{1}{2}$. **[5]**

c) Show that the transformation $w = z + \dfrac{1}{z} - 2i$ maps the circle $|z| = 2$ into an ellipse. Find centre, semi-major and semi-minor axes of ellipse **[5]**

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[5925]-212
S.E. (E & TC/Electronics)
ELECTRONIC & CIRCUITS
(2019 Pattern) (Semester-III) (204181)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*

    2)   *Figures to the right indicate full marks.*

    3)   *Assume suitable data, if necessary.*

    4)   *Neat diagrams must be drawn wherever necessary.*

Q1) a)   Explain with diagram the operation of an adjustable voltage regulater using IC LM 317.   **[7]**

    b)   Design the adjustable voltage regulator for the following specification output voltage = 5V – 10V I_0 = 1.2 A, I_{adj} = 100µA, R_1 = 240Ω.   **[7]**

    c)   What is SMPS? Explain working principle of it.   **[4]**

OR

Q2) a)   Draw and explain the block diagram of LM 337 and list the specification of it?   **[7]**

    b)   Determine the range of output voltage for adjustable voltage regulator LM317 for R_1 = 240Ω, R_2 = 4.7 kΩ Assume I_{adj} = 100 µA.   **[7]**

    c)   Which are the factor that affect on the output of the voltage regulator?**[4]**

Q3) a)   List different configuration of differential amplifier and explain dual input dual output in details?   **[7]**

    b)   Define the characteristics of op-amp   **[6]**

        i)   Input bias current

        ii)   Slew rate

        iii)   CMRR

    c)   Find the 'Q' point for a dual input balanced output differential amplifier with RC = RE = 65 kΩ. supply voltage used is ± 1s V.   **[4]**

OR

Q4) a) Explain the need of level shifting stage in op-amp. Explain any one circuit for the same. **[7]**

b) Draw and explain voltage series feedback amplifier and list their advantages. **[6]**

c) Explain the concept of current mirror circuit? **[4]**

Q5) a) Draw an inverting summing amplifier with three inputs and derive expression for its output voltage Vo? **[8]**

b) Design a practical integrator with input signal of 2VPP and cutoff frequency of 2.5 kHz. for DC voltage gain to 10. **[6]**

c) Explain with diagram the concept of voltage follower circuit using op-amp. **[4]**

OR

Q6) a) Draw and explain an Instrumentation amplifier interface with RTD bridge for temperature measurement. **[8]**

b) Using IC 741 op-amp with supply voltage of ±15V design an inverting schmitt trigger circuit to have V_{UTP} = +3V, V_{LTP} = –3V. **[6]**

c) What is the difference between inverting and non-inverting amplifier. **[4]**

Q7) a) Classify different types of ADC and explain iwth diagram dual scope ADC. **[6]**

b) Calculate the O/P voltage for a DAC whose output range is 0 to 10 V and input binary number 1001. **[6]**

c) Explain various specification of ADC. **[5]**

OR

Q8) a) Explain with neat diagram the register weighted and R-2R DAC? **[6]**

b) For on 10 bit successive approximation type A/D converter driven by a 2MHz clock, find the conversion time? **[6]**

c) Draw and explain V to I convertor. **[5]**

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[5925]-213

S.E. (Electronics/E & T.C/Electronics & Computer)
DIGITAL CIRCUITS
(2019 Pattern) (Semester-III) (204182)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
   1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
   2) *Neat diagrams must be drawn wherever necessary.*
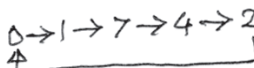   3) *Figures to the right indicate full marks.*

Q1) a) Draw the logic diagram of full-adder and its truth table.   **[7]**

   b) Implement a full-adder using Demultiplexer.   **[5]**

   c) Implement the given logic function using a 4:1 multiplexer   **[5]**

$$f(A,B,C) = \sum m(0,2,4,6)$$

OR

Q2) a) Explain the working of a half-adder? Draw its logic diagram.   **[7]**

   b) Implement the full subtractor using a 1:8 demultiplexer.   **[5]**

   c) Implement the following function using multiplexer   **[5]**

$$f(A,B,C) = \sum m(0,2,4,6)$$

Q3) a) Design a sequence generator using T FFs. $0 \to 1 \to 7 \to 4 \to 2$ **[8]**

   b) Explain the types of shift register.   **[5]**

   c) Explain with diagram the working of D type Flip-flop. Give its truth table.
                                                                            [5]

OR

Q4) a) Design a 3-Bit synchronous counter using JK FF.   **[8]**

   b) With the neat diagram, explain the working operation of 4-bit SISO. **[5]**

   c) Explain S-R flip-flop using NOR gates.   **[5]**

Q5) a) Design the clocked sequential circuit for the state diagram using JK flip flop. **[9]**
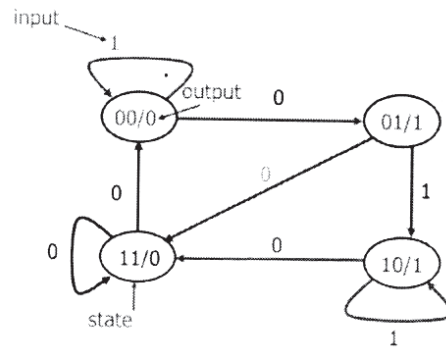
b) Draw ASM chart for 2 bit binary counter having one enable line E such that: E=1, **[8]**

c) Count Enable and E=0, Count Disable.

<p style="text-align:center">OR</p>

Q6) a) Design a sequence detector to detect a sequence 1101 using D FF **[9]** (Use Moore machine).

b) Explain in short: **[8]**
   i)   State Assignment
   ii) ASM chart

Q7) a) Explain the classification based on their physical characteristics. **[8]**
b) Explain the concept of PLA with the help of a block diagram. **[10]**
<p style="text-align:center">OR</p>
Q8) a) Explain the meaning of static and dynamic memories. State their applications. **[8]**
b) Describe with neat diagram AND-OR structure of PLA and PAL. **[10]**

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[5925]-214
S.E. (E & TC)
ELECTRICAL CIRCUITS
(2019 Pattern) (Semester - III) (204183)
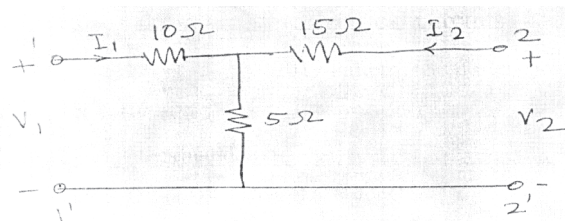
Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagram must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Find the Z Parameters for the Network Shown.   **[8]**

b) Give basic definition of Y parameters explain why Y parameters are called short circuit admittance parameters.   **[6]**

c) Explain the condition of Reciprocity & Symmetry by giving Example. **[6]**

OR

Q2) a) Find Y parameters or the Network Shown.   **[8]**
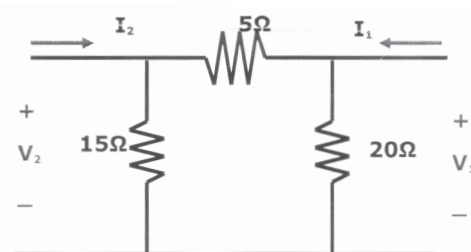
b) Give the applications of Two Port Network Parameters.   **[6]**
c) Explain Network stability.   **[6]**

P.T.O.

Q3) a) What is back emf in DC motor? State its significance? **[8]**

   b) Derive torque equation of DC motor? **[8]**

OR

Q4) a) Explain the various methods of speed control of Dc series motor? **[8]**

   b) Draw neat diagram and explain operation of 3 pt. Starter? **[8]**

Q5) a) Explain the construction of three phase induction motor? **[8]**

   b) Explain speed control using v/f method. **[8]**

OR

Q6) a) Derive the torque equation for the three-phase induction motor? **[8]**

   b) Explain Construction and working Principle of single-phase induction motor. **[8]**

Q7) a) Explain the construction and working principle of BLDC motor. Also draw the Speed Torque Characteristics. **[10]**

   b) Write Note on 'Electric Vehicles' **[8]**

OR

Q8) a) Explain the construction and working principle of Stepper motor. Also draw the Speed Torque Characteristics. **[10]**

   b) Explain any Electric vehicle in detail. **[8]**

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[5925]-215

S.E. (E & TC/Electronics)
DATA STRUCTURES
(2019 Pattern) (Semester - III) (204184)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) What is ADT? Explain stack as an ADT. **[4]**

b) Write a structure for stack using array. Write PUSH and POP function for stack using array. **[8]**

c) Evaluate following postfix expression with the help of stack. **[6]**

5 3 + 6 2/*3 5*+

OR

Q2) a) What is Queue? Explain insertion and deletion operation in Queue with suitable diagram. **[6]**

b) Explain with example: **[6]**
   i) Linear Queue
   ii) Circular Queue

c) Write C functions for : **[6]**
   i) Enqueue in Linear Queue
   ii) Dequeue in Circular Queue

Q3) a) Write structure definition for single Linked list. Differentiate between static memory and dynamic memory allocation. **[6]**

b) Write following C functions in SLL: **[6]**
   i) Insert a node at the beginning
   ii) Delete a node at the end

c) State the limitations of single linked list. Represent following polynomial using linked list. **[5]**

$$20x^9 + 15x^7 + 10x^5 + 5x + 50$$

OR

Q4) a) Write structure definition for double Linked list. Differentiate between array and linked list. **[6]**

b) State the limitations of array. Draw and explain double linked list. **[5]**

c) Write following C functions in circular in SLL. **[6]**

    i) Insert a node at the end

    ii) Delete all nodes in the list

Q5) a) Define binary tree. Explain following terms with suitable examples: **[7]**

    i) Root node

    ii) Left and right sub tree

    iii) Depth of tree

b) Construct the Binary Search Tree (BST) from the following data: **[5]**

CAR, BAG, MAN, ADD, SAD, FAN, TAN

c) Write recursive function for in-order, pre-order and post-order traversal of Binary tree. **[6]**

OR

Q6) a) Define the following terms with suitable example with respect to Binary tree: **[6]**

    i) Strictly Binary Tree

    ii) Completely Binary Tree

    iii) Binary Search Tree

b) Construct the binary search tree (BST) from the following elements: **[6]**

45, 20, 80, 40, 10, 90, 70

Also, show pre-order and post-order traversal for the same.

c) What is AVL tree? Explain all the rotations in AVL tree. Construct AVL tree for the following data: **[6]**

1, 2, 3, 4, 5, 6

Q7) a)   What do you mean by adjacency matrix and adjacency list? Give the adjacency matrix and adjacency list for the graph shown below: **[6]**
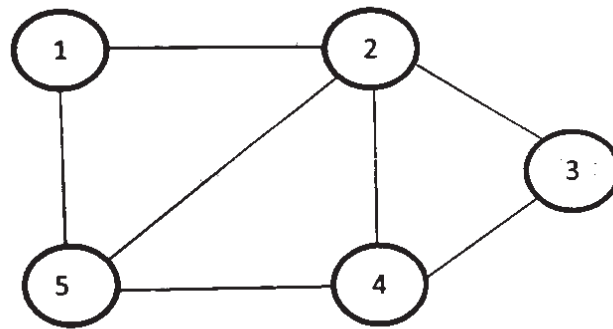
Fig. 1

b)   Explain with suitable example, DFS and BFS traversal of a graph.   **[5]**

c)   Define with an example: **[6]**

i)   Undirected Graph

ii)   Directed Graph

iii)   Weighted Graph

OR

Q8) a)   Define indegree and outdegree of a vertex in graph. Find the indegree and outdegree of following graph.   **[6]**

Fig 2

b) Find out Minimum Spanning Tree of the following graph (figure 3) using Kruskal's algorithm. **[6]**

Fig 3

c) Find the shortest path from node 'a' to all nodes in the graph shown in fig.4 using Dijkstra's algorithm. **[6]**
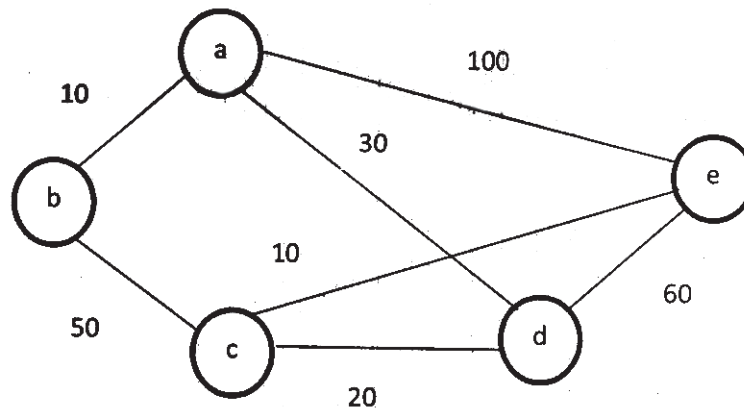
Fig 4

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[5925]-216

S.E.(Electronics & Computer/Electronics/E&TC)
SIGNALS AND SYSTEMS
(2019 Pattern) (204191) (Semester - IV)

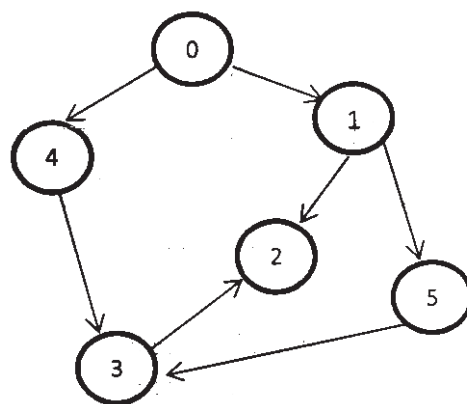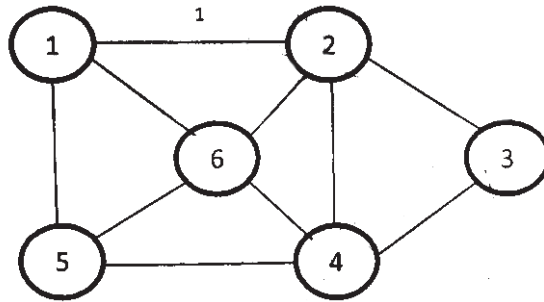*Time : 2½ Hours]*   *[Max. Marks : 70*
Instructions to the candidates:
1) *Neat diagrams must be drawn wherever necessary.*
2) *Figures to the right indicate full marks.*
3) *Use of logarithmic tables, slide - rule, Mollier charts, electronic pocket calculator steam tables is allowed.*
4) *Assume suitable data, if necessary.*

Q1) a) What is Fourier series. Write formula for exponential and Trignometric Fourier series. **[6]**

b) State and explain following properties. **[6]**
   i) Time reversal
   ii) Time Differentiation
   iii) Convolution

c) Determine the FS representation for the signal with periodic wave, shown below using exponential method. **[6]**
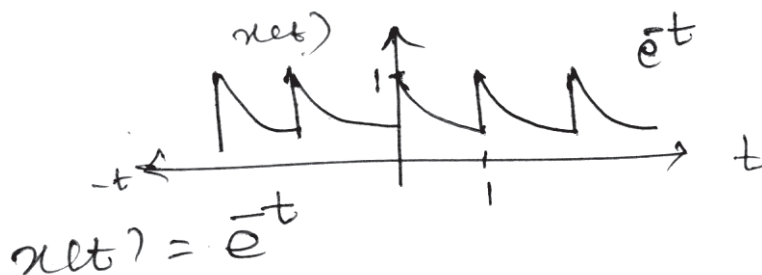
Q2) a) Find the trignometric Fourier series for the periodic signal $x(t)$ given below. **[8]**
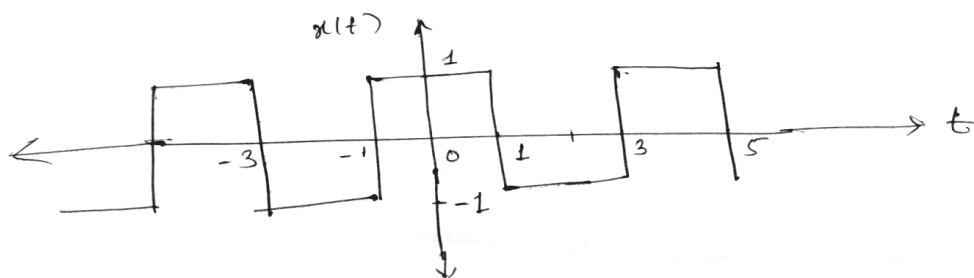
b) State the following properties of CTFS. [6]

    i)   Time scaling

    ii)   Time Integration

    iii) Modulation

c) Explain Gibb's phenomenon of Fourier series. [4]

Q3) a) Find the Inverse Fourier Transform using partial fraction expansion.[7]

$$X(jw) = \frac{1}{(jw)^2 + 5jw + 6}$$

b) Find the Fourier Transform of a constant signal AO. [6]

c) Find the Fourier Transform of a [4]

    i) $x(t) = \delta(t) + u(t)$

    ii) $x(t) = u(-t)$

    Using properties of F.T.

Q4) a) State any six properties of Fourier Transform. [6]

b) Find the Fourier Transform of the signum function. [7]

c) Obtain the Inverse Fourier Transform of [4]

$$X(jw) = \frac{2}{jw+1} + \frac{1}{jw+2}.$$

Q5) a) Find the Laplace Transform and find ROC. [6]

$$x(t) = e^{-3t}u(t) + e^{-2t}u(t)$$

b) State and explain Initial value theorem and final value theorem. [6]

c) Find the Inverse Laplace Transform of $X(s) = \dfrac{2}{(s+4)(s-1)}$ if the ROC

is $-4 \le R_e(s) < 1$. [6]

OR

Q6) a) Find the Laplace Transform of the signal drawn below Find ROC. **[6]**
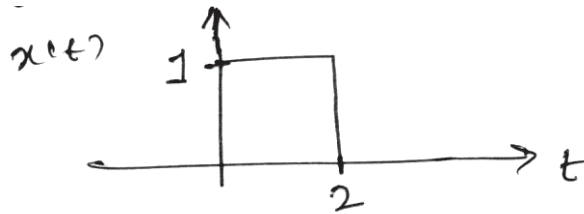
b) Solve the differential equation $\dfrac{dy(t)}{dt}+3y(t)=x(t)$ for input $x(t)=e^{-2t}u(t)$. Assume zero initial conditions. **[6]**

c) Find the Laplace Transform of following using the properties. **[6]**

  i) $x(t)=\dfrac{d}{dt}u(t)$

  ii) $x(t)=u(t+1)$

Q7) a) Define the following terms: **[6]**

  i) Probability

  ii) Joint Probability

  iii) Conditional probability

b) A coin is tossed three times. Write the sample space which gives all possible out comes. A random variable X. Which represents the number of heads obtained on any tripple toss. Calculate and draw the CDF and PDF. **[7]**

c) In a pack of cards, 2cards are drawn simultaneously. What is the probability of getting a Queen and Jack combination. **[4]**

<center>OR</center>

Q8) a) Define probability. Also write the properties of probability. **[5]**

b) A perfect die is thrown. Find the probability that **[6]**

  i) You get even number

  ii) You get perfect square

c) The probability density function of a random variable 'X' is given by

$$f_x(x) = \frac{1}{a} \qquad |x| \leq a$$
$$= 0 \qquad \text{otherwise}$$

[6]

Determine :   i)   Mean

ii)   Mean square

iii)   Standard deviation

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[5925]-217

S.E. (E & TC)

CONTROL SYSTEMS

(2019 Pattern) (Semester - IV) (204192)

Time : 2½ Hours]
Instructions to the candidates:
    1) *Solve questions Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
    2) *Figures to the right side indicate full marks.*
    3) *Assume the suitable data, if necessary.*

[Max. Marks : 70

Q1) a) Using Routh's & Hurwitz's criteria, comment on the stability if characteristic equation is: $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16$. **[8]**

    b) Sketch root locus of the unity feedback system with open loop transfer function $G(S) = \dfrac{K}{S(S+1)(S+4)}$. **[10]**

OR

Q2) a) The open loop transfer function of the unity feedback system is $G(S) = \dfrac{200}{s(s^3 + 6s^2 + 11S + 6)}$ Using Routh criterion determine stability of the system. **[8]**

    b) A unity feedback system has the loop transfer function, $G(S) = \dfrac{k}{s(s+1)(s+3)(s+4)}$ Determine: Breakaway points, intersection with imaginary axis. Plot root locus. **[10]**

Q3) a) For an Unity feedback System with open loop transfer function $G(S) = \dfrac{4}{s(s+2)}$. Determine Damping factor, Undamped natural frequency, reason peak, resonant frequency. **[9]**

    b) Explain Nyquist Stability Criterion. **[8]**

OR

Q4) a) If $G(S)H(S) = \dfrac{1}{s(s+1)}$. Find Resonance peak and resonance frequency. **[9]**

b) Explain Advantages of frequency Domain Analysis. **[8]**

Q5) a) Obtain the expression for state transition matrix using Laplace transform method and state any four properties of state transition matrix. **[9]**

b) Find Controllability and Observability of the system given by state model.

$$A = \begin{bmatrix} 1 & 1 & 5 \\ 1 & -2 & 2 \\ 5 & 2 & -8 \end{bmatrix}, B = \begin{bmatrix} 5 \\ 1 \\ 10 \end{bmatrix}, C = \begin{bmatrix} 10 & 15 & 11 \end{bmatrix}, D = [0] \qquad \textbf{[9]}$$

OR

Q6) a) Obtain the state model for the system with transfer function

$$\frac{Y(s)}{U(s)} = \frac{3S+4}{s^2 + 5S + 6}. \qquad \textbf{[9]}$$

b) Determine the transition matrix of state equation $X = \begin{bmatrix} 0 & -3 \\ 1 & -4 \end{bmatrix} x(t)$. **[9]**

Q7) a) Explain Proportional mode, Integral Mode and Derivative Mode. **[9]**

b) What do you mean by Industrial Automation? What are its types? Explain the architecture of an automation. **[8]**

OR

Q8) a) Explain the Ziegler - Nichols tuning method of tuning a PID controller. **[9]**

b) $\dfrac{C(s)}{R(s)} = \dfrac{1}{S^2 + S + 1}$ Compute the T_r, T_p, T_s and $\%M_p$ for the same. Compare the time domain for proportion gain $K_p = 20$. **[8]**

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[5925]-218

S.E. (Electronics/Computer/E & TC) (Semester - IV)
PRINCIPLES OF COMMUNICATION SYSTEMS
(2019 Pattern) (204193)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:
1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) Explain with the help of neat block diagram Armstrong method of FM generation. **[6]**
b) Differentiate between NBFM and WBFM. **[6]**
c) Explain Pre-emphasis and De-emphasis in detail. **[6]**

OR

Q2) a) With the help of Block diagram explain superheterodyne FM receiver.**[6]**
b) With neat phasor diagram explain balanced slope detector in FM. **[6]**
c) A frequency modulated signal is given by **[6]**

$$x_c(t) = 10\cos\left\{\left[2\pi \times 10^8 t\right] + s\sin\left[2\pi \times 200t\right]\right\}$$

Determine :
   i) The carrier frequency.
   ii) Peak frequency deviation
   iii) The modulation Index

Q3) a) Discuss PWM generation and detection in detail. **[6]**
b) Distinguish between PAM, PWM and PPM. **[5]**
c) What is aliasing? How can it be avoided. **[6]**

OR

Q4) a) Explain Flat-top sampling with waveforms. **[6]**

b) State and explain the sampling theorem in detail when fs > 2fm, fs = 2fm, fs = 2fm. **[5]**

c) Distinguish between Ideal sampling, Natural sampling and Flat-Top sampling. **[6]**

Q5) a) Describe with suitable block diagram pulse code modulation transmitter. **[6]**

b) Explain need of digital communication. **[6]**

c) Describe compading methods µ-law and A - law. **[6]**

OR

Q6) a) Draw and explain PCM Receiver. **[6]**

b) Distinguish between DM and ADM. **[6]**

c) Explain in detail distortion in delta Modulation. **[6]**

Q7) a) Draw and explain CCITT hierarchy of multiplexing. **[6]**

b) Draw line code formats for 10110100. **[6]**

    i)   Rz Unipolar   ii)   NRZ polar

    iii) Rz polar   iv)   Alternate Mark inversion

c) Draw and explain frame synchronizer. **[5]**

OR

Q8) a) What is an eye diagram? Explain the use of eye diagram to measure ISI. **[6]**

b) Explain scrambling and unscrambling with diagram in detail. **[6]**

c) Discuss the properties of line codes. **[5]**

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[5925]-219

S.E. (Electronics/E & TC/Electronics & Computer)
OBJECT ORIENTED PROGRAMMING (2019 Pattern) (Semester - IV) (204194)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) What are the rules for overloading operators? **[4]**

    b) Write down a C++ program to implement operator overloading for complex class. **[8]**

    c) Explain Friend function with example. **[6]**

<div align="center">OR</div>

Q2) a) What is operator overloading? Write a program to overload Unary operator. **[8]**

    b) Write down a C++ program for copy constructor for string class. **[6]**

    c) Differentiate friend function with normal function of the class. **[4]**

Q3) a) Explain containment and Inheritance along with examples. **[6]**

    b) What is Virtual function? Explain how to achieved run time polymorphism. **[6]**

    c) Explain function over loading & function overriding in detail. **[6]**

<div align="center">OR</div>

Q4) a) What does inheritance mean in C++? Give an example of each. **[6]**

b) What is polymorphism? Explain with example to achieved run time polymorphism. **[6]**

c) Write copy constructor for Employee class, in which objects of string class and Date class are the Data members. **[6]**

Q5) a) What is a user defined exception? Write down the scenario where we require use define exceptions. **[6]**

b) What is namespace? To demonstrate namespace with example. **[6]**

c) Explain class template & function template with example. **[5]**

OR

Q6) a) What is stream? Explain types of streams available in C++. **[6]**

b) Explain namespace in C++ with example? **[6]**

c) Compare late binding & early binding. **[5]**

Q7) a) Explain error handling during file operations. **[6]**

b) Write a program using put ( ) to write characters to a file until user enteres a dollar sign. **[6]**

c) Write a note on file operating modes. **[5]**

OR

Q8) a) Explain manipulators for file handling in C++? **[5]**

b) What is file pointer? Write a note on file opening & file closing. **[6]**

c) Explain stream classes hierarchy for file handling in C++. **[6]**

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[5925]-220

S.E. (Electronics & Computer Engineering)
ELECTRONICS CIRCUITS
(2019 Pattern) (Semester-III) (204202)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*

Q1) a)   Draw the block diagram of LM317 and explain in detail.   **[6]**

   b)   Explain SMPS with block diagram.   **[6]**

   c)   Expain current boosting voltage regulator using LM317.   **[6]**

                                    OR

Q2) a)   Explain adjustable voltage regulator using LM317.   **[6]**

   b)   Compare linear and switching mode power supply.   **[6]**

   c)   Explain low drop out regulator with neat diagram in detail.   **[6]**

Q3) a)   Draw the block diagram of op-amp and explain in detail.   **[6]**

   b)   Define and explain the following op-Amppovameter   **[6]**

      i)   Input offset voltage

      ii)   CMRR

      iii) Slew Rate

   c)   Draw the circuit diagram of current mirror and explain in detail.   **[5]**

                                    OR

Q4) a)   Explain the following parameter of OP-AMP   **[6]**

      i)   PSRR

      ii)   Gain bandwidth product

      iii) Input bias current

   b)   Explain the circuit diagram of level shifter.   **[5]**

   c)   Draw the circuit diagram of dual input balance output differential amplifier and explain in detail.   **[6]**

Q5) a) Draw the circuit diagram of full wave preusion rectifier and Explain. **[6]**

b) Explain zero crossing detector using OP-AMP with necessary waveform. **[6]**

c) Explain ciruit diagram of schmitt trigger with waveform. **[6]**

OR

Q6) a) Draw the circuit diagram of three OP-AMP instrumentation amplifier and write its output equation. **[6]**

b) Explain practical differentiator circuit with neat circuit diagram. What are the limitation of ideal differentiator. **[6]**

c) List the important characteristics of comparator. What are the advantages of schmitt trigger over comparator. **[6]**

Q7) a) Define the following terms w.r.t PLL. **[6]**

i) Free ranning frequency.

ii) Lock Range

iii) Capture Range

b) Draw the block diagram of PLL and explain each block in detail. **[5]**

c) List the various method of conversion compare them and which one is fastest. **[6]**

OR

Q8) a) Draw the block diagram of IC PCL 565 and explain in detail. **[5]**

b) Write the short note on application of PLL **[6]**

i) Frequency multiplier.

ii) FM demodulater

c) Draw and explain successive approximation A/D converter. **[6]**

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[5925]-221

S.E. (Electronics and Computer Engineering)
DATA STRUCTURES AND ALGORITHMS
(2019 Pattern) (Semester - III) (204184)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
  1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
  2) *Figures to the right indicate full marks.*
  3) *Assume suitable data, if necessary.*

Q1) a)   Define Queue and explain any one application of Queue.   **[6]**

   b)   Give the postfix and prefix expression $(a+b*c)/(x+y/z)$ **[6]**

   b)   Explain the working of circular queue.   **[5]**

OR

Q2) a)   Construct a function PUSH and POP in 'C' for stack using array.   **[6]**

   b)   Compare stack with Queue.   **[6]**

   b)   Explain types of queues. Write any one in detail.   **[5]**

Q3) a)   Distinguish singly linked list and doubly linked list.   **[6]**

   b)   Construct a singly linked list with its 'C' function to delete a number.**[6]**

   c)   Describe a circular linked list.   **[5]**

OR

Q4) a)   Explain a 'C' function to Insert node in singly linked list.   **[6]**

   b)   Explain a 'C' function to Insert a number in doubly linked list.   **[6]**

   c)   Describe a Link List as ADT.   **[5]**

Q5) a) Explain a binary tree. Name and explain with suitable example the following terms: **[6]**
  i) Root node
  ii) Left sub tree and right sub tree
  iii) Depth of tree

b) Construct the binary search tree (BST) from the following elements. **[6]** 10, 60 40, 28, 14, 50, 6.

c) Explain a 'C' function to insert node in BST (Binary Search Tree). **[6]**

OR

Q6) a) Define the following terms with example with respect to Binary Tree: **[6]**
  i) Strictly Binary Tree
  ii) Completely Binary Tree
  iii) Binary Search Tree

b) Construct the binary search tree from the following elements **[6]** 5, 2, 8, 4, 1, 9, 7 Also show preorder, inorder and postorder traversal for the same.

c) Define Binary Tree. What are its types? Explain with suitable figures. **[6]**

Q7) a) Explain with suitable example the techniques to represent a Graph. **[6]** Note : Consider graph of minimum 6 vertices.

b) Explain Dijkstra's Algorithm with suitable example. **[6]**

c) Explain with suitable example BSF and DSF traversal of graph. **[6]**

OR

Q8) a) Defind the term Graph. With the help of suitable example explain adjacency matrix representation and adjacency list representation of a graph. **[6]**

b) Find minimum spanning tree for the following graph using Prim's Algorithm. **[6]**
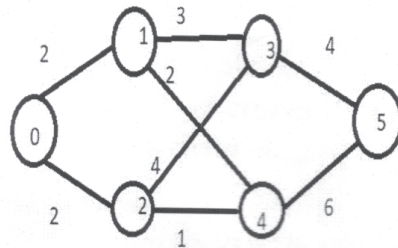
c) Explain an algorithm to find in-degree and out-degree of a vertex with a suitable example. **[6]**

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[5925]-222

S.E. (Electronics & Computer Engineering)
COMPUTER ORGANIZATION
(2019 Pattern) (Semester - III) (204203)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Enlist the functions of the I/O Module. Draw and Explain I/O Module Structure.   **[10]**

   b) Enlist the feature of the Programmable Interrupt Controller Intel 82C59A.**[7]**

OR

Q2) a) Compare Program driven I/O and Interrupt driven I/O. Enlist functions of the DMA controller.   **[10]**

   b) Brief the features of Intel 8237A DMA Controller.   **[7]**

Q3) a) Explain the following types of operations in 8086 with the help of suitable instruction for each type. Data transfer, arithmetic, logical, input-output, and transfer of control.   **[10]**

   b) Draw the architecture of 8086. And enlist the features of it.   **[8]**

OR

Q4) a) Explain the following types of Addressing modes with the help of suitable instructions in 8086. Immediate, direct, indirect, register, register indirect, displacement, and stack.   **[10]**

   b) Explain the instruction Formats in 8086 with examples of suitable instructions. What is Operand? Enlist types of operands.   **[8]**

P.T.O.

Q5) a) What is instruction-level parallelism? What is the difference between superscalar and pipelined? **[5]**

b) Explain different types of hazards that occur in a pipeline. **[5]**

c) Explain instruction level and machine parallelism. **[7]**

OR

Q6) a) Draw and explain the flowchart of four segment instruction pipelining.**[10]**

b) Explain Register organization of microprocessor 8086. **[7]**

Q7) a) Draw and explain the single bus organization of the CPU. **[5]**

b) Write pseudo-micro-steps for the following operations. Register transfer and fetching a word from memory. **[5]**

c) What are Micro instructions? Draw and explain micro-programmed control unit design. **[8]**

OR

Q8) a) Write and explain a control sequence for the following instructions for a single bus organization. ADD (R3), R1. Assuming R1 as the destination.**[10]**

b) What is Microprogram sequencing? Differentiate between Hardwired control and Microprogrammed control. **[8]**

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[5925]- 223

S.E.(Electronics & Computer)
Principles of Programming Language
(2019 Pattern) (Semester-IV) (204206)

Time :2½Hours]   *[Max. Marks : 70*
Instructions to candidates:
1) *Solve question Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6,and Q.7 or Q.8.*
2) *Figures to the right side indicate full marks.*
3) *Assume the suitable data, if neccessary.*

Q1) a) What is mean by Encapsulation ? Explain with example. **[8]**

     b) Compare Pascal ,c,c++ language to explain features for programming in the large? **[10]**

<div align="center">OR</div>

Q2) a) Write a difference between procedural and object oriented programming. **[8]**

     b) Consider a generic function swap (x,y) which interchanges the values of its two arguments. Write a bubble sort in c++that uses swap to inter change the elements. **[10]**

Q3) a) What is mean by primitive data type and list out primitive data types available in Java with example? **[9]**

     b) List out the Java features. **[8]**

<div align="center">OR</div>

Q4) a) Explain the following concept. **[9]**
       (i) Variable.
       (ii) Dynamic Initialization of variable.
       (iii) The scope and life time of variable .

     b) Write a Java program to accept values inside the multidimensional array. **[8]**

Q5) a) What are different types of inheritance supported by Java. **[9]**
         Explain multilevel inheritance with example.

b) How   todefine a package ? How to access ,import a package?   **[9]**
   Explain with examples.

<div align="center">OR</div>

Q6) a) Explain method overriding with a suitable example program.   **[9]**

b) With suitable program segments describe the usage of 'Super' Keyword
   [9]

Q7) a) What is Exception handing? How to handle Exception in Java?   **[9]**

b) Write difference between throw and throws.   **[8]**

<div align="center">OR</div>

Q8) a) Explain reading character and string from input console with suitable
   examples.   **[9]**

b) What is applet ? What is difference between applet and application? **[8]**

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S.E. (Electronics and Computer)
SYSTEM PROGRAMMING AND OPERATING SYSTEMS
(2019 Pattern) (Semester-IV) (204207)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
   1)   Assume suitable data wherever required.
   2)   Figures to the right indicate full marks.

Q1) a)   Consider the following processes where arrisal and barst time are as given below. Calculate the average waiting time and average turn around time if the processes are scheduled using FCFS.   **[6]**

Process	Burst Time	Arrival time
P1	6	0
P2	4	1
P3	7	3
P4	2	5

   b)   Explain Pre-emptive shortest Job First scheduling algorithm in detail.
                                                                              [6]

   c)   List various types of OS with their basic functions.   **[6]**

<div align="center">OR</div>

Q2) a)   Consider the following processes arrival time and burst time as shown below in table. Calculate average waiting time and average turn around time if Quantum time is 2. Use Round Robin Algorithm. Draw GANTT chart.   **[6]**

Process	Burst Time	Arrival time
A	5	0
B	4	2
C	7	4
D	6	6

   b)   Explain 5 state Process model.   **[6]**

   c)   Explain types of thread in detail.   **[6]**

Q3) a) State and explain the conditions for deadlock to occur. **[6]**

b) Find out the safe sequence for the execution of the following processes using Banker's algorithm. Maximum Resources R1=15, R2=8. **[6]**

Allocation Matrix			Maximum Required		
	R1	R2		R1	R2
P1	2	1	P1	5	6
P2	3	2	P2	8	5
P3	3	0	P3	4	8

c) Write short note on : Producer-consumer Problem. **[5]**

OR

Q4) a) Banker's algorithm is used for deadlock avoidance. Explain. **[6]**

b) Define deadlock. Explain the methods for deadlock prevention. **[6]**

c) Write short note on "The Ostrich algorithm". **[5]**

Q5) a) Explain the need of demand paging with advantages. **[6]**

b) Explain the concept of page replacement algorthm. List the different page replacement algorithms. **[6]**

c) Consider the following page reference string A,B,C,D,A,B,E,A,B,C,D,E. Calculate page fault with FIFO page replacement algorithm when frame size is 4. **[6]**

OR

Q6) a) Consider the following page reference string 1, 2, 3, 1, 4, 5, 6, 2, 1, 3, 2,7, 6, 3, 4, 1, 2, 6 Number of page frame =6. Calculate Page fault and Hit ratio using LRU page replacement algorthm. **[6]**

b) Explain LRU page replacement algorithm in detail. **[6]**

c) Explain the virtual memory. **[6]**

Q7) a) Give classification of Input-output Devices. Explain any four properties of classification used for I/O devices. **[8]**

b) Explain in detail file systems and its implementation. **[9]**

OR

Q8) a) Explain file attributes. **[5]**

b) Write short note on: **[6]**
  i) RAID disk
  ii) Disk Scheduling Methods. **[6]**

[5925]-225

S.E. (Electrical Engineering)
POWER GENERATION TECHNOLOGY
(2019 Pattern) (Semester - III) (203141)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume suitable additional data, if necessary.*
5) *Use of non-programmable calculator is allowed.*

Q1) a) Explain the function of the following component in HPP : **[6]**
- i) Dam
- ii) Penstock.

b) Describe the advantages of hydroelectric power plant. **[4]**

c) The average rate of inflow during 12 months for a river are as under **[8]**

Month	Discharge in m³/s	Month	Discharge in m³/s
January	200	July	1600
February	400	August	1200
March	600	September	2000
April	2400	October	1200
May	1200	November	800
June	1800	December	400

Draw the hydrograph. Determine the average inflow and the power that can be developed at an effective head of 90M. Assume overall generation efficiency to be 80%

OR

Q2) a) Differentiate between Kaplan and Pelton wheel turbine. **[4]**

b) Classify hydro electric power plant based on i) head ii) load **[6]**

c) Describe the types of wind turbine electrical generators. **[8]**

Q3) a) Describe the historical development of wind turbine on Indian level. **[3]**

b) Define cut in, cut out and rated speed as applied in wind energy system with suitable diagram. **[6]**

c) Explain how the wind pattern affects power generation in wind energy systems. **[8]**

OR

Q4) a) Write in brief advantages and disadvantages of wind energy. **[3]**

b) Differentiate between horizontal axis and vertical axis wind turbine. **[6]**

c) Explain grid connected wind energy conversion system with the help of neat diagram. **[8]**

Q5) a) What is the need of solar hybrid system? **[4]**

b) Discuss the working of a parabola collector with neat sketch. **[6]**

c) With the help of diagram explain the concept of solar thermal power plant. **[8]**

OR

Q6) a) Explain impact of temperature and insolation on I-V curves of PV cells. **[4]**

b) Explain flat type solar collector and its application. **[6]**

c) Explain the working of PV cell and Simplest Equivalent Circuit for a Photovoltaic Cell. **[8]**

Q7) a) Write a short note on Ocean thermal energy conversion. **[4]**

b) Explain the process of municipal solid waste to energy conversion. **[6]**

c) Describe the following systems in renewable energy system. **[7]**
   i) Stand alone
   ii) Hybrid stand alone

OR

Q8) a) Write a short note on Geothermal energy. **[4]**

b) Explain grid connected renewable systems and their requirements. **[6]**

c) Explain the process Biomass energy conversion. **[7]**

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[5925]-226

S.E. (Electrical)
MATERIAL SCIENCE
(2019 Pattern) (Semester - III) (203142)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*

    2)   *Figures to the right indicate full marks.*

    3)   *Assume suitable data, if necessary.*

    4)   *Neat diagrams must be drawn wherever necessary.*

Q1) a)   Classify solid insulating materials according to the temperature ranges. Hence write properties and applications of any two materials from Class A type. **[6]**

     b)   State the properties and applications of - **[6]**

         i)   Air

         ii)   Transformer oil

     c)   Explain properties of insulating materials which are used in Cables and Transformers. **[5]**

<p style="text-align:center">OR</p>

Q2) a)   Classify insulating materials and hence write properties and application of any two materials from Class F type. **[6]**

     b)   Explain properties of insulating materials which are used in Capacitor and Rotating Machines. **[5]**

     c)   State the properties and applications of - **[6]**

         i)   Sulphur Hexa Fluoride

         ii)   Askarel

Q3) a)   Define with units **[6]**

         i)   Magnetic dipole moment

         ii)   Magnetization

         iii)   Magnetic susceptibility

     b)   With necessary diagram, classify magnetic materials on the basis of magnetic dipole moment and magnetic susceptibility. **[6]**

     c)   What is Curie temperature? Explain Ferro-magnetic behaviour below critical temperature. **[6]**

<p style="text-align:center">OR</p>

Q4) a) Draw and explain magnetization curve for a ferromagnetic material and hence define with uints **[6]**

   i) Coercive force

   ii) Saturation

  b) In a magnetic material, hysteresis loss is 150 W when maximum flux density of 1.3 tesla and frequency is 50 Hz. What would be hysteresis loss if flux density is decreased to 0.8 tesla and frequency is increased to 60 Hz? Assume that hysteresis loss is proportional to $(B_m)^{1.7}$. **[6]**

  c) Differentiate Soft Magnetic Materials and Hard Magnetic Materials. **[6]**

Q5) a) With the neat diagram, explain principle of working of thermocouple. Give its examples along with the temperature ranges. **[6]**

  b) A filament of a 230V lamp is to be drawn from a wire of having a diameter of 0.025mm and resistivity at 28°C is $5.65 \times 10^{-6}\Omega$-cm. If the resistance temperature coefficient at 280°C is 5×10^{-3}/°C. Calculate the lenght of the filament to dissipate 40W at filament temperature of at 3003°C. **[6]**

  c) State and write properties of electrical carbon materials and materials used for Lamp Filaments. **[5]**

<div align="center">OR</div>

Q6) a) With the neat diagram, explain principle of working of thermal bimetal. Give its examples and applications. **[6]**

  b) State and write properties of materials used for solders and materials used for different types of fuses. **[5]**

  c) Describe properties and applications of Constantan and Brass. **[6]**

Q7) a) Explain with neat diagram - Single Electron Transistor (SET) **[6]**

  b) Describe with neat diagrams - Boron Nano Tubes. **[6]**

  c) Explain Nano materials used in Batteries and Photovoltaic Cells. **[6]**

<div align="center">OR</div>

Q8) a) Describe with neat diagram - Nano wires. **[6]**

  b) Describe with neat diagrams - Carbon clusters. **[6]**

  c) Write a short note on - C_{60}. **[6]**

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[5925]-227

S.E. (Elecrical)
ANALOG AND DIGITAL CIRCUITS ELECTRONICS
(2019 Pattern) (Semester-III) (203143)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of Calculator is allowed.*
5) *Assume Suitable data is necessary.*

Q1) a) Write a short note on FPGA. **[6]**

    b) What is DRAM? What are its advantages and disadvantages? **[6]**

    c) Describe in detial Read Only Memory (ROM). **[6]**

OR

Q2) a) What is semiconductor memory? Enlist advantages of it. **[6]**

    b) Write a short note on sequential memories. **[6]**

    c) Write a short note on CPLD. **[6]**

Q3) a) Explain with neat diagram and output waveforms, Op-Amp as a zero crossing detector? **[5]**

    b) Draw circuit of Op-Amp as V-I converter. Also explain its working. **[5]**

    c) Explain generation of saw tooth waveform using OP-AMP. Draw input & output waveforms. **[8]**

OR

Q4) a) Draw neat diagram of Op Amp as a Schmitt trigger and explain its working. **[5]**

    b) With neat pin diagram explain function of each pin of IC 741 **[5]**

    c) Explain generation of sine waveform using OPAMP. Draw input & output wave froms **[8]**

Q5) a) Explain the function of LM 317 as adjustable voltage regulator. **[5]**

b) With neat diagram explain working of IC 555 as a Astable Multivibrator. **[5]**

c) Explain High pass filter using op-amp with its frequency response. **[7]**

OR

Q6) a) What is voltage regulator? Write any two applications of voltage regulator. **[5]**

b) Explain Low pass filter using op-amp with its frequency response. **[7]**

c) With neat diagram explain working of IC 555 as a Monostable Multivibrator. **[5]**

Q7) a) Explain working of single phase half wave rectifier with RL load. **[5]**

b) Explain the working o single-phase full wave centre tapped rectifier with pure resistive laod. **[7]**

c) Define following terms **[5]**

   i) form factor

   ii) Ripple factor

   iii) TUF

OR

Q8) a) With the help of circuit diagram and relevant waveforms, explain the operation of a 3-phase bridge rectifier with resistive load. **[7]**

b) Compare single phase HWR and single phase FWR. **[5]**

c) Draw neat diagram and explin single phase half wave rectifier with pure resistive laod. **[5]**

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[5925]-228

S.E. (Electrical)

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

(2019 Pattern) (Semester - III) (203144)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Neat diagrams must be drawn wherever necessary.*

    2)   *Figures to the right indicate full marks.*

    3)   *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.*

    4)   *Assume suitable data, if necessary.*

Q1) a)   Explain in detail the working of dynamometer types wattmeter with a neat diagram. Also, state its advantages and disadvantages.   **[9]**

    b)   A 3 - phase, 500 V motor load has a power factor of 0.4. Two wattmeters are connected to measure the input. They show the input to be 30 kW. Find the reading of each instrument.   **[8]**

OR

Q2) a)   Derive the torque equation of dynamometer type wattmeter. Explain the errors and its compensation in dynamometer type wattmeter.   **[9]**

    b)   Two wattmeters connected to measure the input to a balanced 3-phase circuit indicate 2000 W and 500 W respectively. Find the power factor of circuit:

       i)   When both the readings are positive

       ii)   When the latter reading is obtained after reversing the connections to the current coil of first instrument.   **[8]**

Q3) a)   Explain in detail the working and construction of single phase induction type energy meter with a neat diagram.   **[9]**

    b)   What is the need of calibration? Explain one method of calibration of energy meter.   **[8]**

OR

Q4) a) Explain electronic energy meter with a neat diagram. **[9]**

b) What are the different types of errors and adjustments in single phase energy meter? **[8]**

Q5) a) How the following measurement can be done using CRO: **[9]**
   i) Current measurement
   ii) Voltage measurement
   iii) Time period measurement

b) What are the classification of transducers? Explain any 2 in detail. **[9]**

OR

Q6) a) Draw and explain the block diagram of DSO. **[9]**

b) Explain low pressure measurement by McLeod gauge. **[9]**

Q7) a) Explain the construction, and working of LVDT. **[9]**

b) Explain nucleonic method for level measurement with a neat diagram. **[9]**

OR

Q8) a) Explain ultrasonic method for level measurement with a neat diagram. **[9]**

b) Explain foil strain gauge with a neat diagram. Also, state its advantages. **[9]**

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SEAT No. :

[Total No. of Pages : 4

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S.E. (Electrical)

ENGINEERING MATHEMATICS - III

(2019 Pattern) (Semester - III) (207006)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) Question No. 1 is compulsory.
2) Attempt Q.1, Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.
3) Neat diagrams must be drawn wherever necessary.
4) Figures to the right indicate full marks.
5) Use of electronic pocket calculator is allowed.
6) Assume suitable data, if necessary.

Q1) Write the correct option: **[10]**

   a)   Fourier sine transform of $f(x) = e^{-x}$, $x > 0$ is   **[2]**

      i) $\dfrac{3\lambda}{1+\lambda^2}$ ii) $\dfrac{\lambda}{1+\lambda^2}$

      iii) $\dfrac{\lambda}{1-\lambda^2}$ iv) $\dfrac{2\lambda}{1+\lambda^2}$

   b)   Standard deviation of four numbers 9, 11, 13, 15 is   **[2]**

      i)   2   ii)   7

      iii)   4   iv) $\sqrt{5}$

   c)   Second moment μ_2 about mean is   **[1]**

      i)   Mean   ii)   Standard deviation

      iii)   Mean deviation   iv)   Variance

   d)   The value of λ so that the vector field

      $\bar{F} = (2x+3y)\hat{i} + (4y-2z)\hat{j} + (3x - \lambda 6z)\hat{k}$ is solenoidal is   **[2]**

      i)   −6   ii)   1

      iii)   0   iv)   −1

e) If $f(z) = u + iv$ be an analytic function where $u = 4xy$, $v = 2y^2 - 2x^2$ the value of $f(z)$ in terms of z is [1]

i) $4z + 2z^2 i$ ii) $2z^2 i$

iii) $-2z^2 i$ iv) $4z - 2z^2 i$

f) If $f(z) = u + iv$ be analytic function where $u = 4xy$ then its harmonic conjugate v will be [2]

i) $2y^2 - 2x^2$ ii) $2y^2 + 2x^2$

iii) $-2y^2 - 2x^2$ iv) $y^2 - x^2$

Q2) a) Find Fourier Transform of $f(x) = e^{-|x|}$. [4]

b) Attempt any one: [5]

i) Find z-transform of $\left(\dfrac{2}{3}\right)^{|k|}$ for all k

ii) Find inverse z-transform of $F(z) = \dfrac{z^3}{(z-1)(z-2)^2}, |z| > 2$

c) Solve, $f(k+2) + 6f(k+1) + 9f(k) = 2^k$, if $f(0) = f(1) = 0$. [6]

OR

Q3) a) Attempt any one: [4]

i) Find z - transform of $f(k) = k^2 4^k$, $k \geq 0$.

ii) Find Inverse z - transform of $F(z) = \dfrac{z^2}{\left(z - \frac{1}{4}\right)\left(z - \frac{1}{5}\right)}, |z| < \dfrac{1}{5}$.

b) Find the Fourier cosine integral representation of the function,

$$f(x) = \begin{cases} x, & 0 < x < a \\ 0, & x > a \end{cases}$$ [5]

c) Solve the following integral equation, [6]

$$\int_0^\infty f(x) \sin \lambda x \, dx = \begin{cases} 1, & 0 \leq \lambda < 1 \\ 2, & 1 \leq \lambda < 2 \\ 0, & \lambda \geq 2 \end{cases}$$

Q4) a) The first four moments of a distribution about the value 4 are –1.5, 17, –30, 108. Find the moments about the mean and β_1 and β_2. **[5]**

b) Obtain regression line of *y* on *x* for the following data: **[5]**

x	6	2	10	4	8
y	9	11	5	8	7

c) 20% of bolts produced by a machine are defective. Determine the probability that out of 4 bolts. Chosen at random: **[5]**

i) No one is defective

ii) Exactly one is defective

OR

Q5) a) Calculate correlation coefficient for the given data: **[5]**

x	1	2	3	4	5	6
y	6	4	3	5	4	2

b) The random variable X has a Poisson distribution. If $P(X = 1) = 0.01487$, $P(X = 2) = 0.04461$. Then find $P(X = 3)$. **[5]**

c) Suppose heights of students follows normal distribution with mean 190 cm and variance 80 cm². In a school of 1000 students, how many would you except to be above 200 cm tall? (Given, $z = 1.1180$, $A = 0.3686$).**[5]**

Q6) a) Find the directional derivative of $\phi = xy + yz + xz$ at (1, 1, 1) along line

$$\frac{x-1}{2} = \frac{y-1}{1} = \frac{z-1}{2}.$$ **[5]**

b) Show that vector field **[5]**

$\bar{F} = \left(y^2 \cos x + z^3\right)\hat{i} + \left(2y \sin x - 4\right)\hat{j} + \left(3xz^2 + 2\right)\hat{k}$ is irrotational. Also find corresponding scalar potential function ϕ such that $\bar{F} = \nabla\phi$.

c) Evaluate $\int_C \bar{F} \cdot d\bar{r}$ for $\bar{F} = x^2\hat{i} + 2xy\hat{j} + z\hat{k}$ along the curve C $x = t$, $y = t^2$, $z = t^3$ from $t = 0$ to $t = 1$. **[5]**

OR

Q7) a) Find the directional derivative of $\phi = e^{2x-y-z}$ at (1, 1, 1) along the line

$$\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-1}{2}.$$ **[5]**

b) Show that (Any one): **[5]**

i) $\nabla \cdot \left(r\nabla\left(\frac{1}{r^3}\right) \right) = \frac{3}{r^4}$

ii) $\nabla^4 \left(r^2 \log r \right) = \frac{6}{r^2}$

c) Using Green's theorem evaluate $\oint_C \overline{F} \cdot d\overline{r}$ where **[5]**

$\overline{F} = (2x - \cos y)\hat{i} + x(4 + \sin y)\hat{j}$ and C is the ellipse $\dfrac{x^2}{9} + \dfrac{y^2}{16} = 1, \ z = 0$.

Q8) a) If $V = 4xy\left(x^2 - y^2\right)$ is harmonic find its harmonic conjugate and determine F(z) in terms of z. **[5]**

b) Evaluate $\oint_C \dfrac{3z+4}{z(2z+1)} dz$ where c is the circle $|z|=1$. **[5]**

c) Find bilinear transformation which maps the points 1, i, –1 of z-plane onto the points 0, 1, ∞ of w-plane. **[5]**

OR

Q9) a) If $u = x^3 - xy^2$ find its harmonic conjugate and hence determine F(z) in terms in z. **[5]**

b) Evaluate $\oint_C \dfrac{z^3 - 5}{(z+1)^2 (z-2)} dz$ where C is the contour $|z|=3$. **[5]**

c) Find the map of straight line $x = 2y$ under the transformation $w = \dfrac{2z-1}{2z+1}$. **[5]**

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S.E. (Electrical Engineering)
ELECTRICAL MACHINES-I
(2019 Pattern) (Semester-IV) (203146)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*
5) *Use of non-programmable calculator is allowed.*

Q1) a) Give any two points of comparison between LAP winding and WAVE winding for DC machine. **[4]**

b) Draw the power stage diagram of DC motor. Clearly indicate various losses along with respective formulae for the losses. **[6]**

c) A DC Shunt motor develops output power of 7355 watt and runs at 700 rpm. It is connected across 400 volt DC supply and draws a current of 23 Ampere. The mechanical and iron losses are 735.5 Watt. **[8]**

Determine-

i) Efficiency of Motor

ii) Armature resistance of motor

OR

Q2) a) The armature of 4 pole DC shunt motor has LAP winding which is accommodated in 60 slots, each slot carries 20 conductors. **[4]**

If the useful flux per pole is 23 milli Weber, determine the total torque developed by motor in Newton meter. The armature current is 50 Ampere. **[6]**

b) What is meant by back emf in DC motor? State the equation of back emf. Also explain how back emf acts as a regulating mechanism when load on DC motor changes. **[8]**

c) Draw the connection diagram of shunt, series DC motors. State their current & voltage distrubution equations.

P.T.O.

Q3) a) State any one application of-   **[3]**
          i)   DC shunt
          ii)   Series &
          iii) Cumulative compound motor

     b) Sketch & explain the Torque- Armature current characteristics of   **[6]**
          i)   DC shunt motor
          ii)   Series motor.

     c) A 250 V DC Shunt motor takes a current of 6 Ampere and runs at 1200
         rpm. The armature resistance is 0.05 Ohm and shunt filed resistance is
         250 Ohm. Determine the speed of motor when it is loaded and taking a
         current of 31 Ampere.   **[8]**

                                    OR

Q4) a) What is meant by reactance voltage in case of commutation in DC
          machine?   **[3]**

     b) Draw the circuit diagram & explain the speed control of DC shunt motor
         by armature voltage control also draw the nature of graph (Armature
         voltage Vs. speed).   **[6]**

     c) Draw the connection diagram of 3 point starter used for DC shunt motor
         & explain the function of   **[8]**
          i)   Hold on coil &
          ii)   Over load coil

Q5) a) Draw the power flow diagram of 3-ph Induction motor.   **[4]**

     b) A 6 pole, 3 phase induction motor is connected to 400 volt, 50 Hz ac
         supply. Calculate-
          i)   the speed of rotating magnetic field of the motor
          ii)   Speed of motor at 3% slip
          iii) the rotor emf frequency at 3% slip   **[6]**

     c) Draw and explain torque-Slip characteristics of 3 phase induction motor
         with respective mathematical expressions. Clearly mark the two regions
         and point of maximum torque and starting torque   **[8]**

                                    OR

Q6) a) Derive the condition for maximum starting torque of 3 phase induction motors with usual notations. **[4]**

b) With suitable diagram explain constructional details of 3 phase slipring induction motor **[6]**

c) The input to 3 phase, 6 pole, 50 Hz, induction motor is 47 kWatt at certain load. The stator losses are 1.5 kWatt and mechanical losses are 1k Watt. Determine the HPoutput power of motor when it runs at 970 rpm. (Take 1 HP = 746 watt) **[8]**

Q7) a) State the types of starters used for induction motors. **[3]**

b) With suitable circuit diagram explain no load and blocked rotor test on 3 phase induction motor. Also write respective formulae involved in calculation part for determining the respective parameters **[6]**

c) Draw the connection diagram of star-delta starter used for 3-ph induction motor & explain its working **[8]**

OR

Q8) a) Obtain the approximate equivalent circuit diagrams fo 3-ph induction motor step by step. Label it & state the meaning of each nomenclature used. **[7]**

b) Using data from No load & Blocked rotor test on 3-ph induction motor; Draw the circle diagram & write the procedure to find full load slip, locate the points for slip = 0, 1 **[10]**

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[5925]-232

S.E. (Electrical Engineering)
NETWORK ANALYSIS
(2019 Pattern) (Semester - IV) (203147)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

   1)   *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

   2)   *Neat diagrams must be drawn wherever necessary.*

   3)   *Figures to the right indicate full marks.*

   4)   *Use of calculator is allowed.*

   5)   *Assume suitable data if necessary.*

Q1) a)   What is time constant? State time constant in case of Series R-L circuit and series R-C circuit. **[6]**

    b)   In the network shown in Fig. 1, switch is closed at $t = 0$ with capacitor is uncharged. Find the value of $i(0^+), \dfrac{di(0^+)}{dt}, \dfrac{d^2i(0^+)}{dt^2}$. **[6]**
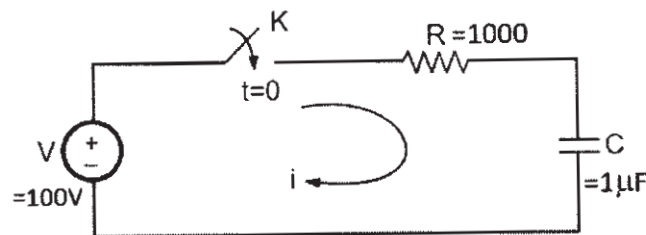
Fig. 1

    c)   In the circuits in Fig. 2. The switch is closed at $t = 0$. **[6]**

       i)   Obtain expression for current in the circuit for $t > 0$. Using the classical method.
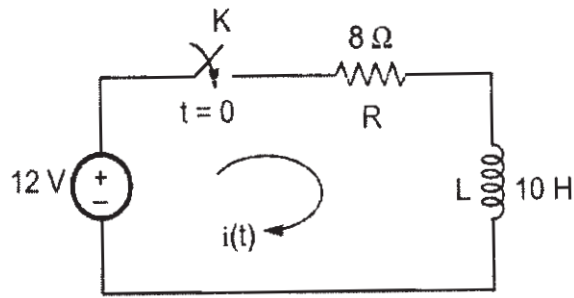
ii) Find value of current at $t = 0.25$ sec.

Fig. 2

OR

Q2) a) A coil which has an inductance of 40mH and a resistance of 2Ω is connected to form an LR series circuit. If they are connected to a 20V DC supply. Find **[6]**

i) Value of the induced emf after 10ms $\left[v(t) = ve - \dfrac{R}{L}t \right]$.

ii) The final steady state value of the current.

iii) Time constant of the RL series circuit.

b) In the network shown in Fig. 3, switch is closed at $t = 0$. Find the value of $i(0^+), \dfrac{di(0^+)}{dt}, \dfrac{d^2i(0^+)}{dt^2}$ Assume the initial current of inductor to be zero. **[6]**
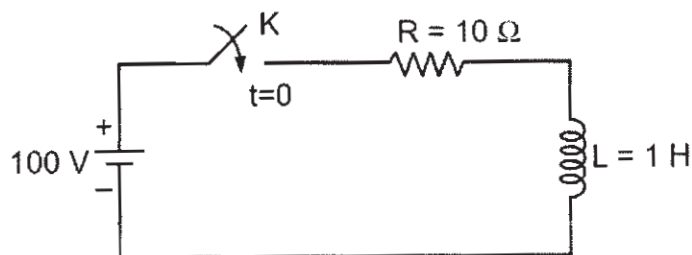
Fig. 3

c) In R-L-C circuit Fig. 4 is excited by D.C. voltage source. Find current $i(t)$ using conventional method. The switch is closed at time $t = 0$. **[6]**
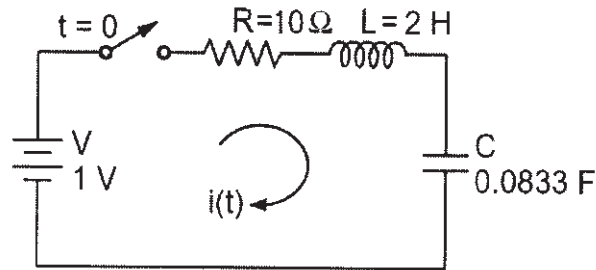

Fig. 4

Q3) a) Find the inverse Laplace transform of given network given F(s). **[5]**

$$F(s) = \frac{(s+2)}{s(s+3)}$$

b) Find the Laplace transform of given network given $f(t)$. **[5]**

$$f(t) = e^{3t} . \sin 2t + t . e^{-2t}$$

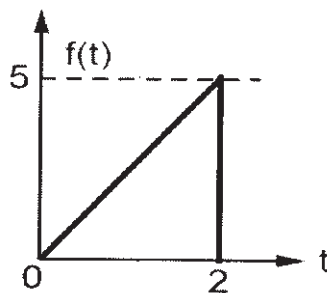c) Obtain $f(t)$ for the signal shown in Fig. 5. Also determine Laplace transform of $f(t)$. **[7]**

Fig. 5

OR

Q4) a) Determine resultant current $i(t)$ if switch is closed at $t = 0$. In R-L-C series circuit Fig. 6 by using Laplace transform. **[9]**
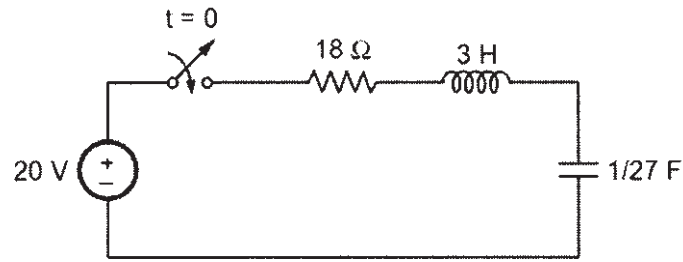

Fig.6

b) Solve the differential equation $\dfrac{d^2 x(t)}{dt^2} + 3\dfrac{dx(t)}{dt} + 2x(t) = 4e^t$, where

$x(0^-) = 1$, $x'(0^{-1}) = -1$. **[8]**

Q5) a) Develop relation between 'Z' parameter and transmission parameter. **[5]**

b) Explain the following in relation with filters. **[6]**

   i)   stop band.

   ii) pass band.

   iii) cut-off frequency.

c) Obtain y-parameters of two port network for the given network in the fig.7. **[7]**
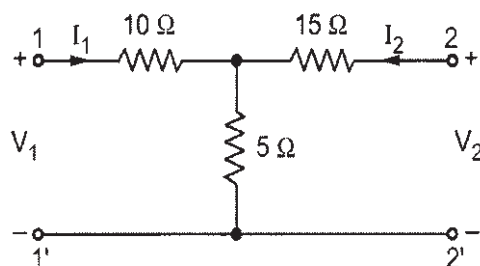

Fig. 7

OR

Q6) a) Define ABCD parameters and Hybrid parameters of two port networks.
[5]

b) Design constant K-low pass filter to have a cut-off frequency of 796 Hz when terminated in a 600 Ω resistance in both the T and π configurations.
[6]

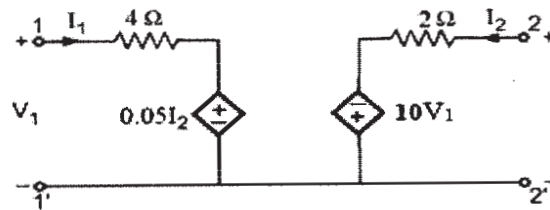c) Obtain Z-parameters of two-port network for the given network in the Fig. 8.
[7]

Fig. 8

Q7) a) Define :
[5]

i) Poles of system function.

ii) Zeros of system function.

b) The voltage V(s) in a network given by :
[6]

$$I(s) = \frac{2s}{(s+1)(s-3)}$$

Plot poles and zeros in the plane and obtain time domain response of current.

c) Find the driving point admittance Y_{11} (s) for the network shown in Fig. 9 and plot pole-zone diagram.
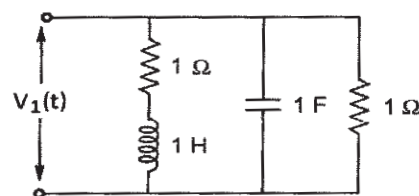**[6]**

Fig. 9

OR

Q8) a) Define various network functions of a one-port network. **[5]**

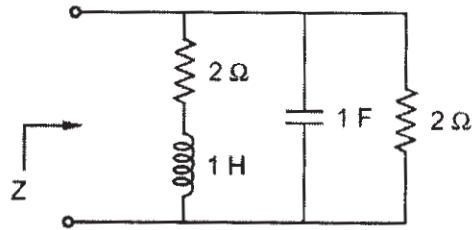b) Find the driving point impedance Z_{11} (s) for the network shown in Fig. 10 **[6]**

Fig. 10

c) The voltage V(s) in a network given by : **[6]**

$$V(s)=\frac{5(s+5)}{(s+2)(s+7)}$$

Plot poles and zeros in the plane and obtain time domain response of voltage.

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S.E. (Electrical)

NUMERICAL METHODS AND COMPUTER PROGRAMMING
(2019 Pattern) (Semester - IV) (203148)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Assume suitable data, jf necessary.*
4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is permitted.*
5) *Assume suitable data, if necessary.*

Q1) a) Prove   **[6]**

i) $\Delta - \nabla = \Delta\nabla$

ii) $(1 + \Delta)(1 - \nabla) = 1$

b) Following table gives the distance in nautical miles of the visible horizon for the given heights in feet above earth.   **[6]**

X height	200	250	300	350	400
Y distance	15.04	16.81	18.42	19.90	21.27

Find the distance when height is 218 feet.

c) Derive the formula for Newton's forward interpolation formula for the equally spaced data points.   **[5]**

<div align="center">OR</div>

Q2) a) Find f(10) of the cubic function passing through the points (4,–43) (7,83) (9,327) and (12,1053) using Newtons divided difference formula.   **[6]**

b) Derive Lagrange's Interpolation formula for unequally spaced data points.**[6]**

c) Apply Bessel's central difference formula to obtain f(32) given that **[5]**

f(25)=0.2707   f(30)=0.3027   f(35)=0.3386   f(40)=0.3794

Q3) a) Derive Trapezoidal rule for numerical integration as a special case of Newton's Cote formula. **[6]**

b) A river is 80m wide. The depth d in meters at a distance x meters from one bank is given in the following table **[6]**

X(m)	0	10	20	30	40	50	60	70	80
D(m)	0	4	7	8	12	15	14	8	3

Find approximately the area of cross section by

i) Trapezoidal rule

ii) Simpson's 1/3rd rule.

c) Derive formula for numerical differentiation of first order using Newton's forward interpolation technique. **[5]**

OR

Q4) a) Evaluate $\int_0^1\int_0^1 (x+y)\,dxdy$ using Simpsons 1/3rd rule with h=k=1/2 **[6]**

b) Evaluate the first and second derivative of $\sqrt{x}$ at $x=15$ from the following data **[6]**

x	15	17	19	21	23
$\sqrt{x}$	3.873	4.123	4.354	4.583	4.796

c) Derive Simpson's 1/3rd rule for numerical integration as a special case of Newton's Cote formula. **[5]**

Q5) a) Solve the system of equations by Gauss Jordan method **[6]**

$x + y + z = 9$

$2x - 3y + 4z = 13$

$3x + 4y + 5z = 40$

b) Use Gauss Seidel method to solve the following system of equations **[6]**

$6x_1 ++x_2+x_3=105$

$4x_1+8x_2+3x_3=155$

$5x_1+4x_2-10x_3=65$

c) Explain Gauss Jacobi method for the solution of linear simultaneous equations. **[6]**

OR

Q6) a) Explain Gauss-Seidal method for solution of linear simultaneous equation. (Numerical is not expected) **[6]**

b) Apply Gauss Jordan method to find inverse of **[6]**

$$A = \begin{bmatrix} 3 & 0 & 2 \\ 2 & 0 & -2 \\ 0 & 1 & 1 \end{bmatrix}$$

c) Using Jacobi iterative method solve the following system of linear simultaneous equations. Take $x(0) = y(0) = z(0) = 0$ perform 5 iterations.**[6]**

$$3x + y + z = 2$$
$$x + 4y + 2z = -5$$
$$x + 2y + 5z = 2$$

Q7) a) Use 4th order RK method to estimate approximate value of y for $x = 0.1$ with step size is 0.1, if $dy/dx = x + y^2$ given that $y = 1$ when $x = 0$.   **[6]**

b) Apply Euler's method to find $y(0.1)$. Given $\dfrac{dy}{dx} = xy$, $y(1) = 5$. Show 5 iterations. **[6]**

c) Explain Euler's method for the solution of ordinary differential equation.**[6]**

OR

Q8) a) Explain Taylor's series method for solution of ordinary differential equations. **[6]**

b) Use Runge Kutta second order method of find an approximate value of y correct to three places of decimal when $x = 0.1$, given that $y = 1.2$ when $x = 1$ and $\dfrac{dy}{dx} = 3x + y^2$. **[6]**

c) Find the value of $x = 0.1$ for the equation $\dfrac{dy}{dx} = 1 + xy$ and $y(0)=1$. Take step size h $= 0.1$ by Taylor series method. **[6]**

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S.E. (Electrical)

FUNDAMENTAL OF MICROCONTROLLER & APPLICATIONS

(2019 Pattern) (Semester-IV) (203149)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) *Solve Q.1 or Q.2, Q.3 or Q.4, or Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume suitable data, if necessary.*

Q1) a) Draw & describe TMOD register. **[6]**

b) Write short note on Data Types in C. **[6]**

c) Write a program to generate square wave of 50Hz frequency with 50% duty cycle on pin 2.3. Assume XTAL=11.0592 MHz & use timer 0 in mode l. **[6]**

OR

Q2) a) Describe the Timer modes in 8051 microcontrollers. **[6]**

b) Draw & explain TCON register. **[6]**

c) Write C Program to toggle bit P1.5 of port P1, 5000 times. **[6]**

Q3) a) Explain interrupt structure of 8051 microcontroller with neat diagram. **[6]**

b) With the help of diagram explain interfacing of ADC 0809 with 8051 microcontrollers. **[6]**

c) Explain Interrupt Priority Register of 8051 Microcontroller. **[5]**

OR

Q4) a) Write short note on Interrupt enable register. **[6]**

b) Write a program to turn off LED for connected to Port 0 when interrupt 0 occurs and turn it on when interrupt 1 occurs. **[6]**

c) Explain the SOC, EOC, & OE pin of ADC 0809. **[5]**

Q5) a) Write Short note on SCON register. **[6]**

b) Explain Steps to transfer Data Serially in 8051 microcontroller. **[6]**

c) Write program to transfer letter 'T'serially 10 times at baud rate of 4800. Use serial port in mode 1. XTAL=12MHz. **[6]**

OR

Q6) a) Write short note AT commands required for GSM. **[6]**

b) Explain Steps to receive Data Serially in 8051 microcontroller. **[6]**

c) Explain Serial port structure of 8051 microcontroller. **[6]**

Q7) a) Explain LED interfacing with 8051 microcontroller. **[6]**

b) With the help of block diagram explain Key interfacing using 8051. **[6]**

c) With the help of block diagram explain Power measurement using 8051. **[5]**

OR

Q8) a) With the help of block diagram explain Voltage & current measurement using 8051. **[6]**

b) Draw interfacing diagram of a stepper motor with 8051 and write program to rotate stepper motor 360 Degree in anticlockwise direction with step angle of 1.8 degree. **[6]**

c) Explain relay interfacing with 8051 microcontroller. **[5]**

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[5925]-235
S.E. (Instrumentation & Control) (Semester - III)
SENSORS & TRANSDUCERS
(2019 Pattern) (206261)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right indicate full marks.*

Q1) a) Draw & explain the working of inclined tube manometer? Give the reason for its higher sensitivity. **[8]**

b) Explain the working principle of McLeod low pressure vacuum gauge. With neat sketch. **[9]**

OR

Q2) a) Explain the working of diaphragm type elastic pressure transducer. With the help of diagram show. how strain gauges are mounted on it. **[8]**

b) Draw & explain the working principle of delta cell capacitive pressure sensor. State its formula is the relationship is linear? **[9]**

Q3) a) Draw & explain the working principle of bimetallic thermometer. List one advantage & disadvantage with two application. **[9]**

b) Explain RTD with its principle of working. Explain three wire lead arrangement of RTD. **[9]**

OR

Q4) a) State four temperature scale available give conversion formulae of it.**[9]**

b) State & explain along with diagram Law of intermediate temperatures and law of intermediate metals of thermocouple.

comment on relationship between temperature & output voltage. **[9]**

P.T.O.

Q5) a) Draw & explain the working principle of venturi meter. Derive the equation of actual flow rate from it. **[9]**

   b) Draw & explain the working principle of Electromagnetic flow meter. Comment on the relationship between the flow rate & voltage. **[9]**

<p align="center">OR</p>

Q6) a) Draw & explain the working principle of orifice meter. Derive the equation of actual flow rate from it. **[9]**

   b) Draw & explain the working principle of Ultrasonic flow meter. Derive the equation of any one method. **[9]**

Q7) a) Draw & explain the working principle of bubble type level measurement. State the equation for it. **[8]**

   b) Draw & explain the working principle of cone & plate viscosity measurement. State the advantages & disadvantages of it. **[9]**

<p align="center">OR</p>

Q8) a) Draw & explain the working principle of chain-balanced float type density measurement technique. Enlist other two techniques for density measurement. **[8]**

   b) Draw & explain the working principle of resistive type humidity sensor measurement technique. Compare with capacitive type of humidity measurement technique. **[9]**

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S.E. (Instrumentation and Control)
LINEAR INTEGRATED CIRCUITS
(2019 Pattern) (Semester - III) (206262)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

    2)   *Neat diagrams must be drawn wherever necessary.*

    3)   *Figures to the right indicate full marks.*

    4)   *Assume suitable data, if necessary.*

Q1) a)   Derive output voltage equation for three op-amps. Instrumentation amplifier. Draw neat circuit diagram. **[9]**

    b)   Draw neat diagram of I -V converter and derive the equation for output voltage. **[8]**

<div align="center">OR</div>

Q2) a)   Draw neat diagram of practical differentiator and derive the output voltage equation. **[9]**

    b)   Write short note on an Isolation Amplifier. **[8]**

Q3) a)   Illustrate with suitable circuit diagram precision half wave rectifier. Draw proper output wave forms. **[9]**

    b)   Design phase shift oscillator using operational amplifier for output frequency of 1KHz. **[9]**

<div align="center">OR</div>

Q4) a)   Elaborate with neat circuit diagram zero trossing detector. **[9]**

    b)   Illustrate with suitable circuit diagram inverting comparator. Draw proper output wave forms. **[9]**

Q5) a)   Design an astable multivibrator using timer 555 to generate 10 KHz frequency at 70% duty cycle. **[9]**

    b)   Describe the operation of voltage controlled oscillator with neat block diagram. **[8]**

<div align="center">OR</div>

Q6) a) Discuss analog multiplexer CD4051 with neat block diagram. **[8]**

b) Draw the pin diagram of timer I C555 and elaborate function of each pin. **[9]**

Q7) a) Design first order high pass filter for f_L =10 KHz. And pass band gain of 2. **[9]**

b) Compare active filters and passive filters. Draw the ideal frequency response for high pass, low pass, band pass and band reject filters. **[9]**

OR

Q8) a) Design second order low pass filter for F_L=1 KHz. **[9]**

b) Elaborate with neat circuit diagram, low voltage regulator using IC 723. **[9]**

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[5925]-237

S.E. (Instrumentation & Control)
ELECTRICAL MEASUREMENTS AND INSTRUMENTATION
(2019 Pattern) (Semester-III) (206263)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of non-programmable Calculator is allowed.*
5) *Assume Suitable data, is necessary.*

Q1) a) Explain the block diagram of cathode ray oscilloscope with neat diagram. **[9]**

b) Explain different techniques of frequency measurement with the help of CRO **[9]**

OR

Q2) a) Explain the internal block diagram of cathode ray tube with neat diagram. **[9]**

b) How to measure phase and frequency with Lissajous pattern. **[9]**

Q3) a) Derive the general balance condition of wheatsone's bridge with neat circuit diagram. State the sources of error in measurement with wheatston's bridge. **[8]**

b) Give detailed classification of bridges. Draw neat circuit diagram, explain working and derive the expression of Kelvin bridge. **[9]**

OR

Q4) a) At balance the resistances of all arms are $Ra=Rb=R_1=R_2=100\Omega$. The battery voltage is 5V and galvanometer resistance is 100Ω. If R_2 is changed to 105Ω. determine the current through the galvanometer (null detector). **[9]**
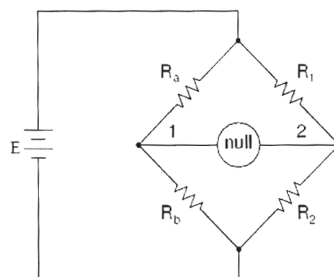

Fig. Q 2a

b) Derive the general magnitude and phase balance condition of AC bridge with neat circuit diagram. **[8]**

P.T.O.

Q5) a)   Explain digital multimeter with neat block diagram.   **[9]**

b)   Why analog to digital converter is used in electronic circuits? Draw and explain the block diagram of digital clamp meter.   **[9]**

<div align="center">OR</div>

Q6) a)   Explain R-2R ladder type digital to analog converter with neat circuit diagram.   **[9]**

b)   State the advantages of digital instruments. Explain digital energy meter with neat block diagram.   **[9]**

Q7) a)   Describe strip chart recorder with neat diagram. What are the types of tracing system?   **[9]**

b)   What is Lab VIEW? Explain different components of Lab VIEW.   **[8]**

<div align="center">OR</div>

Q8) a)   Draw neat diagram of galvanometric type recorder and explain its operation in detail.   **[8]**

b)   What is virtual instrumentation? Describe the architecture of virtual Instrumentation with neat block diagram.   **[9]**

<div align="center">❖ ❖ ❖</div>

[5925]-238

S.E. (Instrumentation)

CONTROL SYSTEM COMPONENTS

(2019 Pattern) (Semester - III) (206264)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right indicate full marks.*

4) *Assume suitable data, if necessary.*

Q1) a) List various pneumatic components. Explain any one in detail. **[6]**

b) Draw and explain 4/3 way pneumatic valve. **[6]**

c) Draw and explain 2/2 way pneumatic valve. **[5]**

OR

Q2) a) Compare Pneumatic System with Electric System (Any 6 important points) **[6]**

b) Draw pneumatic supply diagram with all components. **[5]**

c) List various types of actuators. Explain any one in detail. **[6]**

Q3) a) Explain Hydraulic power supply in detail with neat sketch. **[6]**

b) Explain various properties of oil to be used in hydraulic system. **[6]**

c) List various components of Hydraulic power supply. Explain any one in detail with neat sketch. **[6]**

OR

Q4) a) List various Hydraulic pumps. Draw and Explain any one pump in detail.**[6]**

b) Compare Hydraulic & Electric system. **[6]**

c) Draw and explain 4/3 way Hydraulic valve. **[6]**

Q5) a) Draw and Explain working of UJT. [6]

b) Draw and Explain working of TRIAC. [6]

c) Give the application UJT and TRIAC. [5]

OR

Q6) a) List various commutation techniques. Explain any one in detail Write its application. [10]

b) Draw and Explain circuit of an MOSFET. Explain its various parts. [7]

Q7) a) Explain Construction, working & applications of square root extractor.[8]

b) Explain significance of Alarm Announciator with reference to process industry. [6]

c) Write the applications of square root extractor. [4]

OR

Q8) a) List different materials used for fuses wire and Explain Desirable characteristics of material according to rating. [6]

b) Explain in detail hazardous area classification. [6]

c) Draw and Explain zener barrier in detail. [6]

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[5925]-239

S.E. (Instrumentation Engineering)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - III) (207008)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

 1) *Question No. 1 is compulsory. Solve Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.*
 2) *Neat diagrams must be drawn wherever necessary.*
 3) *Figures to the right indicate full marks.*
 4) *Use of electronic pocket calculator is allowed.*
 5) *Assume suitable data, if necessary.*

Q1) Write the correct option: **[10]**

 a) Given that $F_c(\lambda) = \int_0^\infty u^{m-1}\cos\lambda u\,du = \frac{\sqrt{m}}{\lambda^m}\cos\frac{m\pi}{2}$ then Fourier cosine

   transform $F_c(\lambda)$ of x^3, $x > 0$ is   **[2]**

   i) $\frac{-3}{\lambda^4}$ ii) $\frac{2}{\lambda^3}$

   iii) 0   iv) $\frac{6}{\lambda^4}$

 b) The first and second moments of the distribution about the value 3 are 2 and 20. Second moment about the mean is   **[2]**

   i) 12   ii) 14

   iii) 16   iv) 20

 c) The probability of getting a king or a queen or a jack from a pack of 52 cards is   **[1]**

   i) $\frac{3}{13}$ ii) $\frac{4}{52}$

   iii) $\frac{3}{52}$ iv) $\frac{3}{26}$

d) If the vector field $\bar{F} = (x + 2y + az)\hat{i} + (2x - 3y - z)\hat{j} + (4x - y + 2z)\hat{k}$
   is irrotational then value of a is **[2]**
   i) -4 ii) 3
   iii) -3 iv) 4

e) The value of k such that the function $f(z) = e^x \cos y + ie^x \sin ky$ is analytic
   is **[2]**
   i) $k = -1$ ii) $k = 1$
   iii) $k = 0$ iv) $k = 2$

f) A function $\phi(x, y)$ is harmonic if **[1]**

   i) $\quad \dfrac{\partial^2\phi}{\partial x^2} + \dfrac{\partial^2\phi}{\partial y^2} = 1$ ii) $\quad \dfrac{\partial^2\phi}{\partial x^2} + \dfrac{\partial^2\phi}{\partial y^2} = 0$

   iii) $\quad \dfrac{\partial^2\phi}{\partial x^2} - \dfrac{\partial^2\phi}{\partial y^2} = 1$ iv) $\quad \dfrac{\partial^2\phi}{\partial x^2} - \dfrac{\partial^2\phi}{\partial y^2} = 0$

Q2) a) Find Fourier sine transform of $f(x) = \begin{cases} x^2, & 0 < x \le 1 \\ 0, & x > 1 \end{cases}$. **[5]**

   b) Attempt any one: **[4]**
     i) Find z-transform of $f(k) = e^{-2k}$, $k \ge 0$

     ii) Find inverse z-transform of $F(z) = \dfrac{z}{(z-1)(z-2)}$, $|z| > 2$

   c) Solve, $f(k+2) + 3f(k+1) + 2f(k) = 0$, $f(0) = 0, f(1) = 1$. **[6]**

<div align="center">OR</div>

Q3) a) Attempt any one: **[5]**

     i) Find z - transform of $f(k) = \dfrac{1}{k}$, $k \ge 1$

     ii) Find Inverse z - transform of $\dfrac{3z^2 + 2z}{z^2 - 3z + 2}$, $1 < |z| < 2$

   b) Solve the integral equation, $\displaystyle\int_0^\infty f(x)\cos\lambda x\, dx = e^{-\lambda}$, $\lambda > 0$. **[4]**

   c) Using Inverse Fourier sine transform find $f(x)$,

     if $F_s(\lambda) = \begin{cases} 1 - \lambda, & 0 \le \lambda \le 1 \\ 0, & \lambda \ge 1 \end{cases}$. **[6]**

Q4) a) Find the coefficient of correlation between x & y from the following table: **[5]**

x	1	3	4	6	8
frequency	1	2	4	4	5

b) The problem of mathematics is given to three students A, B & C whose chances of solving it are $\dfrac{1}{2}, \dfrac{3}{4}$ & $\dfrac{1}{4}$ respectively. What is the probability that the problem will be solved. **[5]**

c) A manufacturer knows from experience that the resistance of resistors he produces is normally distributed with mean 100 Ohms and standard deviation 2 Ohms. What percentage of resistors will have resistance between 98 Ohms to 102 Ohms? (Area between 0 to 1 is 0.3413). **[5]**

OR

Q5) a) The regression equations are $8x - 10y + 66 = 0$ and $40x - 18y = 214$ **[5]**

   i) Find the mean values of x and y

   ii) Regression coefficient of y on x

   iii) Regression coefficient of x on y

b) Find first four moments about mean, if the first four moments about median are 3, 40, 100 and 400. **[5]**

c) In an examination, 31% of the students got marks below 45 and 8% students got marks above 64. Find the mean and standard deviation of the normal distribution. (Area between 0 to 1.405 is 0.42 and area between 0 to 0.496 is 0.19). **[5]**

Q6) a) Find the directional derivative of $\phi = e^{2x} \cos(yz)$ at origin in the direction of the vector $\hat{i} + \hat{j} + \hat{k}$. **[5]**

b) Show that the vector field $\overline{F} = \left(6xy + z^3\right)\hat{i} + \left(3x^2 - z\right)\hat{j} + \left(3xz^2 - y\right)\hat{k}$ is irrotational. Also find scalar potential ϕ such that $\overline{F} = \nabla\phi$. **[5]**

c) Evaluate $\displaystyle\int_c \overline{F} \cdot d\overline{r}$ for $\overline{F} = 3x^2\hat{i} + \left(2xz - y\right)\hat{j} + z\hat{k}$ along the path $c : x = t$, $y = t^2$, $z = t^3$ from $t = 0$ to $t = 1$. **[5]**

OR

Q7) a) Find the directional derivative of $\phi = 2x^2 + 3y^2 + z^2$ at the point (2, 1, 3)

along the line $\dfrac{x-2}{1} = \dfrac{y-1}{2} = \dfrac{z-3}{2}$. **[5]**

b) Show that (Any one): **[5]**

i) $\nabla^4(e^r) = e^r + \dfrac{4}{r} e^r$

ii) $\nabla \cdot \left(r\nabla\left(\dfrac{1}{r^n}\right)\right) = \dfrac{n(n-2)}{r^{n+1}}$

c) Using Green's theorem evaluate $\oint_c \overline{F} \cdot d\overline{r}$ where $\overline{F} = \cos y\,\hat{i} + x(1 - \sin y)\,\hat{j}$

and c is ellipse $\dfrac{x^2}{25} + \dfrac{y^2}{9} = 1,\ z = 0$. **[5]**

Q8) a) If $F(z)$ is an analytic function with constant modulus then prove that
$F(z)$ is a constant function. **[5]**

b) Evaluate : $\oint_c \dfrac{\sin^2 z}{\left(z - \dfrac{\pi}{6}\right)^3}\, dz$ where c is circle $|z| = \dfrac{3}{2}$. **[5]**

c) Show that the map $w = \dfrac{2z+3}{z-4}$ transform the circle $x^2 + y^2 - 4x = 0$ into
the straight line $44 + 3 = 0$. **[5]**

OR

Q9) a) Find the harmonic conjugate of $V = e^x \sin y$ such that $F(z) = 4 + i\,V$ is
analytic find $F(z)$ in terms of z. **[5]**

b) Evaluate $\oint_c \dfrac{4z-1}{z^2 - z - 6}\, dz$ where c is closed curve $|z| = 4$. **[5]**

c) Find the bilinear transformation which maps the points 0, 1, 2 of z-plane

onto the points $1, \dfrac{1}{2}, \dfrac{1}{3}$ of w-plane respectively. **[5]**

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[5925]-240
S.E. (Instrumentation & Control Engineering)
CONTROL SYSTEMS
(2019 Pattern) (Semester - IV) (206268)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data if necessary.*
5) *Use of non-programmable calculator/Log table is allowed.*

Q1) a) Explain block diagram reduction technique in detail. Also write steps to solve block diagram. **[9]**

b) Find C(S)/R(S) by using Mason's Gain formula. **[9]**
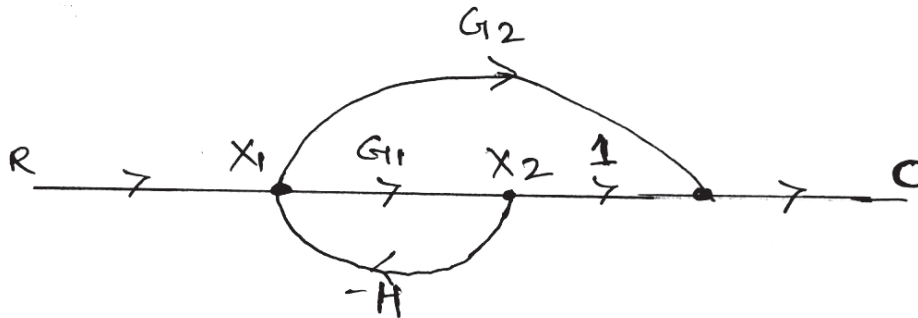
OR

Q2) a) Explain signal flow graph in detail. Also write steps to solve signal flow graph. Explain Mason's Gain formula in brief. **[9]**

b) Obtain C(S)/R(S) by using block reduction rules. **[9]**
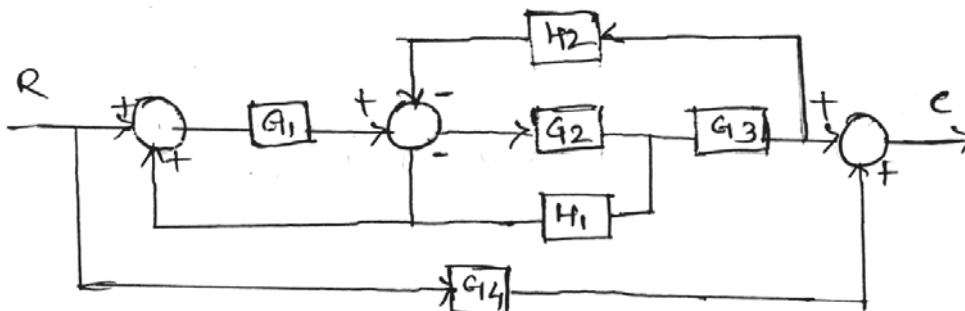
Q3) a) Explain the transient response specifications of second order system with neat diagram. **[8]**

b) The max overshoot and settling time for a control system whose overall transfer function is given by :

$$\frac{C(s)}{R(s)} = \omega_n^2 / (S^2 + 2\xi\omega_n S + \omega_n^2)$$

Are 10% and 4 second respectively? The input being a unit step function. Determine the values of ξ & ω_n in order to satisfy these requirements.**[9]**

OR

Q4) a) Explain all standard test signals along with graphical representation & respective Laplace transform. **[8]**

b) A system has open loop transfer function as : $G(S)H(S) = \dfrac{25}{s(s+10)}$

Find the undamped natural frequency the damping ratio, damped frequency, rise time, peak time, peak overshoot and settling time. **[9]**

Q5) a) Explain time domain analysis method in brief.

The transfer function of unity feedback control system is given by :

$$G(S) = \frac{K}{s(s+4)}$$

Plot the Root Locus & determine the value of K where ξ is 0.707. **[9]**

b) Comment on stability : **[9]**
   i) $S^4 + 10S^3 + 30S^2 + 100S + 25 = 0$
   ii) $S^4 + S^3 + 5S^2 - 4S + 4 = 0$

OR

Q6) a) The transfer function of unity feedback control system is given by : **[9]**

$$G(S) = \frac{K}{s(s+2)(s+4)}$$

Plot the Root Locus & determine the value of K for $\xi = 0.28$.

b) Solve by Routh's Criteria : **[9]**
   i) $S^5 + 4S^4 + S^3 + 4S^2 + S + 5 = 0$
   ii) $S^5 + 5S^4 + S^3 + 2S^2 - S + 8 = 0$

[5925]-240   2

Q7) a) Solve the following by Bode plot analysis method. [9]

$$G(S)H(S) = \frac{4}{S(1+0.5S)(1+0.08S)}$$

Determine gain crossover, phase crossover, gain margin & phase margin. Also comment on stability.

b) State properties of Polar plot. Solve the following with polar plot method.

$$G(S) = \frac{1}{1+0.2s}$$ [8]

OR

Q8) a) Solve the following by Bode plot analysis method. [9]

$$G(S)H(S) = \frac{50}{(s+1)(s+2)}$$

Determine gain crossover, phase crossover, gain margin & phase margin. Also comment on stability.

b) What is frequency domain analysis? Elaborate in brief State the conditions of stability depending on gain cross over frequency & phase cross over frequency. [8]

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[5925]-240 3

S.E. (Instrumentation & Control)
DIGITAL ELECTRONICS
(2019 Pattern) (Semester-IV) (206269)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q.No. 1 or Q.No. 2, Q.No. 3 or Q.No. 4, Q.No. 5 or Q.No. 6, Q.No. 7 or Q.No. 8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Design a two bit magnitude comparator **[9]**

b) Implement the following Boolean function using 8:1 multiplexer $F(A,B,C,D) = \Sigma m (0,1,3,4,7,8,9,12,15)$ **[9]**

OR

Q2) a) Compare combinational circuit and sequential circuit. **[4]**

b) Explain 2 to 4 line Decoder **[6]**

c) Convert D flipflop to T flipflop **[8]**

Q3) a) Explain with timing diagram for . **[8]**
     i) SR flip flop and
     ii) D flip flop.

b) What is sequential logic circuits? Draw and explain JK flip-flop along with logic diagram, truth table. **[9]**

OR

Q4) a) With a neat logic diagram, explain the working of positive edge triggered D flip Hop. Also draw the timing diagram. **[8]**

b) Design the Conversion of JK flip-flop into T-type flip-flop with excitation table, k-map and logic diagram. **[9]**

Q5) a) Design a 3 bit twisted ring counter. Draw logic diagram **[6]**

b) Draw and explain 3 bit asynchronous counter **[8]**

c) Distinguish between synchronous counter and asynchronous counter. **[4]**

OR

P.T.O.

Q6) a) Explain PIPO and PISO shift register with relevant logic diagrams. **[9]**
b) Design MOD 6 synchronous counter with JK flipflop. **[9]**

Q7) a) Draw the block diagram and Explain Programmable Logic Array. **[9]**
b) Describe the operation of TTL logic circuit working as NAND gate.
[8]

OR

Q8) a) Compare TTL and CMOS logic famillies on the basis of following: **[8]**
   i)   Propagation delay
   ii) Power dissipation
   iii) Fan-out
   iv) Basic gate
b) Design digital clock by using counter ICs. **[9]**

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S.E. (Instrumentation & Control Engineering)
PROCESS LOOP ELEMENTS
(2019 Pattern) (Semester - IV) (206270)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume suitable data, if necessary.*

Q1) a) Explain Multi position and floating control mode in brief with neat sketch.**[9]**
b) Explain PI and PID controller in brief with suitable examples. **[9]**

OR

Q2) a) Explain reset windup, rate before reset, bumpless transfer in detail and comment on error. **[9]**
b) State the classification of continuous control modes used in process control system and explain PD controller with suitable example. **[9]**

Q3) a) Explain in brief process reaction curve tuning method. **[8]**
b) Derive an expression for digital PID position algorithm and state the limitation of position algorithm. **[9]**

OR

Q4) a) Explain in brief Ziegler Nichols close loop tuning method. **[8]**
b) Derive an expression for digital PID velocity algorithm and state the merit of velocity algorithm. **[9]**

Q5) a) Explain flashing in brief and suggest the suitable method used to reduce it. **[9]**
b) State the necessity of sizing in control valve, enlist selection criteria's for control valve and comment on i) Rangeability, ii) Valve Capacity, iii) Valve stem, iv) Turndown ratio. **[9]**

OR

P.T.O.

Q6) a) State difference between inherent and installed characteristics and explain control valve characteristics with neat sketch in brief. **[9]**

b) State the need of final control element and explain butterfly and globe control valve in brief with neat sketch. **[9]**

Q7) a) Enlist types of actuators, explain any one with neat sketch and state its merits, demerits and applications. **[8]**

b) Specify the need of positioners, state its application, types and discuss effect of positioner on performance of control valve. **[9]**

OR

Q8) a) State the significance of volume boosters and explain volume booster in brief. **[8]**

b) What is the significance of pressure boosters and elaborate pressure booster in brief. **[9]**

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[5925]-243

S.E. (Instrumentation & Control)
SIGNALS AND SYSTEMS
(2019 Pattern) (Semester - IV) (206271)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
    1)   *Solve Q.1 or. Q.2., Q.3. or Q.4., Q.5. or Q.6, Q.7 or Q.8.*
    2)   *Neat diagrams should be drawn wherever necessary.*
    3)   *Use of Non-programmable Calculator is allowed.*
    4)   *Assume suitable data if necessary.*

Q1) a)   Enlist the properties of Fourier Series. Prove any two properties.   **[9]**

     b)   Show that the following signals are orthogonal over an interval [0, 1], **[8]**

$$f(t) = 1;$$
$$x(t) = \sqrt{3}(1-2t)$$

OR

Q2) a)   Explain the Dirichlet condition of Fourier series?   **[6]**

     b)   Find the exponential Fourier series for $x(t) = e^{-t}$ for T = 0.5 sec   **[11]**

Q3) a)   State and prove the Linearity and Time Shift property of Fourier Transform.   **[10]**

     b)   Find the Fourier Transform of   **[8]**

$$x(t) = te^{-at}u(t)$$

OR

Q4) a)   Find the Fourier Transform of $x(t) = \sin w_c t \, u(t)$.   **[8]**

     b)   Explain the Dirichlet condition of Fourier transform?   **[6]**

     c)   State and verify the duality property.   **[4]**

Q5) a) Explain the relationship between Laplace Transform and Fourier Transform. **[7]**

b) Find the Laplace transform of ; **[10]**

   i) $x(t) = e^{-at}u(t)$

   ii) $x(t) = -e^{-at}u(-t)$

OR

Q6) a) State and explain any two properties of Laplace Transform. **[7]**

b) Determine the initial value $x(0+)$ and the final value $x(\infty)$ for the following Laplace transform X(s) **[10]**

   i) $X(s) = \dfrac{1}{s^2 + 5s + 6}$

   ii) $X(s) = \dfrac{s+7}{s^3 + 5s^2 + s}$

Q7) a) Distinguish between Discrete Random Variables and Continuous Random variables with examples. **[8]**

b) State and explain the properties of the CDF. **[10]**

OR

Q8) a) State and explain the properties of the PDF. **[10]**

b) Define the following terms **[8]**

   i)   Mean

   ii) Variance

   iii) Standard Deviation

   iv) Covariance

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[5925]-244

S.E. (Instrumentation and Control)
DATA STRUCTURES
(2019 Pattern) (Semester - IV) (206272)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right side indicate full marks.*
3) *Neat diagrams must be drawn whenever necessary.*
4) *Use of Calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Write a python program that will perform arithmetic operations on two matrices X and Y and print the result. **[9]**

b) Write a program to create two lists namely L1 & L2, print them and extend list L2 with L1. **[8]**

OR

Q2) a) Write a python program that will **[8]**
i) Create an array containing following elements : 3, 9, 4, 16, 5, 25, 6, 36 and print result.
ii) Add an element in array and print result.
iii) Delete an element from it and print result.
iv) Remove an element from a specified position and print result.

b) Create two lists namely list A and list B. Write a python program that will perform different operations on lists and print the result. **[9]**

Q3) a) Write a note on multidimensional array in Python. **[6]**

b) Determine the output if following code is executed in Python. **[8]**
Set 1 = {24, 38.42, 12, 1978, 'PYTHON'}
print (Set 1)
list 2 = {'INDIA', 0.58, 66.39, 'Earth'}
Set 2 = set (list 2)
print (Set 2)
Set 3 = Set 2|Set 1
  print (Set 3)

c) What is python map? How it is different from dictionary? **[4]**

OR

P.T.O.

Q4) a) Briefly explain the different operations those can be performed on sets.**[8]**

b) Compute the index of the element '89' in the array as shown in the below table. **[4]**

55	28	71	44
30	24	22	36
12	89	41	19

c) Explain maps as abstract data type in Python. **[6]**

Q5) a) What are the limitations of arrays and lists in Python? What is a linked list structure? Which are the types of linked lists? **[9]**

b) Explain the following code in Python related to sorted linked list. **[8]**

```
def sortedSearch(head, target) :
    curNode = head
    while curNode is not None and curNode.data < target :
    if curNode.data == target :
    return True
    else :
    curNode = node.next
    return False
```

OR

Q6) a) Write a note on BAG abstract data type. **[8]**

b) How to build a linked list using a Tail Reference? Write steps to Append Nodes and Remove Nodes using a tail reference and current node respectively. **[9]**

Q7) a) Convert the following expression from Infix to Postfix expression. **[9]**
A * B + C / D

b) Write a note on 'Priority Ques'. **[9]**

OR

Q8) a) Describe the implementation of queue using a Circular Array. **[9]**

b) Write a note on stack ADT. How to implement the stack? **[9]**

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[5925]-245

S.E. (Chemical/Printing/Biotechnology) (Semester-III)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (207004)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) *Question No.1 is compulsory.*
2) *Attempt Q2 or Q3, Q4 or Q5, Q6 or Q7 and Q8 or Q9.*
3) *Assume suitable data, if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*
5) *Figures to the right indicate full marks.*
6) *Use of electronic pocket calculator is allowed.*

Q1) i)   The Fourier cosine transform of an even function $f(x)$ in interval $-\infty < x < \infty$
is given by **[1]**

a) $\int_0^\infty f(u)\sin \lambda u\, du$

b) $\int_0^\infty f(u)\cos ec\lambda u\, du$

c) $\int_0^\infty f(u)\sin \lambda u\, d\lambda$

d) $\int_0^\infty f(u)\cos \lambda u\, du$

ii) Second moment μ_2 about mean is. **[1]**

a) Mean

b) Standard deviation

c) Variance

d) Mean deviation

iii) A dice is thrown 10 times. If getting even number is considered as success,
then the probability of getting four successes is **[2]**

a) $^{10}C_4\left(\dfrac{1}{2}\right)^{10}$

b) $^{10}C_4\left(\dfrac{1}{2}\right)^{4}$

c) $^{10}C_4\left(\dfrac{1}{2}\right)^{8}$

d) $^{10}C_4\left(\dfrac{1}{2}\right)^{2}$

iv) The value of $\nabla^2 r$ is equal to [2]

a) $\dfrac{2}{r}$

b) $\dfrac{-2}{r}$

c) $\dfrac{1}{r}$

d) 0

v) The fourier sine transform $F_s(\lambda)$ of $f(x) = e^{-x}$, $x > 0$ is given by [2]

a) $\dfrac{3\lambda}{1+\lambda^2}$

b) $\dfrac{\lambda}{1-\lambda^2}$

c) $\dfrac{\lambda}{1+\lambda^2}$

d) $\dfrac{1}{1-\lambda^2}$

vi) The partial differential equation of two dimensional heat flow equation is [2]

a) $\dfrac{\partial u}{\partial t} = k\dfrac{\partial^2 u}{\partial x^2}$

b) $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$

c) $\dfrac{\partial^2 u}{\partial t^2} = c^2\dfrac{\partial^2 u}{\partial x^2}$

d) $\dfrac{\partial^2 u}{\partial x^2} - \dfrac{\partial^2 u}{\partial y^2} = 0$

Q2) a) Find the Fourier cosine transform of $f(x) = e^{-x}$. Hence show that [5]

$$\int_0^\infty \dfrac{\cos mx}{1+x^2}dx = \dfrac{\pi}{2}e^{-m}$$

b) Solve integral equation. [5]

$$\int_0^\infty f(x)\cos \lambda x\ dx = \begin{cases} 1-\lambda & ;0 \le \lambda \le 1 \\ 0 & ;\lambda \ge 1 \end{cases}$$

Hence show that $\displaystyle\int_0^\infty \dfrac{\sin^2 z}{z^2}dz = \dfrac{\pi}{2}$

c) Use fourier transform to solve [5]

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, 0 < x < \infty, t > 0$$

Subject to the condition.

i) $u(0,t) = 0$, $t > 0$

ii) $u(x,0) = \begin{cases} 1 & ,0 < x < 1 \\ 0 & ,x > 1 \end{cases}$

iii) $u(x,t)$ is bounded.

OR

Q3) a) Using Fourier integral representation show that. [5]

$$\int_0^\infty \frac{\lambda^3}{\lambda^4 + 4} \sin \lambda x d\lambda = \frac{\pi}{2} e^{-x} \cos x, x > 0$$

b) Using inverse sine transform find. [5]

$$f(x) \text{ if } F_s(\lambda) = \frac{1}{\lambda} e^{-a\lambda}$$

c) Use Fourier transform to solve $\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}; 0 < x < \infty, t > 0$ [5]

where $u(x,t)$ satisfies condition

i) $\left(\dfrac{\partial u}{\partial x}\right)_{x=0} = 0 \quad ,t > 0$

ii) $u(x,0) = \begin{cases} x & ; \quad 0 < x < 1 \\ 0 & ; \quad x > 1 \end{cases}$

iii) $|u(x,t)| < M$

[5925]-245   **3**

Q4) a) Calculate first four moments from following distribution about mean.**[5]**

x	0	1	2	3	4	5	6	7	8
f	1	8	28	56	70	56	28	8	1

b) Obtain line of regression *y* on *x* for the following data. **[5]**

x	2	3	5	7	9	10	12	15
y	2	5	8	10	12	14	15	16

c) A dice is thrown 5 times. If getting an odd number is a success. What is probability of i) 4 successes ii) at least 4 successes. **[5]**

OR

Q5) a) In a sample of 1000 cases, the mean of certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal find

　　i)　How many students score between 12 and 15?

　　ii)　How many students score above 18?

　　[Given: A(–0.8)=0.2881, A(0.4)=0.1554, A(1.6)=0.4452] **[5]**

b) The table below gives the number of books issue from a library on the various days of a week.

Days	Mon	Tue	Wed	Thu	Fri	Sat
Books Issued	120	130	110	115	135	150

Test 5% level of significance whether the issuing is independent of day.

$\left(\text{Given:} \chi^2_{5,0.05} = 11.07\right)$ **[5]**

c) Calculate coefficient of correlation. **[5]**

Q6) a) Find the directional derivative of $\varphi = x^2 - y^2 - 2z^2$ at the point $p(2,-1,3)$ in the direction $p\alpha$ where α is (5, 6, 4). **[5]**

b) Show that the vector field $\overline{F} = \left(8xy + z^4\right)\overline{i} + \left(4x^2 - z\right)\overline{j} + \left(4xz^3 - y\right)\overline{k}$ is irrotational. Find scalar potential function φ such that $\overline{F}=\nabla\varphi$. **[5]**

c) Using Green's theorem for $\overline{F}=xy\overline{i} + y^2\overline{j}$ over region R enclosed by parabola $y = x^2$ and line $y = x$ in the first quadrant, evaluate $\int xydx + y^2dy$. **[5]**

OR

Q7) a) Using stoke's theorem evaluate $\iint\limits_{s} \nabla \times \bar{F}.\hat{N}$ ds where

$\bar{F} = 3y\bar{i} - xz^2\bar{j} + yz^2\bar{k}$ and s is the surface of paraboloid $2z=n^2+y^2$ bounded by $z = 2$. **[5]**

b) Prove that (any one) **[5]**

i) $\bar{b} \times \nabla(\bar{a}.\nabla \log r) = \dfrac{\bar{b} \times \bar{a}}{r^2} - \dfrac{2(\bar{a}.\bar{r})}{r^4}(\bar{b} \times \bar{r})$

ii) $\nabla^4(r^2 \log r) = \dfrac{6}{r^2}$

c) Find the angle between the tangents to the curve $\bar{r} = t^2\bar{i} + 2t\ \bar{j} - t^3\bar{k}$ at the point t = 1 and t = –1. **[5]**

Q8) a) A string is stretched tightly between $x = 0$, $x = l$ and both. ends are given displacement y = asinpt perpendicular to the string. If the string satisfies

differential equation $\dfrac{\partial^2 y}{\partial x^2} = \dfrac{1}{c^2}\dfrac{\partial^2 y}{\partial t^2}$ prove that the oscillations of the string

are given by $y = a\sec\dfrac{pl}{2c}\cos\left(\dfrac{px}{c} - \dfrac{pl}{2c}\right)$. **[8]**

b) Solve the equation $\dfrac{\partial u}{\partial t} = a^2\dfrac{\partial^2 u}{\partial x^2}$ where $u(x,t)$ satisfies the following

conditions. **[7]**
i) $u(0,t) = 0$ ii) $u(l,t) = 0$ for all t
iii) $u(x,0) = x, 0 < x < l$ iv) $u(x,\infty)$ is finite

OR

Q9) a) A rectangular plate is bounded by $x = 0$, $x = a$, $y = 0$, $y = b$. It's surfaces are insulated and temperature along three edges $x = 0$, $x = a$, $y = 0$ is maintained at 0°C. While the fourth edge y = b is maintained of constant temperature u_0 until steady state is reached Find $u(x,y)$. **[8]**

b) Solve $\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}$ if **[7]**

i) u is finite
ii) $u = 0$ when x = 0, π for all t
iii) $u = (\pi x - x^2)$ when t = 0, $0 \le n \le \pi$

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S.E. (Chemical)

INDUSTRIAL CHEMISTRY - I

(2019 Pattern) (Semester- III) (209341)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) *Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*

Q1) a) Explain any two detectors used in gas chromatography. **[6]**

b) State and derive Lambert and Beer's law. **[6]**

c) Explain the principle, technique and application of column chromatography. **[6]**

OR

Q2) a) Explain the important components of gas chromatography. **[6]**

b) Explain the applications of IR spectroscopy. **[6]**

c) Explain the principle and application of TLC. **[6]**

Q3) a) Derive the thermodynamic equation for depression in freezing point of solution. **[6]**

b) Derive the equation for elevation in boiling point and show it is colligative properties. **[6]**

c) A solution of 3.0×10^{-4} kg of camphor [C10H16O] in 25.3×10^{-3} kg of chloroform boils at 334.3 K. Boilingpoint of chloroform is 334 K. Calculate _Hvap and Kb forchloroform. **[5]**

OR

Q4) a) Define and explain Henry and Raoult's law. **[6]**

b) Explain Berkeley and Hartley method for measurement of osmotic pressure. **[6]**

c) 1.51 gm NaCl in 500gm of water (Kb = 0.51 K/molar) elevated boiling point of water by 0.05°C. Calculate the apparent molar mass, Van't Hoff factor and degree of dissociation of NaCl. **[5]**

P.T.O.

Q5) a) Discuss the mechanism of El and E2 reaction of atkyl halides. **[6]**

b) Write short notes on: **[6]**

i) Claisen Rearrangement

ii) Beckman rearrangement.

c) Give the mechanism of Sulfonation of benzene. **[6]**

<div align="center">OR</div>

Q6) a) What are the effects of the following factors on SN^1 and SN^2 reactions?**[6]**

i) Nature of solvent

ii) Nature of leaving group

iii) Nature of nucleophile.

b) Give mechanism of Friedel-Crafts acylation and give its merits. **[6]**

c) Write a short note on Saytzeff rule. **[6]**

Q7) a) Write a short note on diazotisation and coupling in azo dyes. **[6]**

b) Explain any two methods of synthesis. **[6]**

i) Pyrrole

ii) Pyridine

c) Give synthesis of the following dyes: **[5]**

i) Crystal violet

ii) Methyl orange

<div align="center">OR</div>

Q8) a) Give classification of dyes on the basis of application. **[6]**

b) Explain any three methods for synthesis of Furan. **[6]**

c) Give synthesis of the following dyes: **[5]**

i) Phenolphthalein

ii) Alizarin

<div align="center">🌢 🌢 🌢</div>

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S.E. (Chemical)

FLUID MECHANICS

(2019 Pattern) (Semester-III) (209342)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Neat diagrams must be drawn wherever necessary.*

    2)   *Figures to the right indicate full marks.*

    3)   *Assume Suitable data is necessary.*

    4)   *Use of Calculator is allowed.*

Q1)   a)   Derive the expression for continuity equation in 3-D flow?   **[6]**

     b)   Draw a net sketch and explain the working of Venturimeter derive and equation to Calculate flow rate by using Venturimeter.   **[6]**

     c)   A horizontal venturimeter with inlet and throat diameter 30 cm and 15cm respectively is used to measure the flow rate of water the reading of differential monometer connected to the inlet and throat is 20 cm of mercury determining the rate of flow? Take CDd=0.98.   **[6]**

<div align="center">OR</div>

Q2)   a)   Draw a net sketch and explain the working principle of orifice meter derives equation.   **[6]**

     b)   Derive Euler's equation of motion.   **[6]**

     c)   A pitot static tube placed in the center of a 300 mm pipe lines has orifice pointing upstream and other perpendicular to it the mean velocity in the pipe is 0.80 of the central velocity find the discharge through the pipe if the pressure difference between the two orifices is 60mm of Water take coefficient of Pitot tube as CV=0.98   **[6]**

Q3)   a)   Derive Hagen-Poiseuille Equation, highlighting the assumptions made. **[6]**

     b)   A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10m calculate the difference of pressure at two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds.   **[6]**

     c)   Derive " Darcy Weisbach" equation to find head loss due to friction?**[6]**

<div align="center">OR</div>

Q4) a) Derive the relation between the maximum and average velocities along with their position in the cross section of, circular horizontal pipe. **[6]**

b) Prove that expression for laminar flow of fluid. **[6]**

c) Water at 15°C flow between two large parallel plates at a distance of 1.6mm apart, Detemine, **[6]**

    i) Maximum velocity=0.3m/s

    ii) The pressure per unit lenght

    iii) The shear stress at the wall of the plate

Q5) a) With suitable example, describe in detail the Rayleigh's Method of dimensional analysis? **[6]**

b) Explain the term dimensional homogeneous equation? With suitable example. **[6]**

c) The efficiency 'η' of a fan depends on the density 'ρ' the dynamic viscosity 'μ' of the fluid, the angular velocity 'ω', diameter 'D' of the rotor and the discharge 'Q'. Express 'η' in terms of dimensionless parameter. **6]**

OR

Q6) a) Explain Buckingham's π-theorem in detail. **[6]**

b) Explian the concept of boundary layer? **[6]**

c) The pressure difference 'Δp' in a pipe of diameter 'D' and length 'L' due to viscous flow depends on the velocity 'V', viscosity 'μ' and density 'ρ'. Using Buckingham's π-theorem obtain an expression for ΔP. **[6]**

Q7) a) What is high velocity fluidization? Mention the significance of pressure drop in turbulent and fast fluidization. **[6]**

b) Explain operating characteristic of centrifugal pump? **[5]**

c) Explain value and its type with application? **[5]**

OR

Q8) a) Explain phenomenon of cavitation's in centrifugal pumps. How it can be prevented? **[6]**

b) What is fluidization? Write its importance in chemical process industries. **[5]**

c) What is high velocity fluidization? Mention the significance of pressure drop in turbulent and fast fluidization. **[5]**

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S.E. (Chemical)
ENGINEERING MATERIALS
(2019 Pattern) (Semester - III) (209343)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1)   Neat diagrams must be drawn wherever necessary.

2)   Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

3)   Assume suitable data, if necessary.

Q1) a)   Explain in detail Ultrasonic flow inspection test for testing of Engineering materials.   **[9]**

b)   Write down the Applications of Nanomaterials in chemical industry. **[9]**

OR

Q2) a)   Write the difference between destructive and non-destructive hardness test.   **[9]**

b)   What is Nanotechnology? Explain the applications of Nanomaterials in Chemical Industry.   **[9]**

Q3) a)   Draw Iron-Iron carbide equalibrium diagram.   **[9]**

b)   Explain various phases observed in Iron-Iron carbide equilibrium diagram.   **[8]**

OR

Q4) a)   Write the difference between destructive and non-destructive hardness test.   **[9]**

b)   Write down the Applications of Nanomaterials in chemical industry. **[8]**

Q5) Explain principle and working of Transmission Electron Microscope (SEM). **[18]**

OR

Q6) Explain principle and working of Scanning Tunneling microscopy (STM).**[18]**

Q7) a) Define ceramic materials. Write applications of ceramic materials. **[9]**

b) Explain the different mechanical properties of Ceramics. **[8]**

OR

Q8) a) Write a short note on Organic Protective Coatings? **[9]**

b) Write a short note on Glass and its types. **[8]**

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S.E. (Chemical)

PROCESS CALCULATIONS

(2019 Pattern) (Semester - III) (209344)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) In the production of sulphur trioxide, 100 kmol of SO_2 and 200 kmol O_2 are fed to reactor. The product stream is found to contain 80 kmol of SO_3. Find the percentage conversion of SO_2. **[8]**

b) Orthoxylene on oxidation gives phthalic anhydride. The reaction taking place is: **[9]**

$$C_8H_{10} + 3O_2 \rightarrow C_8H_4O_3 + 3H_2O .$$
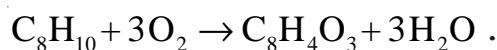
20% excess air is used. The conversion is 50% and the yield of phthalic anhydride is 90%. Calculate the requirement of orthoxylene and air for 100 kmol of phthalic anhydride production.

OR

Q2) a) A combustion chamber is fed with butane and excess air. Combustion of Butane is complete. The composition of the combustion gases on volume basis is given below: **[8]**

CO_2 = 9.39%, H_2O = 11.73%, O_2 = 4.70% and N_2 = 74.18%

Find percentage excess air used and mole ratio of air to butane used.

b) A gas containing 25% CO, 5% CO_2, 2% O_2 and rest N_2 is burnt with 20% excess air. If the combustion is 80% complete, calculate the composition by volume of the flue gases considering the given compositions of gas to be on mole basis. **[9]**

P.T.O.

Q3) a) Calculate the heat of formation of ethane gas at 298.15 K from its elements using Hess's law: **[8]**
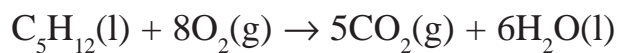
Data:

Heat of formation of $CO_2(g) = -393.51$ kJ/mol

Heat of formation $H_2O(l) = -285.83$ kJ/mol

Heat of combustion of ethane gas at 298.15 K $= -1560.69$ kJ/mol

b) Calculate the standard heat of reaction of the following reaction: **[9]**

$C_5H_{12}(l) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(l)$

Data:

Component	ΔH_f^0 kJ/mol at 298.15 K
$C_5H_{12}(l)$	– 173.49
$CO_2(g)$	–393.51
$H_2O(l)$	–285.83

OR

Q4) a) A stream of carbon dioxide flowing at a rate of 100 kmol/min is heated from 298 K to 383 K. Calculate the heat that must be transferred using C_p data: **[8]**

$C_p^0 = a + bT + cT^2 + dT^3$, kJ/kmol.K

Gas	a	b × 10³	c × 10⁶	d × 10⁹
CO_2	21.3655	64.2841	–41.0506	9.7999

b) The gas having the following composition is at temperature of 775 K: **[9]**

$SO_2 = 7.09\%$, $O_2 = 10.55\%$, $SO_3 = 0.45\%$ and $N_2 = 81.91\%$

Calculate the heat content of 1 kmol gas mixture over 298 K using the heat capacity data given below: $C_p^0 = a + bT + cT^2 + dT^3$, kj/kmol.K

Gas	a	b × 10³	c × 10⁶	d × 10⁹
SO_2	24.7706	62.9481	–44.2582	11.122
O_2	26.0257	11.7551	–2.3426	–0.5623
SO_3	22.0376	121.624	–91.8673	24.3691
N_2	29.5909	–5.141	13.1829	–4.968

Q5) a) Define relative humidity and percentage humidity, and derive a relation between them. **[8]**

b) It is desired to remove 100 kg of water per hour in a dryer. Air is supplied to the dryer at a temperature of 339 K, at a pressure of 101.3 kPa and a dew point of 277.5 K. If the air leaves the dryer at a temperature of 308 K, a pressure of 100.66 kPa and dew point 297 K, calculate the volume of air at the initial condition that must be supplied per hour. **[10]**

Data : Vapour pressure of water at 277.5 K = 0.8365 kPa

Vapour pressure of water at 297 K = 2.9821 kPa

OR

Q6) The dry bulb temperature and dew point of the ambient air were found to be 302 K and 291 K respectively. The barometer reads 100.0 kPa. Compute **[18]**

a) The absolute molar humidity

b) The absolute humidity

c) The percentage RH

d) The percentage saturation

e) The humid heat

Data : Vapour pressure of water at 291 K = 2.0624 kPa,

Vapour pressure of water at 302 K = 4.004 kPa

Q7) a) Explain the following : **[6]**

i) Classsification of fuels

ii) Adiabatic Flame Temperature

b) The orsat analysis of the flue gases from a boiler house chimney gives CO_2 = 11.4%, O_2 = 4.2% and N_2 = 84.4% (mole %). Assuming that complete combustion has taken place. Calculate the % excess air, and also find the C/H ratio in the fuel. **[8]**

c) Explain in detail about proximate analysis of coal. **[4]**

OR

Q8) Calculate the gross and net calorific values of the natural gas at 298.15 K which has the following molar composition: **[18]**

CH_4 = 89.4%, C_2H_6 = 5.0%, C_3H_8 = 1.9%, iso-C_4H_{10} = 0.4%, n-C_4H_{10} = 0.6%, CO_2 = 0.7% and N_2 = 2.0%.

Data :

Component	GCV kJ/mol	NCV kJ/mol
CH_4	890.65	802.62
C_2H_6	1560.69	1428.64
C_3H_8	2219.17	2043.11
iso-C_4H_{10}	2868.20	2648.12
n-C_4H_{10}	2877.40	2657.32

Specific volume of the natural gas at 298.15 K and 101.3 kPa = 24.465 m³/kmol.

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SEAT No. :

[**Total No. of Pages : 3**

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S.E. (Chemical)
HEAT TRANSFER
(2019 Pattern) (Semester-IV) (209348)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
   1)   *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
   2)   *Neat diagrams must be drawn wherver necessary.*
   3)   *Figures to the right indicate full marks.*
   4)   *Assume suitable data, if necessary.*

Q1) a)   Determine the net radiant interchange between two parallel oxidized iron plates, placed at a distance of 25 mm having sides 3*3m. The surface temperatures of two plates are 373 K and 313K respectively. Emissivities of the plates are equal Given $e_1 = e_2$ 0.736.   **[6]**

   b)   Define monochromatic emissive power and monochromatic emissivity.
                                                         [4]

   c)   What is Radiation? Explain black body?   **[4]**

   d)   Explain any TWO   **[4]**
      i)   Specular and Diffuse Reflection
      ii)   Emissivity
      iii) Radiation shield

OR

Q2) a)   Explain   **[6]**
      i)   Radiation Shape Factor
      ii)   Kirchoff's Identity
      iii) Gray Body

   b)   Define: **[5]**
      i)   Irradiation
      ii)   Radiosity
      iii) Absorptivity
      iv) reflectivity
      v)   transmitivity

   c)   Two large parallel plates with emissivities 0.2 & 0.6 are maintained at 1000K & 500 K respectively. A third plate with emissivity 0.08 in introduced as a radiation shield in between two plates. Calculate reduction in heat loss rate per unit area & temperature of the shield?   **[7]**

Q3) a) Define Condensation? differntiate between filmwise and dropwise condensation with example. **[6]**

b) Describe Pool Boiling Curve in detail with neat sketch. **[5]**

c) Write short note on: **[6]**
   i) Heat transfer in agitated vessels.
   ii) Individual & overall heat transfer coefficient.
   iii) Thermal Boundary Layer

OR

Q4) a) Give significance of **[12]**
   i) Nusselt No.
   ii) Prandtl No.
   iii) Grashof No.
   iv) ReynoldsNo.
   v) Peclet No.
   vi) Rayleigh No.

b) Explain Film boiling **[5]**

Q5) a) What is heat exchanger? Explain classification of Heat Exchanger? **[6]**

b) In an oil cooler, 60g/s of hot oil enters a thin metal pipe of diameter 25 mm. An equal mass of cooling water flows through the annular space between the pipe and a large concentric pipe, the oil and water moving in opposite directions. The oil enters at 420 K and is to be cooled to 320 K. If water enters at 290 K, What length of pipe is required? Take Overall heat transfer coefficient U=1108 W/(m^{2}K). specific heat of oil is 2.0 KJ/(Kg K) and that of water is 4.18 KJ/kg K) **[8]**

c) Explain Effectiveness of Heat Exchanger. **[4]**

OR

Q6) a) Draw neat sketch of double pipe heat exchanger and explain **[7]**

b) A shell & tube heat exchanger is to be provided with tubes of 31 mm outer diameter & 27 mm inner diameter, 4 m long. It is required for heating water from 295 K to 318 K with the help of condensing steam at 393 K on the outside of tubes. Determine the number of tubes required if water flow rate is 10kg/sec. Heat transfer coefficient on steam side & water side are 6000W/m^2 K & 850 W m^2 K respectively. Neglect all other resistances. **[7]**

c) Define Capacity ratio and NTU **[4]**

Q7) a) Give types of evaporators and write on Calendria type evaporator with neat sketch. **[7]**

b) An aqueous sodium chloride solution (10 wt%) is fed into a single effect evaporator at a rate of 10000 kg/hr. It is concentrated to a 20 wt% sodium chloride solution. The rate of consumption of steam in the evaporator is 8000 kg/hr. Calculate Capacity (Kg/hr) & Economy of the evaporator. **[6]**

c) Define Capacity and Steam Economy of Evaporator **[4]**

OR

Q8) a) Draw and explain the forward feed multiple effect evaporator. **[7]**

b) What is evaporation? Define Boiling point elevation and explain Duhring's rule in evaporation. **[7]**

c) Describe the different factors affecting the evaporation operation. **[3]**

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[5925]-252

S.E. (Chemical Engineering)
PRINCIPLES OF DESIGN
(2019 Pattern) (Semester - IV) (209349)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Figures to the right indicate full marks.*
3) *Draw neat figures wherever necessary.*
4) *Use of scientific calculator is allowed.*
5) *Assume suitable data wherever necessary.*

Q1) a) Derive the equation to determine the diameter of shaft if i) shaft subject to twisting moment only, ii) shaft subject to bending moment only.   **[8]**

b) A solid circular shaft is subjected to a bending moment of 3000 N-m and torque of 10000 N-m. The shaft is made of 45C8 steel having ultimate tensile stress of 700 MPa and Ultimate shear stress 500 MPa. Assuming the FOS as 06. Determine the diameter of shaft.   **[10]**

OR

Q2) a) Draw neat sketches of different types of keys and state their applications and how they are classified?   **[8]**

b) Design the rectangular key for a shaft of 5 mm diameter. The shearing and crushing stresses for the key material are 42 MPa and 70 MPa. **[10]**

Q3) a) Find the efficiency of following riveted joints: **[10]**

i) Single riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 50 mm.

ii) Double riveted joint of 6 mm plates with 20 mm diameter rivets having a pitch of 65 mm.

P.T.O.

Assume:

Permissible tensile stress in plate is 120 MPa.

Permissible shearing stress in rivets is 90 MPa,

Permissible crushing stress in rivets is 180 MPa.

b) Define welding. Classify welding joints. What are advantages of welded joints over riveted joints & how will you define strength of butt weld joint subjected to tensive force. **[7]**

OR

Q4) a) Derive the equation to determine the length of a cross belt derive along with proper sketch. **[7]**

b) Two pulleys, one 450 mm diameter and other 200 mm diameter, on parallel shaft 1.95 m apart are connected by a crossed belt. Find the length of belt required and angle of contact between the belt and each pully.

What power can be transmitted by the belt when the larger pully rotates at 200 RPM, if maximum permissible tension in the belt is 1 kN, and the coefficient of friction between belt and pully is 0.25? Also draw the sketch. **[10]**

Q5) a) Short note on selection and design of various types of heads for pressure vessels. **[6]**

b) A pressure vessel having outer diameter 1.3 m and height 3.8 m is subjected to an internal pressure of 12 Kg/cm^2. If vessel is fabricated as class B vessel, joint efficiency is 85%, if the vessel is fabricated as class C vessel, with welded joint efficiency is 70% and 50% and if the vessel is provided with a strip all along the longitudinal joint, joint efficiency is 100%. Calculate the vessel thickness under these different conditions and find out how much is the % material saving by welding a strip along the longitudinal joint.

Allowable stress for the material is 1000 Kg/cm^2.

Corrosion allowance is 1 mm. **[12]**

OR

Q6) a) Calculate the thickness of a torispherical heads (100-6) and (80-6) elliptical head (2:1) and hemispherical head for a pressure vessel having design pressure 7 kg/cm². Diameter of vessel is 1.5 m, and the permissible stress is 1250 kg/cm². Welded joint efficiency is 85%. **[12]**

b) Explain the method for calculating thickness of torispherical head subjected to Internal pressure, and External pressure. **[6]**

Q7) a) Write short note on Autofrettage of Monoblock Pressure vessels. **[7]**

b) Calculate the thickness of flanged torispherical head for a vessel having internal diameter 6000mm. Design pressure of vessel is 3.4 kg/cm², inside crown radius is 6000mm. Inside knuckle radius is 380mm.Permissible stress of material is 1190 kg/cm². Welded joint efficiency is 100%. **[10]**

OR

Q8) a) Explain and enlist various materials of construction used for high pressure vessel. **[6]**

b) What is thick wall pressure vessel? Define & explain. **[5]**

b) Define Pressure vessel and give some industrial examples where these are used commonly. **[6]**

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[5925]-253

S.E. (Chemical Engineering)
CHEMICAL TECHNOLOGY - I
(2019 Pattern) (Semester - IV) (209350)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume suitable data, if necessary.*
5) *Use of electronic pocket calculator is allowed.*
6) *Use of cell phone/mobile phone is prohibited in the examination hall.*

Q1) a) Explain use of nitrogen to increase agricultural productivity.   **[5]**

   b) Explain stamicarbon urea stripping process with a simplified flow chart.**[8]**

   c) State methods of production of Nitric acid.   **[4]**

OR

Q2) a) Explain in brief Montecatini intermediate pressure process for production of Nitric acid with process flow diagram.   **[10]**

   b) Describe major engineering problems in the manufacturing of synthetic ammonia based on the pressure catalytic reaction.   **[7]**

Q3) a) Explain how detergents differ form soap.   **[3]**

   b) State importance of surfactants in manufacturing of soap & detergents.**[4]**

   c) Explain basic chemical reaction in saponification.   **[3]**

   d) Explain process of manufacture of detergent : dodecyl benzene sulphonate with process flow diagram.   **[8]**

OR

Q4) a) Explain Ziegler catalytic procedure. **[5]**

b) Explain the difference between Batch saponification process and continuous saponification process. **[5]**

c) Describe in brief process of manufacturing of full-boiled soap on commercial basis with a flow diagram. **[8]**

Q5) a) Explain in brief importance of role of chemistry and Chemical Engineering in Polymerization Industries. **[5]**

b) Explain in brief kinetic reactions in Polycondensation. **[6]**

c) Draw flow chart for manufacture of Polyvinyl resin. **[6]**

OR

Q6) a) Describe in brief major role of plastics in agriculture. **[4]**

b) Explain in brief LDPE and HDPE. **[5]**

c) Explain in brief process description for manufacture of Polyolefins by low pressure Ziegler process with process flow diagram. **[8]**

Q7) a) Describe in brief production of crude petroleum by Drilling. **[4]**

b) Describe in brief types of Refineries, Companies & locations in India. **[6]**

c) Explain in brief description of Isometization process with its process flow diagram. **[8]**

OR

Q8) a) Draw flow chart of synthetic rubber polymerization (SBR) and Copolymers. **[10]**

b) Explain reactions involved in thermal cracking. **[4]**

c) Explain Fluidized bed type catalytic cracking process. **[4]**

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Total No. of Questions : 8]

PA-1232

SEAT No. :

[Total No. of Pages : 2

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S.E. (Chemical)

MECHANICAL OPERATIONS

(2019 Pattern) (Semester - IV) (209351)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

2) *Neat diagrams must be drawn whenever necessary.*

3) *Figures to the right side indicate full marks.*

4) *Assume suitable data if necessary.*

Q1) Derive the equation for minimum fluidization velocity and describe the equation for case of very small particles. **[18]**

OR

Q2) a) Explain with a neat sketch: **[12]**

i) Cyclone separator

ii) Fabric Filter

b) Explain with a neat sketch any one type of electrostatic separator. **[6]**

Q3) a) Write notes on: **[9]**

i) Internal screw mixer

ii) Pony Mixer

iii) Flow pattern with off centre propeller

b) Write an explanatory note on Impellers. **[8]**

OR

Q4) Explain and derive the necessary equation for : **[17]**

a) Mixing Index

b) Power number

P.T.O.

Q5) Explain with a neat sketch Principle, construction and working of Plate and Frame Filter Press. **[18]**

OR

Q6) a) What is filter medium? State the various requirements of filter medium. **[9]**

b) Derive the following for filtration at constant pressure difference: **[9]**

$$\frac{t-t_1}{V-V_1} = \frac{r\mu\upsilon}{2A^2(-\Delta P)}(V-V_1) + \frac{r\mu\upsilon V_1}{A^2(-\Delta P)}$$

Q7) a) What are chain and flight conveyors? Explain any two types of chain conveyors. **[9]**

b) Write an explanatory note on Belt Conveyors. **[8]**

OR

Q8) a) Explain with neat sketch pneumatic type of conveyors. **[8]**

b) Explain with a neat sketch following parts of belt conveyors: **[9]**

i) Belts

ii) Belt idlers

iii) Belt arrangements

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S.E. (Computer Engg./Computer Science and Design Engineering/ Artificial Intelligence & Data Science)
DISCRETE MATHEMATICS
(2019 Pattern) (Semester-III) (210241)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 Q.7 Q.8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Assume suitable data wherever necessary.*

Q1) a) The company has 10 members on its board of directors. In how many ways can they elect a president, a vice president, a secretary and treasure. **[6]**

b) Find eighth term in the expansion of $(x+y)^{13}$ **[6]**

c) A box contains 6 white and 5 black balls. Find number of ways 4 balls can be drawn from the box if **[6]**

   i) Two must be white

   ii) All of them must have same colour

<div align="center">OR</div>

Q2) a) In how many ways can word the 'HOLIDAY' be arranged such that the letter I will always come to left of letter L. **[6]**

b) In how many ways can one distribute 10 apples among 4 children **[6]**

c) Use Binomial theorem to expand $(X^4+2)^3$ **[6]**

Q3) a) Is it possible to draw a simple graph with 4 vertices and 7 edges. Justify? **[7]**

b) Define following terms with example. **[5]**
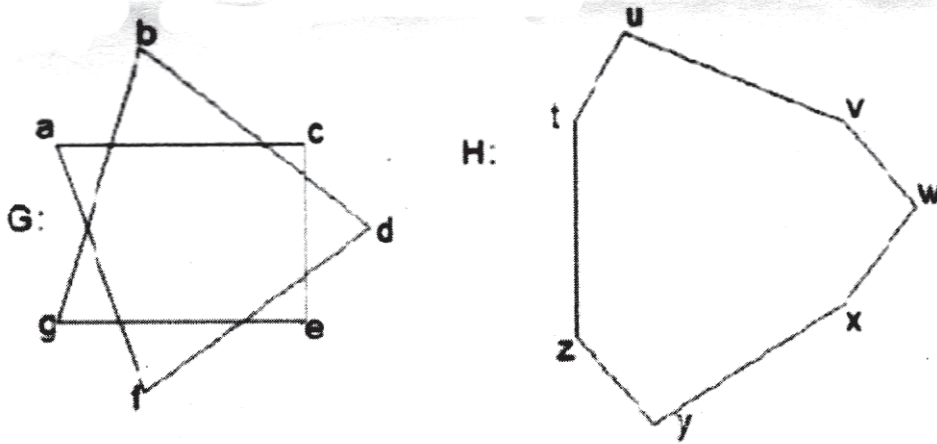
   i) Complete graph

   ii) Regular graph

   iii) Bipartite graph

   iv) Complete bipartitie graph

   v) Paths and circuits

c) The graphs G and H with vertex sets V(G) and V(H), are drawn below. Determine whether or not G and H drawn below are isomorphic. If they are isomorphic, give a function g: V(G)-> V(H) that defines the isomorphism. If they are not explain why they are not. **[5]**

OR

Q4) a) Determine which if the graph below represents Eulerian circuit, Eulerian path, Hamiltonian circuit and Hamiltonian Path. Justify your answer **[7]**
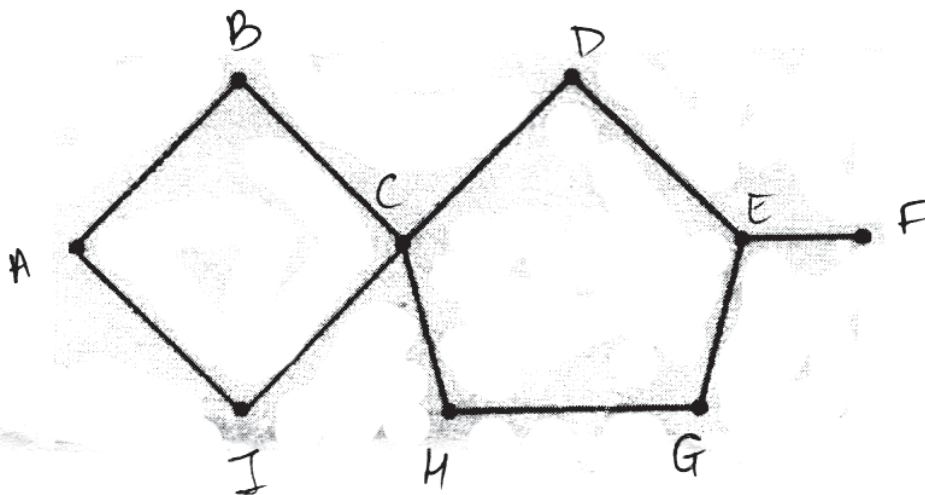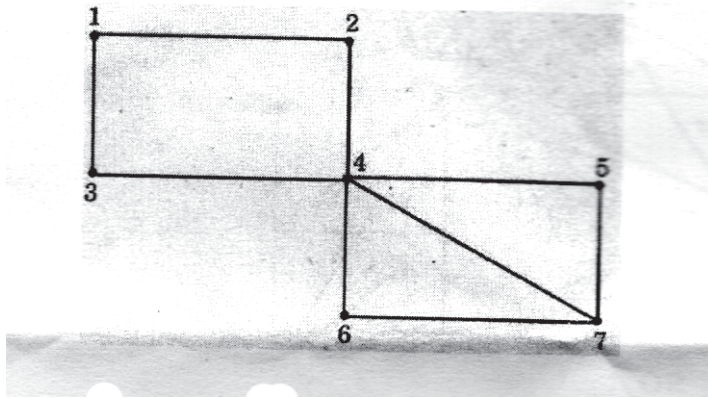
b) A connected planar graph has nine vertices with degree 2,2,2,3,3,3,4,4,5 **[5]**

Find

   i) number of edges

   ii) number of faces

   iii) construct two such graphs

c) Explain the following statement with example **[5]**

"Every graph with chromatic number 2 is bipartite graph"

Q5) a) Construct Huffman tree. **[6]**

| A	5
B	6
C	6
D	11
E	20

b) Explain **[6]**

   i) Cutset

   ii) Tree properties

   iii) Prefix code

c) Give the stepwise construction of minimum spanning tree using Prims algorithm for the following graph. Obtain the total cost of minimum spanning tree. **[6]**
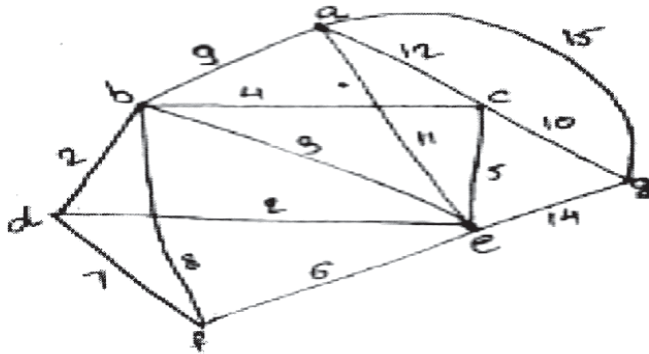
OR

Q6) a) Using the labelling procedure to find maximum flow in the transport network in the following figure. Determine the corresponding minimum cut. **[6]**
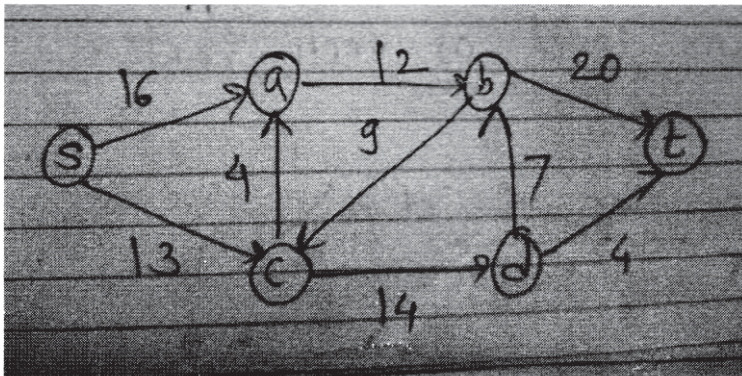
b) Define with example. **[6]**

i) Level and height of a tree.

ii) Binary search tree.

iii) Spanning tree

c) Construct binary search tree by inserting integers in order **[6]**
50,15,62,5,20,58,91,3,8,37,60,24
Find
i) No of internal nodes
ii) leaf nodes

Q7) a) Let R = {0,60,120,180,240,300} and* binary operation so that for a and b in R, a*b is overall angular rotation corresponding to successive rotations by a and by b. show that (R,*) is a group. **[6]**

b) Following is the incomplete operation table of 4-element group. Complete the last two rows. **[6]**

*	e	a	b	c
e	e	a	b	c
a	a	b	c	e
b				
c				

c) Explain Algebraic system and properties of binary operations. **[5]**

OR

Q8) a) Explain the following terms with examples
i) Ring with unity
ii) Integral domain
iii) Field **[6]**

b) Consider the set Q of rational numbers and let a*b be the operation defined by a*b=a+b-ab **[6]**
i) Find 3*4
ii) 2*(-5),
iii) 7*(1/2)
Is (Q,*)a semigroup? Is it commutative?

c) Show that $(Z_n, \oplus)$ is Abelian group **[5]**

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S.E. (Computer /AI&DS)
FUNDAMENTALS OF DATA STRUCTURES
(2019 Pattern) (Semester - III) (210242)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
  1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
  2) *Figures to the right indicate full marks.*
  3) *Neat diagrams must be drawn wherever necessary.*
  4) *Make suitable assumption whenever necessary.*

Q1) a) Write pseudo 'Python' algorithm (recursive) for binary search. Apply your algorithm on the following numbers stored in array from A[0] to A[10] 9, 17, 23,38,45,50,57,76,90,100 to search numbers 10 & 100.**[9]**

   b) Explain the quick sort algorithm. Show the contents of array after every itertion of your algorithm start from following status of array.-

   27, 76, 17, 9, 57, 90, 45, 100, 79.   **[9]**

<div align="center">OR</div>

Q2) a) Explain in brief the different searching techniques. What is the time complexity of each of them?   **[9]**

   b) Write an algorithm of selection sort and sort the following numbers using selection sort and show the contents of an array after every pass:-

   81, 5, 27, –6, 61, 93, 4, 8, 104, 15   **[9]**

Q3) a) What is linked list? Write a pseudo C++ code to sort the elements. **[9]**

   b) What is doubly linked list? Explain the process of deletion of an element from doubly linked list with example.   **[9]**

<div align="center">OR</div>

Q4) a) Explain Generalized Linked List with example.   **[9]**

   b) Write Pseudo C++ code for addition of two polynomials using singly linked list.   **[9]**

Q5) a)   Write an algorithm for postfix evaluation with suitable example.   **[8]**

b)   What is concept of recursion? Explain the use of stack in recursion with example.   **[9]**

<div align="center">OR</div>

Q6) a)   What is need to convert the infix expression into postfix; convert the following expression into postfix expression (a+b) * d + e/(f + a*d) + c.   **[8]**

b)   What is backtracking algorithm design strategy? How stack is useful in backtracking   **[9]**

Q7) a)   Write pseudo C++ code to represent dequeue and perform the following operations on dequeue: **[8]**

   i)   Create

   ii)   Insert

   iii)   Delete

   iv)   Display

b)   What is circular queue? Explain the advantages of circular queue area linear queue.   **[9]**

<div align="center">OR</div>

Q8) a)   Define queue as an ADT. Write pseudo C++ code to represent queue.**[8]**

b)   Explain Array implementation of priority queue with all basic operations.   **[9]**

<div align="center">🜂 🜂 🜂</div>

[5925]-257

S.E. (Computer/Artificial Intelligence & Data Science/ Computer Science & Design Engineering)
OBJECT ORIENTED PROGRAMMING
(2019 Pattern) (Semester - III) (210243)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

   1)   *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.*

   2)   *Figures to the right indicate full marks.*

   3)   *Neat diagrams must be drawn wherever necessary.*

   4)   *Assume suitable data, if necessary.*

Q1) a)   Explain the polymorphism feature of OOP. What are the different ways to achieve polymorphism in C++ Language? Explain them along with examples. **[5]**

     b)   What is operator overloading? Write a program to overload '+' operator for adding two complex numbers which are object of below complex class. **[6]**

         Class Complex

         {

             Private: int real, imag;

         };

     c)   What is Pure virtual function? Illustrate the use of Pure virtual function. **[6]**

<p align="center">OR</p>

Q2) a)   What is runtime polymorphism? How it is achieved in C++. Explain it along with example. **[5]**

     b)   What is function overloading? Write defination of three overloaded functions (add) which will add two integer, float and double numbers respectively. **[6]**

     c)   Explain abstract class concept along with example. **[6]**

Q3) a) What are various functions used to manipulate file pointers? Explain using example. **[7]**

b) What are command line arguments in C++? Write a program to explain the same. **[7]**

c) What are fstream, ifstream and ofstream? Illustrate with help of example. **[4]**

OR

Q4) a) Write a program to create file, read and write record into it. Every record contains employee name, id and salary. Store and retrieve atleast 3 data. **[7]**

b) What do you mean by file handling? Explain the following functions. **[7]**

    i)   open()

    ii)   get()

    iii) getline()

c) Write a program to create files using constructor function. **[4]**

Q5) a) Distinguish between overloaded function and function template with suitable example. **[4]**

b) What is an exception specification? Explain using suitable example. **[6]**

c) What is generic programming? How it is implemented in C++. **[7]**

OR

Q6) a) Write short note on type name and export key-word. **[4]**

b) Explain class template using multiple parameters with help of program. **[6]**

c) Explain exception handling mechanism in C++? Explain by program to handle "divide by zero". **[7]**

Q7) a)   What is purpose of iterator and algorithm.   **[4]**

   b)   What is STL? List and explain different types of STL containers. **[6]**

   c)   Write a program to implement map in STL.   **[8]**

OR

Q8) a)   What are major components of STL.   **[4]**

   b)   State functions of vector STL. Write a program to explain the same.
                                                                         [6]

   c)   What is container? List the container classes in C++. Explain any one
        of them using program.   **[8]**

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S.E. (Computer & Design Engineering)
COMPUTER GRAPHICS
(2019 Pattern) (Semester - III) (210244)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1)   Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.

2)   Neat diagram must be drawn wherever necessary.

3)   Figures to the right indicate full marks.

4)   Assume suitable data if necessary.

Q1) a)   Differentiate between Parallel projection and perspective projection.**[4]**

     b)   What is transformation and write transformation matrix for :   **[4]**

         i)   2-D reflection with respect to line Y = X

         ii)   3-D rotation about Y-axis

     c)   Perform 45° rotation of a triangle A(0, 0), B(1, 1) and C(5, 2). Find transformed coordinates after rotation, (i) About origin, (ii) About P (–1, 1).   **[10]**

OR

Q2) a)   What are the types of projection and write in brief about each type of projection.   **[4]**

     b)   Derive 3D transformation matrix for rotation about a principal axis. **[4]**

     c)   A triangle is defined by $\begin{bmatrix} 2 & 4 & 4 \\ 2 & 2 & 4 \end{bmatrix}$. Find transformed coordinates after the following transformation.   **[10]**

         i)   90° rotation about the origin.

         ii)   Reflection about line X = Y

Q3) a)   Explain backface detection and removal.   **[6]**

     b)   Explain and compare point source and diffuse illumination.   **[5]**

     c)   Compare Gauraud shading and phong shading.   **[6]**

Q4) a) Write short note on Warnock's Algorithm [6]

b) Explain Halftone shading. [5]

c) Explain the following terms with examples: [6]

   i) Color gamut

   ii) Specular Reflection

   iii) Diffuse reflection

Q5) a) Write a short note on interpolation and approximation. [4]

b) Explain blending function for B-spline curve. [7]

c) What are fractals? Explain Triadic Koch in detail. [7]

OR

Q6) a) Explain the Bezier curve. List its properties. [4]

b) Explain Hilbert's curve with an example. [7]

c) With suitable example write short note on the fractal line. [7]

Q7) a) Explain deletion of segment with suitable example. [7]

b) Define Morphing and write the applications of Morphing. [3]

c) Explain architecture of *i*860 [7]

OR

Q8) a) Write a short note on motion specification methods based on : [7]

   i) Geometric and kinematics information.

   ii) Specification methods based on physical information.

b) Write any three important features of NVIDIA gaming platform. [3]

c) Explain renaming of a segment with suitable example. [7]

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[5925]-259

S.E. (Computer Engineering)
DIGITAL ELECTRONICS AND LOGIC DESIGN
(2019 Pattern) (Semester - III) (210245)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Assume suitable data, if necessary.*

Q1) a) What are sequential circuits? Explain excitation table of JK flipflop. **[6]**

    b) Convert Following Flipflops: **[6]**

       i) SR to JK

       ii) JK to D

    c) What is MOD counter? Design MOD - 24 counter using 7490. **[6]**

OR

Q2) a) What are sequential circuits? Explain SR flipflop using a suitable example.**[6]**

    b) Convert Following Flipflops: **[6]**

       i) JK to T

       ii) SR to D

    c) Design sequence detector using MS JK flipflop for sequence 1101. **[6]**

Q3) a) Draw ASM chart for 2-bit UP counter using multiplexer controller method.**[6]**

    b) Draw a block diagram of the PLA device and explain. **[6]**

    c) Implement following Boolean function using PAL. **[5]**

$$F1 = \sum m(0,2,3,4,5,6,7,8,10,11,15)$$
$$F2 = \sum m(1,2,8,12,13)$$

OR

Q4) a) What is an ASM Chart? Design the ASM chart for a 2-bit binary counter having one enable line E such that when: **[6]**

E = 1 (count enabled) and

E = 0 (counting is disabled).

b) Implement 3 bit binary to gray code converter using PLA. **[6]**

c) A combinational Circuit is defined by the following function: **[5]**

$$F1(A,B,C) = \sum m(0,1,3,7)$$

$$F2(A,B,C) = \sum m(1,2,5,6)$$

Implement this circuit with PLA.

Q5) a) Explain the operation of TTL NAND gate. **[6]**

b) Compare TTL and CMOS families and also draw CMOS-NOR Gate. **[6]**

c) Define the following terms and mention the standard values for TTL logic Family: **[6]**

i) Noise Margin

ii) Power Dissipation

iii) Propagation Delay

OR

Q6) a) Explain TTL open collector. **[6]**

b) Draw and explain the circuit diagram of the CMOS Inverter. **[6]**

c) Draw two input standard TTL NAND gate circuit and explain their operation. **[6]**

Q7) a) What is Microprocessor? Explain the system bus in brief. **[6]**

b) Which are various functional units of microprocessors? Explain ALU in brief. **[6]**

c) How Basic Arithmetic operations are performed using ALU IC 74181? **[5]**

OR

Q8) a) What is Microprocessor? Explain various operations of the microprocessor. **[6]**

b) Explain the Memory organization of the microprocessor. **[6]**

c) Explain the 4-bit Multiplier circuit using ALU and shift registers in brief. **[5]**

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[5925]-260
S.E. (Computer/I.T./AI&ML)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - IV) (207003)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:
1) *Q.1 is compulsory.*
2) *Attempt Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of electronic pocket calculator is allowed.*
6) *Assume suitable data, if necessary.*

Q1) Write the correct option for the following multiple choice questions :

i) $y : 1\ 2\ 3$

$x : 1\ 5\ 9$

The least square fit of the form $x = ay + b$ to the above data is _____. **[2]**

a) $x = 2y - 5$

b) $x = 4y + 4$

c) $x = 4y + 1$

d) $x = 4y - 3$

ii) For two events A and B, $P(A) = \dfrac{2}{3}, P(B) = \dfrac{3}{8}$ and $P(A \cap B) = \dfrac{1}{4}$, then the events A and B are _____. **[2]**

a) mutually exclusive and independent

b) not mutually exclusive and not independent

c) independent, but not mutually exclusive

d) mutually exclusive, but not independent

P.T.O.

iii) Using Gauss elimination method, the solution of system of equations

$x+4y-z=-5$, $y+\dfrac{5}{3}z=\dfrac{7}{3}$ and $-13y+2z=19$ is _____. **[2]**

a) $x=\dfrac{117}{71}$, $y=-\dfrac{81}{71}$, $z=\dfrac{148}{71}$

b) $x=\dfrac{71}{117}$, $y=-\dfrac{71}{81}$, $z=\dfrac{71}{148}$

c) $x=-\dfrac{117}{71}$, $y=\dfrac{81}{71}$, $z=-\dfrac{148}{71}$

d) $x=1$, $y=2$, $z=0$

iv) If Lagrange's polynomial passes through $\begin{matrix} x & 0 & 1 \\ y & 1 & 2 \end{matrix}$ then $\int\limits_{0}^{1} y\,dx =$

_____. **[2]**

a) $\dfrac{2}{3}$

b) $\dfrac{3}{2}$

c) $\dfrac{1}{2}$

d) 3

v) If $\sum xy = 2638$, $\bar{x}=14$, $\bar{y}=17$, $n=10$, then $\text{cov}(x,y)=$ _____. **[1]**

a) 25.8

b) 23.9

c) 20.5

d) 24.2

vi) If x_0, x_1 are two initial approximations to the root of $f(x) = 0$, by secant method the next approximation x_2 is given by _____. **[1]**

a) $x_2 = \dfrac{x_0 + x_1}{2}$

b) $x_2 = x_1 - \dfrac{f(x_1)}{f^1(x_1)}$

c) $x_2 = x_1 - \dfrac{(x_1 - x_0)}{(f_1 - f_0)} f_1$

d) $x_2 = x_1 + \dfrac{(x_1 + x_0)}{(f_1 + f_0)} f_1$

Q2) a) The first four moments of a distribution about 4 are –1.4, 17, –30 and 108. Obtain the first four central moments and coefficient of skewness & kurtosis. **[5]**

b) Fit a linear curve of the type $y = ax + b$, to following data, **[5]**

x	10	15	20	25	30
y	0.75	0.935	1.1	1.2	1.3

c) Find the correlation coefficient for the following data, **[5]**

Population density	200	500	400	700	800
Death rate	12	18	16	21	10

OR

Q3) a) Find coefficient of variability for following data, **[5]**

C.I.	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Freq. (f)	4	7	8	12	25	18	10

b) Fit a linear curve $y = ax + b$, by least square method to the data, **[5]**

x	100	120	140	160	180	200
y	0.9	1.1	1.2	1.4	1.6	1.7

c) The regression equations are $8x - 10y + 66 = 0$ and $40x - 18y = 214$. The value of variance of x is 9. Find **[5]**

   i) the mean values of x and y

   ii) the correlation x and y and

   iii) the standard deviation of y

Q4) a) Three factories A, B and C produce light bulbs. 20%, 50% and 30% of the bulbs are available in the market by factories A, B and C respectively. Among these, 2%, 1% and 3% of the bulbs produced by factories A, B and C are defective. A bulb is selected at random in the market and found to be defective. Find the probability that this bulb was produced by factory B. **[5]**

b) On an average, 20% of the computers in a firm are virus infected. If 10 computers are chosen at random from this firm, find the probability that at least one computer is virus infected, using Binomial distribution. **[5]**

c) The height of a student in a school follows a normal distribution with mean 190 cm and variance 80 cm². Among the 1,000 students from the school, how many are expected to have height above 200 cm? **[5]**

(Given : z = 1.118, A = 0.3686)

OR

Q5) a) A die is tampered in such a way that the probability of observing an even number is twice as likely to observe an odd number. Find the expected value of the upper most face obtained after rolling the die. **[5]**

b) The number of industrial injuries per working week in a factory is known to follow a Poisson distribution with mean 0.5. Find the probability that during a particular week, at least two accidents will take place. **[5]**

c) A pea cultivating experiment was performed. 219 round yellow peas, 81 round green peas, 61 wrinkled yellow peas and 31 wrinkled green peas were noted. Theory predicts that these phenotypes should be obtained in the ratios 9:3:3:1. Test the compatibility of the data with theory, using 5% level of significance. (Given : $\chi^2_{tab} = 7.815$) **[5]**

Q6) a) Obtain the root of the equation $x^3 - 4x - 9 = 0$ that lies between 2 and 3 by Newton-Raphson method correct to four decimal places. **[5]**

b) Solve $2x - \cos x - 3 = 0$ by using the method of successive approximations correct of three decimal places. **[5]**

c) Solve by Gauss - Seidel method, the system of equations : **[5]**

$2x_1 + x_2 + 6x_3 = 9$

$8x_1 + 3x_2 + 2x_3 = 13$

$x_1 + 5x_2 + x_3 = 7$

OR

Q7) a) Solve by Gauss elimination method, the system of equations : **[5]**

$4x_1 + x_2 + x_3 = 4$

$x_1 + 4x_2 - 2x_3 = 4$

$3x_1 + 2x_2 - 4x_3 = 6$

b) Solve by Jacobi's iteration method, the system of equations : **[5]**

$20x_1 + x_2 - 2x_3 = 17$

$3x_1 + 20x_2 - x_3 = -18$

$2x_1 - 3x_2 + 20x_3 = 25$

c) Find a real root of the equation $x^3 - 2x - 5 = 0$ by the method of false position at the end of fifth iteration. **[5]**

Q8) a) Using Newton's backward difference formula, find y at x = 4.5 for the following data. **[5]**

x	1	2	3	4	5
y	3.47	6.92	11.25	16.75	22.94

b) Use Simpson's 3/8th rule, to estimate $\int_1^7 f(x)dx$ from the following data. **[5]**

x	1	2	3	4	5	6	7
f(x)	81	75	80	83	78	70	60

c) Use Euler's method to solve $\dfrac{dy}{dx} = x^2 + y$, $y(0) = 1$. Tabulate values of y for x = 0 to x = 0.3. (Take h = 0.1) **[5]**

OR

Q9) a) Use Runge-Kutta method of 4th order to solve $\dfrac{dy}{dx} = \dfrac{y-x}{y+x}$, $y(0)=1$

at $x = 0.2$ with $h = 0.2$. **[5]**

b) Using modified Euler's method, find $y(1.1)$. Given $\dfrac{dy}{dx} = 2 + \sqrt{xy}$, $y(1)=1$.

Take $h = 0.1$. (Two iterations only) **[5]**

c) Determine the value of $y = \sqrt{151}$, using Newton's forward difference formula, from the following data. **[5]**

x	150	152	154	156
$y = \sqrt{x}$	12.247	12.329	12.410	12.490

■■■

[5925]-261

S.E. (Computer Engineering)
(Artificial Intelligence & Data Science) (Computer)
DATA STRUCTURES AND ALGORITHMS
(2019 Pattern) (Semester-IV) (210252)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Find minimum spanning tree of the following graph using kruskals algorithm. **[6]**
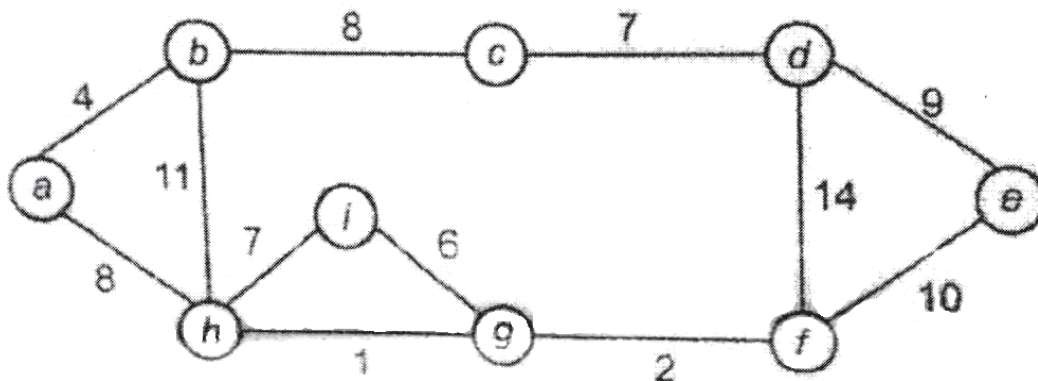
b) Write algorithm for Breadth First Traversal of the graph. Also write its complexity. **[6]**

c) Write Kruskal's algorithm for minimum spanning trees and explain with example. **[6]**

OR

Q2) a) Apply Prim's Algorithm to construct Minimum Spanning Tree, for below drawn graph: Starting vertex is 'a'. **[6]**
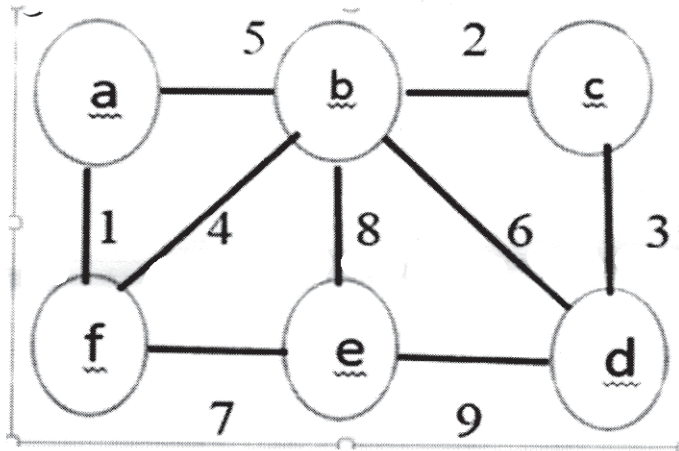
b) Develop pseudo code with one example to traverse a graph using BFS. **[6]**

c) Find the shortest path from a to f, in the following graph using Dijkstra's Algorithm. **[6]**
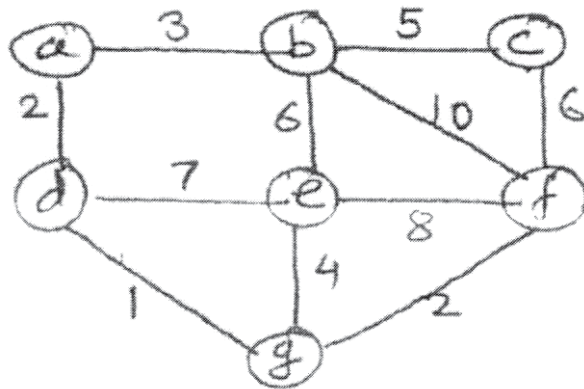
Q3) a) What is OBST? List binary search tree with 3 words (w1, w2, w3) = (do, if, stop) words occurs with probabilities (P1, P2, p3) = (0.4,0.5,0.1) find expected access time in each case. **[6]**

b) Build AVL tree for given sequence of data. Show balance factor of all nodes and name the rotation used for balancing the tree 40,60,80,50,45,47,44,42,75,46,41. **[6]**

c) Write short notes on: **[5]**
   i) Red Black tree
   ii) Splay tree

OR

Q4) a) Construct OBST for given data using dynamic programming approach. Explain stepwise. **[6]**

Index	0	1	2	3
Data	10	20	30	40
Frequency	4	2	6	3

b) Demonstrate Deletion Operation in AVL with example. **[6]**

c) Explain following terms w.r.t. height balance tree LL, RR, LR, RL. **[5]**

Q5) a) Construct B-tree of order 4 by inserting the following data one at a time. 20, 10, 30, 15, 12, 40, 50 **[6]**

b) Write an algorithm to insert a node in B Tree. **[6]**

c) Construct the B+ Tree of order 4 for the following data: 1, 4, 7, 10, 17, 21, 31, 25, 19, 20, 28, 42. **[6]**

OR

Q6) a) Build B+ tree of order 3 for the following:
1, 42, 38, 21, 31, 10, 17, 7, 31, 25, 20, 18. **[6]**

b) Write an algorithm to delete a node from B+tree. **[6]**

c) Insert the keys to a 5-way B-tree:
3, 7, 9, 23, 45, 1, 5, 14, 25, 24, 13, 11, 08, 19, 04, 31, 35, 56 **[6]**

Q7) a) Write short notes on: **[6]**
   i) Factors affecting the file organization
   ii) Indexed sequential files
   iii) Indexing techniques

b) Compare sequential indexed sequential and direct access files. **[6]**

c) Explain any 4 modes of opening the file in C or C++. **[5]**

OR

Q8) a) Explain following operations carried out on sequential files. **[6]**
   i) Add
   ii) Delete
   iii) Search

b) Explain any 3 operations carried out on sequentail file and its pseudo code. **[6]**

c) A file of employees records, has 'employee no' as primary key and the 'department code' and the 'designation code' as the secondary keys. Write a procedure to answer the following query – 'Which employees from systems department are above designation level 4? **[5]**

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S.E. (Computer/AI&DS)

Software Engineering

(2019 Pattern) (Semester - IV) (210253)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Assume suitable data if necessary.*

Q1) a) Explain object oriented view of component level design with suitable example. **[6]**

b) Explain FP based estimation technique? **[6]**

c) What is project scheduling? What are the basic principles of project scheduling? **[6]**

OR

Q2) a) Explain COCOMO Model for project estimation with suitable example. **[9]**

b) How LOC and FP used during project Estimation? Explain both Estimation techniques with suitable example. **[9]**

Q3) a) Explain guidelines for component level design. **[6]**

b) Enlist the golden rules of User Interface Design. **[6]**

c) Explain layered system architecture with neat diagram. **[5]**

OR

Q4) a) Describe notations used for deployment diagram. Describe the importance of Deployment diagram. **[9]**

b) Explain the following architectural styles with merits/demerits : **[8]**

i) Data-centered Architecture

ii) Data-flow architecture

P.T.O.

Q5) a) What is Risk Identification? What are different categories of Risk? **[6]**

b) Define software Risk in detail. What are different types of Software Risk? **[6]**

c) What are the advantages of SCM Repository? Explain functions performed by SCM Repository. **[6]**

OR

Q6) a) What is Software Configuration Management (SCM) **[9]**

b) What is RMMM? Write short note on it? **[9]**

Q7) a) What are difference between white box testing and black box testing. **[6]**

b) Explain the software testing life cycle in detail. **[6]**

c) Explain bottom-up testing with its advantages. **[5]**

OR

Q8) a) What is system testing? Explain any three types system testing. **[9]**

b) Write note on Alpha and Beta Testing. **[8]**

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[5925]-263

S.E. (Computer)
MICROPROCESSOR
(2019 Pattern) (Semester - IV) (210254)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams should be drawn wherever necessary.*
3) *Use of Non-programmable Calculator is allowed.*
4) *Assume suitable data if necessary.*

Q1) a)   Explain the Segment Translation Process with a neat diagram of 80386.**[6]**

   b)   Differentiate and explain GDTR, LDTR, and IDTR.   **[6]**

   c)   Demonstrate General Selector Format in brief.   **[6]**

OR

Q2) a)   Demonstrate General Descriptor Format available in various descriptor tables.   **[6]**

   b)   With the necessary diagram, explain the page translation process in 80386.**[6]**

   c)   Explain the use of following instructions in detail: **[6]**

   i)   LGDT

   ii)   SIDT

   iii) LLDT

Q3) a)   What is call gate? Explain how it is used in calling functions with higher privilege levels.   **[6]**

   b)   Explore five aspects of protection applied in segmentation.   **[6]**

   c)   Explore the need for a protection mechanism in 80386.   **[5]**

OR

P.T.O.

Q4) a) Explain the following terminologies. **[6]**

    i) CPL

    ii) DPL

    iii) RPL

    b) Explain different levels of protection. Describe the rules of protection check? **[6]**

    c) Elaborate on the concept of combining segment protection and page level protection in 80386. **[5]**

Q5) a) Explore memory management in the Virtual 8086 Mode. **[6]**

    b) Explain the TSS descriptor of 80386 with a neat diagram. **[6]**

    c) Explore the role of Task Register in multitasking and the instructions used to modify and read Task Register. **[6]**

<div align="center">OR</div>

Q6) a) Draw and explain the Task State Segment of 80386. **[6]**

    b) With the necessary diagram, explain entering and leaving the virtual mode of 80386. **[6]**

    c) Difference between Real Mode and Virtual 8086 Mode. **[6]**

Q7) a) Explain the following exception conditions with an example: Faults, Traps, and Aborts. **[6]**

    b) With the help of the necessary diagram, explain the structure of IDT in 80386. **[6]**

    c) List and elaborate on different applications of microcontrollers. **[5]**

<div align="center">OR</div>

Q8) a) Differentiate and explain the Interrupt gate and Trap gate descriptor. **[6]**

    b) How interrupts are handled in protection mode. Explain with the help of a neat diagram. **[6]**

    c) Differentiate between Microprocessor and Microcontroller. **[5]**

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[5925]-264

S.E. (Computer Engineering)
PRINCIPLES OF PROGRAMMING LANGUAGES
(2019 Pattern) (Semester - IV) (210255)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
  1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
  2) *Neat diagrams must be drawn whenever necessary.*
  3) *Assume suitable data if necessary.*

Q1) a) Justify the meaning of each characteristic of Java in the statement "Java is simple, architecture neutral portable, interpreted and robust and secured programming language".   **[6]**

   b) Write a program in Java to perform the addition of two matrices (multidimensional arrays) and set the diagonal elements of resultant matrix to 0.   **[6]**

   c) Write a program in Java using switch-case statement to perform addition, subtraction, Multiplication and Division of given two numbers and print the result.   **[6]**

OR

Q2) a) Explain in brief below keywords with example in Java.   **[6]**

      i) Final   ii) Static   iii) This

   b) Define Constructor. List its different types. Demonstrate with suitable example the different types of constructors used in Java.   **[6]**

   c) Write a program which receives *n* integers. Store the integers in an array. Program outputs the number of odd and even numbers present in this array.   **[6]**

Q3) a) Define Inheritance and list the advantages. Explain the types of Inheritance in Java with suitable Java code.   **[9]**

   b) Describe Exception. Write any two examples of exception. Explain keywords try, catch, throw, throws and finally related to exception handling.   **[8]**

OR

Q4) a) Demonstrate the methods of creating packages and importing them in other java programs with example. Write about the access protection in packages. **[9]**

b) Explain abstract classes and polymorphism in Java with appropriate java codes. **[8]**

Q5) a) Write short notes on React JS. Enlist and explain the feature of it. **[6]**

b) Explain life cycle of Thread model in Java. **[6]**

c) State the term thread synchronization. Explain how to achieve thread synchronization in Java. **[6]**

OR

Q6) a) List the features of JavaScript and write a JavaScript program to display Welcome message. **[6]**

b) Write short note angular JS. List its advantages and disadvantages. **[6]**

c) Differentiate Multiprocessing and Multi-threading. **[6]**

Q7) a) Write a program to find the factorial of a given number using LISP. **[6]**

b) Evaluate the following forms of LISP. **[5]**

i) (car (cdr '(1 2 3 4 5)))

ii) (car (cdr '(a(b c)d e)))

iii) (car (cdr(cdr '(1 2 3 4 5 6 7 8))))

c) Explain the basic list manipulation in prolog. **[6]**

OR

Q8) a) Explain the following Equality predicates using suitable example. **[6]**

i) EQUAL

ii) EQ

iii) EQL

iv) =

b) Comparisons between functional programming and logic programming.**[5]**

c) Explain the phrases - "Term", "Facts", "Rule", Goals" used in Prolog with example. **[6]**

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[5925]-265

S.E. (IT)

DISCRETE MATHEMATICS

(2019 Pattern) (Semester-III) (214441)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1)   Answer Q.1, or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.

2)   Figures to the right indicate full marks.

Q1) a)   Find the Shortest Path algorithm using Dijikstra's Shortest path algorithm.
[6]
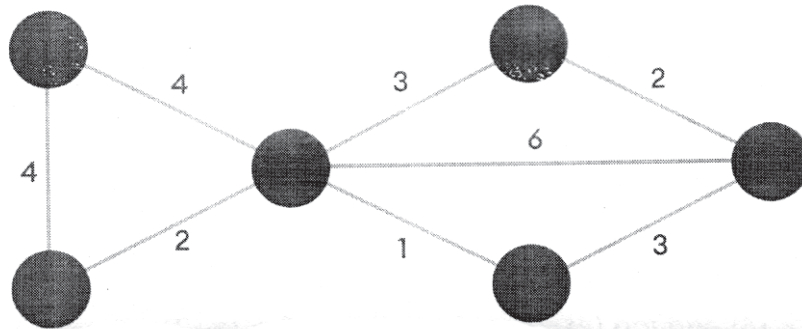
b)   Construct an optimal tree for the weights 3, 4, 5, 6, 12 Find the weight of the optimal tree. **[6]**

c)   Find the maximum flow for the following transport network. **[6]**
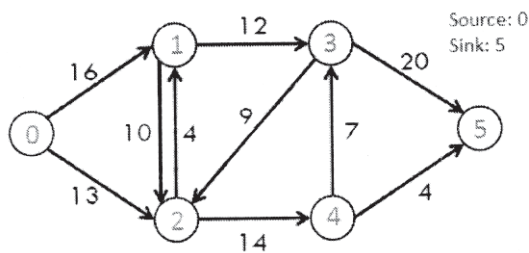
OR

Q2) a)   Define Following with examples: **[6]**

i)   rooted tree

ii)   Spanning tree

iii) Binary Tree

b) Use nearest Neighbourhood method to solve Travelling Salesman problem. **[6]**
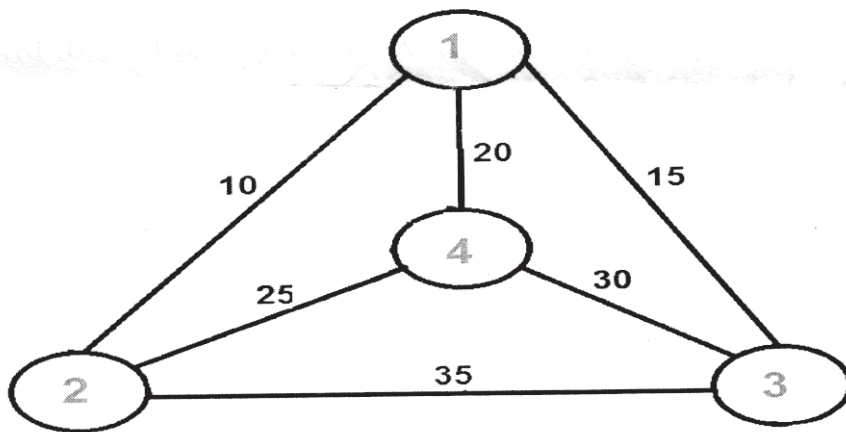
c) Explain Hamiltonian and Euler path and circuits with example. **[6]**

Q3) a) X = {2, 3, 6, 12, 24, 36} and x<=y iff x divides y. Find **[6]**
  i) Maximal Element
  ii) Minimal Element
  iii) Draw the graph and its equivalent hasse diagram for divisibility on the set: {2, 3, 6, 12, 24, 36}.

b) What are the ordered pairs in the relation R represented by the directed graph shown in below Figures? **[6]**
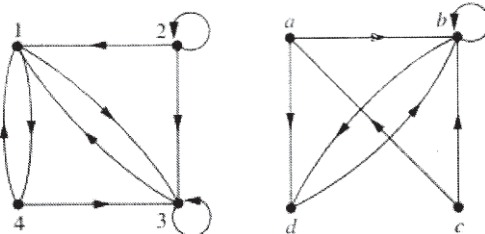
c) Let functions f and g be defined by **[5]**

$$f(X) = 2X+1, g(X) = X^2 - 2$$

Find
  i) gof (4) and fog (4)
  ii) gof (a+2) and fog (a+2)
  iii) fog (5)
  iv) gof (a+3)
  v) gof (a+4)

OR

Q4) a) What is the reflexive closure of the relation R = {(a, b) | a<b} on the set of integers and symmetric closure of the relation R = {(a,b) | a>b} on the set of positive integers? **[6]**

b) Determine whether the relations for the directed graphs shown in Figure are reflexive, symmetric, antisymmetric, and/or transitive. **[6]**
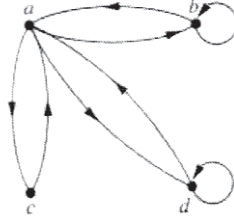
c) Let *X* = {a, b, c). Define *f*: *X*->X such that f ={(a,b), (b, a), (c, c)} **[5]**
Find
i) f^{-1}
ii) f^{-1} of
iii) fof^{-1}

Q5) a) Solve the congruence 8x = 13mod 29 **[6]**

b) For each pair of integer a and b, find integers q and r such that a = bq + r such that 0 <= r <|b|, where a is dividend, b is divisor, q is quotient and r is remainder. **[8]**
i) a = -381 and b=14
ii) a = -433 and b = -17

c) Find all positive divisors of **[4]**
i) 256 = 28
ii) 392 = 23. 72

<div align="center">OR</div>

Q6) a) Which of the following congruence is true? Justify the answer. **[6]**
i) 446 ≡ 278 (mod 7)
ii) 793 ≡ 682 (mod9)
iii) 445 ≡ 536 (mod 18)

b) Compute GCD of the following using Euclidian algorithm. **[6]**
i) GCD (2071, 206)
ii) GCD (1276, 244)

c) Using Chinese Remainder Theorem, find the value of P using following data. **[6]**
p=2 mod 3
p=2 mod 5
p=3 mod 7

Q7) a) Let R = {0o, 45o, 90o, 135o, 180o, 225o, 270o, 315o} and *= binary operation, so that a*b is overall angular rotation corresponding to successive rotations by a and then by b. Show that (R,*) is a Group. **[9]**

b) Let l be the set of all integers. For each of the following determine whether *is an commutative operation or not: **[8]**
i) a*b=max(a,b)
ii) a*b=min(a+2,b)
iii) a*b=2a-2b
iv) a*b= min (2a-b, 2b-a)
v) a*b= LCM (a,b)
vi) a*b=a/b
vii) a*b=power (a,b)
viii) a*b=a 2 + 2b+ab

OR

Q8) a) Show that set G of all numbers of the form a+b √ 2, a, b ∈l forms a group under the operation addition i.e.(a+b √ 2) + (c+√ d 2) = (a+c) + (b+d) √2. **[9]**

b) Determine whether the set together with the binary operation is a semigroup, group a monoid, or neither.
S= {1, 2, 5, 10, 20}, where a*b is defined as GCD (a,b) **[8]**

[5925]-266
S.E. (IT)
LOGIC DESIGN & COMPUTER ORGANIZATION
(2019 Pattern) (Semester - III) (214442)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
  1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
  2) *Neat diagrams must be drawn wherever necessary.*
  3) *Figures to the right indicate full marks.*
  4) *Assume suitable data, if necessary.*

Q1) a)   Explain with a diagram, the conversion of J-K flip flop to D flip flop.**[9]**

   b)   Differentiate between Latch & flip-flop w.r.t. definition, operation, diagram
        of applications etc.   **[9]**

OR

Q2) a)   Design 3-bit synchronous down - counter using MS JK flip flop
        (IC 7476). (Pin numbers are not required) Draw only logic diagram. **[9]**

   b)   What is a shift register? State the types of shift registers with applications
        of each.   **[9]**

Q3) a)   Explain in brief, various functional units of a computer system with a
        block diagram showing interconnection between them.   **[9]**

   b)   Write a short note on: PC, MAR, MBR, TR.   **[8]**

OR

Q4) a)   What is the function of control unit in a CPU? Draw block diagram of
        Hardwived control unit & explain its operation, pros & cons.   **[9]**

   b)   Explain and draw basic structure of Harvard architecture. State the
        differences between Harvard and Von Neu mann architecture.   **[8]**

Q5) a)   What is meant by addressing mode? Explain all addressing modes with
        examples.   **[9]**

   b)   Differentiate between RISC & CISC architecture.   **[9]**

OR

P.T.O.

Q6) a) Explain instruction pipelining w.r.t. operation and speed up formula, achieved by pipelining. **[9]**

b) Explain interrupt w.r.t. its purpose, types. Describe step by step, the interrup handling procedure of microprocessors. **[9]**

Q7) a) Explain with examples the various cache replacement policies. Describe various cache write policies. **[9]**

b) Explain programmed controlled I/O with the help of flow chart. **[8]**

OR

Q8) a) Along with suitable diagram, explain set associative cache mapping technique. **[9]**

b) Explain memory read cycle with the help of suitable timing diagram. **[8]**

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PA-1244

[5925]-267

S.E. (Information Technology)
DATA STRUCTURES & ALGORITHMS
(2019 Pattern) (Semester - III) (214443)

Time : 2½ Hours]
[Max. Marks :70

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right side indicate marks.*

4) *Assume suitable data, if necessary.*

Q1) a) Discuss how a two-way stack can be developed using array and write sudo code for Push, Pop and display operations. **[9]**

b) Write a code for doubly linked list creation, insert and Display and mention the time complexity of operations. **[9]**

OR

Q2) a) Convert the following infix expressions to postfix expressions using stack data structure. 1) A+B*C^D-E/F 2) ((A+B)*C-(D-E))^(F+G)**[9]**

b) Write a sudo code for Queue implementation using array . Perform the following operations: 1) Queue Full 2) Queue Empty 3) equeue 4) dqueue **[9]**

Q3) a) Construct a binary tree from the given traversals

Pre-order: * + a – b c /– d e – + f g h In-order : a + b – c * d – e/f + g – h **[9]**

b) What is a Binary Tree? Explain the following operations on Binary Tree i) Inserting a node in to BT ii) Deletion a node from BT **[8]**

OR

Q4) a) What is the use of threaded binary free? Give the node structure required for a threaded binary tree. Write pseudo code to find in-order successor of any node X in a threaded binary tree. **[9]**

b) Write a pseudo code to implement binary search tree for performing following operations : i) Display - Mirror image ii) Display - Minimum value iii) Display average value iv) Display leaf nodes **[8]**

Q5) a) Define Minimum Spanning Tree. Compare Prim's and Kruskal's Algorithm. Construct a minimum spanning tree for the given graph using Kruskal's Algorithm. What is the cost of the MST? **[9]**
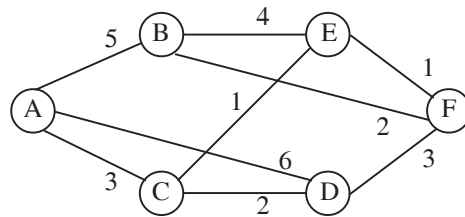
b) Given the following Adjacency matrix, construct the graph and traverse it in Breadth first order starting at vertex 'F'. **[9]**

	A	B	C	D	E	F
A	0	3	7	2	4	0
B	3	0	9	0	0	10
C	7	9	0	1	0	0
D	2	0	1	0	5	8
E	4	0	0	5	0	6
F	0	10	0	8	6	0

OR

Q6) a) Construct an Optimal Binary Search Tree for the following data :

N=4, Key Set = {C, E, M}, {p1, p2, p3} = {0.1, 0.2, 0.15},{q0, q1, q2, q3} = {0.15, 0.05, 0.3, 0.05}. What is the cost of the OBST? **[9]**

b) Define AVL Tree. Illustrate with example the various types of rotations that are performed to balance the binary tree. **[9]**

Q7) a) Explain with example hash functions? **[9]**

   b) Write short note on closed hashing and Open addressing. **[8]**

<div align="center">OR</div>

Q8) a) Explain chaining with replacement and chaining without replacement in hashing? **[9]**

   b) Write Comparison of different file organizations (sequential, index sequential and Direct Access) **[8]**

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[5925]-268

S.E. (Information Technology)
OBJECT ORIENTED PROGRAMMING
(2019 Pattern) (Semester - III) (214444)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

  1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*

  2) *Neat diagrams must be drawn wherever necessary.*

  3) *Figurest to the right side indicate full marks.*

  4) *Assume suitable data if necessary.*

Q1) a) What is Constructor? What are the characteristics of the Constructor? Explain Constructor Overloading with an example?   **[9]**

  b) Write a short note on :   **[9]**

    i)   Garbage collection in Java

    ii) Destructor in C++

OR

Q2) a) Design a class 'Complex' with data members for real and imaginary part. Provide default and Parameterized constructors. Write a program in JAVA to perform **a Subtraction** of two complex numbers.   **[9]**

  b) Discuss with example Dynamic initialization of object in Java.   **[9]**

Q3) a) Define Inheritance. What are the types of Inheritance? How can you inherit a class in Java?   **[9]**

  b) What is polymorphism? Explain compile time and run time polymorphism.
                                                                        [8]

OR

Q4) a) Differentiate between method overriding and method overloading. Explain method overriding concept with an example.   **[9]**

  b) What is interface in java? How to declare an interface, write a syntax? Can we achieve multiple inheritance by using interface? Justify with an example.   **[8]**

Q5) a) What is an exception? Explain the following terms with respect to exception handling: **[9]**

    i) try

    ii) catch

    iii) throw

    iv) finally

  b) Write a generic method to count the number of elements in a collection that have a specific properties like odd integers, prime numbers and palindrome. **[9]**

<div align="center">OR</div>

Q6) a) Explain ArrayList class with an example. **[9]**

  b) Write a java program to accept and display the month number. Throw number format exception if improper month number is entered. **[9]**

Q7) a) Explain FileinputStream class. Write any four methods of File Input stream class with their syntax. **[9]**

  b) Explain following File operations using File class : **[8]**

    i) Create a File

    ii) Read from a File

    iii) Write to a File

    iv) Close a File

<div align="center">OR</div>

Q8) a) Write a short note on : **[8]**

    i) Iterator

    ii) Singleton

  b) Implement a program for maintaining a database of student records using Files. Student has Student-id, name, Roll_no, Class, marks and address. Display the data for few students. **[9]**

    i) Create Database

    ii) Display Database

    iii) Delete Records

    iv) Update Record

    v) Search Record

<div align="center">❄ ❄ ❄</div>

[5925]-269

S.E. (Information Technology)
BASICS OF COMPUTER NETWORK
(2019 Pattern) (Semester - III) (214445)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of Calculator is allowed.*
5) *Assume Suitable data if necessary.*

Q1) a) Define controlled access and list three protocols in this category. Explain any two protocols. **[8]**

   b) Write short note with reference to MAC layer and Physical Layer on:**[9]**
     i) Standard Ethernet
     ii) Fast Ethernet
     iii) Gigabit Ethernet

OR

Q2) a) Write short note on: **[8]**
     i) IEEE 802.3 Standard
     ii) IEEE 802.4 Standard

   b) Describe different channelization techniques mentioned below in short:**[9]**
     i) FDMA
     ii) TDMA
     iii) CDMA

Q3) a) Explain the operation of NAT with suitable example. **[8]**

   b) Compare and Contrast Subnetting, Supernetting. An organization is granted the block 172.16.0.0/18. Design the network and Find how many subnets? Find how many hosts per subnet? What are the valid subnets? What is the broadcast address for last subnet? What is the range of valid hosts in last subnet? **[9]**

OR

Q4) a) What is the need of IPv6? Explain different types of IPv6 address. **[8]**

b) Explain following terms: **[9]**

    i) Private IPv4 address

    ii) Public IPv4 addresses

    iii) NAT

Q5) a) Compare and contrast distance vector routing with link state routing. List out and explain key features of EIGRP that makes it superior to OSPF. **[9]**

b) What is routing? List out and explain different metrics used in various routing protocols. **[9]**

OR

Q6) a) Compare and Contrast Intra Domain and Inter Domain Routing Protocols. List out and explain key features of OSPF that makes it superior to RIP.**[9]**

b) What is BGP? How it avoids count to infinity problem? Explain the difference between internal BGP and external BGP. **[9]**

Q7) a) Explain TCP with its header format. **[9]**

b) What is a Socket? Explain various socket primitives used in client-server interaction with neat diagram for a stream socket. **[9]**

OR

Q8) a) What is silly window syndrome? List different solutions to overcome it. Explain one solution at sender side and receiver side each. **[9]**

b) What do you mean by congestion control in transport layer? What are the different methods to alleviate it? **[9]**

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S.E. (Information Technology)
PROCESSOR ARCHITECTURE
(2019 Pattern) (Semester-IV) (214451)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.No. 1 or Q.No. 2, Q.No. 3 or Q.No. 4, Q.No. 5 or Q.No. 6, Q.No. 7 or Q.No. 8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Write a short note on interrupt structure of PIC18 microcontroller. **[7]**

b) Justify the importance of Interrupt Control Register (INTCON) in PIC18F. **[7]**

c) Explain RCIF and TXIF flag in programming serial communication interrupt. **[4]**

OR

Q2) a) Draw an interfacing diagram for 16X2 LCD with PIC18 F microcontroller and explain its working. **[8]**

b) Write the short note on: **[6]**
   i) ISR
   ii) IVT

c) Differentiate between interrupt and polling. **[4]**

Q3) a) Explain the working of compare mode of CCP Module in PIC18F with block diagram. **[6]**

b) Write short note on SPI protocol. **[6]**

c) Distinguish between synchronous and asynchronous serial communication. **[5]**

OR

Q4) a) List the steps involved in programming PIC microcontroller in capture mode. **[6]**

b) Write short note on I2C bus. **[6]**

c) Explain UART module in PIC18F. **[5]**

P.T.O.

Q5) a) Explain in detail the functions of ADCON1 SFR of PIC18 microcontroller.

[7]

b) State the features of RTC. Explain function of following pins of DS1306

[7]

   i) SERMODE
   ii) SDI
   iii) SDO

c) Find the value for the ADCON0 register if we want FOSC/8, Channel 0, and ADON on. **[4]**

OR

Q6) a) Draw and explain the interfacing diagram of DAC0808 with PIC18FXXX.

[8]

b) Assuming that R=5 Ω and Iref=2 mA for DAC0808, calculate Vout for the following binary inputs: **[6]**

   i) 10011001 (99H)
   ii) 11001000 (C8H)
   iii) 10001000 (88H)

c) Explain in detail the functions of following flags related to onboard ADC of PIC18 microcontroller. **[4]**

   i) GO/DONE
   ii) ADON

Q7) a) Describe the ARM bus technology. **[6]**
   b) Compare the ARM7, ARM9 and ARM11 processors. **[6]**
   c) Discuss the different exceptions in ARM processor. **[5]**

OR

Q8) a) Explain CPSR register of ARM. **[6]**
   b) Write significance of special registers R13, R14 and R15 in ARM7. **[6]**
   c) Write short note on ARM7 processor modes. **[5]**

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[5925]-271

S.E. (Information Technology)
DATABASE MANAGEMENT SYSTEM
(2019 Pattern) (Semester - IV) (214452)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1)   *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

2)   *Neat diagrams must be drawn wherever necessary.*

3)   *Figures to the right indicates full marks.*

4)   *Assume suitable data, if necessary.*

5)   *Use of scientific calculator is permitted.*

Q1) a)   What are different types of joins in SQL? Explain with suitable example.
[6]

     b)   Consider the following Relations. It defines the schema of the database application for a bank. It manages the branches and customers of the bank. Customers take loans (borrow money) or open accounts (deposit money) at one or more branches. **[8]**

         Branch (B_No, B_name, B_city, asset), Customer (C_No,C_Name, C_citystreet)

         Loan(Loan_no, B_name, amount), Account (Acc_No, B_name, Balance)

         Borrower (C_No, Loan_No), Depositor (C_No, Acc_No)

         Answer the following queries in SQL :

         1)   Find the names and address of customers who have a loan.

         2)   Find the total amount of balance of all the accounts

         3)   List all the customers who are borrowers

         4)   Find all the accounts of "shivaji nagar" branch of Pune city.

     c)   What is trigger? State and explain two categories of Triggers.   **[4]**

OR

Q2) a) Explain with suitable example SQL aggregate functions. **[6]**

b) Consider the following database. **[6]**

> Doctor (Doctor_no, Doctor_name, Address, City).
>
> Hospital (Hospital_no. Name. Street, City).
>
> Doc_Hosp (Doctor_no, Hospital_no, Date).

Construct the following Queries in SQL.

1) Find out all Doctors who have visited to Hospital in same city in which they live.

2) Find to which Hospital "Dr. Joshi" has visited.

3) Count no. of Doctors visited to "Shree Clinic" on 1st March 2014.

c) What is Cursor? State and explain two categories of Cursors and their syntax. **[6]**

Q3) a) Define Database normalization. Explain any two normal form with the suitable example. **[8]**

b) Why is query optimization important for databases? **[5]**

c) Explain role of "Selection" operation in query processing. **[4]**

OR

Q4) a) State & Explain Armstrong's axioms& its properties. **[6]**

b) Define Boyce Codd normal form. How does it differ from 3NF? Why is considered a stronger form of 3NF. **[6]**

c) What is query processing? Explain query processing steps with neat sketch. **[5]**

Q5) a) What is transaction? Explain ACID properties of transaction. **[6]**

b) What is deadlock? Explain how deadlock detection and prevention is done. **[8]**

c) What is the need of two phase locking protocol? Explain. **[4]**

OR

Q6) a) What is Serializable schedule? Explain with suitable example the types of serializable schedules. **[6]**

b) What is concurrency control? Explain time stamp based concurrency control. **[8]**

c) Write short note on : Shadow paging. **[4]**

Q7) a) Differentiate between centralized and client server architecture. **[6]**

b) State and explain key elements of parallel database. **[6]**

c) Explain Distributed database architecture with neat sketch. **[5]**

OR

Q8) a) Explain the concept of speed up and scale up in case of parallel databases. **[8]**

b) Explain cloud database in detail. Also expalin architecture along with components. **[9]**

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[5925]-272

S.E. (Information Technology)
COMPUTER GRAPHICS
(2019 Pattern) (Semester - IV) (214453)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answers : Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume Suitable data if necessary.*

Q1) a) Explain with diagram Cohen Sutherland line clipping algorithm. **[6]**

b) Compare homogeneous co-ordinate system and normalized co-ordinate system. **[6]**

c) Show that the Transformation matrix of reflection about line y=x is equivalent to reflection relative to x-axis followed by anticlockwise rotation of 90 degree. **[6]**

OR

Q2) a) What is the concept of vanishing point in perspective projection? Explain with diagram. **[6]**

b) Let ABCD be a rectangle window with A(20,20), B(90,20), C(90,70), D(20,70). Find the region codes for the end points & use Cohen Sutherland line clipping algorithm to clip the following line Q1Q2 with Q1(10,10) and Q2(70,60). **[6]**

c) Explain 3D reflection about XY, YZ, and XZ plane. **[6]**

Q3) a) What is Shading. Explain with diagram Constant intensity shading method. **[6]**

b) Explain CMY and HSV color models. **[6]**

c) What is a segment? How do we create it? Why do we need segments?**[5]**

OR

P.T.O.

Q4) a) Compare Gourand and Phong method of shading. **[6]**

b) What is segment? Explain the concept of segment table and display file. **[6]**

c) Explain CIE chromaticity diagram; also explain how RGB to CMY conversion is done. **[5]**

Q5) a) Explain Koch curve and its application in detail. **[6]**

b) Write short notes on **[6]**

     i) Morphing

     ii) Design of animation sequence

c) What is fractal? Explain Hilbert curve in detail. **[6]**

OR

Q6) a) Write short notes on **[6]**

     i) B-spline curve

     ii) Blending function of Bezier curve

b) What are the methods of controlling animation? **[6]**

c) Explain various types of animation languages. **[6]**

Q7) a) Explain the physical modeling in Virtual Reality. **[6]**

b) Explain haptic feedback in Virtual Reality system. **[6]**

c) What is navigation and manipulation interfaces in virtual reality system?**[5]**

OR

Q8) a) Explain the behavioral modeling in Virtual Reality. **[6]**

b) What are sound displays in Virtual Reality? **[6]**

c) Explain Kinematic modeling in Virtual Reality. **[5]**

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[5925]-273

S.E. (Information Technology)
SOFTWARE ENGINEERING
(2019 Pattern) (Semester - IV) (214454)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answers Question 1 or 2, 3 or 4, 5 or 6, 7 or 8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) What is Software Architecture? Explain Data flow and Layered architectural style of the system. **[9]**

b) What is functional independence? Differentiate between coupling functional independence and Cohesion functional independence. **[9]**

OR

Q2) a) What are the characteristics of a good design? Explain Software Quality Guidelines and Attributes of software design. **[9]**

b) Explain design concepts : **[9]**

    i) Pattern

    ii) Information Hiding

    iii) Modularity

Q3) a) Explain : **[9]**

    i) 4P's of Project Management

    ii) Software Project Estimation

b) What is Decomposition Technique? Explain Decomposition of Problem and Decomposition of Process. **[9]**

OR

Q4) a) Explain Boehm's W^{5}HH Principle. [5]

b) What is the difference between PERT & CPM, state their application. What is the importance of critical path in a project? [9]

c) Explain typical Problems with IT Cost Estimates. [4]

Q5) a) Explain McCall's Quality Factors. [9]

b) Discuss Garvin's eight Quality Dimensions. [8]

OR

Q6) a) Explain Unit Testing? Which testing scheme is suitable to remove conflict of interest? [9]

b) How do you justify the statement "quality is a complex and multifaceted concept". [8]

Q7) a) Explain any Four layers of SCM process in detail. [8]

b) Explain CASE taxonomy. [9]

OR

Q8) a) Explain in brief risk mitigation, monitoring and management. [9]

b) Write short note on: [8]

i) JIRA

ii) Kanban

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[5925]-274

S.Y. B.Tech. (Biotechnology)
BIOCHEMISTRY - I
(2019 Pattern) (Semester - III) (215461)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) Answer the following. [18]
   a) What are proteins? State some common structural features of proteins.
   b) List and depict the structure of amino acids with Nonpolar, aliphatic D grougs.

OR

Q2) Answer the following. [18]
   a) What are the various techniques to separate proteins? Explain any one in detail?
   b) Give the three letter abbreviations and one - letter symbols for Serine, Aspartate, Histidine and Valine

Q3) Answer the following. [17]
   a) Explain in brief the Central Dogma of biology
   b) Explain Hoogsteen Base pairing.

OR

Q4) Answer the following. [17]
   a) Write a short note on sugar phosphate backbone.
   b) Differentiate between purines and pyrimidine.

P.T.O.

Q5) Answer the following.   **[18]**

   a)   Explain the nomenclature of fatty acids with suitable example.

   b)   Define phospholipid and classify them.

<p align="center">OR</p>

Q6) Answer the following.   **[18]**

   a)   What are the types of membrane proteins? Explain them in detail.

   b)   What are the physical and chemical properties of fatty acids.

Q7) Answer the following.   **[17]**

   a)   Write a note on Vitamin A, its sources, functions and toxicity.

   b)   Write notes on -

      i)   Keratomalacia

      ii)   Rickets

<p align="center">OR</p>

Q8) Answer the following.   **[17]**

   a)   Explain any two mineral deficiencies in detail.

   b)   Write a note on any two water soluble vitamin deficiencies.

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[5925]-275

S.E. B.Tech. (Biotechnology)
FLUID FLOW AND UNIT OPERATIONS
(2019 Pattern) (Semester - III) (215462)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.

2) Neat diagrams must be drawn wherever necessary.

3) Figures to the right side indicate full marks.

4) Assume Suitable data if necessary.

Q1) a) Determine the rate at which an air bubble of 0.5mm diameter will rise in liquid having density 1400 kg/m^3 and dynamic viscosity of 0.5 kg/m.s. Assume that the rise of the bubble is within stokes range. Neglect density of air and justify the assumption of stokes range. **[6]**

    b) Write a note differential Settling method. **[4]**

    c) Explain the different types of fluidization. **[8]**

OR

Q2) a) Define and Explain : **[12]**

      i) Drag and Lift force

      ii) Minimum fluidization velocity

      iii) Free and Hindered settling

    b) Write a note on Advantages, Disadvantages and Applications of fluidized bed system. **[6]**

Q3) a) Derive "Kozeny Carman equation" for a pressure drop across packed bed. **[10]**

    b) Write a note on Aggregative and Particulate fluidization. **[7]**

OR

P.T.O.

Q4) a) What is fluidization and minimum fluidization velocity? Explain how the pressure drop across the bed varies during fluidization. **[12]**

b) Write a note on Advantage and Disadvantages of fluidization. **[5]**

Q5) a) Write a short note on "Reciprocating Pump". **[6]**

b) With a neat sketch explain "Power Curve". How is it used for determination of power consumption in an agitated vessel? **[6]**

c) What is swirling and why is it undesirable in the industry? Enlist different methods of preventing swirling. **[6]**

OR

Q6) a) What is Cavitation and NPSH in pumping terminology? **[6]**

b) Explain various flow patterns that are generated in liquid during agitation. **[6]**

c) With a neat sketch, Write a note on Bunbury Mixer. **[6]**

Q7) a) Calculate the operating speed of the Ball Mill from the following data:

Diameter of the ball mill = 500 mm

Diameter of ball = 50 mm.

Operating speed of the ball is 35% of critical speed. **[6]**

b) What is meant by screen effectiveness? What are the factors which reduce the screen effectiveness? **[5]**

c) Describe two methods of screen analysis. **[6]**

OR

Q8) a) It is required to crush 250 tons/hr of ore. The range of the feed size is such that 80% of the feed passes through an opening of 2.5 inch. The product is such that 80% of it passes through an opening of 0.125 inch. Estimate the power consumption per ton of feed. **[6]**

Take Kb= 4.784.

b) Define and Explain Work index. Also Give Relation between Work index and Kb. **[5]**

c) Differentiate between : **[6]**

i) Open circuit and closed circuit grinding.

ii) Ideal screen and actual screen

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[5925]-276

S.E. (Biotechnology)

HEAT TRANSFER

(2019 Pattern) (Semester-III) (215463)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

    2)   *Neat diagrams must be drawn wherever necessary.*

    3)   *Figures to the right indicate full marks.*

    4)   *Assume suitable data, if necessary.*

Q1) a) What is convection? Describe types of convection using 1-2 examples each. **[9]**

    b) What are different applications of dimensional analysis? Give one detail case study. **[9]**

OR

Q2) a) By using Rayleigh's method of dimensional analysis derive an expression for natural convection heat transfer. **[9]**

    b) Explain in detail concept of maximum heat flux and critical temperature drop. **[9]**

Q3) a) What is Radiation? How is it different from conduction and convection phenomena of heat transfer? **[9]**

    b) Write short notes on: **[8]**

       i) Plank's Distribution Law

       ii) Wein's Displacement Law

OR

Q4) a) Define following terms: **[8]**

i)   Absorptivity

ii) Transmitivity

iii) Reflectivity

iv) Emissivity

b) Write a short note on 'Thermal Boundary layer and its significance. **[9]**

Q5) a) Give classification of types of heat exchangers.   **[6]**

b) Alcohol flowing in inner pipe of double pipe exchanger is cooled with water flowing in the jacket. ID of inner pipe is 25 mm and 2 mm thick. The thermal conductivity of steel is 45 W/m K. Film coefficient of alcohol is 1200 W/m^{2}K and that of water is 1800 W/m^{2}K. The inside and outside fouling factors are 5000 W/m^{2}K and 3000 W/m^{2}K respectively, calculate the overall heat transfer coefficient depending on inside as well as outside area of tube.   **[12]**

OR

Q6) a) Draw and explain plate and frame type of heat exchangers. Which flow is considered to be effective?   **[9]**

b) What is NTU effectiveness method? Explain in detail which terminologies are used in this method. How is it different from LMTD?   **[9]**

Q7) a) What is heat of bariation? Derive an expression neglecting heat of bariation.   **[9]**

b) Discuss the terms: i) Evaporator capacity ii) Evaporator Economy. **[8]**

OR

Q8) a) Draw a neat sketch of feed forward and feed backward evaporator. **[9]**

b) Write a short note on boiling point Elevation in an evaporator.   **[8]**

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SEAT No. :

[Total No. of Pages : 2

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S.Y. B.Tech. (Biotechnology) (Semester-III)

MICROBIOLOGY

(2019 Pattern) (215464)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

   1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

   2) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Draw a typical bacterial growth curve and label the various phases. Discuss the factors affecting stationary phase. **[9]**

    b) Explain bacterial enumeration techniques in microbiology? **[9]**

OR

Q2) a) What is Biomass? Describes the methods of biomass determination.**[9]**

    b) Write short note on Batch Cultures. **[9]**

Q3) a) Describe the working principle of Autoclaving. Describe its importance in control of microorganisms. **[9]**

    b) How filtration is used to control microorganisms. **[8]**

OR

Q4) a) Define Antibiotics. Explain the concept of drug resistance. **[9]**

    b) Write a short note on chemical compounds used to control microorganisms. **[8]**

Q5) a) Describe biological method for treatment of municipal waste water. **[9]**

    b) What is symbiosis? Explain with examples. **[9]**

OR

P.T.O.

Q6) a)   Describe the role of microorganism in food.   **[9]**

b)   Define and explain- Nitrogen fixation, Nitrification, Denitrification.   **[9]**

Q7) a)   Write a short note on signs and symptoms of Rabies.   **[9]**

b)   Define terms- epidemiology, Epidemic, Endemic, Pandemic.   **[8]**

OR

Q8) a)   Briefly describe Cholera disease in terms of its causative agent, signs and symptoms, mechanism of pathogenesis, epidemiology, and prevention and/or treatment.   **[9]**

b)   Give two examples each for bacterial, fungal and viral Infectious diseases with their etiological agents.   **[8]**

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[5925]-278

S.Y.B.Tech. (Biotechnology)
BIOCHEMISTRY - II
(2019 Pattern)(Semester-IV)(215470)

Time :2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*

Q1) Answer the following.
a) Justify - All the intermediate products in glycolysis are phosporylated.**[9]**
b) Enlist the enzymes which require Mg2+ to catalyze reactions in glycolysis Depict the reactions for same. **[9]**

OR

Q2) Answer the following.
a) Justify the need of bypass reactions in the synthesis of glucose .Describe the first bypass reaction in gluconeogenesis. **[9]**
b) Imagine and describe the situation when there will be Glucose 6-Phosphate dehydrogenase deficiency. **[9]**

Q3) Write in detail about.
a) The role nucleoside diphosphate sugars in glycogen synthesis. **[9]**
b) Draw a neat labeled diagram of Cori cycle. Explain the significance of the same. **[8]**

OR

Q4) Answer the following.
a) Which enzymes are required for glycogen breakdown? Describe the catalytic activity of debranching enzyme. **[9]**
b) Write a note on
   i) Synthesis of UDP glucose
   ii) Glycogenin. **[8]**

Q5) Answer the following.
   a) Enlist the enzymes involved in digestion and absorption of protein. Depict the diagram showing digestion and absorption of protein. **[9]**

   b) Describe the process of transport ammonia in the bloodstream by Glutamine. **[9]**

OR

Q6) Answer the following.
   a) Write about removal of nitrogen in amino acids degradation. **[9]**
   b) Illustrate the gel filtration and ion exchange chromatography when applied for protein purification. **[9]**

Q7) Answer the following.
   a) What are the sources of NADPH for lipid metabolization? **[9]**
   b) Illustrate the process of digestion and absorption of lipids. **[8]**

OR

Q8) Answer the following.
   a) Differentiate between oxidation of saturated fatty acids and unsaturated fatty acids. **[9]**
   b) Depict a neat diagram showing mobilization of triacylglycerols stored in adipose tissue **[8]**

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[5925]-279

S.Y. (Biotechnology)

CELL BIOLOGY & TISSUE CULTURE

(2019 Pattern) (Semester - IV) (215471)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*

Q1) a) What is apoptosis, and what is the role of mitochondria in apoptosis?
[8]

b) Explain the process of karyokinesis.   **[10]**

OR

Q2) a) What is meiosis-I? Explain the important steps in it.   **[10]**

b) Enlist all the significance points of meiosis.   **[8]**

Q3) a) With a neat labelled diagram explain the nerve cell and add a note on neurotransmitters.   **[6]**

b) What are the different types of epithelial tissues? Describe with labelled diagrams.   **[11]**

OR

Q4) a) What are stem cells? Explain the sources and applications of stem cells.
[9]

b) What are oncogenes and tumor suppressor genes? How are they involved in growth and development of cancer?   **[8]**

P.T.O.

Q5) a) Explain generation number and split ratio and its significance. **[8]**

b) Write a short note on cryopreservation of animal cells. If you are given a flask with 80% confluency, write the detailed stepwise flowchart for cyropreservation give also the flow chart for the cryopreservation and the steps involved right from the flask with 80% confluency. **[10]**

OR

Q6) a) Explain the process of Trypsinization and passaging. Give significance of passaging. **[9]**

b) What are the different types of animal cell culture? Explain in brief. **[9]**

Q7) a) Which are the typical growth hormones used in plant tissue culture? **[8]**

b) Which are the different types of plant tissue culture methods? Describe briefly. **[9]**

OR

Q8) a) What is the significance of Plant Tissue Culture? **[9]**

b) Elaborate on transgenic plants and their uses. **[8]**

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SEAT No. :

[Total No. of Pages : 2

[5925]-280

S.Y.B.Tech. (Biotechnology)
THERMODYNAMICS
(2019 Pattern) (Semester-IV) (215472)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Answer Q1 or Q2, Q3. or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagram must be drawn whenever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of Calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a)   Draw a neat labeled diagram of Carnot's cycle. Explain in brief the Carnot's theorems.   **[9]**

b)   What is the second law of thermodynamics? Give its statements with an example.   **[9]**

OR

Q2) During the summer months there is an increased demand for ice to cool soft drink bottles in various shops It is desired to produce ice at 0ºC, at the rate of 5000 kg per hour, from water at 0ºC. The ambient temperature is 40ºC. To operate the refrigerating machine it is planned to supply power from a heat engine. The heat engine operates between the ambient atmosphere and a source at 100ºC which is supported by solar heating panels. Calculate the minimum power required to operate the refrigerating unit, the maximum possible efficiency of the heat engine and the ratio of the energy rejected to the ambient atmosphere to the energy absorbed from the water at 0ºC. The latent heat of fusion of water at 0ºC. is 6.002 kJ/mol and the molar mass of water is 18×10^{-3} kg/mol.   **[18]**

Q3) Define and explain the following terms: **[17]**

    a)   Partial Molar Properties **[6]**

    b)   Chemical Potential **[6]**

    c)   Excess Properties **[5]**

OR

Q4) Write a note on : **[17]**

    a)   Fugacity **[8]**

    b)   Activity **[9]**

Q5) a)   Write a note on the effect of temperature on the equilibrium constant. Derive an expression for the same. **[9]**

    b)   What is the criterion of chemical reaction equilibria? **[9]**

OR

Q6) What do you mean by the number of independent reactions in a chemically reacting system? How would you determine it ? What is the phase rule as applicable to a reacting system? **[18]**

Q7) Biological systems transform energy from one form to other. justify the statement with any three examples. **[17]**

OR

Q8) a)   Which biological systems are examples where the first and second laws of thermodynamics could be applied? **[8]**

    b)   Write a brief note on the standard state in biochemistry. **[9]**

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[5925]-281

S.Y. B.Tech. (Biotechnology)
GENETICS AND MOLECULAR BIOLOGY
(2019 Pattern) (Semester - IV) (215473)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answers Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Outline the process of DNA replication.   **[9]**

   b) Explain the functions of various enzymes at the replication fork.   **[9]**

                                    OR

Q2) a) Describe the role of

   i)   Primase

   ii)   Helicase

   iii) SSB proteins

   iv)   Topoisomerase   **[9]**

   v)   DNA polymerase

   vi)   DNA ligase in replication.

   b) Write a short note on Okazaki fragments.   **[9]**

Q3) a) Draw tRNA structure and give its functional importance in the cell. **[9]**

   b) Define-Promoter, Enhancer, Activator.   **[8]**

                                    OR

Q4) a) What is RNA splicing? Explain the mechanism of RNA splicing.   **[9]**

   b) Draw neat labeled diagram of ribosomes in prokaryotes and eukaryotes.**[8]**

Q5) a) Define transcription. Explain Transcription cycle in bacteria. **[9]**

b) Differentiate between siRNAs and miRNAs. **[8]**

OR

Q6) a) Describe the properties of three eukaryotic RNA polymerases and their templates. **[9]**

b) What is splicosome? Explain its role in RNA splicing. **[8]**

Q7) a) Define Genetic code and give general features of genetic code. **[9]**

b) Molecular chaperones: cellular machinery for folding. Discuss. **[9]**

OR

Q8) a) Describe mechanism of protein synthesis. **[9]**

b) Write a short note on posttranslational modifications of proteins. **[9]**

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[5925]-282

S.E. (Production & Industrial Engineering)(Production -S.W/RA)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - III) (207007)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
   1)   Question No.s 1 are compulsory.
   2)   Figures to the right indicate full marks.
   3)   Use of logarithmic tables slide rule, electronic pocket calculator is allowed.
   4)   Assume suitable data, if necessary.

Q1) Choose the correct option:

   a)   First four moments of a distribution about the value 4 of the variable are
        –1.5, 17, –30 and 108. The second moment about mean is   **[2]**

   i)   14.75   ii)   15.75

   iii) 23.75   iv)   12.75

   b)   If a random variable X follows binomial distribution with n no. of trials p
        as probability of success & r as no. of success then $p(X = r)$ is   **[2]**

   i) $^nC_r p^r q^{n-r}$ ii) $^nC_r p^r$

   iii) $^nC_r q^r$ iv) $^nC_r p^r q$

   c)   Two events A and B are mutually exclusive $P(A) = \frac{1}{5}$ $P(B) = \frac{1}{3}$. Find the
        probability that either A or B will occur.   **[2]**

   i) $\frac{2}{15}$ ii) $\frac{8}{15}$

   iii) $\frac{1}{15}$ iv) $\frac{3}{5}$

d) The value of λ so that the vector field

$\overline{F} = (2x+3y)\hat{i} + (4y-2z)\hat{j} + (3x-\lambda 6z)\hat{k}$ is solenoidal is [2]

i) −6 ii) −1

iii) 1 iv) 0

e) $\nabla.\overline{r}$ is equal to

i) 2 ii) 1

iii) 0 iv) 3

f) The diff eq^n $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$ subject to condition $u(\infty, y) = 0$ with general

Sol^n $u(x,y) = (C_1 e^{mx} + C_2 e^{-mx})(C_3 \cos my + C_4 \sin my)$ the value of C_1 is [2]

i) 0 ii) $n\pi$

iii) 1 iv) π

Q2) a) Fit a straight line of the form $y = ax + b$ to the following data. [5]

x	1	3	4	6	8	9	11	14
y	1	2	4	4	5	7	8	9

b) The following marks have been obtained by a class of students in two papers.

Paper I	45	55	56	58	60	65	68	70	75	80	85
Paper II	56	50	48	60	62	64	65	70	74	82	90

Calculate the coefficient of correlation.

c) For the following distribution, find first four moments about the mean.**[5]**

x	2.0	2.5	3.0	3.5	4.0	4.5	5.0
f	4	36	60	90	70	40	10

OR

Q3) a) Fit a straight line to the following data. **[5]**

x	0	5	10	15	20	25
y	12	15	17	22	24	30

b) First four moments of a distribution about value 5 are, 2, 20, 40 and 50, find first four central moments, β_1 & β_2 **[5]**

c) From the record of correlation data, variance of x is 9 line of regressions are given by **[5]**

$$8x - 10y + 66 = 0, \ 40x - 18y = 214$$

Find

i) Mean values of x and y

ii) Coefficient of correlation between x and y

Q4) a) A can hit the target 1 out of 4 times, B can hit the target 2 out of 3 times, C can hit the target 3 out of 4 times. Find the probability the target is hit?

[5]

b) An unbiased coin is thrown 10 times. Find the probability of getting atleast g Heads. **[5]**

[5925]-282   **3**

c) In a certain examination test, 2000 students appeared in the subject of statistics. Average marks obtained were 50% with standard deviation 5%. How many students do you expect to obtain more than 60% of marks, supposing that marks follow normal distribution? **[5]**

(Given : Area corresponding to 2 is 0.4772)

OR

Q5) a) An envelope contains 6 tickets with numbers 1, 2, 3, 4, 5, 7. Another envelope contains 4 tickets with numbers 1, 3, 5, 7. An envelope is chosen at random and ticket is drawn from it. Find the probability that the ticket bears the numbers z or 5. **[5]**

b) The average number of misprints per page of a book is 1.5. Assuming the distribution of number of misprints to be poisson, find number of pages containing more than one misprint if the book contains 900 pages. **[5]**

c) The table below gives number of books issued from a certain library on the various days of a week. **[5]**

Days	No. of books issued
Mon.	120
Tues.	130
Wed.	110

Thurs.   115

Fri.   135

Sat.   110

Test at 5% l.o.s. whether issuing the book is day dependent (Given $= X_{5;0.05}^2 = 11.07$)

Q6) a) Find the directional derivative of $\phi = 2x^2 + 3y^2 + z^2$ at the point (2, 1, 3) along the line $\dfrac{x-2}{1} = \dfrac{y-1}{2} = \dfrac{z-3}{2}$ **[5]**

   b) Show that vector field $\overline{F} = (x^2 - yz)\hat{i} + (y^2 - xz)\hat{j} + (z^2 - xy)\hat{k}$ is irrotational. Also find corresponding scalar potential function ϕ such that $\overline{F} = \nabla\phi$ **[5]**

   c) Evaluate $\displaystyle\int_c \overline{F} \cdot d\overline{r}$ for $\overline{F} = 3x^2\hat{i} + (2xz - y)\hat{j} + z\hat{k}$ along the curve $x = t, y = t^2, z = t^3$ from $t = 0$ to $t = 1$.   **[5]**

<div align="center">OR</div>

Q7) a) If the directional derivative of $\phi = axy + byz + cxz$ at (1, 1, 1) has maximum magnitude 4 in the direction parellel to X - axis, find the value of a, b, c.
                                                                                  [5]

   b) Show that (any one)   **[5]**

   i) $\nabla^4(e^r) = e^r + \dfrac{4}{r}e^r$

   ii) $\nabla\left(\dfrac{\overline{a}\cdot\overline{r}}{r^n}\right) = \dfrac{\overline{a}}{r^n} - \dfrac{n(\overline{a}\cdot\overline{r})}{r^{n+2}}$

c) Evaluate $\oint_c \overline{F} \cdot d\overline{r}$ using Green's theorem where

$\overline{F} = (2x - \cos y)\hat{i} + x(4 + \sin y)\hat{j}$ and c is the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$, z = 0. [5]

Q8) a) Solve $\dfrac{\partial u}{\partial t} = k \dfrac{\partial^2 u}{\partial x^2}$ if [7]

i) $u(x, t)$ is bounded

ii) $u(0, t) = 0$

iii) $u(l, t) = 0$

iv) $u(x, 0) = \dfrac{u_0 x}{l}$ $0 < x < l$, u_0 is constant

b) Solve the wave equation $\dfrac{\partial^2 y}{\partial t^2} = a^2 \dfrac{\partial^2 y}{\partial x^2}$ [8]

i) $y(0, t) = 0$

ii) $\left(\dfrac{\partial y}{\partial t} \right)_{t=0} = 0$

iii) $y(\pi, t) = 0$

iv) $y(x, 0) = x$, $0 \le x \le \pi$

OR

Q9) a) An infinitely long uniform plate is bounded by two parallel edges in the - y - direction and on end at right angles to them. The breadth of the plate is π. This end is maintained at temperature u_0 at all points, other edges as zero temperature. Find steady state temperature $u(x, y)$ If it satisfies $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial x^2} = 0$ **[8]**

b) Use Fourier tansform to solve

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2} \quad 0 < x < \infty$$

Under the condition -

i) $u(0, t) = 0$ $t > 0$

ii) $u(x,0) = \begin{cases} 1 & 0 < x < 1 \\ 0 & x > 1 \end{cases}$

c) $u(x, t)$ is bounded. **[7]**

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[5925]-283

S.E. (Production&Industrial Engineering/Production-S.W)
HEAT AND FLUID ENGINEERING
(2019 Pattern) (Semester - III) (211081)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

  1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

  2) *Neat diagrams must be drawn wherever necessary.*

  3) *Figures to the right side indicate full marks.*

  4) *Assume suitable data, if necessary.*

Q1) a) What is laminar and turbulent flow? Discuss in detail. **[9]**

   b) An oil of specific gravity 0.7 is flowing through a pipe of diameter 300mm at the rate of 500litres. Find the head lost due to friction and power required to maintain the flow for a length of 1000 meter. Take kinematic viscosity 0.29 strokes. **[9]**

OR

Q2) a) Water is flowing through a pipe of diameter 200mm with a velocity of 3m/s. Find the head lost due to friction for a length of 5 meter if the co-efficient of friction is given by $0.002 + .09/Re^{0.3}$ where Re is Reynold number. Take kinematic viscosity of water 0.01 stroke. **[9]**

   b) Explain working any two turbines. **[9]**

Q3) a) Draw the sketch of any boiler and explain its working. **[9]**

   b) A boiler working at a pressure of 14 bars evaporates 8kg of water/kg of coal burnt from the feed water entering at 39°c. The steam at the stop value is 0.95dry. Determine the equivalent of evaporation from & at 100°c. **[8]**

OR

Q4) a) Discuss boiler efficiency, equivalent of evaporation and energy balance.**[9]**

   b) What are combustion equation and stoichiometric analysis? **[8]**

P.T.O.

Q5) a) How air conditioning effects on micro and nano manufacturing? **[9]**

b) What are components of refrigeration system and explain its functions.**[9]**

OR

Q6) a) Discuss severity of refrigeration effect on environment system. **[9]**

b) Explain. i) Dry bulb temperature ii) Wet bulb temperature iii) Dry air & iv) Wet air **[9]**

Q7) a) Explain working of compressor with sketch. **[9]**

b) Discuss classification of Internal Combustion engine. **[8]**

OR

Q8) a) What is multi stage compression? Discuss in detail. **[9]**

b) Explain heat balance sheet of Internal Combustion engine. **[8]**

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[5925]-284

S.E. (Production and Industrial Engg. / Production Sandwich)
STRENGTH OF MATERIALS
(2019 Pattern) (Semester - III) (211082)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Assume suitable data, if necessary.*
2) *Figures to the right indicate full marks.*
3) *Use of non-programmable electronic pocket calculator is allowed.*
4) *Student will solve/write the answers to any four questions in single answer book only (Note: Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.)*

Q1) a) Derive equation of shear stress for a beam section. **[7]**

b) A cast iron beam 2.75 m long has one support at the left end and the other support at 0.75 m form the right end. The beam is of T section consisting of a top flange 150 mm × 20 mm and web of 20 mm wide and 80 mm deep. If the tensile and compressive stresses are not to exceed 40 N/mm² and 70 N/mm² respectively find the safe concentrated load W that can be applied at the right end of the beam. **[6]**

c) A cast iron test beam 20 mm × 20 mm in section and 1 metre long and supported at the ends fails when a central load of 640 N is applied. What uniformly distributed load will break a cantilever of the same material 50 mm wide, 100 mm deep and 2 metres long? **[5]**

OR

Q2) a) Derive Bending equation. **[7]**

b) A beam is circular in section having diameter (d). Derive the expression of shear stress over a circular section. **[6]**

c) The cross - section of a beam is rectangle 60 wide and 80 mm deep. The maximum shear stress is 40 MPa. Compute shear stress at (a) 40 mm above neutral axis and (b) 10 mm below neutral axis. **[5]**

Q3) a) Direct stresses of 110 N/mm² (tensile) and 50 N/mm² (tensile) are applied at a point in an elastic material on two mutually perpendicular planes. Determine the allowable shear stresses on these planes if the maximum principal stress in the material is limited to 120 N/mm². (Graphical Method) **[6]**

b) A 15 mm diameter rod, 3 m long, provided with a rigid collar at its lower end hangs from a ceiling. It is stretched by a load dropping freely by gravity on the collar. Find (a) the greatest load can be dropped on the collar from a height of 120 mm (b) the greatest height from which a 5000N load can be dropped on the collar, so that the elastic limit stress of 330 N/mm² is not exceeded. Take E = 2.05 × 10⁵ N/mm². **[6]**

c) Determine the expression for strain energy in a vertical rod strained under its self - weight in terms of g, l, δ, and E. Where δ is the mass density. **[6]**

OR

Q4) a) A uniform metal bar has a cross - sectional area of 700 mm². and a length of 1.50 metre with on elastic limit of 160 N/mm². What is the proof resilience? Find also the maximum value of an applied load which may be suddenly applied without exceeding the elastic limit. Calculate the value of the gradually applied load which will produce the same extension as that produced by the above suddenly applied load. Take E = 2 × 10⁵ N/mm². **[6]**

b) The principal stresses at a point in a bar are 200 N/mm² (tensile) and 100 N/mm² (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major principal stress. Also determine the maximum intensity of shear stress in the material at the point. **[6]**

c) Define the terms principal plane, principal stress and angle of obliquity. **[6]**

Q5) a) The air vessel of a torpedo is 530 mm external diameter and 10 mm thick, the length being 1830 mm. Find the change in the external diameter and the length when charged to 10.5 N/mm² internal pressure. Take E = 2.1 × 10⁵ N/mm² and Poisson's ratio = 0.3. **[7]**

b) Figure shows a horizontal shaft with keyed pulleys, rotating at 1800 rpm. The pulls of the tight and slack sides of the belts over the pulleys are indicated in the figure. Neglecting the weight of the shaft and assuming smooth bearings close to the pulleys, find the diameter of the shaft if the shear stress in the shaft is not to exceed 60 N/mm². **[6]**
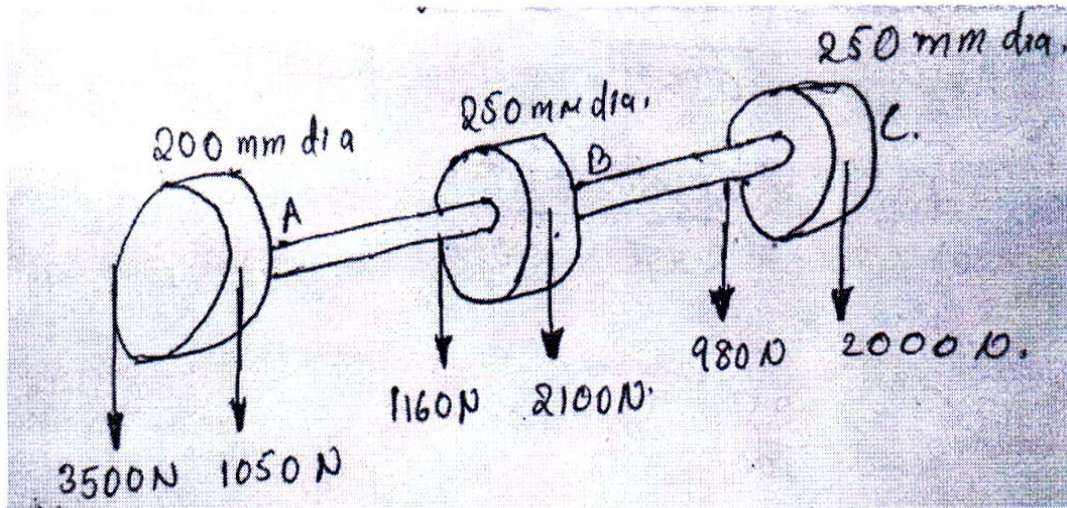
c) Explain assumptions made in the theory of pure torsion. **[4]**

OR

Q6) a) Determine the torque that can be applied to a solid shaft of 20 mm diameter without exceeding an allowable shearing stress of 75 N/mm². What torque can be applied if this solid shaft is replaced by a hollow shaft of the same sectional area with the inner diameter equal to half its outer diameter. **[7]**

b) A 10 mm thick cylinder is filled with an atmospheric pressure. Cylinder has an internal diameter of 180 mm and is l m long. If a 20000 mm³ is additionally pumped into the cylinder, find the hoop stress induced in cylinder (E = 200 GPa and μ = 0.3) **[6]**

c) Explain types of stresses developed in thin cylinder when subjected to internal liquid pressure. **[4]**

Q7) a) Derive expression of slope and deflection for a cantilever of length L carrying a point load W at the free end. **[7]**

b) A hollow cast iron column with fixed ends supports an axial load of 1000 kN. If the column 5.0 m long has an external diameter of 250 mm, find the thickness of metal required. Use Rankine formula, considering a constant of 1/6400 and a working stress of 80 MPa. **[6]**

c) What are the assumptions made in Euler' s theory. **[4]**

<center>OR</center>

Q8) a) A cantilever 150 mm wide and 200 mm deep projects 1.5 m out of wall and carries a point load of 40 kN at a distance 1 m from the fixed end. Find the slope and deflection of the cantilever at the free end. Take E = 200 kN/mm². **[6]**

b) A steel rod 5 m long and 40 mm diameter is used as a column with one end fixed and the other hinged. Determine the critical load, the column can carry by using Euler's formula. Take E = 2×10^5 N/mm². **[6]**

c) Explain the concept of slope and deflection and boundary conditions of beam. **[5]**

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[5925]-285

S.E. Production And Industrial Engg Production Sandwich
MANUFACTURING PROCESSES-I
(2019 Pattern) (211083) (Semester - III)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :
1) *Answer Q.1 or Q2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicates full marks.*
4) *Assume Suitable data if necessary.*

Q1) a) Explain following lathe operations by neat sketches:

     i) Facing ii) Plane turning iii) Chamfering iv) Drilling   **[8]**

    b) With the help of neat sketch, explain horizontal column and knee type milling machine.   **[10]**

OR

Q2) a) List out various taper turning methods on lathe machine. Explain Tail Stock set over method with neat sketch in detail.   **[10]**

    b) State various operations performed on milling machine. Differentiate between up milling and down milling.   **[8]**

Q3) a) With the help of sketch, explain the construction and working of radial drilling machine.   **[10]**

    b) Explain the standard marking system used for grinding wheels.   **[7]**

OR

Q4) a) Differentiate between multiple spindle and gang drilling machine.   **[8]**

    b) With the help of sketch, explain the construction and working of cylindrical grinding machine.   **[9]**

Q5) a) Explain Buffing, Lapping and Burnishing processes in short. **[9]**

b) Explain Polishing, Tumbling and Electroplating processes in short **[9]**

OR

Q6) a) Explain in short Galvanizing & Metal spraying process. **[9]**

b) Explain Honing process with neat sketch in detail. **[9]**

Q7) a) What is additive manufacturing? What are its advantages and limitations?
[9]

b) Explain sheet lamination process in detail. **[8]**

OR

Q8) a) Describe various applications of additive manufacturing. **[8]**

b) Explain powder bed fusion additive manufacturing process in detail. **[9]**

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[5925]-286

S.E. (Production & Industrial Engineering/Production-S.W)
MATERIALS SCIENCE AND METALLURGY
(2019 Pattern) (Semester - III) (211084)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Assume suitable data if necessary.*
3) *Figures to the right indicate full marks.*
4) *Neat diagrams must be drawn wherever necessary.*
5) *Use of scientific calculators is allowed.*
6) *Use of cell phone is prohibited in the examination hall.*

Q1) a) What is Powder Metallurgy (PM)? Discuss advantage and disadvantage of PM. **[8]**

b) Explain following terms : **[8]**
   i) Self-lubricating bearings.
   ii) Cermets.

<div align="center">OR</div>

Q2) a) Write note on : **[8]**
   i) Diamond impregnated Cutting Tools.
   ii) Cemented carbide tipped tools.

b) Describe any two component which can be manufactured by only powder metallurgy technique. **[8]**

Q3) a) Define following : **[10]**
   i) Ferrite.
   ii) Austenite.
   iii) Pearlite.
   iv) Cementite.
   v) Bainite.

b) Draw Fe-C equilibrium diagram and label the temperature, compositions and phase. **[8]**

P.T.O.

OR

Q4) a) What is steel? What do you understand by eutectoid, hypereutectoid and hypoeutectoid steel? **[10]**

b) Explain the following with neat diagram. **[8]**

   i) Peritectic transformation.

   ii) Eutectic transformation.

Q5) a) Draw and Explain the method of plotting TTT diagram and what information is obtained from this diagram. **[10]**

b) Explain terms : **[8]**

   a) Quenching.

   b) Annealing.

   c) Normalizing.

   d) Carburizing.

OR

Q6) a) Define hardenability. How it is measured? **[8]**

b) What is retained austenite? Why it is not desirable? **[10]**

Q7) a) Write note on High temperature alloy. **[9]**

b) Write Note on Copper and its Alloy. **[9]**

OR

Q8) a) Write Note on Aluminum and its Alloy. **[9]**

b) Write Note on Composite Material and Nano Materials. **[9]**

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S.E. (Production and Industrial Engineering/Production Sandwich)
ELECTRICAL AND ELECTRONICS ENGINEERING
(2019 Pattern) (Semester-IV) (203050)

Time :2½ Hours]   *[Max. Marks : 70*
Instruction to the candidates:
    1)   *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
    2)   *Figures to the right indicate full marks.*
    3)   *Assume suitable data, if neccessary.*

Q1) a)   What is GTO? Mention merits of GTO.   **[5]**

    b)   Explain I-V characteristics of SCR.   **[6]**

    c)   Give specifications and applications of SCR.   **[6]**

OR

Q2) a)   Explain I-V characteristics of DIAC and TRIAC.   **[5]**

    b)   Differentiate between IGBT and MOSFET.   **[6]**

    c)   Draw and explain output characteristics of IGBT.   **[6]**

Q3) a)   Explain working of digital to analog converter.   **[5]**

    b)   Define fixed and variable voltage regulator. Explain functions of LM317 as adjustable voltage regulator.   **[6]**

    c)   What is operational amplifier ? List parameters of an ideal OP-AMP.**[6]**

OR

Q4) a)   Explain working of voltage controlled oscillator by using IC 566.   **[5]**

    b)   State ideal and practical characteristics of operational amplifier.   **[6]**

    c)   With the help of pin diagram,explain functions of operational amplifier.   **[6]**

Q5) a) With a neat block diagram,explain functions of programmable logic controller. **[5]**

b) Explain input and output devices with suitable example. **[6]**

c) What are the merits and demerits of PLC. **[6]**

OR

Q6) a) Explain input and output module of programmable logic controller. **[8]**

b) What are different applications of PLC. **[6]**

c) Explain various rules for development of ladder diagram. **[4]**

Q7) a) Mention various features of ATmega328P **[4]**

b) Draw interfacing diagram of LED with arduino board also write the algorithm to link the LED. **[8]**

c) Explain the following functions used to handle GPID in ATmega328P arduino board with suitable example. **[6]**
   i) pinMode ( )
   ii) digitalWrite ( )
   iii) digitalRead ( )

OR

Q8) a) State and explain any three open source embedded platform. **[8]**

b) Explain the concept of GPIO in ATmega328P. **[6]**

c) State any four significant features of Arduino IDE. **[4]**

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[5925]-288

S.E. (Production Engineering) (Sandwich)
THEORY OF MACHINES
(2019 Pattern) (Semester - IV) (211091)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
 2) *Neat diagrams must be drawn wherever necessary.*
 3) *Figures to the right indicate full marks.*
 4) *Assume suitable data if necessary.*
 5) *Use of logarithmic tables, slide rules, Mollier charts, electronic pocket calculator and stem table is allowed.*

Q1) a) State and prove the Kennedy's Theorem. **[8]**

 b) Figure shows a mechanism in which dimensions of various links are as follows: OP=RS=150 mm, PQ=QS=450 mm and RT =375 mm. Crank OP rotating at uniform speed of 180 rpm. Determine velocity of slider T and Angular velocity of QS. Use relative velocity method. **[10]**
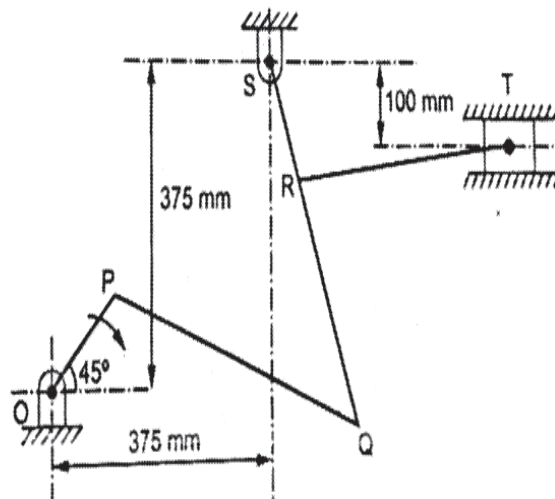
OR

Q2) a) Explain different types of instantaneous centre of rotation. **[8]**

b) A mechanism as shown in fig. has following dimensions: OA= 200 mm, AB = 1.5 m, BC = 600 mm, CD = 500 mm and BE = 400 mm. If crank OA rotate uniformly at 400 rpm anticlockwise, find **[10]**

i) velocity of D

ii) angular velocity of link BC. Use Instantaneous centre of rotation method.
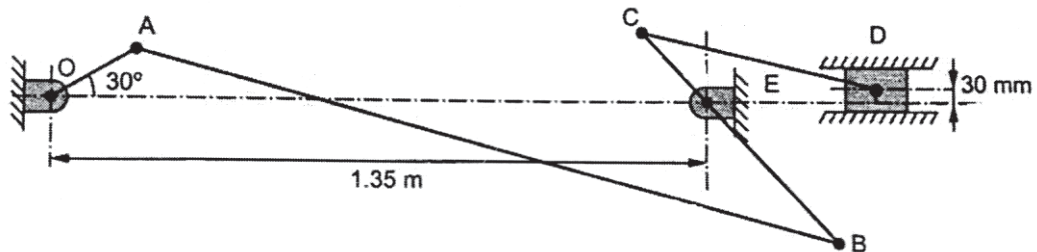
Q3) Toggle mechanism as shown in below given figure, crank OA rotates at a uniform speed of 105 rpm in clockwise direction. Determine velocity and acceleration of slider 'P'. The lengths of various links are: OA = 8 cm, AB = 18 cm, BC =24 cm, BP = 28cm. **[17]**
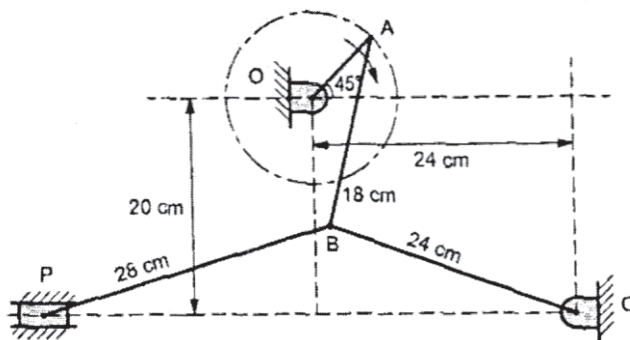
OR

Q4) a) In slider crank mechanism, the stroke of slider is 200 mm and obliquity ratio is 4.5. The crank rotates uniformly at 1000 rpm clockwise. When the crank is 30° past the O.D.C. determine using analytical method **[8]**

i) Velocity and acceleration of piston

ii) Angular velocity and Angular acceleration of connecting rod.

b) In a reciprocating engine, crank length is 25 cm and obliquity ratio is 4. The crank rotates uniformly at 300 rpm in clockwise. Crank is at 30° from IDC. Using Klein's construction method determine: **[9]**

i) velocity and acceleration of piston

ii) Angular velocity and angular acceleration of connecting rod.

Q5) a)   Explain different types of flat belt drive with neat sketches.   **[8]**

b)   A pulley is driven by a belt, the angle of lap being 120°. The belt is 100 mm wide by 6 mm thick and density 1000 kg/m³. If the coefficient of friction is 0.3 and the maximum stress in belt is not to exceed 2 MPa, find the greatest power which the belt can transmit and the corresponding speed of belt.   **[10]**

OR

Q6) a)   Derive an expression for centrifugal tension for flat belt drive: **[8]**

Tc= m.v²

Where, Tc- Centrifugal tension in N,

m - mass of belt in Kg per unit length of belt,

v - velocity of belt in m/s

b)   A shaft rotating at 200 rpm drives another shaft at 300 rpm and transmits 6 Kw through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4 m. The smaller pulley is 0.5 m in diameter. Calculate the stress in belt, if it is cross belt drive. Take μ = 0.3   **[10]**

Q7) a)   Explain in detail the self energize and self-locking brake.   **[8]**

b)   Diameter of brake drum of single block brake shown in fig is 1 m. It sustains 280 Nm torque at 300 rpm. The coefficient of friction is 0.35 and the angle of contact is 90°. Determine the required force 'F' to be applied when the rotation of drum is   **[9]**

i)   clockwise

ii)   anticlockwise

Also find new value of 'a' for self locking of brake.

OR
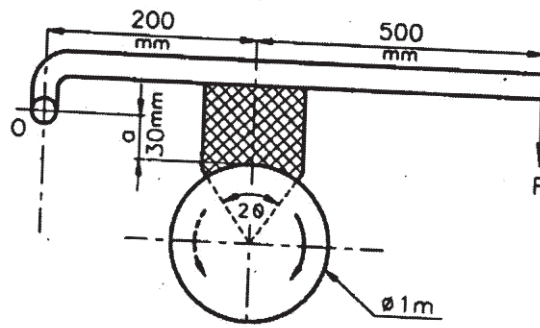
Q8) a) With the help of neat sketch, explain construction and working of epicyclic train dynamometer. **[8]**

b) A band brake as shown in fig. acts on the 3/4th circumference of drum of 450 mm diameter, which is keyed to the shaft. The band brakes provides a braking torque of 225 Nm. One end of band is attached to a fulcrum pin of the lever and the other end to a pin, 100 mm from fulcrum. If the operating force is applied at 500mm from fulcrum and coefficient of friction is 0.25. Find operating force when the drum rotates in **[9]**

    i) Anticlockwise direction

    ii) Clockwise direction.

♦   ♦   ♦
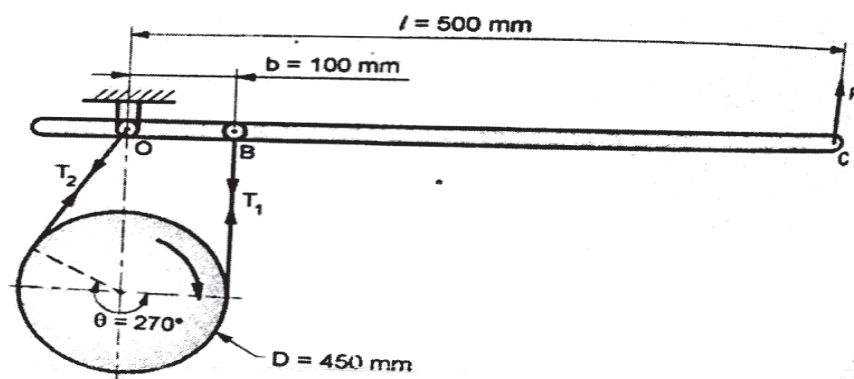
[5925]-289

S.E. (Production and Industrial Engg. & Production Sandwich)

DESIGN OF MACHINE ELEMENT

(2019 Pattern) (Semester - IV) (211092)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*

    2)   *Use of scientific calculator is allowed.*

    3)   *Figures to the right side indicate full marks.*

Q1) a)   Discuss the different types of threads used in power screw.   **[6]**

     b)   Define lead angle, major diameter, lead and pitch in terms of power screw.   **[4]**

     c)   The lead screw of a lathe has Acme threads of 50 mm outside diameter and 8 mm pitch. The screw must exert an axial pressure of 2500 N in order to drive the tool carriage. The thrust is carried on a collar 110 mm outside diameter and 55 mm inside diameter and the lead screw rotates at 30 r.p.m. Determine (a) the power required to drive the screw; and (b) the efficiency of the lead screw. Assume a coefficient of friction of 0.15 for the screw and 0.12 for the collar.   **[8]**

OR

Q2) a)   A vertical two start square threaded screw of a 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing of 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of a lever which is 400 mm long in order to lift and lower the load. The coefficient of friction for the vertical screw and nut is 0.15 and that for collar bearing is 0.20.   **[8]**

     b)   Define core diameter, minor diameter, left hand screw and Multiple thread screw in terms of power screw.   **[4]**

     c)   What is meant by power screw? Give its advantages, disadvantages and applications.   **[6]**

Q3) a) What is meant by springs? Explain different types of springs. **[6]**

b) Solid length, Free length, Spring index and Spring rate in terms of spring. **[4]**

c) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm², find the axial load which the spring can carry and the deflection per active turn. **[8]**

OR

Q4) a) Explain the Surge in Springs. **[6]**

b) Give any 2 applications of springs and any 2 material required for manufacturing of springs. **[4]**

c) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm². Also calculate the maximum shear stress induced. **[8]**

Q5) a) What is spur gear? Enlist any 2 applications of spur gear and Give its detail classification. **[9]**

b) A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4:1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. **[8]**

OR

Q6) a) Define the terms in respective of spur gears: Module, Addendum, Pitch circle diameter and Backlash. **[4]**

b) Discuss the Causes of Gear Tooth Failure. **[5]**

c) The following particulars of a single reduction spur gear are given: Gear ratio = 10:1; Distance between centres = 660 mm approximately; Pinion transmits 500 kW at 1800 r.p.m.; Involute teeth of standard proportions (addendum = m) with pressure angle of 22.5°; Permissible normal pressure between teeth = 175 N per mm of width. Find : **[8]**

   i) The nearest standard module if no interference is to occur;

   ii) The number of teeth on each wheel;

   iii) The necessary width of the pinion; and

   iv) The load on the bearings of the wheels due to power transmitted.

Q7) a) What are rolling contact bearings? Discuss their advantages over sliding contact bearings. **[4]**

b) Write short note on classifications and different types of antifriction bearings. **[5]**

c) A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 kN for 20 per cent of time, 1 kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20×10^6 revolutions at 95 per cent reliability, calculate dynamic load rating of the ball bearing. **[8]**

OR

Q8) a) Where are the angular contact and self-aligning ball bearings used? Draw neat sketches of these bearings. **[7]**

b) How do you express the life of a bearing? What is an average or median life? **[6]**

c) Explain how the following factors influence the life of a bearing : **[4]**
   i)   Load
   ii) Speed
   iii) Temperature
   iv) Reliability

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S.E. (Production/Industrial Engineering)
ADVANCED MATERIALS
(2019 Pattern) (Semester - IV) (211093)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:
1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*
2) *Assume Suitable data necessary.*
3) *Figures to the right indicate full marks.*
4) *Draw neat figures whenever necessary.*
5) *Use of scientific calculators is allowed.*
6) *Use of cell phone is prohibited in the examination hall.*

Q1) a) Which are the key properties of nanomaterials? **[6]**

b) What are the limitations of nanomaterials? **[6]**

c) Which are the important properties desired from electrical materials? **[6]**

OR

Q2) a) What is vulcanization? **[6]**

b) Which are the common magnetic materials? **[6]**

c) How are polymers classified on the basis of their structure? **[6]**

Q3) a) How are magnetic materials classified based on relative permeability? **[6]**

b) What do you mean by carbon nanotubes? **[6]**

c) What is a biodegradable polymer? Give examples. **[5]**

OR

Q4) a) Where are semiconductors used? **[6]**

b) Give one example each of zero-, one- and two-dimensional nanomaterials? **[6]**

c) What do you mean by Engineering plastics? Give examples. **[5]**

P.T.O.

Q5) a) What do you mean by calandering of elastomers? **[9]**

b) Write note on: Mixing mechanisms of rubber/elastomers **[8]**

OR

Q6) a) Which are the manufacturing techniques used for processing of rubbers? **[9]**

b) Write note on: Extrusion of Rubber or elastomer. **[8]**

Q7) a) What do you understand by "Ceramics"? Distinguish between "Traditional" and "Advanced" ceramics . **[9]**

b) Explain with sketch slip casting for Ceramic processing. **[9]**

OR

Q8) a) What is mean by composites? Which are the attractive features of composites make them suitable for special areas of applications? **[9]**

b) Explain with sketch any one technique of metal matrix composite processing. **[9]**

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[5925]-291

S.E. (Production & Industrial Engineering/ Production- S/W)
INDUSTRIAL ENGINEERING & MANAGEMENT (2019 Pattern) (Semester - IV) (211094)

Time : 2½ Hours] [*Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Assume suitable data.*

Q1) a) Elaborate characteristics of successful Entherpreners. **[5]**

b) Classify & explain sources of finance. **[6]**

c) Write a short note on Break Even Analysis. **[6]**

OR

Q2) a) Discuss significance of knowing Intellectual Property Rights (IPR). **[9]**

b) Discuss various theories of motivation. **[8]**

Q3) a) What are the functions of Industrial Engineer? **[8]**

b) Describe different types of plant layout with sketch. Which type of layout should be used for cotton mill? Why? **[9]**

OR

Q4) a) What are various production systems? How they are classified. **[8]**

b) List out various performance rating methods. **[9]**

Q5) a) Discuss concept of wages. **[9]**

b) Explain '5W' & '1H'. **[9]**

OR

Q6) a) State in detail principle of motion economy. **[10]**

b) Compare chronocyclograph to SIMO chart. **[8]**

Q7) a) Elaborate on : two handed process chart. **[8]**

b) Why time study is required. State any one time study technique. **[10]**

OR

Q8) a) Enlist various work sampling methods. **[8]**

b) Describe types of allowances in detail. **[10]**

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S.E. (Production Sandwich)
MANUFACTURING PROCESS - II
(2019 Pattern) (Semester - IV) (211121)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
  1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
  2) *Figure to the right indicates full marks.*
  3) *Neat Diagram must be drawn wherever necessary.*
  4) *Assume Suitable data if necessary.*
  5) *Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*

Q1) a)   Elaborate part programming in detail with any suitable example.   **[9]**

   b)   Discuss significance of FMS.   **[8]**

                                    OR

Q2) a)   Explain the feedback system of NC/CNC machine.   **[9]**

   b)   Describe the principle of working of an automatic pallet changer and
        automatic tool changer.   **[8]**

Q3) a)   Describe the pipe extrusion method with a labeled sketch.   **[9]**

   b)   Describe the continuous extrusion method with a labelled sketch.   **[8]**

                                    OR

Q4) a)   Explain the plastics moulding compound selection procedure and required
        material properties for the production of a shampoo bottle with
        justification.   **[9]**

   b)   Select the material and process for manufacture of 5 litre oil can with
        labelled sketch and justification.   **[8]**

                                                                      P.T.O.

Q5) a) Explain with neat diagram construction and working of LBM processes. **[9]**

   b) Draw schematic diagram of EDM. Explain its construction and working. **[9]**

<div align="center">OR</div>

Q6) a) Explain briefly ECM process characteristics. **[9]**

   b) Elaborate on Rapid Prototyping process. State various methods of rapid prototype. **[9]**

Q7) a) Explain 3-2-1 locating concept using pins with suitable sketches. **[9]**

   b) Explain the term Redundant Location and what are the functions of spring locating buttons and pins? **[9]**

<div align="center">OR</div>

Q8) a) What are various clamping devices? Explain these with the aid of suitable sketches. **[9]**

   b) What are modular fixtures? Brief those fixtures. **[9]**

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[5925]-293

S.E. (Printing Engineering)
THEORY OF PRINTING MACHINE AND MACHINE COMPONENTS
(2019 Pattern) (Semester - III) (202060)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

    1)   *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

    2)   *Figures to the right indicate full marks.*

    3)   *Assume suitable data if necessary.*

    4)   *Neat diagrams must be drawn wherever necessary.*

    5)   *Use of electronic pocket calculator is allowed.*

Q1) a)   Write short note on pivoted block brake.   **[5]**

    b)   Define brake and gives general requirement for good brake lining material.   **[5]**

    c)   A single block brake has a brake drum diameter of 1.5 m and angle of contact is 30°. It takes 350 Nm torque at 400 rpm. [Take u = 0.30] Determine required force P when drum rotating clockwise.   **[8]**
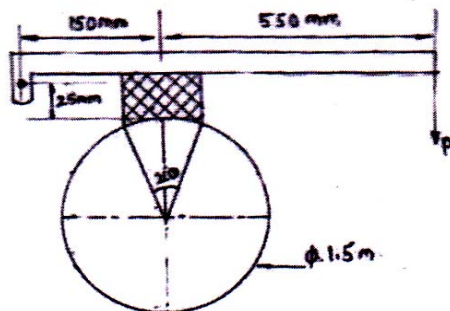
Fig -Q1c

Q2) a)   Differentiate between Flat belt and V belt.   **[5]**

    b)   List out the advantages and disadvantages of belt drives.   **[5]**

c) A leather belt 9 mm × 250 mm is used to drive a cast iron pulley 900mm in diameter at 336 r.p.m. If the active arc on the smaller pulley is 120° and the stress in tight side is 2 MPa. find the power capacity of the belt. The density of leather may be taken as 980 kg/m³ and the coefficient of friction of leather on cast iron is 0.35. **[7]**

Q3) a) With the help of neat sketch explain single black brake. **[5]**

b) Explain self-locking and self-energizing condition for differential band brake. **[5]**

c) A bicycle and rider of mass 120 kg are travelling at a speed of 15 km/hr on a level road. The rider applies brake to the rear wheel which is 0.9 m diameter. How For bicycle will travel before it comes to rest? Pressure applied 100N and u = 0.05. Also find number of revolutions. **[8]**

Q4) a) Classify Belt Drive. **[5]**

b) What is creep of the belt and their expression? **[5]**

c) The belt drive consists of two V-belts in parallel, on grooved pulleys of the same size. The angle of the groove is 30°. The cross-sectional area of each belt is 750 mm² and μ = 0.12. The density of the belt material is 1.2 Mg/m³ and the maximum safe stress in the material is 7 MPa. Calculate the power that can be transmitted between pulleys of 300mm diameter rotating at 1500 r.p.m. Find also the shaft speed in r.p.m. at which the power transmitted would be a maximum. **[7]**

Q5) Figure shows a toggle mechanism in which the crank OA rotates at 120 rpm Find the velocity and the acceleration of the slider at D. **[18]**

OA = 40
AB = 90

100
135
120
90
120
(mm)
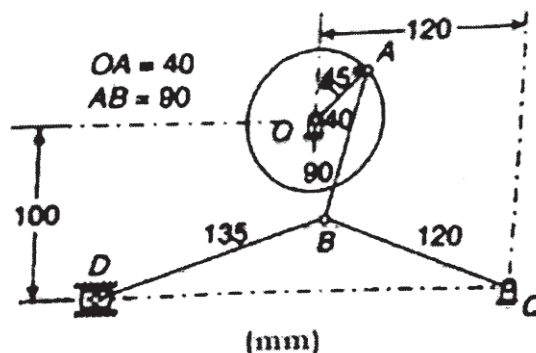
Q6) In the slider-crank mechanism shown in figure, the block P reciprocates along the fixed line CD. The Crank OA rotates clockwise at a uniform speed of 150 rpm. The dimensions of the links (in mm) are OA = AB 250; AP = 400; For the given configuration, find the velocity and acceleration of the block - P. **[17]**
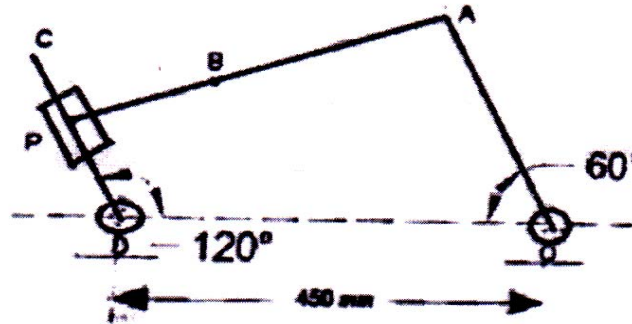
Fig-Q6

Q7) a) Draw and explain the KLEIN's construction for the velocity diagram of a reciprocating engine mechanism? With this construction, how do you find the velocities of the piston and connecting rod in terms of the uniform angular velocity of the crank? **[9]**

b) Consider a reciprocating engine mechanism in which the crank OA rotates at 100 rpm clockwise and OA has turned through 40° from its IDC position The crank length is 40 mm and the connecting rod is 100 mm long. Find the linear velocity and acceleration of the piston and the angular velocity and angular acceleration of the connecting rod. **[9]**

Fig – O7b

[5925]-293   3
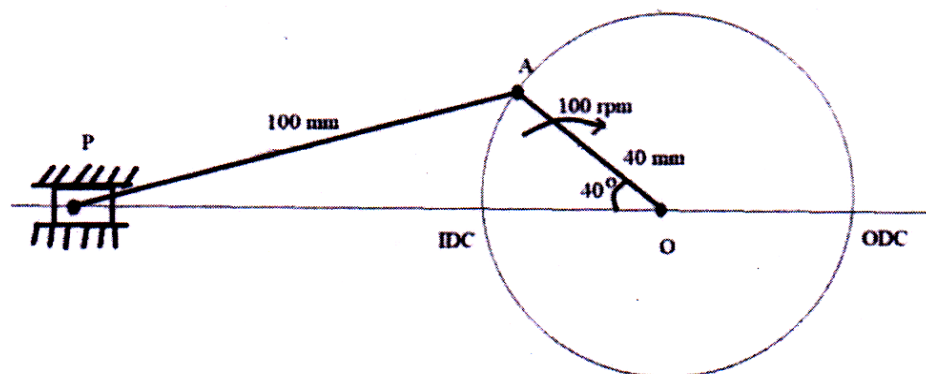
Q8) In a mechanism shown in Fig. 4, the link PQ is free to turn about the end P. at the same time it freely slides in a slotted trunnion R. The slotted trunnion is carried on the second link ST which is freely slides vertically in the guides. Draw the velocity and acceleration diagram at instant when PQ makes an angle 45 to the horizontal and rotating with angular velocity of 50 rad/sec. in the anticlockwise direction. Hence determine the velocity and acceleration of the link ST. **[17]**

Fig - Q8

▽ ▽ ▽ ▽
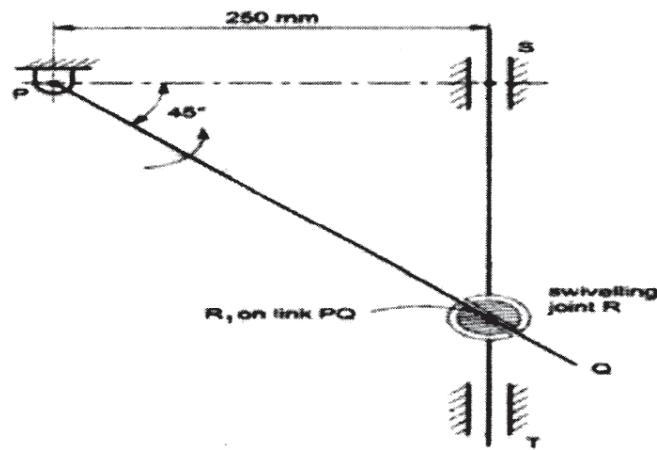
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[**Total No. of Pages : 2**

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S.E. (Printing Engineering)

MATERIAL SCIENCE IN PRINTING AND PACKAGING

(2019 Pattern) (208282) (Semester - III)

Time : 2½ Hours]   [*Max. Marks : 70*

Instructions to the candidates :

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

2) *Figures to the right indicate full marks.*

3) *Assume suitable data if necessary.*

4) *Neat diagrams must be drawn wherever necessary.*

5) *Use of electronic pocket calculator is allowed.*

Q1) a)   Draw neat and labelled diagram of paper making machine and explain the process in details.   **[18]**

OR

Q2) a)   Differentiate between surface tension and surface energy.   **[9]**

   b)   Explain any two method of identification of plastics.   **[9]**

Q3) What is composition of ink? Explain in details ingredients and function of each ingredient used and application for paste and liquid inks.   **[17]**

OR

Q4) a)   Explain following with diagram   **[9]**

   i)   Cross and machine direction.

   ii)   Caliper of paper.

   b)   What is opacity and porosity of paper? What these properties are significant and in which application they are needed to be used.   **[8]**

P.T.O.

Q5) What are varieties of corrugated ply? Explain each with details and state applications. **[18]**

OR

Q6) a) Explain any 3 varieties of plastics with their applications. **[9]**

b) What is thermoset plastic, explain its application. **[9]**

Q7) What is FBB? Explain its properties and applications. What is SBS? Explain its properties and applications. **[17]**

OR

Q8) Write down any 4 properties of paperboard along with its application. **[17]**

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[5925]-296

S.E. (Printing Engineering)
PRINTING DIGITAL ELECTRONICS
(2019 Pattern) (208283) (Semester - III)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

    1)   Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.

    2)   Figures to the right indicates full marks.

    3)   Assume suitable data, if necessary.

    4)   Neat diagrams must be drawn wherever necessary.

    5)   Use of electronic pocket calculator is allowed.

Q1) Perform Following   **[18]**

    a)   1's Complement of 1010010 =

    b)   2's Complement of 1000111

    c) 10111×101

    d) $1110 \div 10$

    e)   Solve (8 - 9) using 2's complement method

    f)   Add 1001 and 1111

    g)   Convert the 12 and 33 in BCD and add them in BCD form.

    h)   110101 - 100011

    i) $10100 + 01011$

<div align="center">OR</div>

Q2) a)   Draw the logical expression for the following given expression $Y = (B \cdot \overline{A}) + (AB)$.   **[4]**

    b)   Design full adder with the help of K-Map.   **[8]**

    c)   Describe the design of one bit magnitude comparator using k-Map.   **[6]**

Q3) Draw the clocked JK flip flop circuit explain its function table and timing diagram. **[17]**

OR

Q4) a) Draw and explain 3 bit asynchronous up counters. **[6]**

b) Draw the circuits of any two combinational circuits. **[6]**

c) Depict any type of shift register in detail. **[5]**

Q5) What is ADC? Describe its specification and Explain any one type of ADC with neat diagram. **[18]**

OR

Q6) a) Write a short note on PLA and PAL. **[6]**

b) Explain any two types of memories. **[6]**

c) Describe 7 segment display and its decode IC. **[6]**

Q7) a) Explain block diagram of digital computer. **[8]**

b) Describe any types of output devices of computer. **[9]**

OR

Q8) Elucidate any 2 uses of sequential and combinational circuits in the field of printing. **[17]**

▽ ▽ ▽ ▽

SEAT No. :

[**Total No. of Pages : 2**

[5925]-297

S.E. (Printing Engineering and Graphic Communication)
ELECTRICAL MACHINES AND UTILIZATION
(2019 Pattern) (Semester - IV) (203155)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q.No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Explain any one method of speed control of 3 phase induction motor. **[9]**

     b) An 18.65 kW, 4 pole, 3 phase, 50 Hz Induction motor has friction and windage losses are 2.5% of output. The full load slip is 4%. Calculate rotor copper loss, rotor input and shaft torque of the motor. **[9]**

OR

Q2) a) Draw Torque-Slip characteristic with modes of operation. **[9]**

     b) The power input to a 3 phase induction motor is 60 kW. The stator losses are 1 kW. Find the mechanical power developed and rotor copper loss per phase. **[9]**

Q3) a) Write short note on flood lighting design. **[9]**

     b) Find total saving in electrical load and percentage increase in illumination if instead of using twelve 150 W tungsten lamps, we use twelve 80 W fluorescent tubes. Assume, **[8]**

        i) Choke loss of 25% of rated lamp wattage.

        ii) Average luminous efficiency throughout life for each lamp is 15 lm/W and for each tube 40 lm/W.

        iii) Coefficient of utilization remains the same in both cases.

OR

Q4) a) Explain types of lighting scheme. **[9]**

b) Explain requirement of good lighting scheme. **[8]**

Q5) a) Explain Vertical core type induction furnace. **[9]**

b) Write short note on Indirect Arc furnace. **[9]**

OR

Q6) a) A slab of insulating material 150 cm² in area and 1 cm thick is to be heated by direct heating. The power required is 400 W at 30 MHz. Material has relative permittivity of 5 and power factor 0.05. Determine the necessary voltage needed. Assume absolute permittivity is 8.854×10^{-12} F/m. **[9]**

b) Explain high frequency eddy - current heating. **[9]**

Q7) a) Explain various types of relays. **[9]**

b) Write short note on Photo Cell. **[8]**

OR

Q8) a) Explain selection of motors depending on load characteristics. **[9]**

b) Explain difference between individual and group drive. **[8]**

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[5925]-298

S.E. (Printing Engineering)
FINISHING TECHNIQUES
(2019 Pattern) (Semester - IV) (208286)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:
1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Compare gathering and in setting process. **[6]**

b) Explain in brief combination folding machine. **[6]**

c) Explain in brief folding to paper style. **[5]**

OR

Q2) a) Compare buckle and knife folding mechanism with suitable diagram.**[6]**

b) Explain in brief folding to print style. **[5]**

c) Explain in brief what is folding? What are its merits? **[6]**

Q3) a) Explain in brief factors to be considered while selecting a adhesives.**[6]**

b) Why rexine is best covering material. **[6]**

c) Explain in brief the effect of wet adhesives on paper and board. **[6]**

OR

Q4) a) Why glue has to be cooked in glue pot only? **[6]**

b) Compare hot melt adhesives and water based adhesives. **[6]**

c) Explain in brief the factors governing the choice of adhesives. **[6]**

Q5) a) Compare embossing and debossing process. **[6]**

b) Explain in brief different lamination methods. **[6]**

c) Explain in detail a index cutting process. **[5]**

OR

Q6) a)   Compare hot and cold foil stamping.   **[6]**

   b)   Explain in detail Ruling process.   **[5]**

   c)   Explain in brief wet and dry lamination methods.   **[6]**

Q7) a)   Calculate papers for endpapers in Quad royal size for 10000 books in royal 8vo size with 1% wastage allowances.   **[6]**

   b)   Calculate boards of 90Dkg of 22"X28" for 1000 books in A5 size.   **[6]**

   c)   Calculate cost of endpapers in RAl size with 90 GSM @ Rs 75 per Kg for 2000 books in A5 size having 240 pages with 2% wastage allowance.   **[6]**

<div align="center">OR</div>

Q8) a)   Calculate papers for endpapers in double crown size for 5000 books in crown 8vo size with 1%.   **[6]**

   b)   Estimate boards of 90Dkg in RAl size for 10000 books in A5 size.   **[6]**

   c)   Calculate cost of papers for endpapers in 2RA0 size with 70 gsm @ Rs. 70 per kg for 5000 books in A5 size.   **[6]**

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SEAT No. :

[Total No. of Pages : 2

[5925]-299

S.E. (Printing Engineering)
INTRODUCTION TO PACKAGING CONCEPTS
(2019 Pattern) (Semester - IV) (208287)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data if required.*
4) *Neat diagrams must be drawn wherever necessary.*
5) *Use of electronic pocket calculator is allowed.*

Q1) a) Explain 5 P's of marketing. **[9]**

     b) How packaging industry is used as marketing tool. **[9]**

OR

Q2) a) What role does product packaging design play in your marketing strategy. **[9]**

     b) Explain market considerations for package design. **[9]**

Q3) a) Explain 4 different scenarios of product and package relationship. **[9]**

     b) Explain product's physical characteristics. **[8]**

OR

Q4) a) Explain the concept of center of gravity with diagram and symbol. **[8]**

     b) How chemical characteristics of a product effect package. **[9]**

Q5) a) Write down the checklist of the items to be considered for quality control. **[9]**

     b) Explain quality standard aspects in packaging. **[9]**

OR

Q6) a) What is the need of quality control in packaging. **[9]**

b) Which ISO standards are important in packaging industry. **[9]**

Q7) a) Explain packaging perception v/s reality. **[8]**

b) What are environment considerations for packaging industry. **[9]**

<div align="center">OR</div>

Q8) a) Explain different packaging laws and regulations. **[8]**

b) What are the further requirements for packaging industry to be considered. **[9]**

<div align="center">❄ ❄ ❄</div>

[5925]-300

S.E. (Printing Engineering)
MICROPROCESSOR AND MICROCONTROLLER
TECHNIQUES IN PRINTING
(2019 Pattern) (Semester - IV) (208288)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8,*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*
5) *Use of electronic pocket calculator is allowed.*

Q1) Explain the pin configuration of 8051 microcontroller. **[18]**

OR

Q2) a) Explain the PSW , flag register of 8051 microcontroller. **[6]**

b) Explain the direct and indirect addressing mode of 8051 with one example of each mode. **[6]**

c) Describe the accumulator and register B of 8051 microcontroller. **[6]**

Q3) Explain the instruction types of 8051 with one examples of each type. **[17]**

OR

Q4) a) Write the short note on special function registers of 8051. **[5]**

b) Explain following instructions in microcontroller 8051 (Any six). **[12]**

    i) MOV A, P3

    ii) ADD A,#80H

    iii) MOV R0,32

    iv) INC A

    v) DIV AB

    vi) MUL AB

    vii) MOV DPTR,#01F00H

    viii) SUB R0, @R1

    ix) MOVX A, @DPTR

Q5) Distinguish between the modes of 8255. **[18]**

OR

Q6) a) Describe the block diagram of programmable IC 8255 **[9]**

b) Describe how the PIC 8259 responds to interrupts? **[9]**

Q7) Explain the interfacing concept and describe the Interfacing of printer with 8085. **[17]**

OR

Q8) Explain the use of microprocessor and microcontroller in the printing industry. **[17]**

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[5925]-301

S.E. (Printing Engg.)
PRINT PRODUCTION TECHNIQUES
(2019 Pattern) (Semester - IV) (208289)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*

    2)   *Figures to the right indicate full marks.*

    3)   *Assume suitable data, if necessary.*

    4)   *Neat diagrams must be drawn whenever necessary.*

Q1) a)   What is Digital Halftone? What are the advantages of Halftone process.**[10]**

      b)   Explain Hybrid Screening.   **[8]**

<div align="center">OR</div>

Q2) Draw the diagram and explain Subtractive Color Model for C,M,Y, C + M, M + Y, Y + C, C + M + Y.   **[18]**

Q3) What is dot gain curve? What is the dot compensation curve?   **[17]**

<div align="center">OR</div>

Q4) What is Plate Linearization process? Explain in details the importance of plate Linearization.   **[17]**

Q5) Explain Trapping, Hue Error, Grayness, and Print Contrast with diagrams and equations.   **[18]**

<div align="center">OR</div>

Q6) Draw and explain a dot variation stripe. Also explain the necessity of Dot compensation Curve.   **[18]**

Q7) Draw and explain the production workflow from Design to Delivery. Also explain what is production strategy.   **[17]**

<div align="center">OR</div>

Q8) What is Gantt chart. Create a Gantt Chart for Book Typesetting Company. Job Delivery time is 15 days, Manuscript pages are 700, Images are 100 Line arts and 150 Hafltone, the job is currently in proof reading department. In Gantt chart, mark number of days assigned to each task and how the job will be completed in 15 days time.   **[17]**

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[5925]-302

S.E. (Automation&Robotics / Mechanical/
Automobile & Mechanical / Mechanical-S.W)
SOLID MECHANICS
(2019 Pattern) (Semester-III) (202041)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

   1)   Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
   2)   Figures to the right indicate full marks.
   3)   Use Graph Paper for Graphical Solution.
   4)   Use of electronic pocket calculator is allowed.
   5)   Assume suitable data if necessary.

Q1) a)   A hollow rectangular beam section square in size having outer dimensions
          120×120 mm with uniform thickness of material 20 mm is carrying a
          shear force of 125 kN. Calculate the maximum shear stress induced in
          the section also draw the shear stress distribution diagram.   **[9]**

   b)   A simply supported beam of span 8 m is subjected to point loads of 60
          kN, 80 kN and 50kN at 2m, 4 m and 6 m from left support respectively.
          Determine slope at left support and deflection under 60 kN and 80 kN
          loads. Take EI= 2.668×10^9 kNm². **[9]**

OR

Q2) a)   A T section of flange 180 mm $\times$ 30 mm and web 200 mm $\times$ 30 mm is
          simply supported at the both ends. It carries two concentrated loads of
          110 kN each acting 2 m distance from each support. Span of the beam
          is 10m. Determine the maximum bending stress induced in the beam and
          draw bending stress distribution diagram and also find bending stress at
          the layer 110 mm from the bottom.   **[9]**

   b)   A cantilever 2 m long carries a uniformly distributed load of 10kN/m
          over 1 m portion from fixed end and a point load of 20 kN at free end.
          Calculate the maximum slope and deflection of the cantilever. Take
          EI=2×10^3 kNm².   **[9]**

Q3) a) A steel shaft of 960 mm diameter is required to transmit 240 kW power at 240 r.p.m. and maximum torque is 40% greater than the mean torque.Find the maximum allowable stress in the shaft material. **[9]**

b) A hollow square section column is 4 m long (Outer dimension 150 mm × 150 mm and Inner dimension 100 mm × 100 mm). If it is fixed at its both ends, find the Euler's critical load on the column and corresponding stress. Take E = 180 Gpa **[8]**

OR

Q4) a) A hollow shaft transmits 100 kW at 120 r.p.m. Allowable shear stress in material is 50N/mm². Shaft shall not twist 2° in 1 m length. Ratio of internal diameter to external diameter is 0.25 Take G = 80 kN/mm². Maximum torque 15% more than mean torque. Calculate maximum external diameter of a shaft. **[9]**

b) A 4 m length of a tube has a buckling load of 2 kN when used as a column hinged at both ends. Calculate buckling load for 4.5 m length of the same tube when used as column if **[8]**

i) Both ends are fixed

ii) One end fixed and other is hinged

iii) One end if fixed and the other free.

Q5) a) A rectangular block of material is subjected to a tensile stress of 110 N/mm² on one plane and a tensile stress of 60 N/mm² on a plane at right angles, together with shear stresses of 70 N/mm² on the faces. Find the following terms. **[9]**

i) The magnitude of principal stresses

ii) The magnitude of greatest shear stress

iii) The location of principle plane

iv) The location of plane containing maximum shear stress.

b) A solid circular shaft is subjected to a bending moment of 45 kNm and a torque of 15 kNm. Design the diameter of the shaft according to: **[9]**

   i) Maximum principal stress theory

   ii) Maximum shear stress theory

   iii) Maximum strain energy theory

   Take μ=0.25, Stress at elastic limit = 200 MPa and factor of safety is 2.

OR

Q6) a) At a point in a strained material, there are two mutually perpendicular stresses of 30 MPa and 70 MPa, both tensile. They are accompanied by a shear stress of 20 MPa. Determine principal plane and principal stresses. Use Mohr's stress circle method only. **[9]**

   b) An axial pull of 25 kN along with a shear force of 20 kN is applied to a circular bar of 20 mm diameter. The elastic limit of the bar material is 250 MPa and Poisson's ratio, μ=0.3. Determine the factor of safety against failure based on: **[9]**

   i) Maximum shear stress theory

   ii) Maximum strain energy theory

   iii) Maximum principal strain energy theory

   iv) Maximum shear strain energy theory

Q7) a) Determine the stress resultant at four corners of column subjected to eccentric load of 500kN, as shown in Fig.1. **[8]**
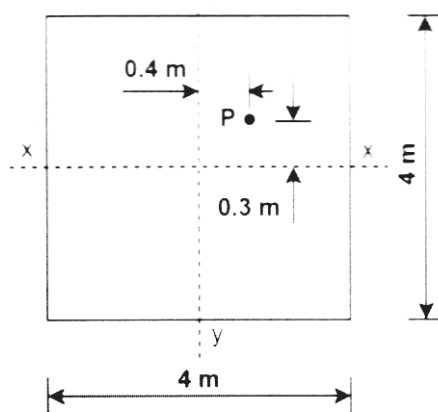
Fig. 1

b) A segment of a generator shaft is subjected to a torque T and an axial force P, as shown in the Fig.2. The hollow shaft having outer diameter d_2=280 mm and inner diameter d_1=230 mm and delivers 1800 kW at 4.0 Hz. If the compressive force, P=525 kN. What are the maximum tensile, compressive and shear stresses in the shaft? **[9]**
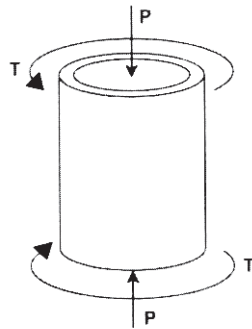
Fig. 2

OR

Q8) a) A hollow rectangular section is having external size 600 mm × 550 mm and internal size 500 mm × 450 mm. It carries a vertical load of 110 kN at the outer edge of the column on X-axis. Calculate maximum and minimum intensities of stress in the section. Assume 600 mm side horizontal. **[8]**

b) Determine the Principal stress in the beam at point A as shown in Fig.3. **[9]**
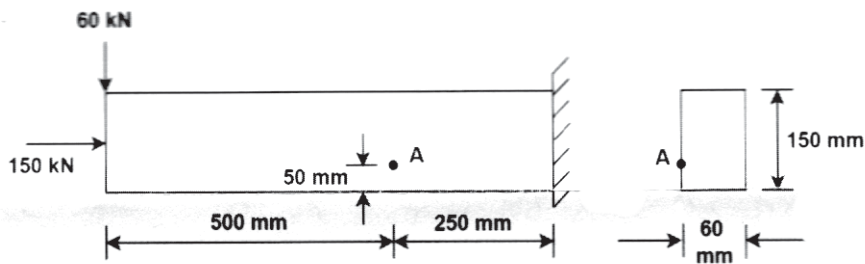
Fig. 3

[5925]-303

S.E. (Mechanical/Automobile & Mechanical/ Mechanical-S.W/ Automation &Robotics)
SOLID MODELING & DRAFTING
(2019 Pattern) (202042) (Semester - III)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Use of electronic scientific pocket calculator is allowed.*
5) *Assume suitable daa, if necessary.*

Q1) a) Using Euler-Poincaré Formula calculate and validate following geometric entities shown in Fig Q1 a - (i), (ii), (iii). **[9]**
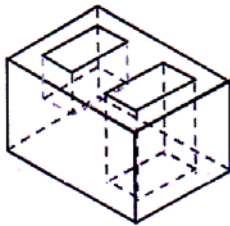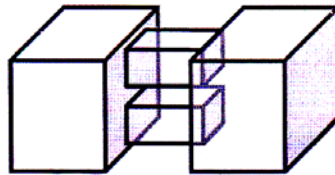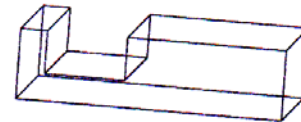
Fig. Q1a (i)   Fig. Q1a (ii)   Fig. Q1a (iii)

b) Enumerate various solid-modeling techniques and compare them. **[9]**

OR

Q2) a) Explain the concept of Feature Based Modeling. **[6]**

b) How Euler's equations are used to validate 3D Solids? Explain. **[6]**

c) Explain the Design for safety. **[6]**

Q3) a) A triangle with vertices P(5, 0), Q(9, 0) and R(9, 5) has undergone reflection about line y = x. Find the concatenated transformation matrix and then find new coordinates of triangle PQR using transformation matrix. **[11]**

b) Compare Geometric Transformation with Geometric Mapping. **[6]**

OR

Q4) a) Explain how 3D View of a geometric model in MCS can be converted into Orthographic Vies (2D Views). **[7]**

b) The coordinates of the center of the circle in WCS are [3, 4.5]. Find the coordinates of the center of the circle with respect to MCS. The orientation of WCS and MCS are shown below in Fig Q4b. **[10]**
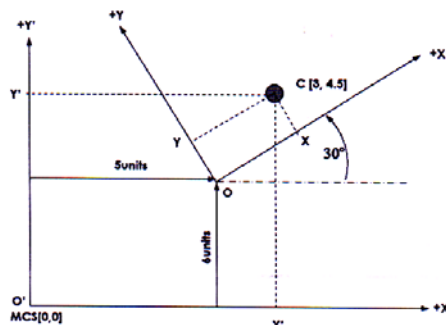
Fig. Q4b

Q5) a) Explain CAD Kernel in detail. **[8]**

b) Explain the requirement of CAD file format for different applications in detail. **[10]**

OR

Q6) a) Explain Direct Data Translators with neat sketch. **[6]**

b) What is Data interoperability? Explain in detail. **[6]**

c) Explain CAD Data file in detail. **[6]**

Q7) a) Explain Product and Manufacturing Information (PMI) and its importance in detail. **[10]**

b) Explain the problems associated with CAD Customization. **[7]**

OR

Q8) a) Explain the CAD API and Micro in detail. **[8]**

b) Explain the need, advantages and disadvantages of Customization. **[9]**

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SEAT No. :

[Total No. of Pages : 3

[5925]-304

S.E. (Mechanical/Automobile & Mechanical/Mechanical-S.W)
ENGINEERING THERMODYNAMICS (2019 Pattern)
(Semester-II) (202043)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Solve four questions; Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Use of steam tables, Mollier charts and scientific table is allowed.*

4) *Assume suitable data wherever necessary.*

5) *Figures to the right indicate full marks.*

Q1) a)   Explain the terms Available energy, Unavailable energy and Availability. **[6]**

   b)   What do you mean by 'Clausius inequality'? **[6]**

   c)   Steam expands adiabatically in a turbine from 20 bar, 400°C to 4 bar, 250°C. calculate: **[5]**

   i)   The isentropic efficiency of the process;

   ii)   The loss of availability of the system assuming an atmospheric temperature of 20°C. The changes in K.E. and P.E. may be neglected.

OR

Q2) a)   Prove that entropy is a property of a system **[6]**

   b)   300 kJ/s of heat is supplied at a constant fixed temperature of 290°C to a heat engine. The heat rejection takes place at 8.5°C. The following results were obtained: **[6]**

   i)   215 kJ/s are rejected.

   ii)   150 kJ/s are rejected.

   iii)   75 kJ/s are rejected.

   Classify which of the result report a reversible cycle or irreversible cycle or impossible results.

   c)   3 kg of gas (c_v=0.81 kJ/kg K) initially at 2.5 bar and 400 K receives 600 kJ of heat from an infinite source at 1200 K. If the surrounding temperature is 290 K, find the loss in available energy due to above heat transfer. **[5]**

P.T.O.

Q3) a) A vessel having a capacity of 0.05 m$_3$ contains a mixture of saturated water and saturated steam at a temperature of 245°C. The mass of the liquid present is 10 kg. **[6]**

Find the following:

i) The pressure

ii) The mass

iii) The specific volume

iv) The specific enthalpy

v) The specific entropy and

vi) The specific internal energy

b) Draw p-v, T-s and h-s diagram for Rankine cycle. **[6]**

c) Explain the Limitations of Carnot Cycle. **[5]**

OR

Q4) a) p-V-T (Pressure-Volume-Temperature) surface for pure substance. **[6]**

b) A vessel having a volume of 0.6 m$_3$ contains 3.0 kg of liquid water and water vapour mixture in equilibrium at a pressure of 0.5 MPa. Calculate. **[6]**

i) Mass and volume of liquid;

ii) Mass and volume of vapour.

c) Compare Rankine Cycle and Carnot Cycle. **[5]**

Q5) a) Explain the Bomb calorimeter with a neat sketch. **[6]**

b) The percentage composition of sample of liquid fuel by weight is, C=84.8 per cent, and H$_2$=15.2 per cent. Calculate **[6]**

i) The weight of air needed for the combustion of 1 kg of fuel;

ii) The volumetric composition of the products of combustion if 15 per cent excess air is supplied.

c) Following results were obtained when a sample of gas was tested by Junker's gas calorimeter: Gas burnt in the calorimeter=0.80 m$_3$, Pressure of gas supply=5.2cm of water, Barometer=75.5 cm of Hg. Temperature of gas=13°C, Weight of water heated by gas=28 kg, Temperature of water at inlet=10°C, Temperature of water at outlet=23.5°C, Steam condensed=0.06 kg. Determine the higher and lower calorific values per m$_3$ of the gas at a temperature of 15°C and barometric pressure of 76 cm of Hg. **[6]**

OR

Q6) a)   The gravimetric analysis of a sample of coal is given as 82% C, 10% H_2 and 8% ash. Calculate: The stoichiometric A/F ratio and the analysis of the products by volume.   **[6]**

b)   The chemical formula for alcohol is C_2H_6O. Calculate the stoichiometric air/fuel ratio by mass and the percentage composition of the products of combustion per kg of C_2H_6O.   **[6]**

c)   Explain adiabatic flame temperature?   **[6]**

Q7) a)   Give the classification of boilers.   **[6]**

b)   Derive an expression for the diameter of chimney.   **[6]**

c)   Draw a neat sketch of Cochran boiler. Name different parts of the boiler.   **[6]**

OR

Q8) a)   Differentiate fire tube boilers and water tube boilers.   **[6]**

b)   Draw a neat sketch of fusible plug and explain its construction and working.   **[6]**

c)   Give the classification of draught. List out Merits of Natural Draught. **[6]**

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[5925]-305

S.E. (Mechanical/Automation & Robotics Engg.)
ENGINEERING MATERIALS AND METALLURGY
(2019 Pattern) (202044) (Semester - III)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of Logarithmic tables, slide rule, electronic pocket calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Define the following with the help of a neat sketch.   **[5]**

  i)   Ordered Substitutional Solid Solution

  ii)   Disordered Substitutional Solid Solution

  b) What is meant by a binary Solid Solution alloy, draw the cooling curve of a typical solid solution alloy.   **[5]**

  c) What is a peritectic transformation? Show the peritectic point on Fe-C phase diagram. Evaluate the percentage of constituent elements at the peritectic point.   **[8]**

OR

Q2) a) Explain how the following factors affect the nucleation process and graph the effect as a function of temperature.   **[5]**

  i)   Nucleation Rate.

  ii)   The Growth Rate

  b) What is Gibb's phase rule? Explain the various terms involved in it.   **[5]**

  c) What is an Eutectoid transformation? Show the Eutectoid point on Fe-C phase diagram. Evaluate the percentage of constituent elements at the Eutectoid point.   **[8]**

Q3) a) State the difference between Martensite and Pearlite on the basis of the Following points. **[5]**

      i)   Mechanism of formation

      ii)   Microstructure

      iii) Cooling rate

      iv) Properties

      v)   Application

b) Give any two reasons why Hypereutectoid steels in an Iron-Carbon Alloy are annealed from above the lower critical temperature (A_1) but never from above the upper critical temperature (A_{cm}). **[5]**

c) Describe the induction hardening technique and its two advantages and two disadvantages over flame hardening. **[7]**

<div align="center">OR</div>

Q4) a) What is retained austenite? Write any two advantages and one disadvantage of Retained austenite in hardened steel? **[5]**

b) State the difference between Annealing and Normalizing with reference to the following points ? **[5]**

      i)   Procedure

      ii)   Microstructure

      iii) Mechanical properties imparted after the process

      iv) Internal Stresses

      v)   Grain size distribution

c) Show the following heat treatment cycles on a common Isothermal Transformation diagram of a hypoeutectoid steel. **[7]**

      i)   Martempering

      ii)   Austempering

      also state the reason why the Austempering processes is expensive?

Q5) a) What is the content of carbon in Low Carbon Steel? State two Properties and two applications of Low Carbon Steel. **[5]**

b) What type of stainless steel would you prefer for the following and Why? **[5]**

    i)   Razor Blades

    ii)   Wrist watches

c) Explain the manufacturing process of a Malleable Cast Iron with the help of a Time – Temperature plot. State any four applications of Malleable Cast Iron. **[8]**

<p align="center">OR</p>

Q6) a) What is the content of carbon in High Carbon Steel? State two Properties and two applications of High Carbon Steel. **[5]**

b) State the composition of the following steels which are designated as per Indian standard Designation system. **[5]**

    i)   25 C5

    ii)   35 Mn 1 S 18

c) Explain the effect of the following factors on the microstructure and properties of Cast Iron. **[8]**

    i)   Amount of total phosphorous, silicon and the equivalent carbon due to the presence of them (phosphorous and silicon)

    ii)   Rapid cooling, Slow cooling

Q7) a) What is 85-5-5-5 bronze? State any three applications of it. **[5]**

b) What is the percentage of Zinc in Gilding metals? State any four uses of Gilding metals. **[5]**

c) What is Nickel's crystal structure? Give the composition, at least one property, and use of the Nickel Alloys listed below. **[7]**

    i)   Invar

    ii)   Inconel

<p align="center">OR</p>

Q8) a) What are bearing materials? Give the composition of the following bearing material. **[5]**

    i) White Metal Alloys

    ii) Copper-Lead Alloys

b) List any two materials that are commonly used in additive manufacturing. Also, for each of them, mention two areas of Application. **[5]**

c) What is Aluminium's crystal structure? Give the composition, at least one property and use of the Aluminium Alloys listed below. **[7]**

    i) Y-Alloy

    ii) Hinduminium

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[5925]-306

S.E. (Automobile &Mechanical/Mechanical Sandwich)
ELECTRICAL AND ELECTRONICS ENGINEERING
(2019 Pattern) (203156) (Semester - III)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

　　1)　Attempt Question 1 or 2, 3 or 4, 5 or 6, 7 or 8.

　　2)　Neat diagrams must be drawn wherever necessary.

　　3)　Figures to the right indicate full marks.

　　4)　Assume suitable data, if necessary.

Q1) a) Derive the emf equation of a DC machine and explain the significance of emf induced in a DC motor. **[6]**

b) A 220 V, DC shunt motor runs at 1000 rpm when the armature current is 25 A. Calculate the speed if the torque developed is doubled. Given that armature resistance is 0.25 Ω. **[6]**

c) Explain rheostatic control and field control methods of controlling speed of a DC shunt motor. **[6]**

OR

Q2) a) Draw and explain the characteristics of a DC shunt motor. **[6]**

b) A 230 V, 4 pole lap wound DC shunt motor takes no-load current of 4 A when running at 1200 r.p.m. The resistance of armature winding is 0.1 Ω and shunt field winding is 115 Ω. Total brush contact drop is 2 V. If it takes current of 60 A on full-load, calculate its full load speed. Assume that flux gets weakened by 5% on full-load condition due to armature reaction. **[6]**

c) What is braking in a motor? Explain regenerative braking of DC shunt motor with the help of neat diagrams. **[6]**

P.T.O.

Q3) a) Derive the expression for the torque developed in a three phase induction motor under running conditions. **[6]**

b) A 6 pole, 50 Hz, three phase induction motor running on full load with 4% slip develops a torque of 149.3 N-m at its pulley rim. The friction and windage losses are 200 W and the stator copper and iron losses equal 1620 W. Calculate i) output power ii) rotor copper losses and iii) % efficiency at full load. **[6]**

c) Explain the operation of star-delta starter for a three phase induction motor with neat schematic. **[5]**

OR

Q4) a) Draw and explain the torque-slip characteristics for the three phase induction motor. **[6]**

b) A 3 Φ, 6 pole, 50 Hz induction motor has a slip of 1% at no load, and 3% at full load. Determine : i) Synchronous speed ii) No load speed iii) Full load speed iv) Frequency of rotor current at standstill v) Frequency of rotor current at full load. **[6]**

c) Differentiate between slip ring and squirrel cage induction motor. **[5]**

Q5) a) State and explain the components and subsystems of Hybrid Electric Vehicle (HEV). **[6]**

b) Explain the configuration of a Parallel Hybrid EV. **[6]**

c) Draw and explain Vehicle to Grid (V2G) technology with the help of suitable block diagram. **[6]**

OR

Q6) a) Compare the series and parallel configurations of Hybrid Electric Vehicle (HEV). **[6]**

b) Differentiate between Battery EV and Plug-in EV. **[6]**

c) Elaborate the impact of usage of EV on power grid. **[6]**

Q7) a) Write voltage, specific energy, C-rate, cycle life, thermal runaway and applications of LFP battery. **[6]**

b) Draw the block diagram of Battery Management System (BMS) and explain the working of it. **[6]**

c) Explain the factors for selection of motors for an EV. **[5]**

OR

Q8) a) State advantages and disadvantages of LMO Battery. **[6]**

b) Explain the operation of a BLDC motor drive for an EV with the help of a block diagram. **[6]**

c) Elaborate the factors used in selection of a battery for an EV. **[5]**

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S.E. (Automobile & Mechanical/Mechanical/ Mechanical Sandwich/Automation & Robotics)
KINEMATICS OF MACHINERY
(2019 Pattern) (Semester - IV) (202047)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Explain with neat sketch Kennedy's theorem.   **[5]**

b) In the mechanism shown in Fig. determine the acceleration fo the slider C. $O_1A = 100mm$, $AB = 120mm$, $O2B = 150mm$, and $BC = 350mm$. The crank O_1A rotates at 240rpm.   **[13]**
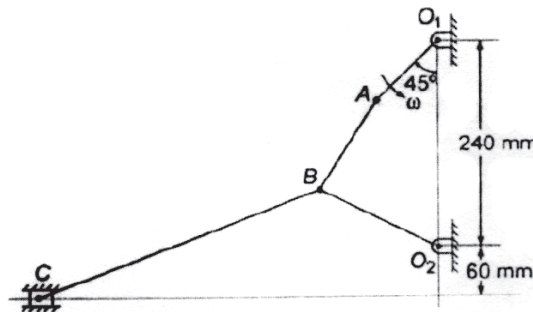
OR

Q2) a) Explain coriolis acceleration with neat sketch.   **[5]**

b) Fig shows a six link mechanism. The dimensions of links are OA = 100 mm, AB = 580 mm, BC = 300 mm, QC = 100 mm and CD = 350 mm. The crank OA rotates at 150rpm. For the position when crank OA makes an angle of 30º with the horizontal determine by using ICR method, Total no. of links are 6.   **[13]**

i) Linear velocity of points B, C and D.

ii) Angular velocity of links AB, BC and CD.
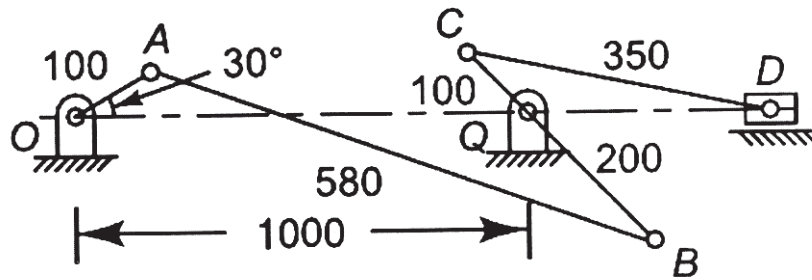
Q3) a) Explain the following terms : **[6]**

i) Type synthesis

ii) Number synthesis

iii) Dimensional synthesis

b) Determine the Chebyshev spacing for the function $y = x^{1.5}$ for the range $1 \leq x \leq 3$ where three precision points are required. For these points, determine θ_2, θ_3 & ϕ_2, ϕ_3 if $\Delta\theta = 400$ & $\Delta\phi = 900$. **[11]**

OR

Q4) a) Explain the following terms : **[6]**

i) Function generation

ii) Path generation

iii) Motion generation

b) Design a four bar mechanism with input link l_2, coupler link l_3 & output link l_4, Angles θ & ϕ for 3 successive positions are given below : **[11]**

Position	1	2	3
θ	40°	55°	70°
ϕ	50°	60°	75°

If grounded link l = 30mm using Freudenstein's equation, find out lenghts of other links to satify given positional conditions. Also draw synthesize mechanism in its first position & comment on the mechanism obtained.

Q5) a) What do you mean by interference and undercut? **[7]**
Define :
i) Helix angle
ii) Transverse circular pitch
iii) Transverse module

b) A pair of spur gears with involute teeth is to a gear ratio of 4 : 1. The arc of approach is not to be less than the circular pitch and smaller wheel is the driver. The angle of pressure is 14.5°. **[11]**
Find : i) the least number of teeth that can be used on each wheel and
ii) the addendum of the wheel in terms of the circular pitch?

OR

Q6) a) What do you understand by 'gear train'? Discuss the various types of gear trains. **[4]**

b) An epicyclic gear consists of three gears A, B and C as shown in Fig. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m. If the gear A is fixed, determine the speed of gears B anc C. **[14]**
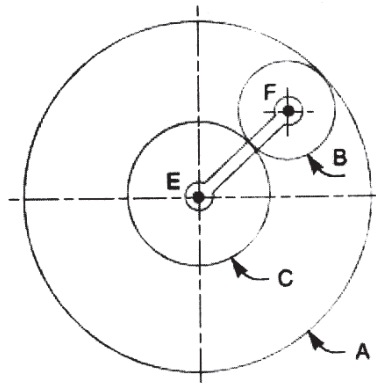
Q7) a) What are the various types of automation? Explain them. **[5]**

b) A cam is to be designed for a knife edge follower with the following data : **[12]**

i) Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.
ii) Dwell for the next 30°.
iii) During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.
iv) Dwell during the remining 180°.
The radius of the base circle of the cam is 40 mm.
Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft.

OR

Q8) a) What are the benefits of automated production lines? **[5]**

b) A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion as described below. **[12]**

   i) To raise the valve through 50mm during 120° rotation of the cam;

   ii) To keep the valve fully raised through next 30°;

   iii) To lower the valve during next 60°; and

   iv) To keep the valve closed during rest of the revolution i.e. 150°;

The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft.

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[5925]-308

S.E. (Automation and Robotics)
PRINCIPLES OF ROBOTICS
(2019 Pattern) (Semester - IV) (202524)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
   1) Answer four questions from the following.
   2) Draw neat labeled diagrams wherever necessary.
   3) Figures to the right side indicate full marks.
   4) Use of non programmable electronic calculator is permitted.
   5) Assume suitable/ standard data if necessary.

Q1) a) Classify the robot end-effector from the view point of control. Sketch and explain a cam actuated gripper used for robots. **[4]**

   b) Discuss the functions of manipulators. Sketch and explain a pneumatic manipulator control circuits used for robots. **[6]**

   c) Distinguish between two-point and three-point centering of robot gripper. Explain any two types of grippers used for robots. **[8]**

<div align="center">OR</div>

Q2) a) How is a robot end-effector specified? Discuss the design considerations in the robot end-of-the-arm tooling. **[4]**

   b) Suggest which type of gripper is suitable for following application and justify. **[6]**

       i) Medical applications

       ii) Pick & Place

   c) Write short notes on: **[8]**

       i) Magnetic grippers.

       ii) Soft Robotic Grippers.

Q3) a) Explain sensor selection and design consideration for robotic application. **[4]**

   b) Discuss response, accuracy and sensitivity in relation to robot sensors. Explain the working of proximity and range sensors. **[6]**

   c) Distinguish between tactile and no-tactile sensors. Sketch and explain the working of an acoustic sensor. **[7]**

<div align="center">OR</div>

Q4) a) What are the different types of sensor? Classify them. Sketch and explain the use of torque sensor. **[4]**

b) What are safety sensors? Discuss the use of light curtain in industrial robots. **[6]**

c) Distinguish between absolute and incremental encoders. Sketch and explain the working of optical encoder and specify its application. **[7]**

Q5) a) What are homogeneous transformations of coordinates? Write the homogeneous transformation matrix for translation in 3D space. **[4]**

b) Discuss the various inputs to an inverse kinematics of 2 DOF robots. **[6]**

c) A point P(8, 4, and 1) is attached to a robo frame and subjected to following transformation. Find the coordinate of point relative to reference frame. **[8]**

i) Rotation of 90° about Z-axis.

ii) Followed by rotation of 90° about Y-axis.

iii) Followed by translation of [4, -3, 7].

OR

Q6) a) Explain the geometric based inverse kinematic analysis of two joints robot. **[4]**

b) Discuss the major parameters of DH convention for robot manipulator. **[6]**

c) Figure shown in 6.c is a planar 2 DOF PR robotic arm. Perform the inverse kinematic analysis and find out the joint angles?

Given data: L1 = 10 cm, L2 = 8 cm, X = 13 cm, Y = 18 cm, Ø = 75° **[8]**
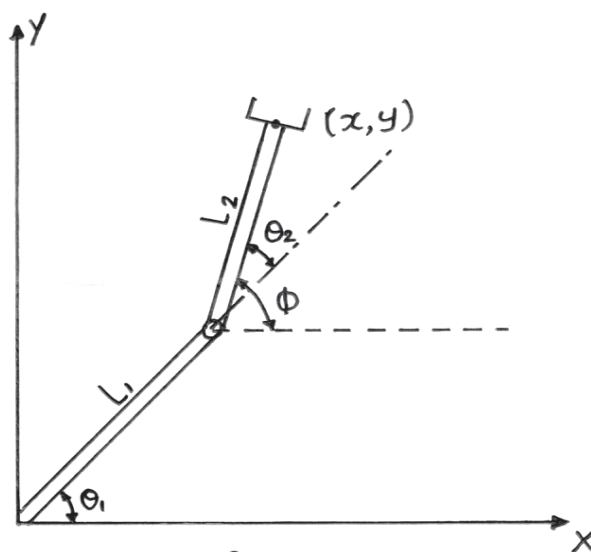
Fig. 6.C

Q7) a) Discuss the relative merits and demerits of different textual robot languages. Explain the different program instructions. **[4]**

b) V ~~~~~~ w letters by Robot using VAL Language. **[6]**
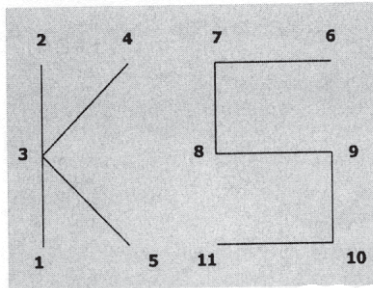
c) State characteristics of work which promote application of robots. Discuss robot application for assembly and inspection. **[7]**

OR

Q8) a) What is robot software and explain common software elements of a robot. **[4]**

b) Sketch and explain with suitable example "A Robot Program as a path in Space" **[6]**

c) Enumerate the non-manufacturing areas where robots are expected to be used. Discuss robot application for welding and machine loading. **[7]**

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[5925]-309

S.E. (Automation & Robotics) (Semester - IV)
FLUID AND THERMAL ENGINEERING
(2019 Pattern) (202523)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer four questions from the following*
2) *Draw neat labeled diagrams wherever necessary*
3) *Figures to the right side indicate full marks.*
4) *Use of non programmable electronic calculator is permitted.*
5) *Assume Suitable/Standard data jf necessary.*

Q1) a) What is Siphon? Where it is used? Explain its working. **[9]**

b) A 2500 m long pipeline is used for transmission of power. 120kW power is to be transmitted through the pipe in which water having a pressure of 4000kN/m² at inlet is flowing, If the pressure drop over the length of pipe is 800kN/m² and $f = 0.006$. Find **[9]**

i) Diameter of the pipe

ii) Efficiency of transmission.

OR

Q2) a) Derive an expression for Dupit's equation? Explain the concept of equivalent pipe for pipes in parallel. **[9]**

b) Two reservoirs containing water have difference of levels of 70m and are connected by a 250mm diameter pipe which is 4 km long. The pipe is tapped midway between reservoirs and water is drawn at rate of 0.04 m³/ sec. Assuming friction factor =0.04, determine rate at which water enters in the lower reservoir. **[9]**

Q3) a) Define control valve. Explain its classification. **[8]**

b) What is hydraulic actuator? Discuss its construction and working? **[9]**

OR

Q4) a) What are the advantages and disadvantages of: i) Electric Actuator ii) Globe Valve. **[8]**

b) Write a short note on: Ball Valve. **[9]**

Q5) a) What do you mean by compressor? Differentiate between Reciprocating and Rotary Compressors. **[8]**

b) A single stage, single acting reciprocating compressor has air entering at 1 bar, 20°C and compression occurs following polytropic compression with index 1.2 upto delivery pressure of 12 bar. The compressor has mechanical efficiency of 0.88. Determine the isothermal efficiency and cylinder dimensions. Also find out the rating of drive required to run the compressor which admits 1m³ of air per minute. **[9]**

OR

Q6) a) Explain Vane type Compressor with neat sketch. **[8]**

b) A single stage reciprocating air compressor takes in 7.5 m³/min of air at 1 bar and 30°C and delivers it at 5 bar. The clearance is 5% of the stroke. The expansion and compression are polytropic, n=1.3, Calculate: (i) The temperature of delivered air (ii) Volumetric efficiency (iii) Power of the compressor. **[9]**

Q7 a) What is radiation? Explain laws of radiation with examples. **[9]**

b) A 2m long and 0.3 cm diameter electric wire extends across a room at 15°C. Heat is generated in the wire as a result of resistance heating and surface temperature of wire is measured to be 152°C in steady operation. Also the voltage drop and electric current through the wire are measured to be 60 V and 1.5 A, respectively. Disregarding any heat transfer by radiation, determine the convection heat transfer coefficient for heat transfer between the outer surface of the wire and the air in the room.**[5]**

c) Two large parallel plates with surface conditions approximating those of a blackbody are maintained at 816°C and 260°C, respectively. Determine the rate of heat transfer by radiation between the plates in W/m² and the radiative heat transfer coefficient in W/m²K. [Take Stefan-Boltzmann constant = 5.7×10^{-8} W/m²K.] **[4]**

OR

Q8) a) How the thermal conductivity varies with temperature. **[9]**

b) A kitchen oven has its maximum temperature set at 300°C where as the temperature in the kitchen may vary from 20°C to 35°C due to seasonal variation. Workout the necessary thickness of fibre glass (K= 0.035W/°C) insulation to ensure that the outside temperature of oven does not exceed 40°C. The average heat transfer coefficient between the outside over surface and the kitchen air is 10W/m2°C. Neglect the thermal resistance of metal wall and pressure that steady conditions prevail. **[9]**

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S.E. (Automation&Robotics/Mechanical/Automobil & Mechanical)
MANUFACTURING PROCESSES
(2019 Pattern) (Semester - IV) (202050)

Time :2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
    1)   *All questions are compulsory i.e. solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
    2)   *Neat diagrams must be drawn wherever necessary.*
    3)   *Figures to the right indicate full marks.*

Q1) a)   Explain with neat sketch any two sheet metal operations.   **[8]**

    b)   What is centre of pressure? Write a detailed procedure for centre of pressure. Also Find centre of pressure of component shown in fig. 1 is to be made from mild steel sheet of 1.7 mm thick.   **[10]**

Fig. 1
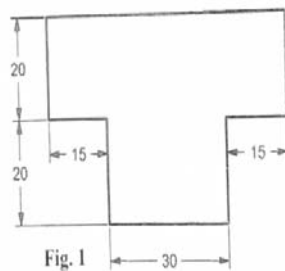
OR

Q2) a)   Explain compound and progressive sheet metal dies.   **[8]**

    b)   A part shown in fig. 2 is to be made from sheet of 3 mm thick and ultimate shear strength of material is 30 N/mm^2,   **[10]**

    Determine:

    i)   Stock Strip layout

    ii)   % utilization of stripi

    iii)   Clearance between punch and die,

iv) Blanking force,

v) Sectional view of press.

Fig. 2
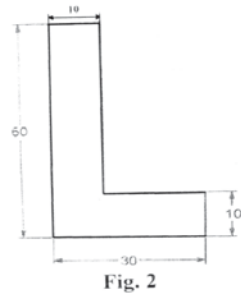
Q3) a) What is coating on an arc welding electrode, with advantages. **[6]**

b) Explain principle of TIG welding with advantages. **[6]**

c) Explalin in detail type of joints used in welding. **[5]**

OR

Q4) a) Compare between Spot and Seam weld process. **[6]**

b) Compare between Soldering and brazing process. **[6]**

c) Explain any five defects in welding process. **[5]**

Q5) a) Defferentiate between thermoplastics and Thermosetting plastics. **[6]**

b) Explain with figure injection molding process. **[6]**

c) Explain in detail extrusion of pipe and extrusion of sheets. **[6]**

OR

Q6) a) Explain with figure blow molding process. **[6]**

b) Explain in detail vacuum forming process. **[6]**

c) Write short notes on pressure forming process. **[6]**

Q7) a) Explain with figure Spray lay-up process.   [6]

   b) Explain with figure vacuum impregnation process.   [6]

   c) Write short notes on nano-composites.   [5]

                                    OR

Q8) a) Explain with figure Hand lay-up Process.   [6]

   b) Explain with figure Fabrication of ceramic matrix composites.   [6]

   c) Write short notes on Filament winding process.   [5]

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[5925]-311

S.E. (Automobile & Mechanical/Automation & Robotics/ Mechatronics /Mechanical /Mechanical Sandwich)

ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - IV) (207002)

Time : 2½ Hours] [*Max. Marks : 70*
Instructions to the candidates:
1) *Question No. 1 is compulsory. Solve Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) The first four moments of a distribution about mean of the variable are 0, 2, 0 and 11. Then $\beta_2 =$ **[2]**
   i) 2.5   ii) 2.3999
   iii) 2.75   iv) 0.5987

   b) If $\overline{F} = (x^2 y)\hat{i} + (xyz)\hat{j} + (z^2 y)\hat{k}$ then curl $\overline{F}$ at (1, 1, 2) is **[2]**

   i) $5\hat{i} + \hat{j}$ ii) $3\hat{i} + \hat{j} + \hat{k}$

   iii) $3\hat{i} + \hat{k}$ iv) $3\hat{i} + \hat{j}$

   c) The most general solution of the partial differential equation $\dfrac{\partial u}{\partial t} = c^2 \dfrac{\partial^2 u}{\partial x^2}$ representing heat flow along a bar is **[2]**

   i) $(c_1 \cos mx + c_2 \sin mx)e^{-c^2 m^2 t}$

   ii) $(c_1 \cos mx + c_2 \sin mx)e^{-m^2 t}$

   iii) $(c_1 \cos mx + c_2 \sin mx)(c_3 \cos cmt + c_4 \sin cmt)$

   iv) $(c_1 \cos mx + c_2 \sin mx)(c_3 e^{my} + c_4 e^{-my})$

   d) In Binomial probability distribution, if $p = q$, then $P(\overline{X} = r)$ is **[2]**

   i) ${}^n c_r \left(\dfrac{1}{2}\right)^{n-r}$ ii) ${}^n c_1 \left(\dfrac{1}{2}\right)^{n}$

   iii) ${}^n c_r \left(\dfrac{1}{2}\right)^{n}$ iv) ${}^n c_n \left(\dfrac{1}{2}\right)^{n}$

e) If $\bar{r} = x\hat{i} + y\hat{j} + z\hat{k}$ then $\nabla \cdot \bar{r} =$ **[1]**

   i)   1   ii)   2

   iii)   3   iv)   4

f) In a poisson distribution if $P(r=3) = 6P(r=4)$, then $P(r=2)$ is equal to **[1]**

   i)   0.025   ii)   0.01148

   iii)   0.251   iv)   0.1148

Q2) a) Fit a straight line of the Form $y = ax + b$ to the following data. **[5]**

x	1	3	4	5	6	8
y	−3	1	3	5	7	11

b) Calculate the first four moments about the mean of the following distribution. **[5]**

x	1	2	3	4	5	6	7	8	9	10
F	6	15	23	42	62	60	40	24	13	5

c) Find the coefficient of correlation for the following table. **[5]**

x	10	14	18	22	26	30
y	18	12	24	6	30	36

OR

Q3) a) Fit a straight line to the following data. **[5]**

x	0	5	10	15	20	25
y	12	15	17	22	24	30

b) First four moments of a distribution about value 4 are −1.5, 17, −30 and 108. Find the first four moments about mean β_1 & β_2. **[5]**

c) Obtain the regression lines for the following table. **[5]**

x	6	2	10	4	8
y	9	11	5	8	7

Q4) a) From 20 tickets marked 1 to 20, one ticket is drawn at random. Find the probability that it is marked with multiple of 3 or 5. **[5]**

b) A fair coin is tossed 6 times. Find a probability of getting: **[5]**

   i)   at least four heads

   ii)   not heads

c) Assuming that the distance of 1000 brass plugs taken consecutively from machine from a normal distribution with mean 0.7515 cm and standard deviation 0.0020 cm. How many of the plugs are likely to be approved if the acceptable diameter is 0.752 ± 0.004 cm. (Given Area = 0.478 for $z = 2.25$ and Area 0.4599 for $z = 1.75$). **[5]**

OR

Q5) a) A can hit the target 1 out of 4 times. B can hit 2 out of 3 times. C can hit the target 3 out of 4 times. Find the probability that at least 2 hit the target. **[5]**

b) In a certain factory turning out razor blades there is a small chance of $\dfrac{1}{500}$ for any blade to be defective. The blades are supplied in a pack of 10. Use Poisson distribution to calculate the approximate number of packets containing no defective and two defective blades, in a consignment of 10,000 packets. **[5]**

c) Among 64 off spring of a certain cross between European horses, 34 were red, 10 were black and 20 were white. According to a genetic model, these numbers should be in the ratio $9:3:4$. Is the data consistant with the model at 5% level of significance $\left(\chi^2_{v-1,0.05}=5.99\right)$. **[5]**

Q6) a) Find the directional derivative of $\phi = x^2 - y^2 - 2z^2$ at the point $P(2,-1,3)$, in the direction PQ where Q is (5, 6, 4). **[5]**

b) Show that the vector field $\overline{F}=\left(8xy+z^4\right)\overline{i}+\left(4x^2-z\right)\overline{j}+\left(4xz^3-y\right)\overline{k}$ is irrotational. Find Scalar potential function ϕ such that $\overline{F}=\nabla\phi$. **[5]**

c) Using Green's theorem for $\overline{F}=xy\overline{i}+y^2\overline{j}$ over region R enclosed by parabola $y=x^2$ and line $y=x$ in the first quadrant, evaluate $\int\limits_{c} xy\,dx+y^2dy$. **[5]**

OR

Q7) a) Using Stoke's theorem evaluate $\iint\limits_{s}\nabla\times\overline{F}\cdot\hat{N}\,ds$ where $\overline{F}=3y\overline{i}-xz^2\overline{j}+yz^2\overline{k}$ and s is surface of the paraboloid $2z=x^2+y^2$ bounded by $z=2$. **[5]**

b) Prove that (any one): **[5]**

i) $\overline{b}\times\left(\nabla\left(\overline{a}\cdot\nabla\log r\right)\right)=\dfrac{\overline{b}\times\overline{a}}{r^2}-\dfrac{2\left(\overline{a}\cdot\overline{r}\right)}{r^4}\left(\overline{b}\times\overline{r}\right)$

ii) $\nabla^4\left(r^2\log r\right)=\dfrac{6}{r^2}$

c) Find angle between the tangents to the curve $\overline{r}=t^2\overline{i}+2t\overline{j}-t^3\overline{k}$ at the points $t=1$ and $t=-1$. **[5]**

Q8) a) A homogeneous rod of conducting material of length 100 cm has its ends kept at zero temperature and the temperature initially is **[8]**

$$u(x,0) = x, \qquad 0 \le x \le 50,$$
$$= 100 - x, \quad 50 \le x \le 100.$$

Find the temperature $u(x, y)$ at any time.

b) Solve following $\dfrac{\partial^2 y}{\partial t^2} = c^2 \dfrac{\partial^2 y}{\partial x^2}$ subject to **[7]**

i) $y(0,t) = 0, \forall t$

ii) $y(l,t) = 0, \forall t$

iii) $\left(\dfrac{\partial y}{\partial t} \right)_{t=0} = 0$

iv) $y(x,0) = \dfrac{3a}{2l} x, \qquad 0 \le x \le \dfrac{2l}{3}$

$$= \dfrac{3a}{l}(l-x), \; \dfrac{2l}{3} \le x \le l$$

OR

Q9) a) Solve the equation $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$ subject to **[8]**

i) $u = 0$ when $y \to \infty$ for all x

ii) $u = 0$ when $x = 0$ for all y

iii) $u = 0$ when $x = l$ for all y

iv) $u = x(1 - x)$ when $y = 0$ for $0 < x < 1$.

b) The initial temperature along the length of an infinite bar is given by

$$u(x,0) = 2, \quad |x| < 1$$
$$= 0, \quad |x| > 1.$$ If the temperature $u(x,t)$ satisfies the equation

$\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}, -\infty < x < \infty, t > 0,$ find the temperature at any point of the bar at time t. **[7]**

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[5925]-313

S.E. (Mechatronics Engineering)
HEAT AND MASS TRANSFER
(2019 Pattern) (Semester - III) (217542)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Use of logarithmic tables, slide rule, and electronic pocket calculator is allowed.*
4) *Figures to the right indicates full marks.*
5) *Assume suitable data, if necessary.*

Q1) a)   Explain various stages of combustion in C. I. Engine with neat sketch.
[8]

b)   What is heat engine? Differentiate between Otto cycle and diesel cycle.
[5]

c)   Classify Internal Combustion Engines.   **[3]**

OR

Q2) a)   Draw PV and TS diagram for the following :   **[6]**

i)   Otto cycle

ii) Diesel cycle

iii) Dual cycle

b)   Explain working of four stoke S. I. Engine with neat sketch.   **[6]**

c)   Write a difference between two stroke engine and four stroke engine.
[4]

Q3) a)   Explain in detail thermal conductivity, thermal diffusivity and thermal contact resistance.   **[9]**

b)   Explain different types of insulating materials.   **[4]**

c) An aluminium sphere having radius 0.0809m and initially at temperature of 350°C is suddenly immersed in a fluid at 30°C with convection coefficient of 60 W/m² K. Estimate the time required to cool the sphere to 100°C. **[5]**

Take thermo physical properties as C = 900 J/kg.K,

ρ = 2700 kg/m³, k = 205 W/mK

OR

Q4) a) Explain variation of thermal conductivity of metals and non-metals with temperature. **[5]**

b) What is principal assumption in the lumped system analysis and when is it applicable? **[5]**

c) A steel pipe with 50 mm OD is covered with a 6.4 mm asbestos insulation [k = 0.166 W/mk] followed by a 25 mm layer of fiber-glass insulation [k = 0.0485 W/mK]. The pipe wall temperature is 393 K and outside insulation temperature is 311 K. Calculate the interface temperature between the asbestos and fiber-glass. **[8]**

Q5) a) Explain significance of following dimensionless numbers : **[10]**

i) Prandtl Number

ii) Grashoff Number

iii) Reynold Number

iv) Nusselt Number

v) Biot Number

b) Water at 20°C enters a 2 cm diameter tube with a velocity of 1.5 m/s. The tube is maintained at 100°C. Find the tube length required to heat the water to a temperature of 60°C. **[8]**

Use properties of fluid as :

Pr = 4.31, ρ = 992.2 kg/m³

C_p = 4174 J/kg K, k_f = 0.634 W/mK,

v = 0.659 x 10⁻⁶ m²/s, Nu = 0.023 Re⁰·⁸ Pr⁰·⁴

OR

Q6) a) Write statements and mathematical expressions for following laws in radiation heat transfer : **[10]**

   i) Planks law

   ii) Wiens law

   iii) Kirchhoff's law

   iv) Lamberts cosine law

   v) Stefan's Boltzmann's law

b) Calculate the net radiant heat exchange per m^2 area for two large parallel plates at temperatures of 427°C and 27°C respectively. ε (hot plate) = 0.9 and ε (cold plate) = 0.6. If a polished aluminium shield is placed between them, find the percentage reduction in the heat transfer, ε (shield) = 0.4 **[8]**

Q7) a) Explain the six regimes of pool boiling with the help of neat curve. **[8]**

b) In a certain double pipe heat exchanger hot water flows at rate of 50000 kg/hr and gets cooled from 95°C to 65°C. At the same time 50000 kg/hr of cooling water at 30°C enters the heat exchanger. The flow conditions are such that overall heat transfer coefficient remains constant at 2270 W/m^2 K. Determine the heat transfer area required and the effectiveness, assuming two streams are in parallel flow. Assume for the both the streams c_p = 4.2 kJ/kg K. **[10]**

OR

Q8) a) Derive an expression for LMTD for counter flow heat exchanger with neat sketch. **[7]**

b) An oil cooler for a lubrication system has to cool 1000 kg/hr of oil (c_p = 2.09 kJ/kg °C) from 80°C to 40°C by using a cooling water flow of 1000 kg/hr at 30°C. Give your choice for a parallel flow or counter flow heat exchanger, with reasons. Calculate the surface area of the heat exchanger, if the overall heat transfer coefficient is 24 W/m^2 °C. Take c_p of water = 4.18 kJ/kg°C. **[8]**

c) Classify heat exchangers in brief. **[3]**

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[5925]-314

S.E. (Mechatronics Engineering)

DIGITAL ELECTRONICS

(2019 Pattern) (Semester - III) (217543)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

   1)   *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

   2)   *Figures to the right indicate full marks.*

   3)   *Neat diagrams must be drawn wherever necessary.*

   4)   *Assume suitable data if necessary.*

Q1) a)   Draw and explain SR flipflop using NAND gates with Timing diagram.

                                                                            [9]

       b)   Explain with neat diagram working of serial-in serial-out 4-bit shift register. Draw necessary timing diagram.   **[9]**

OR

Q2) a)   Design MOD-5 synchronous counter using JK-Flip-Flops.   **[9]**

       b)   Design a sequence generator to generate a pulse train 110011 using D-Flip-Flop.   **[9]**

Q3) a)   What is ASM chart? Give its applications & advantages?   **[8]**

       b)   Draw the ASM chart for the following State Machine. A 2-bit up-counter is to be designed with enable signal 'X'. If X = 0, then counter changes the state as 00-01-10-11-00. If X=1 the counter remains in the same state. Design the circuit using JK-FF & suitable MUX.   **[9]**

OR

Q4) a)   Implement full adder circuit using suitable PLA.   **[8]**

       b)   Design BCD to Excess -3 code converter using PAL.   **[9]**

Q5) a) Explain with the help of circuit diagram 2-input TTL NAND gate with Totem pole output driver. Write advantages of Totem-Pole output. **[9]**

b) Draw and explain the circuit diagram of CMOS inverter. Give advantages & disadvantages of CMOS. **[9]**

OR

Q6) a) Draw three input standard TTL NAND gate circuit & explain its operation. Give disadvantages of Totem-Pole output. **[9]**

b) Draw and explain the working of 2-input CMOS NOR gate. Give characteristics of CMOS. **[9]**

Q7) a) Explain the System Bus, Data Bus, Address Bus, Control Bus. **[8]**

b) Draw & explain the basic building blocks of an ideal microprocessor-based system with the help of neat diagram with its characteristics. **[9]**

OR

Q8) a) Describe semi-conductor memory organization & operation. **[8]**

b) Write short note on ALU. Give the applications of Microprocessor. **[9]**

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[5925]-315

S.E. (Mechatronics Engineering)
ANALYSIS OF MECHANICAL STRUCTURE
(2019 Pattern) (Semester - III) (217544)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

    2)   *Neat diagrams must be drawn wherever necessary.*

    3)   *Use of logarithmic tables, slide rule, and electronic pocket calculator is allowed.*

    4)   *Figures to the right indicates full marks.*

    5)   *Assume suitable data, if necessary.*

Q1) a)   A cantilever beam, 60 mm wide by 100 mm high and 2 m long carries UDL of 3000N/m over entire span. Compute the magnitude and location of the maximum flexural stress. Determine the type and magnitude of the stress in a fiber 20 mm from the top of the beam at fixed end. **[6]**

    b)   A 230 mm × 500 mm simply supported beam carries a UDL of 20 KN/m over a span of 8 m. Determine the maximum shear stress at a section 2 m from the support. **[4]**

    c)   A cast iron beam 40 mm wide and 80 mm deep is simply supported on a span of 1.2 m. The beam carries a point load of 15 KN at the center. Find the deflection at the center. Take E = 108000 N/mm². **[8]**

OR

Q2) a)   The cantilever beam with cross section 50 mm wide and 150 mm deep is 3 m long and loaded by an end force of 10 KN. The material is steel with E = 210 GPa. Find the maximum deflection of the beam and maximum stress. Take E = 200GPa. **[6]**

    b)   Derive the relation between Maximum shear stress and avg. Shear stress. **[4]**

P.T.O.

c) A simply supported beam as shown in fig.1, of 3m span carries two point load of 120 KN at distance 0.6 m and 2 m from the left support. If for the beam $1 = 16 \times 10^0$ mm⁴ and $E = 2 \times 10^5$ N/mm², Calculate the deflection under loads using Macaulay's Method. **[8]**
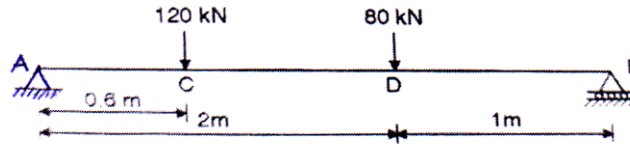
Fig. 1

Q3) a) A hollow circular shaft has an external diameter of 100 mm and internal diameter of 80 mm. Find the safe power that can be transmitted if allowable shear stress is 100 MPa. and maximum angle of twist is 3° for 2 m length. Take speed of shaft = 2.5 revolutions per second and maximum torque to exceed by mean torque by 20 % Take G = 80 GPa. **[8]**

b) A mild steel tube 22 mm diameter and 3 mm thick is 2 m long. It is used as a strut, hinged at two ends. Calculate the crippling load by Euler's formula. Assume E = 200 Gpa. **[5]**

c) Explain the limitations of Euler's Buckling theory. **[4]**

OR

Q4) a) Design the diameter of solid circular shaft to transmit 50 KW power rotating at 150 r.p.m. Maximum torque is likely to exceed mean torque by 25%. Permissible shear stress is equal to 60 Mpa. Also calculate angle of twist for 2 m length Assume G = 85 Gpa. **[8]**

b) Find the shortest length 'L' for a pin ended steel column 60 mm × 100 mm in cross section for which Euler's formula is applicable. Take E is equal to 200 Gpa and proportional limit is equal to 250 Mpa. **[5]**

c) What are the assumptions made in the analysis of struts and columns by Euler's Bucking theory. **[4]**

Q5) a) A plane element is subjected to stresses as shown in fig. 2. Determine the principal stresses maximum shear stress and position of principal plane. **[9]**
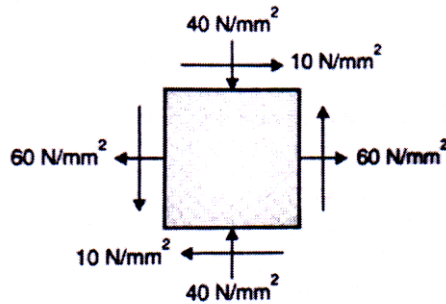
Fig. 2

b) The stresses on two mutually perpendicular planes through a point in a body are 30 Mpa and 15 Mpa both tensile along with shear stress of 25 Mpa. Find : **[8]**

   i) Magnitude and direction of principal stresses

   ii) Maximum shear stress and their planes

   iii) Normal and shear stresses on the planes of maximum shearing stress. Use Mohr's circle method.

OR

Q6) a) A solid circular shaft made from plain carbon carbon steel with a yield point of 250 MPa. is subjected to a peak bending moment of 530 N-m. due to transverse loading and twisting moment of 600 N-m. For a factor of safety 3. Determine required diameter of shaft using. **[9]**

   i) Maximum Normal Stress Theory

   ii) Maximum shear stress theory.

b) A point in a strained material is subjected to stress as shown in fig.3. Using Mohr's circle method Determine the magnitude and direction of major and minor principal stress. **[8]**
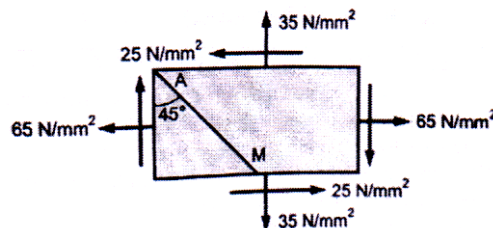
Fig.3

Q7) a) A column support load of 400 KN is shown in figure 4. Find the stresses at the corner of the column at its base. **[10]**
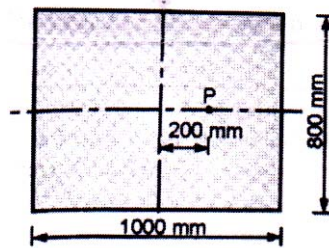
Fig. 4

b) A short column 200 mm × 100 mm is subjected to an eccentric load of 60KN at an eccentricity of 40 mm in the plane bisecting the 100 mm side. Find the maximum and minimum intensities of stresses at the base. **[8]**

OR

Q8) a) A masonary pier 3 m × 4 m supports a vertical load of 600 KN at a point as shown in fig. 5. Find the stresses at the corners of the pier. **[10]**
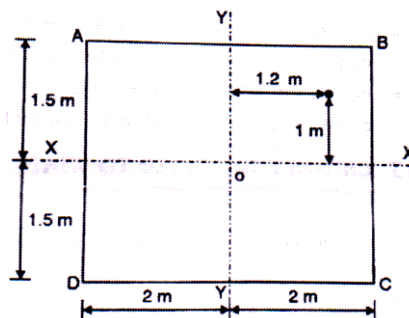
b) A hollow circular steel column having external diameter 200 mm and internal diameter 150 mm carries a vertical load of 80 KN acting with an eccentricity of 50 mm. Calculate maximum and minimum stress intensities in the section. **[8]**

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[5925]-316

S.E. (Mechatronics)

ENGINEERING MATERIAL

(2019 Pattern) (Semester - III) (217541)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right indicates full marks.*

4) *Assume suitable data, if necessary.*

Q1) a) Explain cooling curve with its importance and draw the diagram of cooling curves for pure metal and binary solid solution. **[7]**

b) Explain solid solution and factors that governs Hume Rothery's rule of solid solubility. **[7]**

c) Draw FE-C diagram and label the temperature, composition and phases. **[4]**

OR

Q2) a) Explain solidification of pure metal and discuss how nucleation and grain growth effect on solidification. **[7]**

b) List out the transformation reaction in Fe- C diagram and explain in details. **[7]**

c) Define the terms : **[4]**

  i) Phase   ii) Proeutectic

  iii) Hypoeutectic   iv) Hypereutectic

Q3) a) What is retained austenite? Explain the effects of retained austenite. **[7]**

b) Distinguish between full annealing and process annealing. **[7]**

c) Define tempering. What are the effects of tempering on mechanical properties of steel? **[4]**

OR

P.T.O.

Q4) a) List out case hardening processes. Describe carburizing and induction hardening with neat sketch. **[7]**

b) Describe the various transformation of austenite at different temperature with TTT diagram. **[7]**

c) Explain austempering and martempering. **[4]**

Q5) a) What are the effects of following alloying elements on steel? (Any 6) : **[6]**

i) Carbon   ii) Chromium

iii) Manganese   iv) Sulfur

v) Tungsten   vi) Nickel

vii) Silicon

b) Write short note on : **[6]**

i) Indian standard code for designation of plain and alloy steel.

ii) AISI and SAE standard for plain and alloy steel.

c) Describe nodular cast iron. **[5]**

<p align="center">OR</p>

Q6) a) Compare between white cast iron and gray cast iron. **[6]**

b) Give classification of ferrous alloy and their applications. **[6]**

c) Write note on stainless steel. **[5]**

Q7) a) State and explain properties of copper and its applications. **[6]**

b) Explain aluminium alloys : **[6]**

i) Duralumin

ii) LM5

iii) Y alloy

c) Explain characteristics of Nickel alloy. **[5]**

<p align="center">OR</p>

Q8) a) Describe materials used in additive manufacturing. **[6]**

b) Explain any three cobalt alloys with composition and application. **[6]**

c) Write short note on bearing materials. **[5]**

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[5925]-317

S.E. (Mechatronics Engineering)
KINEMATICS OF MACHINERY
(2019 Pattern) (Semester - IV) (217547)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
  1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
  2) *Neat diagram must be drawn wherever necessary.*
  3) *Use of drawing instruments, electronic pocket calculators are allowed.*
  4) *Figures to the right indicate full marks.*
  5) *Assume suitable data if necessary.*

Q1) a) In the toggle mechanism shown in Fig. 8.16, the slider D is constrained to move on a horizontal path. The crank OA is rotating in the counter-clockwise direction at a speed of 180 r.p.m. increasing at the rate of 50 rad/s². The dimensions of the various links are as follows: OA = 180mm; CB = 240mm ; AB = 360mm ; and BD = 540 mm.
For the given configuration, find
  i) Velocity of slider D and angular velocity of BD, and
  ii) Acceleration of slider D and angular acceleration of BD.
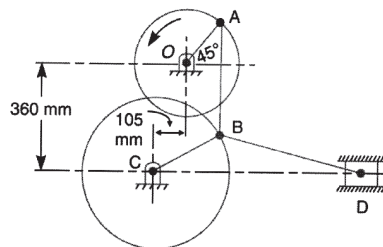
[10]

  b) Explain the concept of Acceleration Image Principal. **[4]**
  c) State and explain Kennedy's theorem of three centers inline. **[4]**

OR

Q2) a) The dimensions and configuration of the four bar mechanism, shown in Fig. , are as follows :P1A = 300 mm; P2B = 360 mm; AB = 360 mm, and P1 P2 = 600 mm. The angle AP1P2= 60°. The crank P1A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s², both clockwise. Determine the angular velocities and angular accelerations of P2B, and AB and the velocity and acceleration of the joint B. **[10]**

P.T.O.
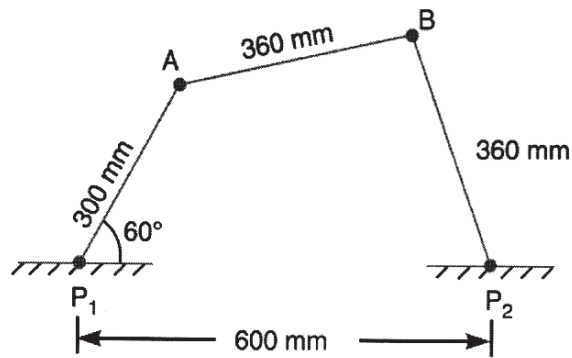
b) Fig. shows a sewing needle bar mechanism O1ABO2CD where in the different dimensions are as follows : Crank O1A = 16 mm; = 45°; Vertical distance between O1 and O2 = 40 mm; Horizontal distance between O1 and O2 = 13 mm; O2B = 23mm; AB = 35 mm; O2BC = 90°; BC = 16 mm; CD = 40 mm. D lies vertically below O1.

Find the velocity of needle at D for the given configuration. The crank O1A rotates at 400 r.p.m. **[8]**
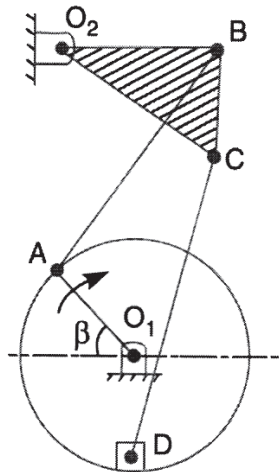
Q3) a) Synthesize a four bar mechanism for three successive positions given in the table below :

Positions	1	2	3
θ	30	90	180
φ	40	115	175

Consider L1 = Grounded Link, L2 = Input Link, L3 = Coupler Link, L4 = Output Link, θ = input link angle, ø = output link angle, 1f the grounded link of length 100 mm is horizontal and input link is of 20 mm

length, synthesize the mechanism using precision positions of the input link and precision position of output link. Ground the pivot of the input link on left hand side and ground the pivot of output link on right hand side. Input and output links are rotating in opposite directions. Use the method of inversion Draw the mechanism in its first precision position. **[10]**

b) Explain the term Path Generation. **[3]**

c) Explain structural error related to synthesis of mechanism. **[4]**

OR

Q4) a) Determine the chebyshev spacing for function $Y = e^x$ for the range $0 \leq X \leq 4$ where three precision points are required. For these position points, determine The value of θ and y when $\Delta\theta = 90°$ and $\Delta\phi = 120°$. **[10]**

b) Explain the three position synthesis of single slider mechanism by using inversion method. **[7]**

Q5) a) Derive the expression for a minimum number of teeth on gear wheel required to avoid interference with neat sketch. **[8]**

b) Define the following terms: **[3]**

i) Length of path of recess

ii) Backlash in gears

iii) Working depth of gear tooth

c) In an epicyclic gear train, an arm carries two gears A & B having 30 and 45 teeth respectively and is shown in fig. **[6]**
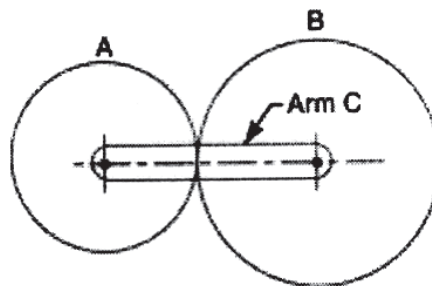
If the arm rotates at 100 rpm in anticlockwise direction about the centre of gear A which is fixed, determine the speed of gear B. Use tabular method.

OR

Q6) a) Compare cycloidal and involute gear tooth profile. **[5]**

b) Define formative number of teeth for Helical gear and express the formula with terms. **[3]**

c) A pair of spiral gears is required to connect two shafts 150 mm apart, the shaft angle being 70°. The velocity ratio is to be 1.5 to 1, the faster wheel having 80 teeth and a pitch circle diameter of 100 mm. Find the spiral angles for each wheel. **[9]**

Q7) a) A cam, with a minimum radius of 35 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below: **[13]**

    i) To raise the valve through 50 mm with uniform velocity during 60° rotation of the cam;

    ii) To keep the valve fully raised through next 40°;

    iii) To lower the valve during next 120° with S.HM.; and

    iv) To keep the valve closed during rest of the revolution i.e. 140°.

The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft.

b) Write note on Artificial intelligence in automation. **[5]**

<div align="center">OR</div>

Q8) a) A cam is to be designed for a knife edge follower with the following data: **[13]**

    i) Cam lift = 40 mm during 60° of cam rotation with simple harmonic motion.

    ii) Dwell for the next 40°.

    iii) During the next 90° of cam rotation, the follower returns to its original position with simple harmonic motion.

    iv) Dwell during the remaining 170°.

Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft, and

b) Write note on automated assembly line for car manufacturing. **[5]**

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[5925]-318

S.E. (Mechatronics Engineering)
FLUID MECHANICS AND MACHINERY
(2019 Pattern) (Semester - IV) (217548)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Use of logarithmic tables, slide rule, and electronic pocket calculator is allowed.*
4) *Figures to the right indicate full marks.*
5) *Assume suitable data, if necessary.*

Q1) a) Define HGL and TEL. Derive an expression for volume flow rate for Venturimeter with neat sketch. **[8]**

b) Explain the concepts of pipes are connected in series, parallel, siphon and equivalent pipe with neat sketch. **[8]**

OR

Q2) a) A pipe of diameter 300 mm and length 350 m is used for transmission of power by water. Total head at the inlet of pipe is 500 m. Find the maximum power available at the outlet of pipe, if the value of coefficient of friction f = 0.006. **[8]**

b) Derive an expression for Darcy-Weisbach equation. **[8]**

Q3) a) Determine the dimensions of the quantities given below. **[10]**
   i) Velocity
   ii) Acceleration
   iii) Density
   iv) Force
   v) Work done

b) The efficiency η of a fan depends on density ρ, dynamics viscosity μ, of the fluid, angular velocity ω, diameter D of the rotor and discharge Q. Express η in terms of dimensionless parameters. **[8]**

OR

Q4) a) Write a short note on Dimensionless number and their significance (give any four). **[8]**

b) Write a short note on **[10]**
   i) Buckingham's Pi theorem
   ii) Dimensional Homogeneity
   iii) Boundary layer thickness
   iv) Hydrodynamic entrance region
   v) HGL & TGL

Q5) a) A Reaction turbine works at 450 rpm under a head of 120 m, diameter at inlet is 120 cm and flow area is 0.4 m². Angles made by absolute and relative velocity are 20° and 60° respectively at inlet. **[8]**

   Determine
   i) Volume flow rate
   ii) Power developed
   iii) Hydraulic efficiency.

   Assume whirl velocity at outlet zero.

b) Write difference between Impulse turbine and Reaction turbine. **[4]**

c) Explain construction and working of francis Turbine with application. **[6]**

OR

Q6) a) Explain the following for hydraulic turbine **[4]**
   i) Hydraulic Efficiency
   ii) Mechanical Efficiency

b) Explain construction and working principle of Kaplan Turbine with application. **[6]**

c) A Pelton wheel is to be designed for the following specifications:

   Shaft Power = 11,772 kW, Head = 380 meters, Speed = 750 r.p.m; overall efficiency = 86%; Jet diameter is not to exceed one sixth of the wheel diameter. Determine: **[8]**
   i) The wheel diameter
   ii) The number of jets required
   iii) Diameter of the jet.

   Take Kvl = 0.985 and Kul = 0.45

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Q7) a) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m. works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40 at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine: **[8]**

       i) Vane angle at inlet

      ii) Work done by the impeller on water per second

     iii) Manometric efficiency

   b) Explain the following efficiency for centrifugal pump. **[6]**

       i) Manometric Efficiency

      ii) Mechanical Efficiency

     iii) Overall Efficiency

   c) Explain in detail classification of hydraulic pump. **[4]**

<div align="center">OR</div>

Q8) a) Explain construction and principle of working of Centrifugal pump. **[6]**

   b) Explain the following **[4]**

       i) Static Head

      ii) Manomeric Head

   c) The internal and external diameter of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are 20 and 30 respectively. The water enters the impeller radially and velocity of flow is constant. Determine the flow velocity and work done by the impeller per unit weight of water. **[8]**

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[5925]-319

S.E. (Mechatronics Engineering)
ELECTRICAL MACHINES AND DRIVES
(2019 Pattern) (Semester - IV) (217549)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Use of logarithmic tables, slide rule & electronic pocket calculator is allowed.*
4) *Figures to right indicate full marks.*
5) *Assume suitable data, if necessary.*

Q1) a) With a suitable diagram explain the Armature reaction in synchronous machine.   **[9]**

   b) Give comparison between salient pole and non-salient pole type synchronous machine.   **[9]**

<div align="center">OR</div>

Q2) a) Develop circuit model for 3 phase Synchronous Machine.   **[9]**

   b) For 2200v, 440KvA, single phase alternator the armature resistance is $0.5\,\Omega$, field current of 40A gives an open circuit voltage of 1160v and short circuit current of 200A. Calculate synchronous impedence & reactance. Also find % regulation at 0.8 pf lag.   **[9]**

Q3) a) Justify 'steady state depends on relative characteristic of motor and load both'.   **[8]**

   b) Explain in detail block diagram of electrical drives.   **[9]**

<div align="center">OR</div>

Q4) a) Explain four quadrant operation of motor driving a hoist load. **[8]**

b) A drive has following parameters $T_M = (150 - 0.1 N)$ N-m where N is in rpm $T_l = 100$ N-m.

Test whether the motor will start or not? Find the equilibrium speed. Test steady state stability of this motor load using condition of stability. **[9]**

Q5) a) Explain regenerative braking in case of DC Motor. **[9]**

b) Write a short note on step down Chopper controlled DC drives. **[9]**

OR

Q6) a) Explain plugging of DC Motor. **[9]**

b) Explain single phase fully controlled rectifier fed DC Motor drive. **[9]**

Q7) a) Explain v/f control method of speed control of DC Motor. **[8]**

b) What are the advantages and disadvantages of stepper motor? Write down the applications of stepper motor. **[9]**

OR

Q8) a) Write a short note on closed loop control of Induction Motor drives. **[9]**

b) Compare VSI and CSI for induction Motor drive. **[8]**

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[5925]-320

S.E. (Mechatronics)
SENSORS AND ACTUATORS
(2019 Pattern) (Semester - IV) (217550)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a) Explain Basic Principle of working of Rotameter with neat diagram? Why it is called as variable area meter? **[6]**

b) What are elastic pressure transducers? What are their applications? **[6]**

c) What is basic Principle of working piezoelectric pressure sensors? What are their applications? **[6]**

<p align="center">OR</p>

Q2) a) Explain Bernoulli's equation and its importance in flow measurements?**[6]**

b) Explain Working Principle Vacuum Pressure measurement? **[6]**

c) Explain working principle of Hall Effect Sensors? What are its applications? **[6]**

Q3) a) What is modeling of DC motor? How heat dissipation in DC motor can be managed? **[6]**

b) Write a short note on Velocity Profile optimization in DC Motor? **[5]**

c) What are various types of Stepper motors? What are the Characteristics features of Stepper Motor. **[6]**

<p align="center">OR</p>

Q4) a) What are Linear Actuators? Explain working of solenoid? **[6]**

b) What are characteristics of Induction motors? **[5]**

c) Explain Working Principle of Stepper Motor? Explain What is step angle? **[6]**

P.T.O.

Q5) a) Write a Short note on Pneumatic Actuator Systems? What are the advantages of Pneumatic Actuator? **[6]**

b) What are Pumps and Compressor used in Hydraulic and Pneumatic Systems? **[6]**

c) Draw symbols of pumps, compressor, filter, control valves, pressure regulation, relief valves, accumulator in Pneumatic Systems? **[6]**

OR

Q6) a) Draw relevant symbols of pumps , filter, control valves, pressure regulation, relief valves, accumulator in Hydraulic Systems? **[6]**

b) Write a Short note on Hydraulic Actuator Systems? What are the Limitations of Hydraulic Actuator? **[6]**

c) What are Electro active Polymers? What are their specific applications?**[6]**

Q7) a) Explain following terms **[6]**

i) Actuator bandwidth

ii) Frequency Response

b) What are power and energy consideration during actuator selection?**[6]**

c) Write a short note on tradeoffs between force/displacement. **[5]**

OR

Q8) a) What are industrial considerations during actuator selection? **[6]**

b) Write a short note on tradeoffs between torque/speed. **[6]**

c) Write a short note on control system and electronics for Industrial need. **[5]**

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S.E. (Mechatronics Engineering)
APPLICATIONS OF INTEGRATED CIRCUITS
(2019 Pattern) (Semester-IV) (217551)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume suitable data, if necessary.*

Q1) a) Explain the working of Inverting Comparator. **[6]**

b) Explain in detail with neat circuit diagram sample and hold circuit, also draw its input and output waveform. **[6]**

c) Explain with a neat circuit diagram working of inverting Schmitt Trigger with its input-output waveform and hysteresis plot. **[6]**

OR

Q2) a) For the Inverting Schmitt trigger shown in fig. below Calculate UTP, LTP and hysteresis width. Draw input and output waveforms. Also Comment on Hysteresis loop. **[6]**
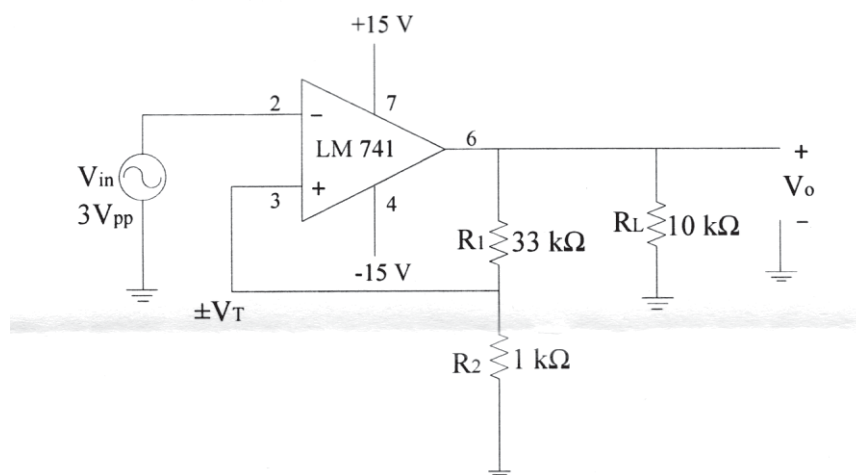
b) Explain in detail working of square wave generator with neat circuit diagram. Draw waveforms of output voltage and capacitor voltage. **[6]**

c) Draw circuit digram and input-output waveform of precision half wave & full wave rectifier. **[6]**

P.T.O.

Q3) a) Draw circuit diagram and explain D/A converter with binary weighted resistors and write output voltage equation, Vo. **[6]**

b) Write a short note on Performance parameter of DAC. **[6]**

c) Explain the operation of Dual Slope ADC. **[5]**

OR

Q4) a) With the help of neat Diagram, Explain Flash type ADC. **[6]**

b) Draw the circuit diagram of R/2R Ladder type DAC. **[6]**

c) Write a short note on Performance parameter of ADC. **[5]**

Q5) a) Explain the working of functional block diagram of IC 555 Timer. **[6]**

b) Write a short note on Basic operation of Power Amplifier LM 380. **[6]**

c) Explain PLL operation in detail with neat block diagram. **[6]**

OR

Q6) a) Explain Voltage controlled Oscillator 566 and write its applications. **[6]**

b) Draw block diagram and explain any one application of IC PLL 565 in detail. **[6]**

c) Explain voltage Divider using multiplier 534. **[6]**

Q7) a) Explain with neat block diagram IC Voltage Regulator. **[5]**

b) Explain typical connections of 78XX and 79XX regulators with Circuit diagram. **[6]**

c) Explain the following. **[6]**
   i) Current limiting Feature.
   ii) Current fold back protection.

OR

Q8) a) Draw and explain the functional diagram of 723 regulator. **[6]**

b) Write a short note on IC LM 317. **[6]**

c) What are the Switching regulator topologies? Expalin any one. **[5]**

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S.E. (Artificial Intelligence and Data Science)
OPERATING SYSTEMS
(2019 Pattern) (Semester - III) (217521)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Solve questions Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right indicate full marks.*

4) *Assume suitable data, if necessary.*

Q1) a)   What is deadlock detection and recovery? Explain two options of deadlock recovery.   **[6]**

b)   What is the producer consumer problem? How to solve it using semaphore and Mutex?   **[6]**

c)   What are different types of classical synchronization problems? Explain any one in detail.   **[6]**

OR

Q2) a)   What is Inter Process Communication? Why it is important for operating system.   **[6]**

b)   Write short note on critical section, Monitors and mutex.   **[6]**

c)   What do you mean by pipe? Explain anonymous and named/FIFO pipe.   **[6]**

Q3) a)   Explain the following term :   **[6]**

i)   Compaction

ii)   Belady's anomaly

iii)   Thrashing

P.T.O.

b) Why is the principle of locality crucial to use of virtual memory? Explain with example. **[6]**

c) Reference String 1 2 3 2 1 5 2 1 6 2 5 6 3 1 3 6 1 2 4 3. Execute LRU and OPR on above string. Consider page frame of 3 pages Write page hit and page faults if any. **[5]**

OR

Q4) a) Write and explain algorithms for : **[6]**

i) Allocating region

ii) Freeing region

b) Differentiate between : **[6]**

i) Internal and external fragmentation

ii) Fixed and variable size partitioning

c) Explain in brief what is paging and segmentation. How logical physical Address Translation is done in both. **[5]**

Q5) a) What is file system? Explain File system implementation in detail. **[6]**

b) Explain following term with respect to directory structure **[6]**

i) Two level directory structure (with diagram)

ii) Tree structured Directories (with diagram)

c) Define following term with respect to disk access **[6]**

i) Seek time

ii) Rotational Latency

iii) Data transfer time

OR

Q6) a) Explain directory structure with types its types. Also discuss directory implementation in details. **[6]**

b) What is free space management (FSM)? Explain how bit vector and linked list performs on FSM. **[6]**

c) What is the advantage of the double buffering scheme over single buffering? **[6]**

Q7) a) Explain scheduling in **[6]**

        i)   Linux Operating Systems

        ii)   UNIX free BSD OS

   b) Explain grep utility and its variations with examples. **[5]**

   c) Explain system calls exec() and brk(). **[6]**

<div align="center">OR</div>

Q8) a) What are the requirements for Linux system administrator? Define the design principles of LINUX systems. **[6]**

   b) Explain different types of hypervisors. **[5]**

   c) Explain in detail the memory management in LINUX system. **[6]**

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S.E. (Artificial Intelligence and Data Science)
STATISTICS
(2019 Pattern) (Semester-IV) (217528)

Time : 2½ Hours] *[Max. Marks : 70*
Instructions to the candidates:
1) *Q.1 or Q.2 Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Assume suitable data, if necessary.*
4) *Figures to the right indicate full marks.*

Q1) a) Calculate: **[10]**

i) Quartile deviation (Q.D.),

ii) Mean Deviation (M.D.) from mean, for the following data:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of students	6	5	8	15	7	6	8

b) The variables X and Y are connected by the equation aX + bY + c = 0. Show that the correlation between them is -1 if the signs of a and b are alike and +1 if they are different. **[8]**

OR

Q2) a) An alalysis of monthly wages paid to the workers of two firms A and B belonging to the same industry give the following results: **[10]**

	Firm A	Firm B
Number of workers	500	600
Average daily wage	Rs. 186.00	Rs. 175.00
Variance of distribution of wages	81	100

i) Which firm, A or B, has a larger wage bill?

ii) In which firm, A or B, is there greater variability in individual wages?

iii) Calculate (a) the average daily wage, and (b) the variance of the distrubution of wages of all the workers in the firm is A and B taken together.

P.T.O.

b) In a partially destroyed laboratory, record of an analysis of correlation data, the following results only are legible: **[8]**
Variance of X=9. Regression equations: 8X–10Y+66=0, 40X–18Y=214.
what are:
i) the mean values X and Y ,
ii) the correlation coefficient between X and Y,
iii) the standard deviation of Y?

Q3) a) A Dice is thrown 10 times. If getting an odd number is a sucess. What is the probability of getting **[5]**
i) 8 successes
ii) at least 6 success?

b) Fit Poisson's distribution to following data and calculate theoretical frequencies. **[6]**

x	0	1	2	3	4
f	122	60	15	2	1

c) In a Sample of 1000 caes the means of a certain test is 14 and standard deviation is 2.5 assuming the distrubution to be normal find **[6]**
i) How many students scored between 12 & 15.
ii) How many scored below 8.
[Given: A(z = 0.8) = 0.2881), A(z = 0.4) = 0.1554), A (z = 2.4) = 0.4918]

OR

Q4) a) A Random variable X with following probability distrubution **[5]**

X	1	2	3	4	5	6	7
P(X)	k	$2k$	$3k$	k^2	k^2+k	$2k^2$	$4k^2$

Find.
i) k
ii) $P(x > 5)$
iii) $P(1 \le x \le 5)$

b) In a continuous distribution density function **[6]**

$f(x) = kx^2(1 - x^3), 0 \le x \le 1.$

Find the value of
i) k
ii) Mean
iii) Variance

c) MNC company conducted 1000 candidates' aptitude test. The average score is 45 and the standard deviation of score is 25. Assuming normal distribution for the result. **[6]**

Find

i) The number of candidate whose score exceed 60.

ii) The number of candidates whose score lies between 30 & 60.

[Given: $A(z = 0.6) = 0.2257$)]

Q5) a) In an experiment of pea breeding.the following frequencies of seeds were obtained. **[6]**

Round and green	Wrinkle and green	Round and yellow	wrinkle and yellow	Total
222	120	32	150	524

Theory predicts that the frequencies should be in the proportion 8:2:2:1. Examine the correspondence betwen theory and experiment. Given chisquare (0.05,3) = 7.815

b) The average marks in mathematics of a sample of 100 students was 51 with standard deviation of 6 marks. Could this have a random sample from the population with average marks 50? Given $Z\alpha$ at 5% level of significance = 1.96 **[6]**

c) A random sample of 16 newcomers gave a mean of 1.67 m and standard deviation of 0.16 m. Is the mean height of newcomers significantly different from the mena height of students' population of the previous year? Given $t_{0.05, 15} = 2.13$ **[6]**

OR

Q6) a) Following table shows number of books issued on the various days of week from a certain library At 5% level of significance test the null hypothesis that number of books issued in department of the day. **[6]**

Day	Mon.	Tue.	Wed.	Thurs.	Fri.	Sat.
No. of books issued	120	130	110	115	135	110

Given: Chi-square value at 5% level of significance for degrees of freedom 5 is 11.071.

b) A random sample of 900 members has mean 3.4 cms. Can it be reasonable regarded as a sample from a large population of mean 3.2 cms and standard deviation 2.3 cms. **[6]**

c)   Find the F-statistics form the following data: [6]

Sample	size (n)	Total observation $\sum x$	Sum of squares of observations
1	8	9.6	61.52
2	11	16.5	73.26

Q7) a)   State & Prove Neyman-Pearson Fundamental Lemma.   [9]

b)   Given the frequency function   [8]

$$f(x,\theta) = \frac{1}{\theta}; 0 \le x \le \theta$$

$$= 0 ; \text{elsewhere}$$

And that you are testing the null hypothesis $H_0 : \theta = 1 \, vs \, \theta = 2$ by means of a single observed value of *x*. what would be the size of Type I and Type II error. If you choose the interval

i) $0.5 \le x$

ii) $1 \le x \le 1.5$

Also obtain the power function of the test.

OR

Q8) a)   Write short notes on   [8]

i)   Most powerful test

ii)   Uniformly most powerful test

iii) Advantages and disadvantages of non-parametric tests

iv)   Level of significance

b)   Explain in detail about test for the Equality of means of serveral normal populations.   [9]

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S.E. (Artificial Intelligence and Data Science)
INTERNET OF THINGS
(2019 Pattern) (Semester-IV) (217529) (Theory)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
  1) *Attempt Ques. 1 or 2, 3 or 4, 5 or 6, 7 or 8.*
  2) *Draw Neat and Clean Diagram.*
  3) *Assume suitable data, if necessary.*

Q1) a) Explain with the help of neat diagram the components of IoT with pros and cons? **[9]**

  b) With the help of following sector justify how IOT technology impacting on end to end user. **[9]**

   i)   Big Data Analytics

   ii)   Telematics

   iii) Home Automation

OR

Q2) a) Explain in brief SCADA with block diagram and SCADA functionality with middleware structure? **[9]**

  b) How IoT plays an important role in smart city, smart appliances, smart parking, smart lightning? **[9]**

Q3) a) Explain Block diagram of RFID system with frequency ranges? Explain any two strengths and weaknesses of RFID over Barcode? **[9]**

  b) Explain with the help of a neat diagram cellular Machine to Machine application network? **[8]**

OR

Q4) a) Explain Application layer IOT protocol in detail? **[9]**

  b) Explain advanced message queuing protocol with architectural diagram? **[8]**

Q5) a) Why is security required in IoT? Explain in detail various security models in the Internet of Things. **[10]**

b) What is threat analysis in the Internet of Things? Explain details of threat analysis. **[8]**

OR

Q6) a) What is Internet of Things security tomography? Explain in detail layered attacker mode? **[10]**

b) Explain in detail access control and messages integrity of Internet of Things. **[8]**

Q7) a) Write a detailed business model scenario for the Internet of Things. **[7]**

b) Explain in detail application of Internet of Things in city automation and home automation. **[10]**

OR

Q8) a) Write applications of Internet of Things for e-health body area network. **[7]**

b) Explain in detail business model and business innovation in the Internet of Things. **[10]**

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S.E. (Artificial Intelligence and Data Science)
MANAGEMENT INFORMATION SYSTEMS
(2019 Pattern) (Semester - IV) (217530)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a)   What is IT infrastructure? Explain in brief its components.   **[8]**

b)   Explain how to Secure information systems with system vulnerability? Explain the value of security and control in Business.   **[9]**

OR

Q2) a)   What is Business Intelligence? Explain its foundations database and Information management?   **[9]**

b)   Discuss Management Issues. Explain Hardware and Software Platform trends.   **[8]**

Q3) a)   Define Enterprise Application and explain with examples?   **[9]**

b)   Explain importance of project management and how to manage project risk?   **[8]**

OR

Q4) a)   Write a note on managing global systems. Explain technology issues and opportunities for global value chain?   **[8]**

b)   How to enhance decision making and building information systems?**[9]**

Q5) a) Elaborate Customer Relationship Management in detail with a suitable case study? **[9]**

b) Describe e-commerce system with its functions, applications and issues. Take a case study of Amazon/Flipkart. **[9]**

OR

Q6) a) Elaborate supply chain management in detail with suitable case study?**[9]**

b) Explain decision support system in businesses with its different components and role of OLTP systems under DSS? **[9]**

Q7) a) Write short note on : **[9]**

    i) Neural Network

    ii) Virtual Reality

    iii) Expert System

b) Explain in detail Predictive Analytics with a case study of an insurance company? **[9]**

OR

Q8) a) Write short note on: **[9]**

    i) Business Intelligence

    ii) Genetic Algorithms

    iii) Fuzzy Logic

b) How MIS helps in decision making process? Elaborate all the phases in the process of decision making? **[9]**

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S.E. (Artificial Intelligence and Machine Learning)
DISCRETE MATHEMATICS
(2019 Pattern) (Semester - III) (218541)

Time :2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
   1)   Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
   2)   Neat diagrams must be drawn wherever necessary.
   3)   Figures to the right indicate full marks.
   4)   Assume suitable data, if necessary.

Q1) a) Explain the following types of graphs with the help of examples: **[6]**
   i)   Simple graph
   ii)   Asymmetric diagraph
   iii)   Symmetric diagraph
   iv)   Connected and disconnected graphs

   b) Use Dijkstra's algorithm to find the shortest path between a and z. **[6]**
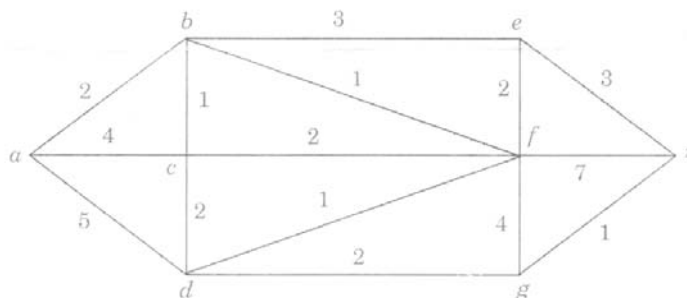
   c) Use nearest neighbor method to find the Hamiltonian circuit starting from 'a' in the following graph, find its weight. **[6]**

OR
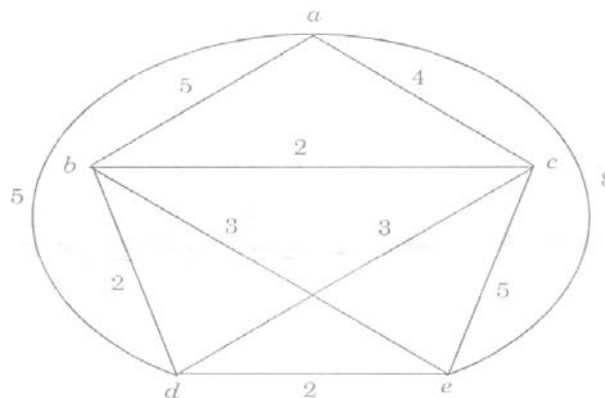
Q2) a) Find the chromatic number with the help of graph coloring for: **[6]**

     i)   K5 (complete graph with 5 vertices)

     ii)   Any complete bipartite graph.

     iii)   C4 (cyclic graph with 4 vertices).

  b) Explain the following types of graphs with the help of examples: **[6]**

     i)   Hamiltonian path

     ii)   Hamiltonian Circuit

     iii)   Eulerian Path

     iv)   Eulerian Circuit

  c) Show that the maximum number of edges in a simple graph with n vertices is **n.(n-1)/2**. **[6]**

Q3) a) Consider these relations on the set of integers: **[6]**

R1 = {(a, b) | a ≤ b},

R2 = {(a, b) | a > b},

R3 = {(a, b) | a = b or a = –b},

R4 = {(a, b) | a = b},

R5 = {(a, b) | a = b + 1},

R6 = {(a, b) | a + b ≤ 3},

Which are symmetric and which are anti-symmetric?

  b) Functions, f, g & h are defind on the set X = {1,2,3} as **[6]**

f = {(1, 3), (2, 1), (3, 2,)}

g = {(1, 2), (2, 3), (3, 1)}

h = {(1, 2), (2, 1), (3, 3)}

     i)   Find fog and gof. Are they equals?

     ii)   Find fogoh and fohog.

  c) If A = {a, b, c, d} and R = {(a, b), (c, d), (c, c), (d, a), (a, a), (b, b), (d, d)} is a relation on A Draw digraph of R. **[5]**

<div align="center">OR</div>

Q4) a) Define: One to one, onto, and bijctive relation. **[6]**

  b) i)   Find the lower and upper bounds of the subsets {a, b, c}, {j, h}, and {a, c, d, f } in the poset with the Hasse diagram shown in figure?

ii) Find the greatest lower bound and the least upper bound of {b, d, g}, if they exist, in the poset shown in Figure? **[6]**

c) Solve the following recurrence relation **[5]**
ar–3ar–1 = 2, r> = 1, a0 = 1.

Q5) a) Determine quotient and remainder for the following. **[4]**

i) 97 / 11
ii) –97 / 11

b) Using primality test theorem determine if the following numbers are prime? Justify your answer: **[4]**
i) 143
ii) 227

c) Using Chinese Remainder Theorem find the value of X such that: **[10]**
X = 2 mod 3
X = 4 mod 5
X = 2 mod 7

OR

Q6) a) Define Mersenne prime number? Which of the following is a Mersenne prime number. **[6]**
i) 31
ii) 71
iii) 127
iv) 255

b) Using Fermat's Theorem and Fermat's Euler theorem solve the following: **[6]**
i) 11 ^ 143 mod 15
ii) 15 ^ 260 mod 17

c) Find multiplicative inverse of 34 mod 57 using Extended Euclidean Algorithm. **[6]**

Q7) a) Consider the (2,6) encoding function e. e(00) = 000000, **[8]**
 e(10) = 101010
 e(01) = 011110, e(11) = 111000
 Find minimum distance of e.
 How many errors will e detect?

 b) Let R = {0°, 60°, 120°, 180°, 240°, 300°} **[7]**
 and * = binary operation, so that a * b is overall angular rotation corresponding to successive rotations by a and then by b. Show that (R, *) is a Group.

 c) Define integral Domain. **[2]**

<p align="center">OR</p>

Q8) a) Determine whether description of * is a valid definition of a binary operation on the set. **[6]**
 i) On R, a*b = ab (ordinary multiplication)
 ii) On Z +, a*b = a/b
 iii) On Z, a*b = ab
 iv) On Z+, a*b = a–b
 v) On Z, a*b = 2a + b
 vi) On R, a*b = ab/3

 b) S= {1, 2, 3, 6, 12}, where a*b is defined as LCM (a,b). Determine whether it is an Abelian Group or not. **[7]**

 c) Consider set A = {1, 3, 5, 7,....} i.e. a set of odd positive integers. Determine whether A under is closed under: **[4]**
 i) Addition
 ii) Multiplication
 Justify your answer with 1 example.

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[5925]-333

S.E. (Artificial Intelligence and Machine Learning)
DATA STRUCTURES & ALGORITHMS
(2019 Pattern) (Semester - III) (218542)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Convert the following infix expressions to postfix expressions. **[9]**

    i) $K + L - M*N + (O\hat{}P)*W$

    ii) $x\hat{}y/(5*z)+2$

  b) Discuss various types of queue data structures and their applications.**[9]**

OR

Q2) a) Write sudo code for evaluating a given valid postfix expression and apply the same to evaluate ab+cd–* if a = 5, b = 2, c = 7 and d = 1.**[9]**

  b) Define ADT for circular queue for linked representation and write sudo code for insert and delete operations for the same queue and mention time complexity of insert & delete. **[9]**

Q3) a) Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example. **[9]**

  b) Write a c++ function or pseudo code to **[8]**

    i)   Count leaf nodes,

    ii)   Find height of tree

OR

Q4) a) Explain Insertion and Deletion Operation on Binary Search Tree with Example. **[9]**

  b) Discuss and explain with example following with reference to trees. **[8]**

    i)   Height of the Tree

    ii)   Complete Binary Tree

    iii) Full Binary Tree

    iv) Strictly Binary Tree

Q5) a) Write complete Kruskal's algorithm. For the given graph, Find Minimum spanning tree using Kruskal's algorithm. **[9]**
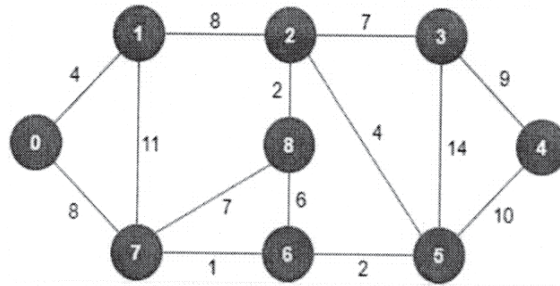
b) Create a Min Heap for : 10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11 and 13. After creation delete element 6 and repair it. Now insert element 20 and show the final result. **[9]**

OR

Q6) a) Define AVL trees. Construct AVL tree step by step for the following data: 25, 12, 17, 30, 15, 14, 37, 27, 40, 29, 28. **[9]**

b) Write algorithm for BFS and Show the working of BFS algorithm on the following graph. **[9]**
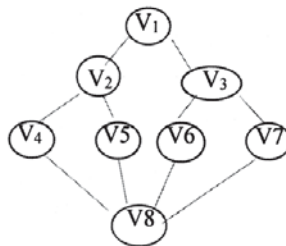
Q7) a) What is Hashing? Explain Open and Closed hashing Data Structure with example. **[9]**

b) What is Hashing function? Explain the characteristics of good hash function. **[8]**

OR

Q8) a) What is File? Explain different types of file organization. **[9]**

b) What is Index? Explain different types of Index. **[8]**

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[5925]-334
S.E. (Artificial Intelligence and Machine Learning)
COMPUTER NETWORKS
(2019 Pattern) (218543) (Semester - III)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
   1)   Neat diagrams must be wherever necessary
   2)   Figures to the right side indicate full marks.
   3)   Use of calculator is allowed.
   4)   Assume Suitable data jf necessary.

Q1) a)   What is hamming code in computer network? Data bits 1001101 is transmitted using a hamming code, show the actual bit string transmitted (Consider even parity). Suppose 7th bit from left is inverted during transmission, show that this error is detected and corrected at the receivers end. **[8]**

b)   What are the functions of Data Link Layer? Draw the taxonomy of protocols for involved in data exchange at data link layer. Compare and contrast the Go-Back-N ARQ protocol with Selective Repeat ARQ. **[9]**

OR

Q2) a)   Write short note on **[8]**

   i)   IEEE 802.3 Standard   ii)   IEEE 802.4 Standard

b)   Compare and Contrast flow control and Error Control. Explain the working of Cyclic Redundancy Check (CRC) using the following. Example (show the complete steps of division)

Data bits: 1101110110. Generator Polynomial: $X^3 + X + 1$

Write the redundant bits that will be sent along with the data bits.

Suppose the 2nd bit from the left is inverted during transmission. Show that error is detected at the receiver's end. **[9]**

Q3) a) Explain difference between Classful and Classless Addressing. Write a brief note on OSPF protocol. **[8]**

b) Explain following terms **[9]**

i) Datagrams

ii) Fragmentation

iii) routing table

OR

Q4) a) Explain ARP protocol with diagram. **[8]**

b) Explain following terms **[9]**

i) Private IPv4 address   ii) Public IPv4 Addresses

iii) NAT

Q5) a) Explain TCP with its header format. **[9]**

b) What is a Socket? Explain various socket primitives used in client-server interaction with neat diagram for a stream socket. **[9]**

OR

Q6) a) What is silly window syndrome? List different solutions to overcome it. Explain one solution at sender side and receiver side each. **[9]**

b) What do you mean by congestion control in transport layer? What are the different methods to alleviate it? **[9]**

Q7 a) Explain the operation of DHCP with state transition diagram. **[9]**

b) Explain different server types in detail. **[9]**

OR

Q8) a) What is the purpose of DNS? How does recursive resolution differ from iterative resolution? Explain with suitable diagram. **[9]**

b) Describe the functions of the two FTP connections. List difference between FTP & TFTP in a tabular format. **[9]**

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[5925]-335

S.E. (A.I & M.L. Engineering)
OBJECT ORIENTED PROGRAMMING
(2019 Pattern) (Semester - III) (218544)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.

2) Neat diagrams must be drawn wherever necessary.

3) Figures to the right side indicate full marks.

4) Assume suitable data if necessary.

Q1) a) What is constructor? What are the characteristics of constructor? Explain 'copy constructor' in Java. **[9]**

b) Write a short note on : **[9]**

   i) Garbage Collection in Java

   ii) Destructor in C++

OR

Q2) a) Design a class 'matrix' with data members. Provide default and Parameterized constructors. Write a program in JAVA to perform addition of two matrices. **[9]**

b) How can we initialize the object dynamically in Java programming? **[9]**

Q3) a) Define Inheritance. What are the types of Inheritance? Write down benefits of inheritance in details. **[9]**

b) Design a base class shape with two double type values and member functions to input the data and compute_area() for calculating area of shape. Derive two classes: triangle and rectangle. Make compute_area() as abstract function and redefine this function in the derived class to suit their requirements. Write a program in Java that accepts dimensions of triangle and rectangle and display calculated area. Use the concept of run time polymorphism. **[8]**

OR

P.T.O.

Q4) a) How constructors get executed in multilevel inheritance? Explain with an example. **[9]**

b) What is interface in java? How to declare an interface, write a syntax? Can we achieve multiple inheritance by using interface? Justify with an example. **[8]**

Q5) a) List Java's Built-in Exception? Write the importance of finally block. **[9]**

b) What is collection in Java? Differentiate between vector and ArrayList. **[9]**

OR

Q6) a) What is generic programming? Explain LinkedList class. **[9]**

b) What is an exception? Demonstrate Nested try statements with an example. **[9]**

Q7) a) What is stream? Explain various stream classes in Java. **[9]**

b) Write a short note on 'Singleton' design pattern. **[8]**

OR

Q8) a) Distinguish between : **[8]**

i) Inputstream and Reader classes

ii) Outputstream and Writer classes

b) Discuss about Random Access files in Java in detail. **[9]**

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PA-1303

[5925]-336

S.E. (A.I & M.L)

SOFTWARE ENGINEERING

(2019 Pattern) (Semester - III) (218545)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answers Question 1 or 2, 3 or 4, 5 or 6 and 7 or 8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) What are elements of Design model? What are the elements of architectural design? Explain Design principles? **[9]**

b) Explain guidelines for component level design and principles for User Interface Design. **[9]**

OR

Q2) a) What is Software Architecture? Explain Data centered and object oriented architectural style of the system. **[9]**

b) What is Software Design? Explain design concepts : **[9]**

     i) Abstraction

     ii) Modularity

     iii) Concurrency

Q3) a) Explain : **[8]**

     i) 4P's of Project Management

     ii) Software Project Estimation

b) Calculate activity expected time and variance for given problem. [8]

Activity ID	Optimistic Time (t_0)	Most Likely Time (t_m)	Pessimistic Time (t_p)
A	2	4	6
B	3	7	10
C	2	3	5
D	4	7	9
E	12	16	20
F	2	5	8
G	2	2	2
H	2	3	4
I	2	3	5
J	2	5	6
K	3	3	3

OR

Q4) a) What is COCOMO II? What areas does COCOMO II address? [8]

b) Explain Information domain values (any 4). [8]

Q5) a) Discuss Garvin's eight Quality Dimensions. [8]

b) How Defects are managed? Explain. [9]

OR

Q6) a) List out ISO 9126 Quality Factors. [9]

b) Enumerate seven Principles of Testing. [8]

Q7) a) What is software SCM repository? Explain the features of tool set supporting SCM Repository. [9]

b) Write short note on : [9]
    i)   Test Driven Development (TDD)
    ii) Collaborative development

OR

Q8) a) What is Software Reuse? Explain benefits and Drawbacks of software reuse. [9]

b) What is configuration identification in SCM? [9]

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[5925]-337

S.E. (AI/ML)
OPERATING SYSTEMS
(2019 Pattern) (Semester - IV) (218552)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Assume suitable data, if necessary.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*

Q1) a) Explain with pseudo-code implementation of dining philosopher problem using semaphore. **[6]**

b) What are the necessary conditions for a deadlock situation to occur? Discuss different methods to handle deadlocks. **[6]**

c) What is deadlock? Explain how wait-for graph is obtained. **[6]**

OR

Q2) a) Consider the following snapshot of the system at time T_0. **[12]**

Processes	Allocation			Max			Available		
P1	0	1	0	7	5	3	2	3	0
P2	3	0	2	3	2	2			
P3	3	0	2	9	0	2			
P4	2	1	1	2	2	2			
P5	0	0	2	4	3	3			

    i) Determine Need matrix.

    ii) Determine safe sequence.

    iii) Check whether following request can be granted.

    Request P5 → (0 1 0) and Request P1 → (2 0 0)

b) What is Semaphore? Write the pseudo code for implementing Bounded buffer problem using semaphore. **[6]**

P.T.O.

Q3) a) For the given reference string with 4 page frame available, determine the number of page faults for FIFO, OPTIMAL, LRU algorithms: **[12]**

1, 3, 4, 3, 5, 6, 1, 8, 5, 3, 1, 2, 7, 6, 4, 2, 5.

b) Explain with the help of neat diagram Hierarchical page table. **[5]**

<div align="center">OR</div>

Q4) a) A 1 MByte block of memory is allocated using the buddy system **[8]**

i) Show the result of the following sequence in the graphical form for Request 45KB, Request 180 KB, Request 140KB, Request 230KB, Return C, Request 80KB, Return B, Return D, Request, 120KB, Return A, Return E, Return F.

ii) Draw the tree representation after Return B.

b) Consider six memory partitions of size 500 KB, 400 KB, 200 KB, 600 KB, 300 KB and 250 KB. These partitions need to be allocated to five processes of sizes 150 KB, 490 KB, 468 KB, 360 KB, and 220 KB in that order. **[9]**

Perform the allocation of processes using-

i) First Fit Algorithm

ii) Best Fit Algorithm

iii) Worst Fit Algorithm

Q5) a) For the give sequence of disk request, determine the total distance travelled of disk head. In satisfying the entire request for FCFS, C-SCAN, and SSTF algorithms. Initial head position is 100 and total number of cylinders in the disk is 200.

27, 129, 110, 186, 147, 41, 10, 64, 120 **[12]**

b) Explain free space management with examples. **[6]**

<div align="center">OR</div>

Q6) a) Explain any four types of file organization techniques. **[6]**

b) With the help of neat diagram explain record blocking. **[6]**

c) Write Short note on I/O buffering. **[6]**

Q7) a) Define Loaders and explain its function. **[6]**

b) Explain the phases of compiler in detail. **[8]**

c) Define Macro processor with example. **[3]**

<p align="center">OR</p>

Q8) a) Explain the term "Forward Reference" and Backpatching" in Assemblers. **[6]**

b) Explain Compile and Go Loader. **[6]**

c) Describe the compilation process. **[5]**

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[5925]-338

S.E. (AI & ML)

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(2019 Pattern) (Semester - IV) (218553)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

  1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.

  2) Neat diagrams must be drawn wherever necessary.

  3) Figures to the right indicate full marks.

  4) Assume suitable data, if necessary.

Q1) a) What are the elements of propositional logic? **[5]**

  b) Define an inference procedure. **[5]**

  c) Specify the syntax of First-order logic in BNF form. Also give one example. **[7]**

OR

Q2) a) Differentiate forward and backward reasoning. **[7]**

  b) What is propositional logic? Explain with example. **[5]**

  c) Define Declarative and procedural knowledge. **[5]**

Q3) a) What is machine learning? Give an overview of machine learning with suitable diagram. **[6]**

  b) Explain three cross validation techniques. **[6]**

  c) What is Dataset? Differentiate between Training dataset and Testing dataset. **[5]**

OR

Q4) a) Differentiate between **[6]**

   i) Positive and Negative Class.

   ii) Training dataset and Testing dataset.

  b) Explain different types of machine learning techniques. **[6]**

  c) Discuss various applications of machine learning. **[5]**

P.T.O.

Q5) a) What is Supervised and Unsupervised Learning? Give real life example of supervised and unsupervised learning. **[6]**

b) What is dimensionality reduction explain subset selection in detail? **[6]**

c) Write short note PCA. **[6]**

OR

Q6) a) Explain supervised, unsupervised and semi supervised Learning. **[6]**

b) Explain with example forward and backward selection method for subset selection. **[6]**

c) Why do we need dimensionality reduction? What are its drawbacks? **[6]**

Q7) a) Consider following confusion matrix and calculate following : **[9]**

i) Accuracy

ii) Precision

iii) Recall

iv) Error rate

Confusion Matrix		Predicted		Total
		+	−	
Actual	+	8	10	18
	−	4	8	12
Total		12	18	30

b) What is overfitting and underfitting? What are the catalysts of overfitting? **[9]**

OR

Q8) a) How the performance of Regression is assessed? Write any four-performance metrics used for it. **[9]**

b) Consider the three-class classification matrix. Calculate accuracy, precision and recall per class. **[9]**

Confusion Matrix	Predicted			Total
Actual	15	2	3	20
	7	15	8	30
	2	3	45	50
Total	24	20	56	100

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[5925]-339

S.E. (BOS : Artificial Intelligence and Machine Learning)
DATA BASE MANAGEMENT SYSTEM
(2019 Pattern) (Semester - IV) (218554)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagram must be drawn whenever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data if necessary.*
5) *Use of Scientific Calculator is permitted.*

Q1) a)   Explain the characteristics and advantage of SQL.   **[9]**

b)   Explain different aggregation functions in detail.   **[9]**

OR

Q2) a)   Explain trigger with its type and example in detail.   **[9]**

b)   Explain embedded SQL and dynamic SQL in detail.   **[9]**

Q3) a)   Explain the purpose of normalization and different type of anomalies in detail.   **[9]**

b)   Explain transformation of relational expression in detail.   **[8]**

OR

Q4) a)   Explain difference between 3NF and BCNF.   **[9]**

b)   Explain measures of query cost in detail.   **[8]**

P.T.O.

Q5) a) Explain time stamping method and deadlocks in concurrency control.**[9]**

b) Explain log based recovery in detail. **[9]**

OR

Q6) a) Explain recoverable and non-recoverable schedule in detail. **[9]**

b) Explain database architecture in detail. **[9]**

Q7) a) Explain architecture of parallel database in detail. **[9]**

b) Explain mobile database in detail. **[8]**

OR

Q8) a) Explain architecture of distributed database in detail. **[9]**

b) Explain XML database in detail. **[8]**

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[5925]-340

S.E. (Artificial Intelligence and Machine Learning)
COMPUTER GRAPHICS
(2019 Pattern) (Semester - IV) (218555)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a) Explain the basic transformation techniques in 3D Graphics. **[6]**

     i) Scaling

     ii) Rotation

     iii) Translation

   b) Compare homogeneous co-ordinate system and normalized co-ordinate system. **[6]**

   c) Explain vanishing points as 1 point, 2 point and 3 point. **[6]**

<p align="center">OR</p>

Q2) a) Explain with diagram parallel and perspective projection. **[6]**

   b) Explain 3D reflection about XY, YZ and XZ plane. Explain rotation about arbitrary axis in 3D transformation. **[6]**

   c) Let ABCD be a rectangle window with A(20, 20), B(90, 20), C(90, 70), D(20, 70). Find the region codes for the end points & use Cohen Sutherland line clipping algorithm to clip the following line P1P2 with P1(10, 30) and P2(80, 90). **[6]**

Q3) a) What is segment? Explain different operations on segment with example.**[6]**

   b) Explain CMY and HSV color models. **[6]**

   c) Define Color Gamut. Explain CIE Chromaticity diagram. **[5]**

<p align="center">OR</p>

Q4) a) Explain the concept of segment table and display file. **[6]**

b) Explain with diagram Phong shading algorithm in detail. **[6]**

c) Explain different types of light sources. Also explain specular reflection.**[5]**

Q5) a) Differentiate between Bezier curve and B-spline curve. **[6]**

b) Write a short note on Interpolation and approximation. **[6]**

c) What are the methods of controlling animation? **[6]**

OR

Q6) a) Explain Bezier curve. List its properties. **[6]**

b) Write short notes on: **[6]**

i) Morphing

ii) Design of animation sequence

c) What is fractal? Explain Hilbert curve in detail. **[6]**

Q7) a) What is the different usage of Virtual Reality? Explain in detail. **[6]**

b) Explain haptic feedback in Virtual Reality system. **[6]**

c) What is kinematic modeling in a Virtual Reality? **[5]**

OR

Q8) a) Explain the Graphics Rendering Pipeline. **[6]**

b) Expalin gesture interfaces in Virtual Reality. **[6]**

c) What is geometric modeling in a Virtual Reality? **[5]**

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[5925]-341

S.E. (Robotics and Automation)
STRENGTH OF MATERIALS
(2019 Pattern) (Semester - III) (211082)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Neat diagrams must be drawn wherever necessary.*
2) *Figures to the right side indicate full marks.*
3) *Use of calculator is allowed.*
4) *Assume suitable data, if necessary.*

Q1) a) A beam of an I-section shown in Fig. is simply supported over a span of 4 m. Find the uniformly distributed load the beam can carry if the bending stress is not to exceed 100 N/mm². **[8]**
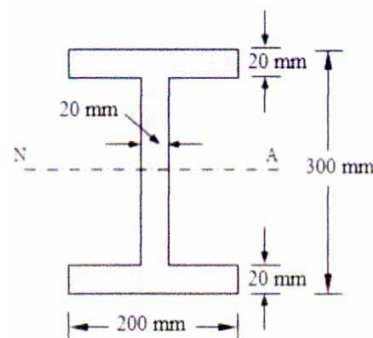
b) Derive an expression for section modulus of hollow rectangular section. **[4]**

c) A rectangular beam of size 60 mm × 100 mm has a central rectangular hole of size 15 mm × 20 mm. The beam is subjected to bending and the maximum bending stress is limited to 100 N/mm². Find the moment of resistance of the hollow beam section. **[5]**

OR

Q2) a) A rectangular beam of width 200 mm and depth 300 mm is simply supported over a span of 5 m. Find the safe uniformly distributed load that the beam can carry per meter length if the allowable bending stress in the beam is 100 N/mm². **[9]**

P.T.O.

b) An I section beam 350 × 200 mm has a web thickness of 12.5 mm and a flange thickness of 25 mm. It carries a shearing force of 200 kN at a section. Sketch the stress distribution across the section. **[8]**

Q3) a) Derive an expression for Principal Stresses in a general two-dimensional state of stress. **[8]**

b) A steel bar 4 mm in length and 40 mm × 40 mm in section is subjected to a axial pull of 150 KN. Calculate the strain energy stored in the bar and also find extension of the bar. Assume modulus of elasticity as 200 GPa. **[9]**

OR

Q4) a) Derive an expression for the maximum shear stress in a general two-dimensional state of stress and also an expression for the aspect angle of the corresponding plane. **[7]**

b) Evaluate the principal stresses and principal planes for the state of stress shown in Figure. **[10]**
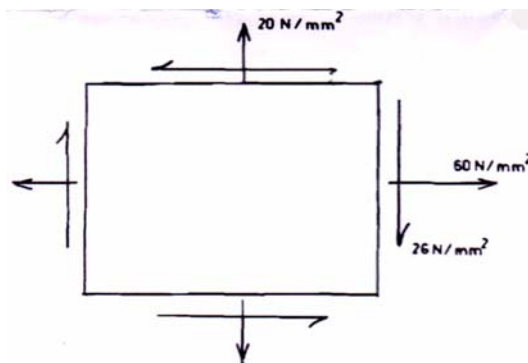
Q5) a) What must be the length of a 5mm diameter aluminium wire so that it can be twisted through 1 complete revolution without exceeding a shear of 42N/mm². Take, G = 27 GPa. **[8]**

b) A cylindrical shell 1 m long, 150 mm internal diameter having metal thickness as 7 mm is filled with fluid of atmospheric pressure. If an additional 25 cc of fluid is pumped into the cylinder, find the pressure exerted by the fluid on the cylindrical shell and the resulting hoop stress. Assume modulus of elasticity = 2 × 10⁵ MPa and Poisson ratio of 0.27. **[10]**

OR

Q6) a) A thin cylindrical vessel of 2 m diameter and 4 m length contains a particular gas at a pressure of 1.65 N/mm². If the permissible tensile stress of the material of the shell is 150 N/mm², find the minimum thickness required. **[9]**

b) A cylindrical boiler is 2 m in diameter and 15 mm in thickness carries steam at a pressure of 0.8 N/mm²: Find the stresses in the shell. **[9]**

Q7) a) Explain Macaulay's method to determine the slope and deflection of beam. **[9]**

b) A beam 6 m long, simply supported at its ends, is carrying a point load of 50 KN at its center. The moment of inertia of the beam is 78×10^6 mm⁴. If modulus of elasticity for the material of the beam = 2.1×10^5 N/mm², calculate deflection at the center of the beam and slope at the supports. **[9]**

OR

Q8) a) Derive Euler's formula for buckling load for column with hinged ends. **[9]**

b) A cantilever of length 4 m carries a uniformly distributed load over the entire length. If the deflection at the free end is 50 mm, find the slope at the free end. **[9]**

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S.E. (Robotics and Automation)
Industrial Electronics and Electrical Technology
(2019 Pattern) (211501) (Semester - III)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

1) *Solve Q.1 or Q.2,Q.3 or Q.4,Q.5 or Q.6,Q-7. or Q-.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume suitable additional data, if necessary.*
5) *Use of non-programmable calculator is allowed.*

Q1) a) Draw and explain the interfacing of Atmega 328P microcontroller with the temperature sensor (LM35). **[6]**

b) Draw and explain the interfacing diagram of Atmega 328P microcontroller to control the operation of DC motor using PWM. **[6]**

c) What is accelerometer? Explain how does it works, mention its types.**[6]**

OR

Q2) a) Explain in detail the concept of ADC in Atmega 328P based Arduino board. **[6]**

b) Draw interfacing circuit diagram of LVDT to Atmega 328P microcontroller and explain the algorithm for the interfacing. **[6]**

c) Explain the concept of PWM in detail. What is duty cycle of the signal? What will be duty cycle of pulse with period of 10m sec, which will remain on for 2 m sec. **[6]**

Q3) a) Explain with a neat sketch. the construction of a DC motor. **[6]**

b) Draw and explain following characteristics of DC motor. **[6]**

   i) Torque - Armature current characteristics (T Vs I_a)

   ii) Speed - Armature current characteristics (N Vs I_a)

   iii) Speed - Torque characteristics (N Vs T)

c) A 4 pole, 250 V, DC series motor has a wave-connected armature with 220 conductors. The flux per pole is 25 m Wb when motor is drawing 50 A from the supply. Armature resistance is 0.20 Ω while series field winding resistance is 0.25 Ω Calculate speed under this condition. **[5]**

OR

Q4) a) Explain construction and working of three-point starter along with its sketch. **[6]**

b) Explain any two methods of speed control of DC shunt motor. **[6]**

c) A 240 V, DC shunt motor takes a line current of 15 A. Resistance of shunt field winding is 150 Ω and resistance of armature is 0.3 Ω. Find the armature current and back emf. **[5]**

Q5) a) Derive the torque equation of three-phase induction motor. **[6]**

b) Sketch and explain typical torque-slip characteristics of three-phase induction motor. **[6]**

c) The power input to the rotor of 440 V, 50Hz, 6 pole, 3-phase induction motor is 60 kW. The motor electromotive force is observed to make 100 complete alterations per minute. Calculate i) Slip; ii) rotor speed; iii) rotor copper loss per phase. **[6]**

OR

Q6) a) Compare the squirrel cage and wound rotor induction motor in detail. **[6]**

b) A 400 V, 4 pole, 3 phase and 50 Hz star connected induction motor has a rotor resistance and reactance per phase equal to 0.02 Ω and 0.2 Ω respectively. Determine i) Starting torque; ii) Slip at which maximum torque will occur; iii) Speed at which maximum torque will occur; iv) Maximum torque; v) Full load slip. Assume stator to rotor tums as 4. **[6]**

c) Enlist the different speed control methods of three-phase induction motor. Explain v/f speed control method in detail with suitable diagram or characteristics. **[6]**

Q7) a) Explain construction and working of Brush less DC motor (BLDC) with neat sketch. **[6]**

b) Explain construction and working of linear induction motor (LIM) with neat sketch. **[6]**

c) Explain the construction and working of Universal motor with neat sketch. **[5]**

OR

Q8) a) Explain construction and working of stepper motor with neat sketch. **[6]**

b) Explain the construction and working of shaded pole induction motor with neat sketch. **[6]**

c) Compare ac series and dc series motor in detail. **[5]**

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[5925]-343

S.E. (Robotics & Automation)
MANUFACTURING TECHNOLOGY
(2019 Pattern) (Semester - III) (211502)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

2) *Figures to the right side indicate full marks.*

3) *Neat diagrams must be drawn wherever necessary.*

4) *Assume Suitable data if necessary.*

5) *Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*

Q1) a) Explain with neat sketch tube drawing process.   **[9]**

   b) Explain extrusion operation with its schematic diagram.   **[8]**

<div align="center">OR</div>

Q2) a) Explain various die materials and their properties for wire drawing process.   **[9]**

   b) With neat sketch, differentiate between direct and indirect extrusion process.   **[8]**

Q3) a) Explain with neat sketch Shielded Metal Arc Welding (SMAW) process?   **[9]**

   b) Explain with neat sketch Gas Tungsten Arc Welding (GTAW) with water cooled torch?   **[8]**

<div align="center">OR</div>

Q4) a) Explain the application of Alternating Current (AC), Direct Current Straight Polarity (DCSP) and Direct Current Reverse Polarity (DCRP) in Shielded Metal Arc Welding (SMAW) process.   **[9]**

   b) How the heat balance is achieved in spot welding, explain the spot welding process?   **[8]**

<div align="right">*P.T.O.*</div>

Q5) a) Explain with neat diagram construction and working of Abrasive Jet Machining (AJM) process. **[9]**

b) Draw schematic diagram of Water Jet Machining (WJM). Explain its construction and working. **[9]**

OR

Q6) a) Explain with neat sketch Electron Beam Machining (EBM) process.**[9]**

b) Explain with neat sketch Electro Chemical Machining (ECM) process. **[9]**

Q7) a) Explain the application of robot in welding process. **[9]**

b) Explain the application of robot in material handling application. **[9]**

OR

Q8) a) Explain spray painting robots and its advantages. **[9]**

b) Explain forging robots and press working robot. **[9]**

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S.E. (Robotics and Automation)
MATERIALS SCIENCE AND ENGINEERING METALLURGY
(2019 Pattern) (Semester - III) (211503)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.

2) Assume suitable data if necessary.

3) Figures to the right indicate full marks.

4) Draw neat figures whenever necessary.

5) Use of scientific calculator is allowed.

6) Use of cell phone is prohibited in the examination hall.

Q1) a) What is conditioning of metal powders? Why is it done?   **[8]**

 b) Explain Term: **[8]**

 i) Electrical Contact Materials.

 ii) Cermets.

OR

Q2) a) What is powder Metallurgy? Discuss advantage and disadvantage.**[8]**

 b) Write note on: **[8]**

 i) Diamond impregnated Cutting Tools.

 ii) Cemented carbide tipped tools.

Q3) a) Define following: **[10]**

 i) Ferrite

 ii) Austenite

 iii) Pearlite

 iv) Cementite

 v) Bainite

 b) Classify C.I.? And give its application.   **[8]**

OR

P.T.O.

Q4) a) What is steel? What do you understand by eutectoid, hypereutectoid and hypoeutectoid steel? **[10]**

b) Explain the following with neat diagram. **[8]**

i) Sensitization of steel.

ii) Eutectic transformation.

Q5) a) What is temper embrittlement? How it is avoided? **[10]**

b) Explain terms: **[8]**

i) Quenching

ii) Normalizing

OR

Q6) a) Define hardenability. How it is measured? **[9]**

b) Write note on : **[9]**

i) Carburizing.

ii) Nitriding.

iii) Carbonitriting.

Q7) a) Write note on High temperature alloy. **[9]**

b) Give composition and properties of any three bearing materials. **[9]**

OR

Q8) a) Write note on copper and its alloy. **[9]**

b) Write note on Composite Material and Nano Material. **[9]**

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[5925]-345

S.E. (Robotics and Automation)
INDUSTRIAL ENGINEERING AND MANAGEMENT
(2019 Pattern) (Semester - IV) (211508)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Describe the elements of entrepreneurial ecosystem. **[8]**

     b) Describe various funding organizations which supports an entrepreneurship. **[9]**

OR

Q2) a) Describe the support organizations which helps an entrepreneurship (start ups) **[9]**

     b) Describe the factors which motivates entrepreneurship. **[8]**

Q3) a) Describe the following tools and techniques of Industrial Engineering. **[8]**
      i) Work study
      ii) Micro motion study
      iii) Value analysis
      iv) Plant layout

     b) Define Productivity, Total and Partial Productivity. **[9]**
      The following data is available for a company. The output is Rs. 20,00,000. Calculate Partial productivity considering the input resources and total productivity.

Input Resources	Rs.
Labour	4,00,000
Material	8,00,000
Capital	5,00,000
Energy	1,00,000
Other expenses	1,50,000

OR

P.T.O.

Q4) a) Describe Taylor Piece Wage System and Merrick Piece Wage System with suitable illustration. State the advantages and limitations of these systems. **[8]**

b) Define Job evaluation and Job specification. What are the different methods of Job evaluation? **[9]**

Q5) a) Define Method study. Explain the different factors to be considered while selecting the job for method study. **[9]**

b) Describe Two Handed process chart with suitable illustration and appropriate symbols. **[9]**

OR

Q6) a) Describe String diagram and Travel chart. **[9]**

b) Describe Multiple activity chart with appropriate symbols. **[9]**

Q7) a) Describe the process to carry out work sampling study. State how the standard time is calculated using work sampling study. **[9]**

b) The following data is available for a cycle using stop watch time study. Determine **[9]**

i) Normal time for a given cycle

ii) Standard time (Assuming 15% Allowance)

Element No.	Observed time(Min)	Rating(%)
1	1.5	100
2	2	110
3	2.9	100
4	1	110
5	1.4	120
6	3.2	100
7	2	120

OR

Q8) a) Describe various steps used in time study. **[9]**

b) The following data is collected from work sampling study. **[9]**

Determine

i) Normal time

ii) Standard time (Assuming 15% Allowance)

Duration of the study (Hrs)	192
Total number of units produced during study	640
Total number of observations	3000
Number of observations of productive work	2400
Number of observations of machine controlled work	1600
Average performance rating	90
Total allowances (%)	15

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S.E. (Robotics & Automation Engineering)
CONTROL SYSTEM ENGINEERING
(2019 Pattern) (Semester - IV) (211509) (Theory)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *All questions are compulsory.*
2) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
3) *Assume suitable data, if necessary.*
4) *Use of electronic pocket calculator is allowed.*
5) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Give Properties of Root Locus. **[8]**

b) Sketch root Locus of unity feedback system with open loop transfer function $G(S) = K/S ((S+1)((S+4)$. **[9]**

OR

Q2) a) Explain Routh Hurwitz Stability Criteria. **[8]**

b) i) The system with Characteristics Equation

$Q(S) = S^3 + 2KS^2 + (K+2)S + 4 = 0$ find range of K for stability.**[5]**

ii) Investigate the stability of system with Characteristics equation

$Q(S) = S^5 + 5S^4 + 10S^3 + 10S^2 + 5S + 1 = 0$ **[4]**

Q3) a) Sketch Polar Plot with Open loop transfer function.

i) $G(S)H(S)=1 – 2S/S(1 + 2S)$ **[4]**

ii) $G(S)H(S) = 1+ 2S/(S + 1) (1 – 2S)$ **[4]**

b) Draw a typical frequency response of system and explain different frequency response specifications. **[9]**

OR

Q4) a) Derive the expression for Resonant Frequency and Resonant Peak. **[8]**

b) For the system with open loop transfer function $G(S)H(S)=5/S(S+2)$ Sketch Nyquist plot and investigate stability. **[9]**

Q5) a) Define PLC? What are the necessity of PLC? Give advantages and disadvantages of PLC. **[9]**

b) Explain the selection criteria used for PLC. **[9]**

OR

Q6) a) Explain PLC interfacing with I/O devices? What are the different types of command used in PLC. **[9]**

b) State the sampling theorem explain the process of sampling and quantization with waveform. **[9]**

Q7) a) Explain the procedure to design lead compensator using Bode diagram. **[8]**

b) Design a lead compensator for system with transfer function G(S)=25/S(S+6) to meet following specifications. **[10]**

i) m_p = 5%

ii) t_s = 0.75 sec

OR

Q8) a) Explain the procedure to design of lead compensator using root locus. **[6]**

b) Design lead compensator for the system with open loop transfer fucntion

$$G(S) = \frac{20}{S(S+5)}$$ to meet followin specification. **[12]**

i) Steady state error for ramp input to be less than or equal to 0.025.

ii) Phase Margin of at least 45°

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S.E. (Robotics and Automation)

DESIGN OF MACHINE ELEMENTS

(2019 Pattern) (211510) (Semester - IV)

Time : 2½ Hours]　　　　　　　　　　　　　　　　　　*[Max. Marks : 70*

Instructions to the candidates :

　　1)　Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.

　　2)　Use of scientific calculator is allowed.

　　3)　Figures to the right indicate full marks.

Q1) a)　Discuss the different types of threads used in power screw.　　**[6]**

　　b)　Define lead angle, major diameter, lead, and pitch in terms of power screw.　　**[4]**

　　c)　The lead screw of a lathe has Acme threads of 50 mm outside diameter and 8 mm pitch. The screw must exert an axial pressure of 2500 N in order to drive the tool carriage. The thrust is carried on a collar 110 mm outside diameter and 55 mm inside diameter and the lead screw rotates at 30 r.p.m. Determine i) the power required to drive the screw; and ii) the efficiency of the lead screw. Assume a coefficient of friction of 0.15 for the screw and 0.12 for the collar.　　**[8]**

OR

Q2) a)　A vertical two start square threaded screw of a 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing of 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of a lever which is 400 mm long in order to lift and lower the load. The coefficient of friction for the vertical screw and nut is 0.15 and that for collar bearing is 0.20.　　**[8]**

b) Define core diameter, minor diameter, left hand screw, and Multiple thread screw in terms of power screw. **[4]**

c) What is meant by power screw? Give its advantages, disadvantages and applications. **[6]**

Q3) a) What is meant by springs? Explain different types of springs. **[6]**

b) Solid length, Free length, Spring index, and Spring rate in terms of spring. **[4]**

c) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm², find the axial load which the spring can carry and the deflection per active turn. **[8]**

OR

Q4) a) Explain the Surge in Springs. **[6]**

b) Give any 2 applications of springs and any 2 material required for manufacturing of springs. **[4]**

c) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm². Also calculate the maximum shear stress induced. **[8]**

Q5) a) What is spur gear? Enlist any 2 applications of spur gear and Give its detail classification. **[9]**

b) A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4:1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20 full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. **[8]**

OR

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Q6) a) Define the terms in respective of spur gears: Module, Addendum, Pitch circle diameter, and Backlash. **[4]**

b) Discuss the Causes of Gear Tooth Failure. **[5]**

c) The following particulars of a single reduction spur gear are given: **[8]**

Gear ratio = 10:1; Distance between centres = 660 mm approximately; Pinion transmits 500 kW at 1800 r.p.m.; Involute teeth of standard proportions (addendum = m) with pressure angle of 22.5°; Permissible normal pressure between teeth = 175 N per mm of width. Find :
i) The nearest standard module if no interference is to occur;
ii) The number of teeth on each wheel;
iii) The necessary width of the pinion; and
iv) The load on the bearings of the wheels due to power transmitted.

Q7) a) What are rolling contact bearings? Discuss their advantages over sliding contact bearings. **[4]**

b) Write short note on classifications and different types of antifriction bearings. **[5]**

c) A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 kN for 20 per cent of time, 1 kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20×10^6 revolutions at 95 per cent reliability, calculate dynamic load rating of the ball bearing. **[8]**

OR

Q8) a) a) Where are the angular contact and self-aligning ball bearings used? Draw neat sketches of these bearings. **[7]**

b) How do you express the life of a bearing? What is an average or median life? **[6]**

c) Explain how the following factors influence the life of a bearing : **[4]**
i) Load ii) Speed iii) Temperature iv) Reliability.

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S.E. (Robotics & Automation)
METROLOGY AND QUALITY ASSURANCE
(2019 Pattern) (Semester - IV) (211511)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figure to the right indicates full marks.*
3) *Neat Diagram must be drawn wherever necessary.*
4) *Assume Suitable data if necessary.*
5) *Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*

Q1) a) Explain in detail primary & secondary texture. **[8]**

b) Explain concept of RMS value for surface roughness. **[9]**

OR

Q2) a) With neat sketch explain Tomlinson surface tester. **[8]**

b) Explain effective diameter measurement by three wire method. **[9]**

Q3) a) What is cost of quality? Explain its types. **[8]**

b) Explain $\bar{X}$ -Chart & P-Chart. **[9]**

OR

Q4) a) Explain Process Capability Index. **[8]**

b) The following table gives the number of missing rivets noted in a newly fabricated bus, construct c-chart and comment on process. **[9]**

Bus number	1	2	3	4	5	6	7	8	9	10
No. of missing rivets (c)	14	13	26	20	9	25	15	11	14	13

Q5) a) State Seven QC tools & explain any three with neat sketch. **[9]**

b) Write a short note on: **[9]**

    i) Quality Circle

    ii) Kaizen

    iii) Kanban

OR

Q6) a) Explain in detail TQM and its importance. **[9]**

b) Explain Juran's Trilogy with neat sketch. **[9]**

Q7) a) Explain ISO 9000 and its importance. **[9]**

b) Explain the Concept of Quality Management System (QMS). **[9]**

OR

Q8) a) What is Quality audit and explain three types of quality audit. **[9]**

b) Explain ISO 14000 & list its benefits in detail. **[9]**

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S.E. (Robotics and Automation)
COMPUTER GRAPHICS FOR ROBOTICS
(2019 Pattern) (Semester-IV) (211512)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Neat diagrams must be drawn wherever necessary.*
2) *Figures to the right indicate full marks.*
3) *Use of Calculator is allowed.*
4) *Assume suitable data, if necessary.*

Q1) a) A quaternion q_1 rotates 0° about Y axis and quaternion q_2 rotates 90° about Y axis. Obtain the interpolation quaternion at parameter $t = 0.4$. **[12]**

b) Explain the application of Inverse distance weighting method for surface generation. **[5]**

OR

Q2) a) Obtain the interpolation vector the vectors v_1= [2 0] and v_2 = [01] at $t = 0.3$. **[12]**

b) Explain the application of quaternions to obtain the combined roll, pitch and yaw motion of a robot gripper. **[5]**

Q3) a) Obtain x-y co-ordinates of a point on Bezier curve at parameter value t =0.4 considering control points as (2,5), (3,8), (5,3) and (2,15). **[12]**

b) Explain the applications of B spline and Bezier curves in robot path planning. **[5]**

OR

Q4) a) Obtain x,y, and z co-ordinate of point on the quadratic Bazier surface patch at u=0.5 and v=0.5 using following control points: **[10]**

$p_{\omega} = (0.0.0)$ $p_{01} = (1.1.0)$ $p_{02} = (2.0.0)$

$p_{10} = (0.1.1)$ $p_{11} = (1.2.1)$ $p_{12} = (2.1.1)$

$p_{30} = (0.0.2)$ $p_{21} = (1.1.2)$ $p_{22} = (2.0.2)$

b) What are B-spling curves? How the geometric continuity is determined for B spline curves? **[7]**

Q5) a) A plane contains vectors $a = i - j + 3k$ and $= i - 2k$. A point in the plane is (1, 3, 2). Obtain the equation of plane. **[10]**

b) Determine the point of intersection of two lines AB and CD having co-ordinates of point A(3, 1, 2), point B (4, 4, 6), point C(2, 1, 5) and point D(3.857, 2.285, 2.428). Consider parameter *t* for line AB as 0.7 and parameter *s* for line CD as 0.3. **[8]**

OR

Q6) a) Obtain the equation of the plane inclined to Y axis ad Z axis by 45°. It is parallel to X axis and contains a point (0, 0, 1). **[10]**

b) Write note on: Application of analytic geometry in robotics **[8]**

Q7) a) Demonstrate with example, the outer product of 2 Vectors in 3 dimensional space. **[9]**

b) Explain the applicaitons of applied geometric algebra for modelling of robotics physics. **[9]**

OR

Q8) a) Show that the multiplication of basis blades e_3 and e_{13} is $-e_1$ **[9]**

b) Write short note on: Reflection and rotation. **[9]**

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[5925]-350

S.E. (Mechanical /Automobile)
APPLIED THERMODYNAMICS
(2019 Pattern) (Semester - IV) (202048)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn whenever necessary.*
4) *Make suitable assumption whenever necessary.*
5) *Scientific calculator is allowed.*

Q1) a) Draw neat sketch and explain any three types of fuel injector nozzles used in CI engine. **[8]**

b) Draw neat sketches of any three types combustion chambers used in SI engines. **[9]**

OR

Q2) a) What is ignition delay in CI engines? Explain any three factors affecting the ignition delay. **[8]**

b) Explain with sketch the phenomenon of detonation in SI engine. State any two factors affecting flame speed. **[9]**

Q3) a) Explain Heat balance sheet with its different component. **[9]**

b) A single cylinder 4 - stroke engine gave the following results while running on full load : Area of indicator card = 300 mm²; Length of diagram = 45 mm, Spring constant = 1.5 bar/mm; Speed of the engine = 400 rpm; Load on the brake = 370 N; Spring balance reading = 55 N; Diameter of brake drum = 1.2 m; Fuel consumption = 2.8 kg/h; Calorific value of fuel = 41800 kJ/kg; Diameter of cylinder = 160 mm; Stroke of piston = 200 mm. Calculate: **[9]**

i) Brake power.

ii) Indicated mean effective pressure.

iii) Brake specific fuel consumption.

iv) Brake thermal efficiency.

OR

Q4) a)   What is mean by Dynamometer? Explain working of any one type of Dynamometer with the help of neat sketch.   **[9]**

   b)   During a test on a single cylinder, four stroke engine having a compression ratio of 8, following data were recorded: Bore = 12 cm; Stroke = 14.5 cm; Indicated mean effective pressure = 2.5 bar; Dead load on dynamometer, W = 60 N; Spring balance readings, S = 19 N; Effective radius of the flywheel, R = 40 cm; Fuel consumption, mf = 1.0 kg/hr., Calorific value of the fuel used, C = 42000 kJ/kg; Speed, N = 2500 rpm. Determine its indicated power, brake power, mechanical efficiency, air standard efficiency.   **[9]**

Q5) a)   Enumerate the various components of IC engine to be lubricated. Explain with neat sketch any one type of lubrication system.   **[8]**

   b)   Explain the need of lubrication of Engine in Automobiles. List down the different Engine components lubricated in the Automobiles.   **[9]**

OR

Q6) a)   Draw neat, labelled sketch of battery ignition system. List down various parts of battery ignition systems.   **[8]**

   b)   Enumerate the various alternative fuels for IC engines. What are the advantages and disadvantages of LPG as alternative fuel in engine?   **[9]**

Q7) a)   What are the advantages of multi-staging in reciprocating air compressor?**[6]**

   b)   Compare rotary compressor with reciprocating compressor. A single stage reciprocating compressor takes 1 m³ of air per minute at 1.013 bar at 15°C and delivers it at 7 bar according to law PV$^{1.35}$ = constant, and clearance is negligible.   **[6]**

   c)   Calculate: **[6]**
      i)   Mass of the air delivered per minute
      ii)   Delivery temperature
      iii) Indicated power
      Take individual gas constant R = 287 J/kgK

OR

Q8) a)   Explain with neat sketch multi-stage reciprocating air compressor.   **[6]**

   b)   Explain roots blower compressor with neat sketch.   **[6]**

   c)   A single stage single acting reciprocating air compressor has entering at 1 bar, 20°C and compression occurs following polytropic with index 1.2 up to the delivery pressure of 12 bar. The compressor runs at the speed 240 rpm and has L/D ratio of 1.8 the compressor has mechanical efficiency of 0.88. Determine the isothermal efficiency and cylinder dimesions. Also find out the rating of drive required to run the compressor which admits 1m³ of air per minute.   **[6]**

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S.E. (Automobile & Mechanical Engg.)
FLUID MECHANICS
(2019 Pattern) (Semester - IV) (202049)

Time : 2½ Hours]   [*Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*
5) *Use of electronic pocket calculator is allowed.*

Q1) a)   Define following terms :   **[4]**

   i)   Path line   ii)   Stream line

   iii) Streak line   iv)   Stream tube

b)   Distinguish between :   **[6]**

   i)   Uniform & Non uniform flow

   ii)   Steady & Unsteady flow

   iii) Rotational & Irrotational flow

c)   The velocity potential function is given by $\phi = (x^2 - y^2)$ find the velocity vector for the given fluid flow. Also show that ϕ represents possible case of flow.   **[7]**

<div align="center">OR</div>

Q2) a)   Explain following properties with their mathematical properties : **[4]**

   i)   Velocity potential

   ii)   Stream function

b)   Derive continuity equation for 1D flow along streamline.   **[6]**

c)   The velocity vector in the fluid flow is given by $V = 2x^3\hat{i} - 5x^2y\hat{j} + 2t\hat{k}$. Obtain velocity & acceleration at point (2, 1, 0) at time $t = 1$s.   **[7]**

<div align="right">*P.T.O.*</div>

Q3) a) Differentiate between venturimeter & orificemeter. **[4]**

b) State & Derive Bernoulli's equation along streamline. **[6]**

c) An oil of specific gravity 0.9 & viscosity 10 poise is flowing through a pipe of diameter 110mm. The velocity at the center of pipe is 2m/s find : **[8]**

   i) The pressure gradient in the direction of flow.

   ii) Shear stress at the pipe wall

   iii) Velocity at a distance 30mm from pipe wall

OR

Q4) a) Show that the value of coefficient of friction for viscous flow through the circular pipe is given by $f = 16/Re$. **[4]**

b) Derive an expression of velocity & shear stress distribution for laminar flow through pipe. **[6]**

c) A conical tube of length 3m is fixed vertically with its smaller end upwards. The velocity of flow at smaller end is 4m/s; while at its lower end is 2m/s. The pressure head at the smaller end is 2m of liquid. The loss of head through the pipe is 0.95 $(v_1-v_2)^2/2g$ where v_1 velocity at smaller end & v_2 velocity at lower end. Determine the pressure head at the lower end. Flow takes place in downward direction. **[8]**

Q5) a) Explain the following term with their graphical representation : **[4]**

   i) Hydraulic Grade line

   ii) Total Energy line

b) What is siphon? Explain its working along with the diagram? **[6]**

c) Find the displacement thickness, the momentum thickness for the velocity distribution in the boundary layer is given by

$$\frac{u}{v} = 2\left(\frac{y}{\delta}\right)\cdot\left(\frac{y}{\delta}\right)^2.$$ **[8]**

OR

Q6) a) Define the following term with brief explanations : **[4]**

   i) Boundary layer

   ii) Boundary layer thickness

   iii) Drag

   iv) Lift

b) What do you mean by Boundary layer separation? Write the methods of preventing the separation of boundary layer. **[6]**

c) A pipe of diameter of 0.4m and length 2000 m is connected to a reservoir at one end. The other end of the pipe is connected to a junction from which two pipes of lengths 1000m and diameter 3000m are parallel. These parallel pipes are connected to another reservoir, which is having level of water 10m below the water level of the above reservoir. Determine the total discharge if $f = 0.015$. Neglect minor losses. **[8]**

Q7) a) State and explain Buckingham's π-theorem. What do you mean by repeating variables? How are repeating variables selected in Dimensional Analysis? **[8]**

b) The Frictional Torque of disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by

$$T = D^5 N^2 \rho \phi \left[\frac{\mu}{D^2 N \rho} \right].$$ **[9]**

OR

Q8) a) Explain the following Dimensionless number along with mathematical expressions : **[8]**

i) Reynolds Number

ii) Froude's Number

iii) Euler's Number

iv) Weber Number

b) A Fluid of density ρ_1 and viscosity μ, flows at a velocity v through a circular pipe of diameter D. By using Buckingham's π-theorem. Prove

that shear stress τ_0 at wall is given by $\tau_0 = \rho v^2 \phi \left[\frac{\rho v D}{\mu} \right]$. **[9]**

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[5925]-354

S.E. (Mechanical Sandwich)
FLUID MECHANICS AND MACHINERY
(2019 Pattern) (Semester - IV) (202062)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Use of logarithmic tables, slide rule, and electronic pocket calculator is allowed.*
4) *Figures to the right indicate full marks.*
5) *Assume suitable data, if necessary.*

Q1) a) Explain major and minor losses in the pipe with fig and formulae in detail (with fig and formulae). **[8]**

b) Explain Pipes in series, Pipes in parallel and concept of Equivalent Pipe with fig and equations. **[8]**

OR

Q2) a) Derive an expression of velocity and Shear stress distribution for laminar flow between fixed Parallel plates. **[8]**

b) The pressure drop Δp in a pipe of diameter D and length *l* depends on the density ρ, viscosity μ of the fluid flowing, mean velocity V of flow and average height of protuberance t, show that the pressure drop can be expressed in the form: **[8]**

$$\Delta p = \rho V^2 f\left(\frac{L}{D}, \frac{\mu}{\rho VD}, \frac{t}{D}\right)$$

Q3) a) A jet of water of diameter 60 mm strikes a curved plate at its centre with a velocity of 18 m/s. The curve plate is moving with velocity of 6 m/s in the direction of jet. The jet is deflected through an angle of 165 degree : find (i) the force exerted by the jet on the plate, (ii) work done by the jet on the plate per second, (iii) power of the jet, and (iv) efficiency of the jet. **[10]**

   b) Prove that the condition for maximum efficiency (V = 3u) for a jet of water strikes at centre of a curved vane also finds an expression for maximum efficiency. **[8]**

OR

Q4) a) A Pelton wheel has 2.5m of diameter operates under a following conditions

   Net Head = 300m

   Speed 300rpm

   Jet deflection angle = 165°

   Cv = 0.98, Jet Diameter = 0.2 m

   Relative velocity at outlet = 0.9 times relative velocity at inlet. Mechanical efficiency = 95%. Calculate the power delivered by the runner, speed ratio , Hydraulic Efficiency, Overall efficiency and, Draw velocity triangle. **[10]**

   b) Define Gross Head, Net Head, Jet Ratio, Run Away Speed, volumetric efficiency, Hydraulic Efficiency, Mechanical Efficiency ,and Overall Efficiency related to Pelton wheel. **[8]**

Q5) a) Explain unit quantities in reaction turbine. **[6]**

   b) Explain Francis Turbine with fig.(construction and working principle) **[8]**

   c) Draw Velocity Triangles of Francis Turbine. **[4]**

OR

Q6) a) A Kaplan turbine develops 24647.7 kW power at an average head of 39 meters. Assuming speed ratio of 2, flow ratio of 0.6, diameter of boss is equal to 0.35 times the diameter of runner and overall efficiency of 90 %. Calculate diameter, speed and specific speed of the turbine. **[8]**

b) Write difference between Impulse turbine and Reaction turbine. **[5]**

c) Explain details classification of Hydraulic turbines. **[5]**

Q7) a) A centrifugal pump is to discharge 0.118 m³/s at a speed of 1450 r.p.m against a head of 25 m. The diameter and width of the impeller at outlet are 250 mm and 50 mm respectively. If the manometric efficiency is 75%. Determine the vane angle at the outlet. **[8]**

b) Define the following terms. **[5]**

    i) Suction head

    ii) Delivery head

    iii) Static head

    iv) Virtual head

    v) Manometric head

c) Explain cavitation and NPSH in pump **[5]**

OR

Q8) a) The internal and external diameter of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are 20 and 30 respectively. The water enters the impeller radially and velocity of flow is constant. Determine the flow velocity and work done by the impeller per unit weight of water. **[6]**

b) Explain working principle of centrifugal pump with figure. **[7]**

c) What is Priming? Explain methods of priming in pump. **[5]**

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SEAT No. :

[**Total No. of Pages : 3**

[5925]-355

S.E. (Mechanical-Sandwich)

MANUFACTURING ENGINEERING

(2019 Pattern) (Semester - IV) (202063)

Time : 2½ Hours]
[Max. Marks : 70

Instructions to the candidates:

    1)   *Neat diagrams must be drawn wherever necessary.*

    2)   *Figures to the right indicate full marks.*

    3)   *Assume suitable data if necessary and mention it clearly.*

    4)   *All questions are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

Q1) a)   Compare TIG with MIG welding processes.   **[5]**

    b)   Demonstrate the principle of Spot Welding process in brief. How 'Heat Balance' to be obtained in resistance welding? Explain.   **[6]**

    c)   Describe the principle of oxy-fuel gas cutting. Explain how gas cutting torch is different than welding torch?   **[6]**

OR

Q2) a)   Illustrate with neat sketches common types of welded joints. Also discuss various welding positions.   **[5]**

    b)   Explain GTAW (Gas Tungsten Arc Welding) process with neat sketch.   **[6]**

    c)   Demonstrate the different types of flames used in oxyacetylene welding. Give application of each flame.   **[6]**

Q3) a)   Explain the geometry of a single point cutting tool with suitable sketches.   **[6]**

    b)   Explain cutting speed and feed rate. Find the time required for machining a work-piece of 50 mm diameter, 350 mm length, turn all over in 4 passes. Approach length is 2 mm, Over-travel = 2 mm, the feed = 0.5 mm/rev and cutting speed is 50 m/min.   **[6]**

    c)   State Taylors' Tool life equation. Enlist the factors affecting tool life.**[6]**

OR

Q4) a) Demonstrate the various types of chips formed during metal cutting.**[6]**

b) The following equation for tool life is given for a turning operation $vT^{0.13}$ $f^{0.77}d^{0.37} = C$, A 60 min tool life was obtained while cutting at $v = 30$ m/min, $f = 0.30$ mm/rev, and $d = 2.5$ mm. Calculate the change in tool life if the cutting speed, feed and depth of cut are increased by 25% together.
[6]

c) Explain any six operations performed on lathe machine with neat sketch.
[6]

Q5) a) Compare drilling and reaming operations. A hole of 30 mm diameter and 75 mm depth is to be drilled. The suggested feed is 1.3 mm/rev and cutting speed is 62 m/min. Assuming tool approach and tool over travel of 6mm, calculate : **[5]**

 i) Spindle RPM and

 ii) Cutting time

b) Explain following Milling operations with suitable sketch : **[6]**

 i) Plain Milling

 ii) Straddle Milling

 iii) Gang Milling

c) Compare Up milling and Down milling operations with sketch. **[6]**

OR

Q6) a) Differentiate between Gang drilling and Multi-spindle drilling machines.
[5]

b) Construct a Radial Drilling Machine and Explain. Show various motions of tool head. **[6]**

c) Index for 51 divisions by compound indexing using following Brown and Sharpe Plate. **[6]**

 Plate 1 - 15, 16, 17, 18, 19, 20 holes

 Plate 2 - 21, 23, 27, 29, 31, 33 holes

 Plate 3 - 37, 39, 41, 43, 47, 49 holes

Q7) a) Explain the Standard Marking System of a grinding wheels. **[6]**

b) Explain the Principle of centreless grinding with neat sketch. What kind of jobs can be machined with centreless grinding? **[6]**

c) Classify broaching machines. Discuss advantages and disadvantages of broaching. **[6]**

OR

Q8) a) Explain the following in relation to grinding wheel **[6]**

i) Loading

ii) Glazing

iii) Dressing

b) Draw a neat sketch of broach and name its different parts. **[6]**

c) Write a note on Honing process. **[6]**

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[5925]-356

S.E. (Mechanical (Sandwich))
THERMAL ENGINEERING
(2019 Pattern) (Semester - IV) (202061)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Solve Q.1 Or Q.2, Q3. Or Q.4, Q.5 or Q.6, Q.7 or Q.8*

    2)   *Figures to the right indicates full marks.*

    3)   *Draw the neat sketches wherever necessary.*

    4)   *Use of Psychrometric chart is permitted.*

    5)   *Use of non-Programable calculator are allowed.*

    6)   *Assume suitable data if necessary.*

Q1) a) Define the following terms: **[8]**

    i)   absolute humidity

    ii)   Relative humidity

    iii)   Dry bulb temperature

    iv)   Wet bulb temperature

    b) Explain with neat sketch on psychrometric chart, the following processes: Sensible heating, Sensible Cooling, humidification, dehumidification.**[9]**

<div align="center">OR</div>

Q2) a) What are the factors affecting the comfort air conditioning? **[8]**

    b) How the air conditioning systems are classified and explain the winter air conditioning system with neat sketch. **[9]**

Q3) a) Explain Otto cycle & derive the expression for thermal efficiency of Otto cycle? **[9]**

    b) Explain gas turbine cycle.with reheating and derive expression for net workdone. **[9]**

<div align="center">OR</div>

Q4) a) A four stroke, four-cylinder petrol engine of 250 mm bore and 375 mm stroke works on otto cycle. The clearance volume is 0.01052 m³. The initial pressure and temperature are 1 bar and 47°C. if the maximum pressure is limited to 25 bar, find the following **[9]**

    i) The air standard efficiency of the cycle,

    ii) The mean effective pressure

    b) Compare Gas turbine and IC engine. **[9]**

Q5) a) What is difference between the naturally aspirated or conventional engine and supercharged engine. **[8]**

    b) Explain with neat sketch battery ignition system. **[9]**

OR

Q6) a) Explain liquid cooling system of engine and what are its advantages and disadvantages? **[8]**

    b) What is necessity of lubrication system and what are different types Lubrication systems and explain anyone of them? **[9]**

Q7) a) What is catalytic converter? explain its working with neat sketch. **[8]**

    b) An IC engine uses 6kg of fuel having calorific value 44000 KJ/kg in one hour. The IP developed is 18KW. The Temperature of 11.5 kg of cooling water was found to rise through 25°C per minute. The temperature of 4.2 kg of exhaust gas with specific heat 1 KJ/kg K was found to rise through 220°C. Draw the heat balance sheet for the engine. **[10]**

OR

Q8) a) What are Sources of Pollutants from SI engine? **[9]**

    b) Explain stages of combustion in SI engine with P-θ diagram. **[9]**

PSYCHROMETRIC CHART
NORMAL TEMPERATURE
SI Units
SEA LEVEL
BAROMETRIC PRESSURE: 101.325 kPa

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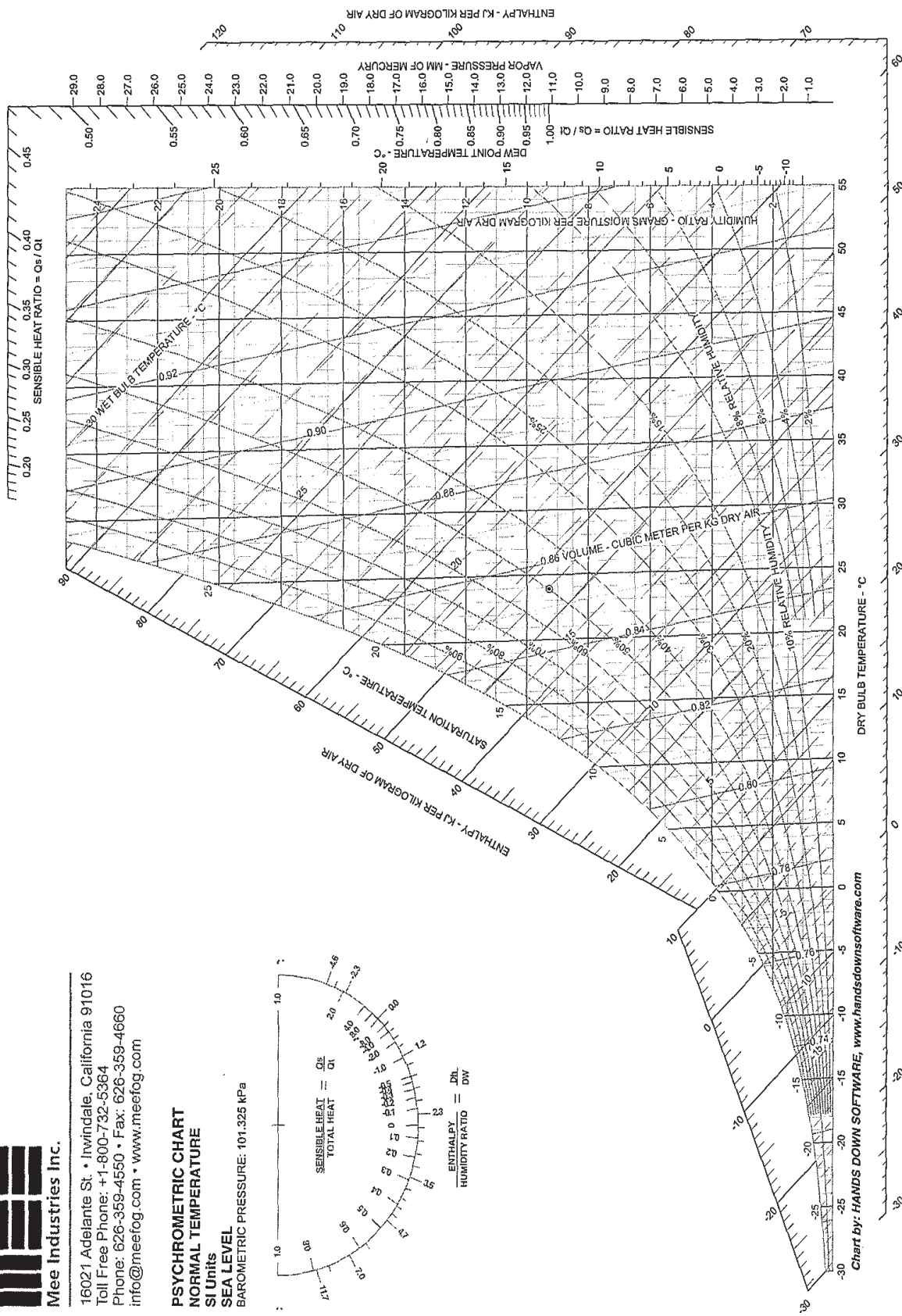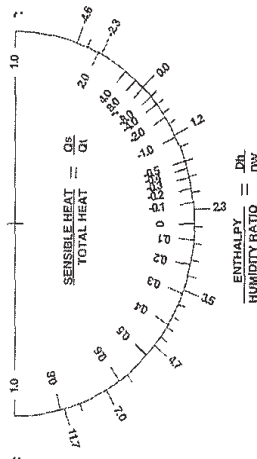
[5925]-357

S.E. (Computer Science & Design Engg.)

DATA STRUCTURE AND ALGORITHMS

(Theory) (2019 Pattern) (218242) (Semester - III)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) End sem Exam based on 3, 4, 5,6 units.

2) Draw neat and clean diagram.

3) Assume suitable data if necessary.

4) Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.

Q1) a) Define following terms with example (i) Internal sorting (ii) External sorting (iii) Sort stability. **[5]**

b) Write pseudo code C/C++ for bubble sort technique. Show it's working pass by pass for arranging numbers in ascending order. Given number list :10,4,55,21,6. **[6]**

c) Explain C/C++ pseudo code of linear search with suitable example. Analyze it's time complexity. **[6]**

OR

Q2) a) Write C/C++ pseudo code for radix sort method with suitable example.**[5]**

b) Explain C/C++ pseudo code of quick sort using recursive method. Sort following data using quick sort. Consider last element as a pivot and show partition at each step. List the data after every pass. : 10,80,30,90,40,50,70. **[6]**

c) What is divide and conquer algorithmic strategy?. Explain it's application in binary search. Consider following data to search element 100 using binary search method. Show all necessary steps during searching.9,17,23,38,45,50,57,76,79,90,100. **[6]**

P.T.O.

Q3) a) Write C/C++ function to reverse a linear singly linked list by changing link pointers. Assume that linked list contains numbers. **[7]**

b) What is doubly linked list with example? Write a C/C++ function to delete a node from DLL at the following position. (i) at the beginning (ii) at the end. **[7]**

c) Compare linear and circular linked list. **[4]**

OR

Q4) a) Write a C/C++ pseudo code for inserting node(i) at start and (ii)at end in SLL. **[7]**

b) What is CLL explain with suitable example? List the applications of CLL and write it's advantages over linear linked list. **[7]**

c) Compare sequential and linked memory organization. **[4]**

Q5) a) List the applications of STACK? Explain STACK as an ADT. **[4]**

b) What is recursion? Write a recursive function to compute factorial of a number num = 4 simulate the working of this function using stack. **[6]**

c) Write an algorithm to convert infix expression to postfix expression and solve the example A*(B+C)/D-G. **[7]**

Clearly indicate the contents of stack.

OR

Q6) a) Explain the concept multistack with a suitable example. **[4]**

b) Write pseudo code in C/C++ to implement the stack using array to perform the following primitive operations. **[6]**

(i) Push (ii) Pop (iii) Stack empty (iv) Stack full

c) Evaluate the following postfix expression and show stack after every steps in tabular form. A=5,B=6,C=2,D=12,E=4 ABC+*DE /- **[7]**

Q7 a) What are the disadvantages of linear queue? Discuss how they can overcome. **[4]**

b) Define following with example **[6]**

(i) circular queue (ii) multi-queue (iii) dequeue

c) Explain circular queue using an array and write a pseudo code for enqueue, dequeue and display operations. **[8]**

<div align="center">OR</div>

Q8) a) Explain how queue can be used in Job scheduling? **[4]**

b) What is double ended queue? Why do we need dequeue? Give an ADT for dequeue. **[6]**

c) How to perform insert and delete operation on priority queue explain with pseudo code for each operation. **[8]**

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[5925]-358

S.E. (Computer Science & Design Engineering)
LOGIC DESIGN AND COMPUTER ARCHITECTURE
(2019 Pattern) (218245) (Semester - III)

Time : 2½ Hours]
[Max. Marks : 70

Instructions to the candidates :

1) *Total number of questions are 8.*
2) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
3) *Assume suitable data, if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Develop SR Flip flop using NAND gate. Draw its truth table. Illustrate what will happen in SR flip flop if S=R=0 with example. **[6]**

b) Build 3 bit synchronous counter using T flip flop. **[6]**

c) Write short note on Sequential and combinational circuit. **[4]**

d) Write short note on Asynchronous Counter. **[2]**

OR

Q2) a) Build D flip flop from JK flip flop using knowledge of flip flop conversion logic. **[6]**

b) Construct MOD 99 ripple counter using 7490 IC. **[5]**

c) State and explain different types of Shift register. **[4]**

d) What is the difference between latch and flip flop? **[3]**

Q3) a) What a neat diagram of computer architecture explain the components involved in modern computer architecture. **[6]**

b) Explain the pipelining process in VLIW processors. **[5]**

c) Write short note on Von Neumann architecture. **[3]**

d) Define Micro-operation. Specify how internal hardware organization of a digital computer is best defined? **[3]**

OR

Q4) a) How does instruction set, compiler technology, CPU implementation and control and cache and memory hierarchy affect the CPU performance and justify the effects in terms of program length, clock rate and effective CPI? **[6]**

b) What is Bus? Draw the single bus structure. **[5]**

c) What are the five classic components of a computer? **[4]**

d) Show the representation of registers in block diagram form. **[2]**

Q5) a) State and Explain types of operands Addressing modes **[6]**

b) Explain Features of multicore Intel core 17 **[5]**

c) What is the use of PC register? **[4]**

d) What are the two state elements needed to store and access an instruction? **[3]**

OR

Q6) a) State characteristics of RISC & CISC. **[6]**

b) Define Interrupt, explain its types. **[5]**

c) Explain advantages of Multicore. **[4]**

d) Write the instruction format for the jump instruction. **[3]**

Q7) a) Draw and explain the structure of memory hierarchy. **[6]**

b) State and explain Characteristics of Memory Systems. **[5]**

c) Differentiate SRAM From DRAM. **[4]**

d) What are the various memory technologies? **[2]**

OR

Q8) a) Explain how read and write operation are carried out in cache memory. **[6]**

b) Explain different mapping functions of Cache memory. **[5]**

c) What are the steps to be taken in an instruction cache miss? **[4]**

d) Write short note on cache memory? **[2]**

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[5925]-360

S.E. (Automation & Robotics Enginnering)
ELECTRICAL TECHNOLOGY
(2019 Pattern) (Semester - III) (202521)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

1) *Solve Q1. or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume suitable additional data, if necessary.*
5) *Use of non-programmable calculator is allowed.*

Q1) a) Distinguish between squirrel cage and slip ring induction motors. **[6]**

b) Explain construction and working principle of a shaded pole motor with neat sketches. **[6]**

c) Draw a neat schematic of star-delta starter for three phase induction motor and explain its operation. **[6]**

OR

Q2) a) Sketch a typical torque-slip characteristic of a three-phase induction motor. Explain its nature. What is the effect of increasing the rotor resistance on this characteristic? **[6]**

b) Draw and explain the equivalent circuit of a three-phase induction motor.**[6]**

c) Write any one application each in case of following motors. **[6]**

     i) Linear induction motor

     ii) Slip ring induction motor

     iii) PMSIM

     iv) Shaded pole motor

     v) Squirrel cage induction motor

     vi) Capacitor spilt phase motor

Q3) a) Derive an expression for induced emf in an alternator. **[6]**

b) Explain working principle of Universal Motor. State its any two applications. **[6]**

c) Write the steps in selecting a particular motor for an industrial application. **[5]**

OR

Q4) a) Explain the construction of an alternator in details with the help of suitable diagrams. **[6]**

b) What is a stepper motor? Explain construction and working of any one type of stepper motors. **[6]**

c) What is a duty cycle in case of electric motors? State types of duty cycles for electric motors. **[5]**

Q5) a) Explain the typical Electric Supply System with the help of neat diagram.**[6]**

b) Compare the DC and AC transmission systems. **[6]**

c) Draw the line diagram of typical HVDC transmission system and explain its operation in details. **[6]**

OR

Q6) a) Explain the significance of widespread presence of EHV transmission lines in power systems. **[6]**

b) Write the advantages of HVDC transmission system over AC transmission system. **[6]**

c) Classify the types of HVDC links. Discuss the applications of each of these links. **[6]**

Q7) a) Using the block diagram reduction technique, determine the transfer function C(s)/R(s) **[6]**
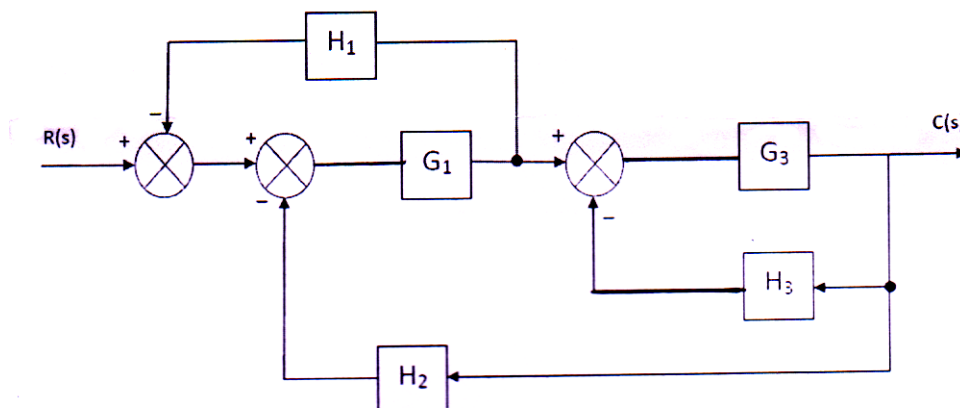
Fig. Q. 7 a)

b) Write a short note on stepper motor used as an actuator in control systems. **[6]**

c) Distinguish between open loop and closed loop control system with significant points. **[5]**

<div align="center">OR</div>

Q8) a) Using Mason's gain formula, determine the transfer function C(s)/R(s).**[6]**
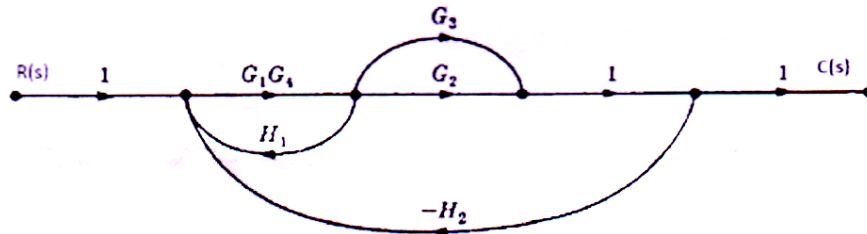
Fig. Q. 8 a)

b) Derive the transfer function of an armature controlled DC servomotor with usual notations. **[6]**

c) Represent the following mechanical system by node representation method and hence write the node equations. **[5]**

Fig. Q. 8 c)

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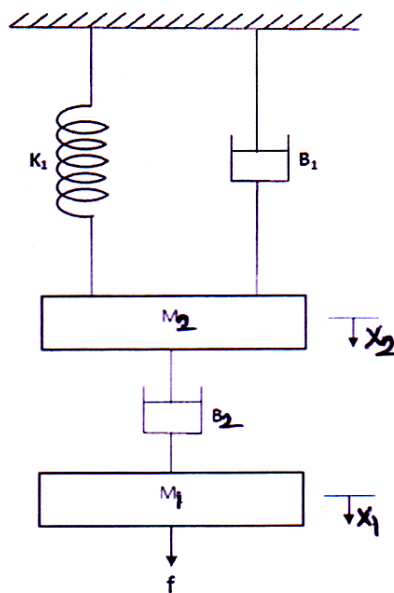
[5925]-360 3

[5925]-365

S.E. (Automation & Robotics Engineering)
INDUSTRIAL ELECTRONICS
(2019 Pattern) (202522) (Semester - III)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

   1)   *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*

   2)   *Figures to the right indicate full marks.*

   3)   *Neat diagrams must be drawn wherever necessary.*

   4)   *Assume suitable additional data, if necessary.*

   5)   *Use of non-programmable calculator is allowed.*

Q1) a)   State the types of programming languages and explain any two.   **[6]**

      b)   Explain UP Counter and DOWN Counter.   **[6]**

      e)   Draw a ladder diagram for stepper motor control.   **[6]**

<div align="center">OR</div>

Q2) a)   Explain ladder logic programming with symbols of PLC.   **[6]**

      b)   State the types of timers. Explain on delay timer operation with diagram.**[6]**

      c)   Draw the ladder diagram to verify the truth table of: i) AND gate ii) OR gate iii) NOT Gate.   **[6]**

Q3) a)   List out the Communication Protocols used in PLC.   **[6]**

      b)   Differentiate between SCADA and HMI.   **[6]**

      c)   What are the functions of HMI.   **[5]**

<div align="center">OR</div>

Q4) a) Explain the types of HMI? **[6]**

b) Explain with neat diagram hierarchical level in Industrial Communication Networks. **[6]**

c) Explain the advantages of HMI. **[5]**

Q5) a) Explain the process model for process of production of polyvinyl chloride by the polymerization of vinyl chloride monomer. **[6]**

b) Develop PLC Programming Batch Process ladder logic program according to logic given below, **[6]**

i) Ingredient A is sent to the tank first by energizing solenoid 1. The flow meter gives one pulse for every gallon of flow. Solenoid Valve will be open until 200 gal has poured in.

ii) After ingredient A is in the tank, 200 gal of ingredient B should be added. The process of adding follows the same procedure as ingredient A.

iii) Once step 2 is done, the mixer motor starts and runs for 10s.

iv) After mixing is complete, solenoid 3 should open, let the mixed batch goes to the finished tank.

iv) When the tank is empty, the low-level sensor turns ON to open solenoid 3 to close and restarts the process again.

c) What is Extrusion? Explain in detail types of extrusion? **[6]**

OR

Q6) a) Define recipe as per ANSI/ISA S88 standard. Explain its types. **[6]**

b) Develop ladder logic program for Multiple Pumps Control according to the logic given below:

i) The start/stop push button is provided for control of the two input pump motors P1 and P2.

ii) The Start/Stop pushbutton station is operated to control pump P1.

iii) When the tank is full drain pump motor P3 is started automatically and runs until the low-level sensor is actuated.

iv) After 3 fillings of the tank by pump P1 control automatically shifts to pump P2.

v) The operation of the start/stop pushbutton now controls pump P2.

vi) After 3 fillings of the tank by pump P2, the sequence is repeated.

c) Describe the three types of control typically needed in batch manufacturing. **[6]**

Q7) a) Compare CMOS and TTL logic family. **[6]**

b) Define the following terms: **[6]**

   i) Power Dissipation

   ii) Propagation delay

   iii) Noise Margin

c) Explain with a neat diagram CMOS NOR gate. **[5]**

OR

Q8) a) Explain the concept of Tristate logic. **[6]**

b) What is logic family? Give comparisons between TTL, ECL and CMOS logic families. **[6]**

c) Explain with a neat diagram CMOS inverter. **[5]**

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[5925]-501

S.E. (Chemical) (Semester - II)
MECHANICAL OPERATIONS
(2015 Pattern) (209351)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Attempt Q.No. 1 or 2, Q.No. 3 or Q4, Q.No. 5 or Q6.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*

Q1) a) Write an explanatory note on   **[12]**

   i)   Sigma mixer

   ii) Pony mixer

   b) Explain in detail impellers used in mixing.   **[5]**

OR

Q2) a) What are various types of Mixers used for paste and plastic materials?
       Explain any two in berief.   **[7]**

   b) With the help of neat sketch distinguish between radial flow and axial
       flow for impellers.   **[10]**

Q3) a) Explain in detail the plate and frame filter.   **[8]**

   b) A rotary filter operating at 2rpm, filters 1000 lit/min operating under the
       same vacuum neglecting the resistance of the filter cloth, at what speed
       must the filter be operated to give a filtration rate of 2000 lit/min.   **[8]**

OR

Q4) a) Enlist the different type of centrifugal filters. Explain any one in detail.**[8]**

   b) For filtration at const pressure difference, derive the relation between
       $(t-t_1)/(v-v_1)$ & $(v-v_1)$, where $(t-t_1)$ represents the time of the constant
       pressure filtration and $(v-v_1)$ the corresponding volume of filtrate
       obtained.   **[8]**

Q5) a) Describe in detail elements of belt conveyor, What are the merits and application of belt conveyors. **[9]**

b) Write a note on screw conveyor. **[8]**

OR

Q6) Write note on. **[17]**

a) Pneumatic conveyor

b) Bucket elevator

c) Belt conveyor.

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[5925]-502A

S.E. (Chemical)
CHEMISTRY - II
(2015 Pattern) (Semester - II) (209347)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates :

    1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.

    2) Neat diagrams must be drawn wherever necessary.

    3) Figures to the right indicate full marks.

    4) Assume suitable data, if necessary.

Q1) a)   What are enzymes? How do they function?   **[6]**

    b)   Define the following terms with example :   **[6]**

        i)   Coordination no

        ii)   Ligand

        iii) Complex ions

OR

Q2) a)   What happen when glucose is treated with the following :   **[6]**

        i)   Sodium borohydride

        ii)   Phenyl hydrazine

        iii) Bromine Water

    b)   Explain the non-existence of low spin tetrahedral complex using CFT.**[6]**

Q3) a)   What is an adsorption isotherm? Explain the Freundlich isotherm.   **[5]**

    b)   What is a redox titration? Explain direct titration with any one example.**[4]**

    c)   Give the important properties of zeolites.   **[4]**

OR

Q4) a)   What is an adsorption isotherm? Explain the Langmuir isotherm.   **[5]**

    b)   Explain mechanism of catalysis reaction involving formation of activated complex.   **[4]**

    c)   Explain the way to calculate pH after equivalence point for weak acid-strong base.   **[4]**

P.T.O.

Q5) a) What is conformational isomerism? Give different conformation of butane. **[6]**

b) Which are the conditions and characteristic of geometrical isomers to occur by giving suitable example. **[6]**

OR

Q6) a) Discuss the E-Z system of naming geometrical isomers with suitable example. **[6]**

b) Explain the terms enantiomers and diastereomers giving examples. **[6]**

Q7) a) What is meant by the following terms **[5]**

    i) Antipyretic   ii) Tranquilizers

    iii) Antihistamines   iv) Antibiotic

    v) Anaesthetic

b) Explain the term Growth regulators. **[4]**

c) Mention the uses of Naphthyl acetic acid. **[4]**

OR

Q8) a) Discuss the synthesis of Aspirin, Paracetamol. **[5]**

b) Give the chemical reaction in preparation of **[4]**

    i) Diammonium superphosphate.

    ii) Triple superphosphate

c) Briefly mention the applications of insecticide. **[4]**

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[5925]-503

S.E. (Chemical)
HEAT TRANSFER
(2015 Pattern) (Semester - II) (209348)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Assume suitable data, jf necessary.*
4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is permitted*

Q1) a) What is dimensional analysis? Explain different methods of dimensional analysis?   **[6]**

   b) Thermal conductivity of a material at any temperature is given by equation, K = 0.925 + 0.000486 T(W/m K). If the plane wall of thickness 25cm is constructed using this material & the two sides are maintained at 1200 °C & 450 °C respectively. Calculate the heat flow rate per unit area.   **[6]**

OR

Q2) a) Derive an expression for rate of heat for composite cylinders made of different thermal conductivities K_1 and K_2.   **[6]**

   b) A pipe of O. D. 300 cm is covered with two layers of insulation ($k_1 = 0.105$ W/mK and $k_2 = 0.07$ W/mK). The better insulating material is on the outside and is 40 mm thick. The other insulating material is of 50mm thickness. The inner and outer surface temperatures of the insulations are 623K and 323K. Estimate the heat loss per meter length and temperature of the surface between two layers of insulation.   **[6]**

Q3) a) Derive the steady state heat flow equation for composite Plane wall?**[6]**

   b) Two very large parallel planes with emissivities 0.3 and 0.8 exchange the heat. Estimate the percent reduction in heat transfer when a polished aluminium radiation shield with emissivity 0.04 is placed between them.**[6]**

OR

Q4) a) Air at 2 atmosphere and 200°C is heated as it flows through the tube with diameter of 1 inch (2.54 cm) at a velocity of 10 m/s. Calculate the heat transfer per unit length of tube if constant heat flux condition prevails at the wall and the wall temperature is 20°C above the air temperature all along the length of the tube. **[6]**

Data:

Properties of air at bulk temperature of 200°C are,

Density: 1.493kg/m^3

Prandtl No: 0.681

Viscosity: 2.57×10^{-5} kg/m.s

Thermal conductivity: 0.0386 W/mK

Specific heat : 1.025kJ/kg.K

b) What are the different laws of Radiation? Explain Stefan Boltzmann's law? **[6]**

Q5) a) An aqueous sodium chloride solution (10 wt %) is fed into a single effect evaporator at a rate of 10000 Kg/hr. It is concentrated to a 20 wt% sodium chloride solution. The rate of consumption of steam in the evaporator is 8000 Kg/hr. Calculate Capacity (Kg/hr) & Economy of the evaporator. **[5]**

b) Explain the Construction and working of Calendria type Evaporator with neat sketch. **[4]**

c) Describe the different factors affecting the evaporation operation. **[4]**

OR

Q6) a) A weak solution is to be concentrated from 10% to 50% by weight solute concentration with a feed rate of 30000kg/hr. Steam is available at pressure 0.20MPa and at saturation temperature of 393K. The evaporator is operating at reduced pressure such that boiling point is 323K. Calculate the steam consumption if the feed is introduced at 293K. **[5]**

Data:

Specific heat of feed: 3.98kJ/kg.K

Latent heat of condensation of steam at 0.20MPa = 2202 kJ/kg

Latent heat of vaporization of water at 323 K = 2383kJ/kg

b) Draw and explain the forward feed multiple effect evaporator. **[4]**

c) Define Boiling point elevation and explain Duhring's plot. **[4]**

Q7) a) Write short note on the Log mean Temperature Difference (LMTD) **[4]**

b) Draw a neat sketch of 1-2 Shell and Tube Heat exchanger and explain.**[5]**

c) Water at the rate of 1.133 kg/sec. is heated from 35°C to 75°C by oil having a specific heat of 1.9 KJ/Kg°C. The fluids are used in a counter flow double pipe heat exchanger, & the oil enters the exchanger at 110°C & leaves at 75°C. The overall heat transfer coefficient is 320 W/m²C. Calculate the heat exchanger area. Specific heat of water is 4.18 KJ/Kg°C.
[4]

OR

Q8) a) Define Effectiveness and Capacity Ratio of Heat Exchanger. **[4]**

b) Draw a neat sketch of Double pipe heat exchanger and explain. **[5]**

c) Water enters a counter flow double pipe heat exchanger at 288K flowing at a rate of 1300kg/hr. It is heated by oil flowing at rate of 550kg/hr from an inlet temperature of 367K. Determine the total heat transfer and outlet temperature of oil and water for 1m² area of heat transfer. **[4]**

Data: Specific heats of oil and water are 2000J/kg.K and 4187 J/kg.K

Overall Heat transfer coefficient is 1075 W/m²K.

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[5925]-504

S.E. (Chemical)

PRINCIPLES OF DESIGN

(2015 Pattern) (Semester-II) (New) (209349)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

1) *Neat diagrams must be drawn wherever necessary.*
2) *Black figures to the right indicate full marks.*
3) *Assume suitable data, if necessary..*
4) *Use of calculator is allowed.*

Q1) a) The piston rod of a steam engine is 50mm in diameter and 600 mm long. The diameter of the piston if 400 mm and the maximum steam pressure is $0.9 N/mm^2$. Find the compression of the piston rod if the young's modulus for the material of the piston rod is $210 KN/mm^2$. **[6]**

b) What do you mean by factor of safety? **[6]**

OR

Q2) a) A simply supported beam 6m long is carrying a uniformly distriubuted load of 2KNm over a length of 3m from the right and Draw the S.F and B.M diagram for the beam and also calculate the maximum B.M on the section. **[6]**

b) Explain the following terms in concentration with design of machine members subjected to variable loads. **[6]**

i) Endurance Limit

ii) Fatigue

iii) Stress concentration

Q3) a) Find the diameter of a solid steel shaft to transmit 20kW. At 200rpm. The ultimate shear stress for the steel may be taken as 360 Mpa and a factor of safety as 8. If a hallow shaft is to be need in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameter is 0.5. **[17]**

b) How are the keys classified? Draw neat sketches of different types of keys and state their applications. **[6]**

OR

Q4) a) Determine the length of the weld run for a plate of size 120mm wide and 15mm thick to be welded to another plate by means of **[7]**
   i)   A single transverse weld and
   ii) Double parallel fillet welds when the joint is subjected to variable loads.

   b) Enumerate the different types of riveted joints and rivets. **[6]**

Q5) a) The inside diameter of cylinder is 25 cm and is subjected to an internal pressure of 600kg/cm². Allowable tensile stress of the material is 1400 kg/cm². What should be the minimum thickness of the vessel? **[6]**

   b) Explain with a neat sketch various types of flanged joints used in pressure vessels. **[6]**

OR

Q6) a) Calculate the thickness of a tori spherical heads (100-6) and (80-6)elliptical head (2:1) and hemispherical head for a pressure vessel having design pressure 7kg/cm². diameter of vessel is 1.5m and the permissible stress is 1250kg/cm². welded joint efficiency is 85%. **[6]**

   b) What are various types of welding joints used in pressure vessels? Discuss with neat sketch. **[6]**

Q7) a) With neat sketch explain stresses induced in thick vessel subjected to internal pressure. **[6]**

   b) A multilayer vessel is to be operated at 133.33MN/m² and is to be fabricated by using three shells. Inside diameter of the vessel is 30.5cm while outside diameters 59.5 cm. The vessel is fabricated by shrink fit construction. The internal diameter are 38.5cm and 47.6cm respectively. Determine the maximum combined stress at the inteface, interface pressure and the circumferential stress variation in each of the three shells. **[7]**

OR

Q8) a) Calculate the thickness of a flanged tori spherical head for a vessel having internal diameter 6000 mm. Design pressure of the vessel is 3.4 kg/cm². Inside crown radius is 6000 mm. Inside knuckle radius is 380 mm. Permissible stress of the material is 1190 kg/cm², welded joint efficiency is 100%. **[7]**

   b) What are the important points to be considered while designing a pressure vessel? **[6]**

[5925]-505

S.E. (Chemical)

CHEMICAL ENGINEERING THERMODYNAMICS-I
(2015 Pattern) (Semester-II) (209350)

Time : 2 Hour]   *[Max. Marks : 50*

Instructions to the candidates:
  1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
  2) *Neat diagram must be drawn wherever necessary.*
  3) *Figures to the right indicate full marks.*
  4) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.*
  5) *Assume suitable data, if necessary.*

Q1) a) Nitrogen gas is confined in a cylinder and its pressure is maintained by a weight placed on the piston. The mass of piston and the weight together is 50 kg. The acceleration due to gravity is 9.81 m/s^2 and the atmospheric pressure is 1.101325 bar. Assume frictionless piston, find: **[8]**

   i) The force exerted by the atmosphere, the piston, and the weight on the gas if the piston is 100 mm in diameter.

   ii) The pressure of gas.

   iii) The work done by the gas, if the gas is allowed to expand pushing up piston and the weight by 400mm.

   b) Distinguish between Steady state, Equilibrium State. **[4]**

OR

Q2) a) Heat is transferred to 10 Kg. of air which is initially at 100 Kpa and 300K until its temperature reaches 600K. Determine W, Q, ΔU ΔH for following processes. **[8]**

   i) Constant volume process

   ii) Constant pressure process

   Take Cp = 29.099 KJ/Mol.K, Cv = 20.785 KJ/Mol.K, Mol.Wt. of air = 29

   b) Derive expression for work done for a reversible adiabatic ideal gas process. **[4]**

Q3) a) Obtain an expression for determination of standard heat of reaction of temperature T if standard heat of reaction is gievn at temp. T1. Use following heat capacity equation $Cp = \alpha + \beta T + \gamma T^2$ **[8]**

b) Explain Standard heat of reaction and Standard heat of combustion.**[4]**

OR

Q4) a) With respect to 1 Kg liquid water **[8]**

i) Initially at 273 K it is heated to 373 K by contact with a heat reservoir at 373 K What is the entropy change of the water? What is total entropy change?

ii) Initially at 273 K, it is first heated to 323 K by contact with heat reservoir at 323 K and then to 373 K by contact with a reservoir at 373 K what is total entropy change?

b) Explain carnot cycle with carnot principle. **[4]**

Q5) a) Prove that $Cp-Cv=\beta^2VT/k$ **[7]**

b) Derive residual properties with PVT data or equation of state. **[6]**

OR

Q6) Prove **[13]**

a) $dH=CpdT+[V-T(dV/dT)_p]dV$

b) $dS=CpdT - (dV/dT)_p dP$

Q7) a) Explain free expansion Lindes process with diagram. **[6]**

b) A refrigeration machine operating at a condenser temperatue of 290 K needs 1 KW of power per ton of refrigeration. Determine the following: **[7]**

i) The coefficient of performance

ii) The heat rejected to condenser

iii) The lowest temperature that can be maintained.

OR

Q8) a) Explain absorption refrigeration cycle. **[6]**

b) A house has a winter heating requirement of 30 KJ/s and summer cooling requirement of 60 KJ/s. Consider a heat pump installation to mainatain the house temperature at 20 ℃ in winter and 25 ℃ in summer. This requires circulation of the refrigerant through interior exchager coils at 30 ℃ in winter and 5 ℃ in summer. Underground coils provide heat source in winter and the heat sink in summer. For a year round ground tempearture of 15 ℃, the heat transfer characteristics of the coil necessitate refrigerant tempertaure of 10 ℃ in winter and 25 ℃ in summer. What are the minimum power requirements for winter heating and summer cooling? **[7]**

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[5925]-506
S.E. (Chemical)
PROCESS CALCULATIONS
(2015 Pattern) (Semester - I) (209344)

Time : 2 Hours] [*Max. Marks : 50*

Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) It is required to make 1000 kg mixed acid containing 60% H_2SO_4, 32% HNO_3 and 8% water by blending (i) the spent acid containing 11.3% HNO_3, 44.4% H_2SO_4 and 44.3% water (ii) aqueous 90% HNO_3 and (iii) aqueous 98% H_2SO_4. All percentage are by mass. Calculate the quantities of each of the three acids required for blending. **[8]**

b) The available nitrogen in an urea sample is found to be 45% (by mass). Find the actual urea content in the sample. **[4]**

OR

Q2) a) A gas mixture contains 0.274 Kmol of HCl, 0.337 Kmol of N_2 and 0.089 Kmol of O_2. Calculate (i) Average molecular weight of gas mixture (ii) Volume occupied by this mixture at 405.3 KPa and 303 K. **[4]**

b) 10000 kg/h of solution containing 20% methanol is continuously fed to a distillation column. Distillate is found to contain 98% methanol and waste solution form the column carries 1% methanol. All percentage are by weight. Calculate (i) the mass flow rate of distillate and bottom product (ii) the percent loss of methyl alcohol. **[8]**

P.T.O.

Q3) a) A coke is known to contain 90% carbon and 10% non-combustible ash (by weight): (i) find the moles of oxygen theoretically required to burn 100 kg of coke completely? (ii) If 50% excess air is supplied, calculate the analysis of gases at the end of combustion. **[6]**

b) A stream of carbon dioxide flowing at a rate of 100 kmol/min is heated from 298 K to 383 K. Calculate the heat that must be transferred using CP data: $C_p^o = a + bT + cT^2 + dT^3$, KJ/Kmol.K **[6]**

Gas	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
CO_2	21.3655	64.2841	−41.0506	9.7999

OR

Q4) a) Gaseous benzene reacts with hydrogen in the presence of Ni catalyst as per the reaction:

$$C_6H_6 (g) + 3H_2 (g) \rightarrow C_6H_{12}(g)$$
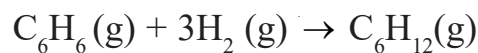
30% excess hydrogen is used above that required by the above reaction. Conversion is 50% and yield is 90%. Calculate the requirement of the benzene and hydrogen gas for 100 moles of cyclohexane produced. **[6]**

b) The gas having the following composition is at temperature of 775 K.

SO_2=7.09%, O_2=10.55%, SO_3 = 0.45% and N_2 = 81.91%

Calculate the heat content of 1 kmol gas mixture over 298 K using the heat capacity data given below : $C_p^0 = a + bT + cT^2 + dT^3$, *kj/kmol*.K

Gas	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
SO_2	24.7706	62.9481	−44.2582	11.122
O_2	26.0257	11.7551	−2.3426	−0.5623
SO_3	22.0376	121.624	−91.8673	24.3691
N_2	29.5909	−5.141	13.1829	−4.968

[6]

Q5) a) Define wet bulb temperature, dry bulb temperature, humid volume and humid heat. **[4]**

b) A gas mixture containing benzene vapour is saturated at 101.325 kPa and 323 K. Calculate the absolute humidity if the other component of the mixture is (i) nitrogen (ii) carbon dioxide.
Data : Vapour pressure of benzene at 323 K = 36.664 kPa. **[9]**

OR

Q6) An absorption tower, packed with Telleratte packings, is used to absorb carbondioxide in an aqueous monoethanol amine solution (MEA). The volumetric flow rate of incoming dry gas mixture is 1000 m^3/h at 318 K and 101.3 kPa a. The CO_2 content of the gas is 10.4 mole %, while the outgoing gas mixture contains 4.5 mole % CO_2. A 3.2 M monoethanol amine solution is introduced at the top of the tower at the rate of 0.625 L/s. Dissolved CO_2 concentration of the entering solution is 0.166 kmol/kmol of MEA. Find the concentration of dissolved CO_2 in the solution leaving the tower.
Data : Specific volume of the gas at 318 K and 101.3kPa a,   V
= 26.107m^3/kmol. **[13]**

Q7) Calculate the gross and net calorific values of the natural gas at 298.15 K which has the following molar composition:

CH_4 = 89.4%, C_2H_6=5.0%, C_3H_8=1.9%, iso-C_4H_{10} = 0.4%, n-C_4H_{10}=0.6% CO_2 = 0.7% and N_2 = 2.0%.

Data:

Component	GCV kJ/mol	NCV kJ/mol
CH_4	890.65	802.62
C_2H_6	1560.69	1428.64
C_3H_8	2219.17	2043.11
iso-C_4H_{10}	2868.20	2648.12
n-C_4H_{10}	2877.40	2657.32

Specific volume of the natural gas at 298.15 K and 101.3 kPa = 24.465 m^3/kmol. **[13]**

OR

Q8) The ultimate analysis of a coal sample is given below: carbon = 61.5%, hydrogen = 3.5%, sulphur = 0.4%, ash = 14.2%, nitrogen = 1.8% and rest oxygen.

Calculate:

a) Theoretical oxygen required per unit weight of coal kg/kg.

b) Theoretical dry air required per unit weight of coal kg/kg.

c) The Orsat analysis of flue gases when the coal is burned with 90% excess dry air. **[13]**

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SEAT No. : ☐

[Total No. of Pages : 2

[5925]-508

S.E. (Chemical Engineering)

CHEMISTRY - I

(2015 Pattern) (Semester - I) (209341)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

   1)   *Answer Q. No. 1 or 2, 3 or 4, 5 or 6, 7 or 8.*

   2)   *Figures to the right indicate full marks.*

Q1) a)   Explain paramagnetic nature of oxygen using M.O.T.   **[4]**

    b)   Explain structure and stability of carbon free radicals.   **[4]**

    c)   Compare between order and molecularity of reaction.   **[4]**

<div align="center">OR</div>

Q2) a)   Draw resonance structure for aniline and phenol.   **[4]**

    b)   Derive the integrated rate equation for the first order reactions.   **[4]**

    c)   The reaction rate constant at 3°C was found to be 8.9×10^{-3} L/mol and 7.1×10^{-2} L/mol at 35°C. What is the activation energy of this reaction?**[4]**

Q3) a)   Explain technique and application of thin layer chromatography.   **[5]**

    b)   Give the instrumentation in single beam UV-visible spectro-photometer.**[4]**

    c)   Define terms :   **[4]**

       i)   Henrys law

       ii)   Molal elevation constant

       iii)   Vant Haff factor

       iv)   Osmotic pressure

<div align="center">OR</div>

Q4) a)   Give principle and instrumentation of flame photometry.   **[5]**

    b)   Derive the equation showing the relation between molecular mass of non-volatile solute & elevation in boiling point.   **[4]**

    c)   1.00 g of non-Electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. The k_f of benzene is 5.12 k kg mol^{-1}. Find molar mass of solute.   **[4]**

Q5) a) Explain the factors affecting rate of SN^1 & SN^2 reaction. **[4]**

b) Give the nitrating agents and mechanism involve in nitration of benzene.**[4]**

c) Write short note on Beckmann rearrangement. **[4]**

OR

Q6) a) Electrophilic substitution in nitrobenzene is at meta only. While amino benzene at ortho and para explain. **[4]**

b) Identify compounds A & B in the following reactions. **[4]**

$$CH_3 - CH_2 - CH_2 - I + KOH \xrightarrow{\text{Alcoholic}} A \xrightarrow{\text{HBr}} B$$

$$CH_3 - \underset{\underset{I}{|}}{CH} - CH_3 + KOH \xrightarrow{\text{Alcoholic}} A \xrightarrow{\text{HBr/H}_2\text{O}_2} B$$
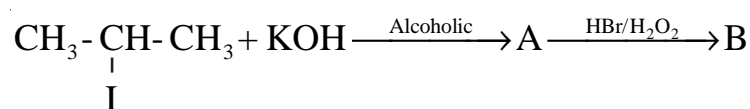
c) Discuss mechanism involved in Fredal Craft alkylation. **[4]**

Q7) a) Give two methods each for the synthesis of pyridine and quinoline. **[5]**

b) Explain with the help of equations what happens when **[4]**

   i) Acetylene and ammonia are passed over red hot tube

   ii) 1, 4 diketone is heated in presence of P_2O_5

c) Give steps involved in the preparation of methyl orange. **[4]**

OR

Q8) a) Describe classification of dyes on the basis of mode of action. **[5]**

b) Complete the following reactions and predict product **[4]**

   i) $\xrightarrow[\text{100°C}]{\text{SO}_3/\text{ pyridine}}$

   ii) $\xrightarrow{\text{CHCl}_3 / \text{KOH}}$

   iii) $\xrightarrow{\text{Sn} / \text{HCl}}$

   iv) $\xrightarrow[\text{10°C}]{\text{HNO}_3 / (\text{CH}_3\text{CO})_2\text{O}}$
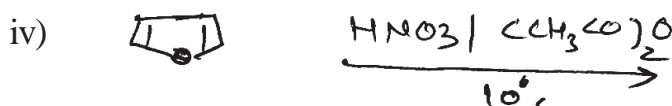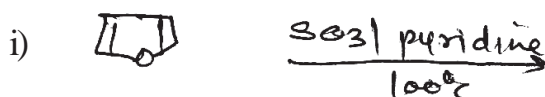
c) Explain the following: **[4]**

   i) What are Chromophores and auxochromes.

   ii) Phenolphthaleini shows pink colour in basic medium

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[5925]-509

S.E. (Chemical)
FLUID MECHANICS
(2015 Pattern) (Semester - I) (209342)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

  1)   *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8.*
  2)   *Neat diagrams must be drawn wherever necessary.*
  3)   *Figures to the right side indicate full marks.*
  4)   *Use of Calculator is allowed.*
  5)   *Assume Suitable data f necessary.*

Q1) a)   State and prove Hydrostatic law.   **[6]**

   b)   Draw Shear stress - shear rate diagram and explain rheological behavior
       of different fluids.   **[6]**

                                      OR

Q2) a)   If density of a liquid is 837 kg/m^3 find its specific weight, specific gravity,
       and specific volume if kinematic viscosity of this liquid is 1 .73cm^2/s
       obtain its dynamic viscosity.   **[6]**

   b)   Classify the various type of manometers explain any one in detail.   **[6]**

Q3) a)   Draw a net sketch and explain the working principle of orifice meter
       derives equation.   **[6]**

   b)   An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through
       a circular pipe of diameter 50mm and of length 300m. The rate of flow
       of fluid through the pipe is 0.35 litres/sec.Find the pressure drop in a
       length of 300m.   **[6]**

                                      OR

Q4) a)   Prove that expression for laminar flow of fluid,   **[6]**

$$f = \frac{16}{\text{Re}}$$

b) A horizontal venturimeter with inlet and throat diameter 300mm and 100mm respectively is used to measure the flow of water the pressure intensity at inlet is 130 KN/m² while the vacuum pressure head at the throat is 350mmof mercury assuming that 3% of head is lost in between the inlet and throat find **[6]**

i) The value of Cd for venturimeter

ii) Rate of flow

Q5) a) Explain the term dimensional homogeneous equation? With suitable example. **[7]**

b) Explain Boundary layer growth over a flat plate? **[6]**

OR

Q6) a) With suitable example, describe in detail the Rayleigh's Method of Dimensionalanalysis? **[6]**

b) Explain phenomenon of cavitation in centrifugal pumps. How it can be prevented? **[7]**

Q7) a) Define and explain boundary layer and its property? **[6]**

i) Laminar boundary layer.

ii) Turbulent boundary layer.

iii) Laminar sub-layer.

b) Using Buckingham's π-theorem, show that the discharge 'Q' consumed by an oil ring is given by, **[7]**

$$Q = N d^3 \phi \left[\frac{\mu}{\rho N d^2}, \frac{\sigma}{\rho N^2 d^3}, \frac{\omega}{\rho N^2 d} \right]$$

Where,'d' is the internal diameter of the ring, 'N' is rotational speed, 'ρ' is density, 'μ' is the viscosity, 'σ' is the surface tension and 'w' is the specific weight of oil.

OR

Q8) a) Explain Buckingham's π-theorem in detail. **[7]**

b) Explain fluidization with its type and application? **[6]**

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[5925]-510

S.E. (Chemical)
ENGINEERING MATERIALS
(2015 Pattern) (Semester-I) (209343)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
   1)   *Neat diagrams must be drwn wherever necessary.*
   2)   *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
   3)   *Assume suitable data, if necessary.*

Q1) a)   Write the classification of Engineering Materials with example.   **[6]**

    b)   A steel rod of 30 mm diameter, 280 mm long is subjected to axial forces alternating between maximum compression of 15 KN and a maximum tension of 5 KN. Find the difference between the greatest and least length of the rod. E=210 GPa.   **[6]**

OR

Q2) a)   Define the following terms: **[6]**
      i)   Resilience
      ii)   Hardness
      iii)   Shear stress

    b)   Draw and explain stress-Strain curve for ductile materials.   **[6]**

Q3) a)   Write a shrot note on Ultrasonic flow inspection Hardness Test.   **[6]**

    b)   Explain Tensile testing of material in brief.   **[6]**

OR

Q4) a)   Explain Sol-Gel method for synthesis of Nano material's   **[6]**

    b)   Write note on Physical Vapor Deposition method for synthesis of Nano material's.   **[6]**

Q5) Explain principle and working of Scanning Electron Microscope (SEM.) **[13]**

OR

Q6) Explain principle and working of Transmission Electron Microscope (TEM).

[13]

Q7) a) Write a short note on Glass and its types **[6]**
b) Define ceramic materials. Write applications of ceramic materials. **[7]**

OR

Q8) a) Write a short note on the Refractories materials **[6]**
b) Discuss in detail applications of Ceramic materials. **[7]**

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Total No. of Questions : 8]

SEAT No. : ☐

PA-1333

[Total No. of Pages : 4

[5925]-511

S.E. (Civil Engineering)

ARCHITECTURAL PLANNING AND DESIGN OF BUILDINGS

(2015 Pattern) (Semester - II) (201005)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

   1)   *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

   2)   *Figures to the right indicate full marks.*

   3)   *Draw neat figures wherever necessary.*

   4)   *Assume suitable data if required.*

Q1) a)   What do you mean by TDR and how is it used? Enlist the documents required for TDR? **[6]**

     b)   Explain the following principles of architectural planning with sketches : **[6]**

        i)   Unity.

        ii)   Composition.

<div align="center">OR</div>

Q2) a)   Explain any two principles of planning with respect to an educational building. **[6]**

     b)   Enlist the documents to be submitted along with building plans for approval. **[6]**

Q3) a)   What do you mean by earthquake resistant structures? What is its importance in concern with loss of human life, property and infrastructure? **[6]**

     b)   What are Acoustical defects? Explain any two in detail. **[6]**

P.T.O.

Q4) a) Explain the necessity of ventilation? What are various types of ventilation? **[6]**

b) What do you mean by perspective drawing? What is the use of perspective drawing? **[6]**

Q5) Draw to a suitable scale developed plan of a single storey framed residential building with schedule of openings having following units : **[13]**

Sr. No.	Unit	Numbers	Size (in meter)
1	Living room	1	4.0×5.5
2	Bed room	2	3.2×3.4
3	Kitchen	1	3.0×3.4
4	W.C.	1	1.1×1.2
5	Bath	1	1.25×2.1
6	Staircase		Rise = 0.16 m & Tread = 0.27 m, Width of each flight = 1.0 m
7	Wall thickness		0.23m (outer) & 0.15 m (inner)
8	Floor height		3.2 m

OR

Q6) Draw to a suitable scale developed plan of a single storey framed residential building with schedule of openings having following units : **[13]**

Sr. No.	Unit	Numbers	Size (Sq.m)
1	Living room	1	18
2	Bed room	2	12
3	Kitchen	1	10
4	W.C.	1	1.2
5	Bath	1	2.5
6	Staircase		Use suitable dimensions of Rise and Tread, Width of each flight & landing
7	Wall thickness		0.23m (outer) & 0.15 m (inner)
8	Floor height		3.2

Q7) Design a single storey hostel building for 50 students : **[13]**

a) 20 Rooms, Two seated with 7.5 m^2 /Students and 10 single seated rooms with 9 m^2 area.

b) Recreation room – 35m^2.

c) Gymnasium – 15m^2.

d) Office area – 20 m^2, assume additional suitable data.

Draw to a suitable scale line plan with schedule of openings.

OR

Q8) Design a primary school for 5 classrooms, the building is single storied RCC framed structure. The following units are to be provided : **[13]**

a) Number of students per classroom - 40.

b) Primary classroom - 50 m².

c) Drawing room - 75 m².

d) Headmasters room - 15 m².

e) Administrative office - 30 m².

f) Common staff room - 60 m².

g) Medical unit - 30 m².

h) Book store - 15 m².

i) Sanitary block (Ladies and Gents) – Suitable no.

Draw to suitable scale line plan with schedule of openings.

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[5925]-512

S.E. (Civil Engineering)
FLUID MECHANICS - I
(2015 Pattern) (Semester - II) (201004)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

   1)   *Answer any six questions from Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.*

   2)   *Neat diagrams must be drawn wherever necessary.*

   3)   *Figures to the right indicate full marks.*

   4)   *Use of calculator is allowed.*

   5)   *Assume suitable data, if necessary.*

Q1) a)   Define: Specific volume of a liquid. Also state its SI unit.   **[1+1]**

      b)   Explain kinematic similarity between model and prototype. Also state formula for velocity and acceleration scale ratio.   **[2+1]**

OR

Q2) a)   Derive an expression for pressure intensity inside a soap bubble.   **[3]**

      b)   Enlist any four applications of the model testing.   **[2]**

Q3) a)   What is inverted U-tube differential manometer? How it can be used to determine the pressure difference between two pipes.   **[1+1]**

      b)   A vertical gate of 5 m height and 3 m wide closes a tunnel running full with water. The pressure at the bottom of the gate is 195 KN/m². Determine the total pressure on the gate and position of the centre of the pressure.   **[2+1]**

OR

P.T.O.

Q4) a) A U-tube monometer is used to measure the pressure of oil (specific gravity 0.85) flowing in a pipe line. It's left end connected to pipe and right limb is open to the atmosphere. The centre of pipe is 100 mm below the level of mercury in the right limb. If the difference of mercury level in the two line is 160 mm, then determine the head and pressure.

[1.5 + 1.5]

b) What is the neutral equilibrium of floating body? Draw the line sketch to show position of M & G in case of neutral equilibrium. **[1+1]**

Q5) a) Distinguish between laminar and turbulent flow. **[2]**

b) Two pipes A & B of diameters d_1 and d_2 converge to form C pipe of diameter d. If the liquid flows with a velocity of v_1 and v_2 in the pipe A & B respectively, what will be the flow velocity in the C pipe? **[3]**

OR

Q6) a) What do you mean by steady and unsteady flow? Gives the example of each. **[1+1]**

b) A stream function is given by $\Psi = 5x–6y$. Calculate the velocity components and magnitude of the resultant velocity at any point. **[2+1]**

Q7) a) Enlist the assumptions made in derivation of Bernoulli's equations. **[2]**

b) Define coefficient of contraction, coefficient of discharge and coefficient of velocity of an orifice. **[1+1+1]**

OR

Q8) a) Draw a well labeled sketch of venturimeter. **[2]**

b) The head of water over the centre of an orifice of diameter 20 mm is 1 m. The actual discharge through the orifice is 0.85 litres/s. Find the coefficient if discharge. **[3]**

Q9) a) Show that for laminar flow through circular pipe, the maximum velocity of flow is twice the average velocity. **[5]**

b) The fluid of viscosity 0.7 Ns/m² and specific gravity 1.3 is flowing through the circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m², find **[2+2+2]**

i) The pressure gradient

ii) The average velocity

iii) Reynolds number of the flow.

c) State and explain any four factors affecting the growth of boundary layer. **[4]**

OR

*Q10)*a) Derive an expression for Hagen- Poiseuille equation for steady laminar flow in circular pipe. **[5]**

b) Explain the development of boundary layer over a smooth flat plate. **[4]**

c) Explain any three methods of control of boundary layer separation with neat sketches. **[6]**

*Q11)*a) Determine the wall shearing stress in a pipe of diameter 100 mm which carries water. The velocities at the pipe centre and 30 mm from the pipe centre are 2 m/s and 1.5 m/s respectively. The flow in the pipe is given as turbulent. **[6]**

b) Explain hydro-dynamically smooth and rough boundaries with neat sketch. **[2+2]**

c) What is equivalent pipe? Derive Dupit's equation for equivalent pipe (A compound pipe of 3 different pipes). **[1+4]**

OR

*Q12)*a) Derive an expression for loss of head due to sudden enlargement in pipe flow. **[5]**

b) A pipe 1 m diameter and 15 km long transmits water of velocity of 100 cm/sec. The friction coefficient of pipe is 0.005.Calculate the head loss due to friction? **[4]**

c) Explain: **[3+3]**

i) Prandtls mixing length theory for turbulent flow

ii) Observations made by O. Reynolds in Reynolds experiment for laminar, transit & turbulent flow with sketch.

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[5925]-513

S.E. (Civil)

STRUCTURAL ANALYSIS - I

(2015 Pattern) (Semester - II) (201008)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right indicate full marks.*

4) *Assume suitable data, if necessary.*

5) *Use of electronic pocket calculator is allowed.*

Q1) a) A simply supported beam AB having span 4m is loaded and supported as shown in figure 1. Determine the deflection at D using Macaulay's method in terms of EI. **[6]**
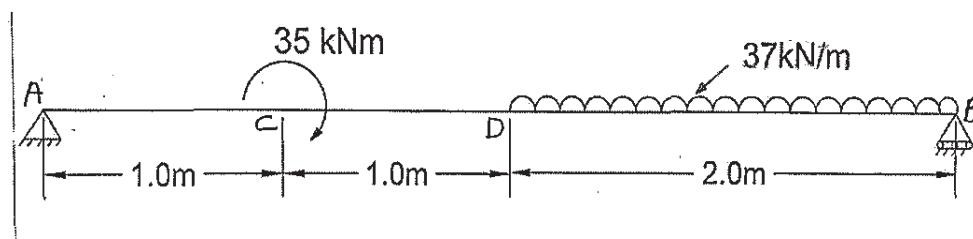
Figure 1

b) Determine slope at A for the simply supported beam shown in figure 2 by conjugate beam method. **[6]**

Figure 2

OR
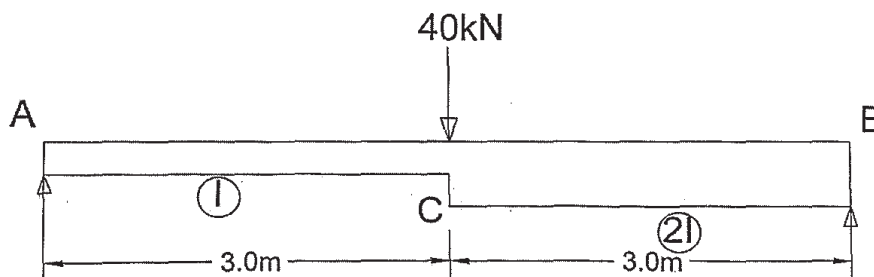
Q2) a) Determine moment at B for the continuous beam loaded and supported as shown in figure 3 by Clapeyron's theorem. Draw BM.D. **[6]**
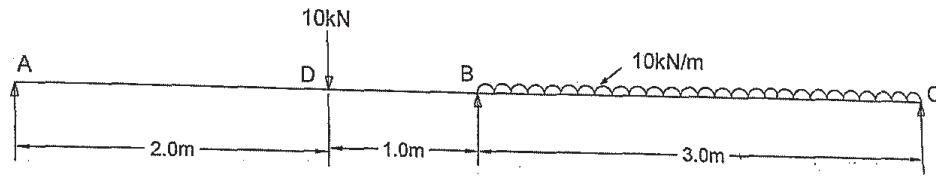
Figure 3

b) Determine the vertical deflection at the C of the truss shown in figure 4. $E = 200$ GPa, $A = 10^{-4}$ m^2 for all members Use Castigliano's method.**[6]**
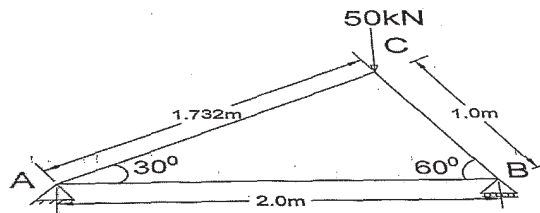
Figure 4

Q3) a) Determine the vertical deflection at the point D of the frame shown in figure 5. Use Castigliano's method. **[6]**
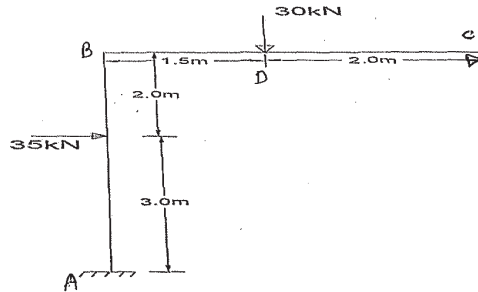
Figure 5

b) Analyze the truss shown below using Castigliano's method. AE = constant **[6]**
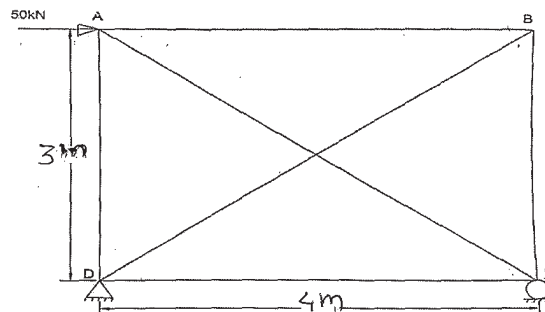
Figure 6

OR

Q4) a)   A simply supported beam has a span of 12m .Uniformly distributed load of 30 kN/m and 4m long crosses the girder from left to right. Draw influence line diagram for shear force at a section 5m from left support. Calculate the negative and positive values at the section. **[6]**
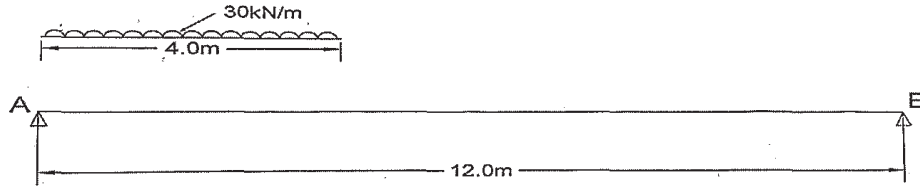
Figure 7

b)   Two wheel loads 150 kN and 80 kN spaced 0.6 m apart roll on the girder as shown in figure 8. Find maximum positive and maximum negative shear force at section C. **[6]**
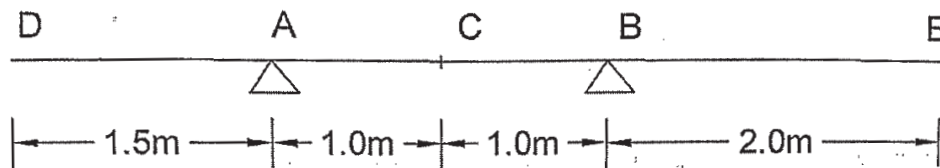
Figure 8

Q5) A three hinge circular arch as shown below carries u.d.l. of W k N /m over the whole span. Determine the horizontal thrust and maximum bending moment for the arch. **[13]**
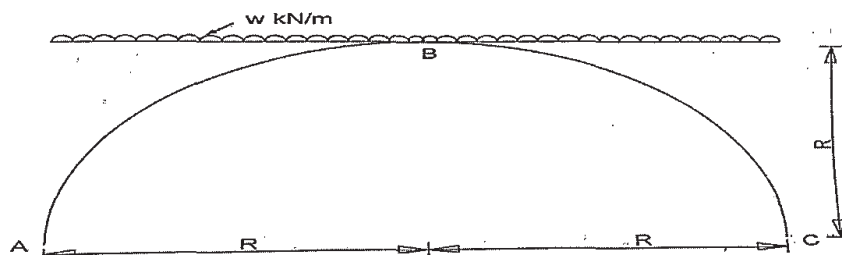
OR

Q6) A two hinged parabolic arch of span 25 m and rise 5m carries uniformly distributed load of 38 k N/m over l0m span from left end. Find the horizontal thrust. **[13]**
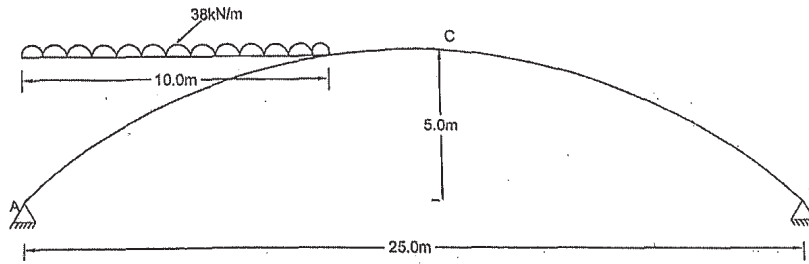
Q7) a) Draw true and idealized stress strain curve for mild steel in Tension.**[6]**

b) A cantilever beam ABC shown in figure is subjected to point load W at the cantilever end. Find the value of the load at Collapse. **[7]**

OR
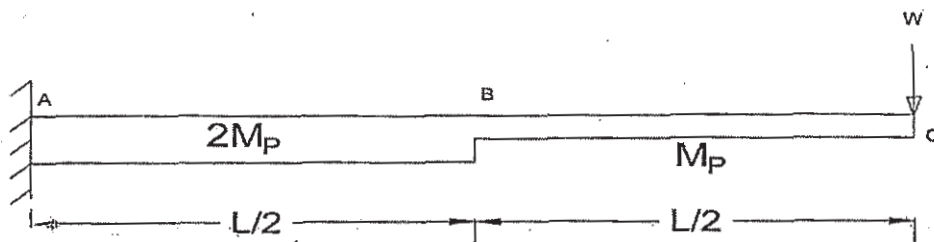
Q8) a) Determine the shape factor for the beam section shown in figure **[7]**

Top Flange = 75 × 10.5 mm

Bottom flange = 75 × 10.5 mm

Depth of web = 80 mm

Thickness of web = 10.5 mm

b) Explain basic theorems of plastic Analysis. **[6]**

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SEAT No. :

[Total No. of Pages : 4

[5925]-514

S.E. (Civil Engineering)
CONCRETE TECHNOLOGY
(2015 Pattern) (Semester-II) (201007)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Answer Q.Nos. 1 or 2,3 or 4,5 or 6 and 7 or 8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Your answers will be valued as a whole.*
5) *Use of electronic pocket calculator is allowed.*
6) *Assume suitable data, if necessary.*
7) *Use of IS code 10262, 456 is not allowed.*

Q1) a) Write a short note on chemical composition of cement. **[6]**

  b) Define work ability. what are the different methods to measure work ability? Explain any one in detail. **[6]**

OR

Q2) a) Explain alkali aggregate reaction. State factors promoting & controlling the reaction. **[6]**

  b) State & explain various operations involved during the concreting from mixing to finishing of concrete surface. **[6]**

Q3) a) State the various types of non-destructive tests carried on hardened concrete. Explain Ultrasonic pulse velocity test in detail. **[6]**

  b) Enlist the types of vibrators used for compaction of concrete. Explain any one in detail. **[6]**

OR

Q4) a) Explain the compressive strength of concrete. How it is determined in laboratory? **[6]**

  b) Write a short note on: **[6]**

   i) Cellular light weight concrete

   ii) Ferrocement

Q5) Using Indian Standard recommended guidelines, design a concrete mix for a reinforced concrete structure to be subjected to the severe exposure conditions for the following requirements: **[13]**

A) Stipulations for proportioning

    i)   Grade designation : M30,

    ii)   Standard deviation, s=5

    iii)   Type of cement :OPC 53 grade conforming to IS 8112

    iv)   Workability: 100 mm(slump)

    v)   Degree of supervision: Good

    vi)   Type of aggregate: Angular coarse 20mm aggregate,

    vii)   Maximum cement content:450 kg/m^3

    viii) Chemical admixture type: 2% Superplasticizer conforming to IS 9103

B) Test data for materials

    i)   Specific gravity of cement : 3.15

    ii)   Specific gravity of admixture : 1.145

    iii)   Specific gravity of

        a)   Coarse aggregate - 2.74

        b)   Fine aggregate- 2.57

    iv)   Water absorption

        a)   Coarse aggregates - 0.5%

        b)   Fine aggregates – 2.00%

    v)   Free surface moisture

        a)   Coarse aggregates – Nil (absorbed moisture also nil)

        b)   Fine aggregates – Nil

vi) Sieve analysis

    a)   Coarse aggregate:

IS Sieve Sizes (mm)	Analysis of Coarse Aggregate Fraction		Percentage of different Fractions			Remarks
	I	II	I (60%)	II (40%)	Combined (100%)	Confirming of Table 2 of IS 383
20	100	100	60	40	100	
10	0	71.2	0	28.5	28.5	
4.75		9.40		3.7	3.7	
2.36		0				

    b)   Fine aggregate: Conforming to grading zone I

C)   Design considerations:

Table 1: From IS 10262; Maximum water content per cubic meter of concrete.

Sr.No.	Nominal Maximum Size of Aggregate (mm)	Maximum Water Content (kg)
i)	10	208
ii)	20	186
iii)	40	165

Table 2: from IS 10262; Volume of Coarse Aggregate per Unit Volume of Total Aggregate.

Sr. No.	Nominal Maximum Size of Aggregate (mm)	Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone IV	Zone III	Zone II	Zone I
i)	10	0.50	0.48	0.46	0.44
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.75	0.73	0.71	0.69

Table 3: From IS 456, Different Exposure conditions for reinforced concrete

Sr. No.	Exposure	Minimum cement Content (Kg/m³)	Maximum free Water cement ratio	Minimum grade of concrete
i)	Mild	300	0.55	M20
ii)	Moderate	300	0.50	M25
iii)	Severe	320	0.45	M30
iv)	very Severe	340	0.45	M35
v)	Extreme	360	0.40	M40

OR

Q6) a) What do you mean by concrete mix design? What are various factors affecting concrete mix design? **[7]**

b) What do you mean by nominal mix, standard mix and design mix? **[6]**

Q7) a) Explain in detail corrosion monitoring techniques of reinforcement and its preventive measures. **[5]**

b) Write a note on: **[8]**
   i) Retrofitting by FRP
   ii) Attack by Seawater

OR

Q8) a) Explain process of preparation of surface for repairs along with its importance. **[5]**

b) State and explain factors affecting the Permeability of concrete. What measures should be taken to reduce permeability of concrete? **[8]**

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[5925]-515

S.E. (Civil Engg.)
ENGINEERING GEOLOGY
(2015 Pattern) (Semester-II) (207009)

Time : 2 Hour]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams should be drawn wherever necessary.*

Q1) a) Discuss diagenesis process of Sedimentary rocks. Write in brief the types of sedimentary rocks with suitable examples. **[6]**

b) State and explain the general principles of STRATIGRAPHY. **[6]**

OR

Q2) a) Discuss in detail the significance of foliations of metamorphic rocks on Civil projects. **[6]**

b) Define Mineral. Explain classification of MINERALS with suitable examples. **[6]**

Q3) a) What are JOINTS? Describe types of Joints and their Civil Engineering Significance. **[6]**

b) What is FOLD? Give nomenclature of the FOLD. Describe how fold passes in to the Fault. **[6]**

OR

Q4) a) Write in detail mineral wealth of GONDWANA. **[6]**

b) What is REJUVENATION? Explain two features resulting due to rejuvenation. **[6]**

Q5) a) Explain Preliminary Geological Investigations carried out for Tunneling Exploration. **[6]**

b) Discuss the feasibility of dam site, with dipping and horizontal strata. **[7]**

OR

Q6) a) Explain with appropriate example the feasibility of dam alignment which is crossing a DYKE. **[6]**

b) A site is proposed for excavation of tunnel is A-B and M-N, which is passing through axis and limb region of fold respectively. Justify the suitability of tunnel is such conditions. **[7]**

Q7) a) Discuss in brief the Natural and Artificial causes of LANDSLIDES. Enlist the measures to prevent LANDSLIDE. **[7]**

b) Discuss feasibility of DAM in folded areas. Draw neat diagrams. **[6]**

OR

Q8) a) Explain the Geological conditions favorable for natural springs and artesian wells. **[7]**

b) Define Aquifers. Explain in short the types of aquifers. **[6]**

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[5925]-516

S.E. (Civil)
ENGINEERING MATHEMATICS - III
(2015 Pattern) (Semester - I) (207001)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Attempt Q.No.1 or Q.No.2; Q.No.3 or Q.No.4, Q.No5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Neat diagram must be drawn wherever necessary.*
3) *Figures to the right indicates full marks.*
4) *Use of logarithmic tables, electronic pocket calcualtor and steam tables is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Solve any two of the following.   **[8]**

     i) $(D^2+3D+2) \, y = \sin e^x$.

     ii) $\dfrac{d^2y}{dx^2} + 4y = \tan 2x$ (by method of variation of parameters).

     iii) $x^2 \dfrac{d^2y}{dx^2} - 4x\dfrac{dy}{dx} + 6y = x^5 + 2x^3$.

   b) Apply Gauss elimination method to solve the system of equations.**[4]**

$$x_1 + 4x_2 - 2x_3 = 4$$

$$4x_1 + x_2 + x_3 = 4$$

$$3x_1 + 2x_2 - 4x_3 = 6$$

OR

Q2) a) The differential equation satisfied by a beam, uniformly loaded with one end fixed and second subjected to a Tensile force P is given by: $\text{EI}\dfrac{d^2y}{dx^2} - P\,y = \dfrac{W}{2}x^2$.

Show that the elastic curve for the beam under conditions $y = 0, \dfrac{dy}{dx} = 0$, when $x = 0$, is given by $y = \dfrac{W}{2p}\left[x^2 + \dfrac{2}{n^2} - \dfrac{e^{nx}}{n^2} - \dfrac{e^{-nx}}{n^2} \right]$ Where $\text{EI} = \dfrac{P}{n^2}$ **[4]**

b) Use Euler's method to solve the equation $\frac{dy}{dx} = 1 + xy$ subject to the conditions : at $x = 0$, $y = 1$ and tabulate y for $x = 0$ (0.1) 0.5. **[4]**

c) Solve the following system by Cholesky's method: **[4]**

$9x_1 + 6x_2 + 12x_3 = 15$

$6x_1 + 13x_2 + 11x_3 = 25$

$12x_1 + 11x_2 + 26x_3 = 40$

Q3) a) The two regression equations of the variables x and y are $x = 19.13 - 0.87y$, $y = 11.64 - 0.50x$. **[4]**

Find

   i) $\bar{x}, \bar{y}$

   ii) The correlation coefficient between x & y.

b) On an average a box containing 10 articles is likely to have 2 defectives. Deterimine the probability that a given box will have defectives less than or equal to 2. **[4]**

c) Find the directional derivative of $\phi = x + y^2 + z$ at (1, 1, −1) along the vector $2\bar{i} + \bar{j} + 2\bar{k}$. **[4]**

OR

Q4) a) Number of road accidents on a highway during a month follows poisson distribution with mean 5. Find the probability that in a certain month, number of accident on the highway will be less than 3. **[4]**

b) Prove the following (any one). **[4]**

   i) $\nabla\left(\dfrac{\bar{a}\cdot\bar{r}}{r^3}\right) = \dfrac{\bar{a}}{r^3} - 3\dfrac{(\bar{a}\cdot\bar{r})\bar{r}}{r^5}$.

   ii) $\nabla^2\left(\dfrac{1}{r^2}\right) = \dfrac{2}{r^4}$.

c) Show that vector field $\bar{F} = (x^2 - yz)\bar{i} + (y^2 - zx)\bar{j} + (z^2 - xy)\bar{k}$ is irrotational. Find scalar potential ϕ such that $\bar{F} = \nabla\phi$. **[4]**

Q5) Solve any two.

a) Verify Green's theorem : for $\vec{F} = x\hat{i} + y^2\hat{j}$ over the first quadrant of the circle $x^2 + y^2 = 1$. **[7]**

b) Evaluate $\iint_s \left(2xy\hat{i} + yz^2\hat{j} + xz\hat{k}\right).d\vec{s}$ over the surface of the region bounded by $x = 0$, $y = 0$, $y = 3$, $z = 0$ $x = 4$ and $z = 6$. **[6]**

c) Evaluate $\iint_s \left(\nabla \times \vec{F}\right).\hat{n}ds$ where $\vec{F} = y^2\hat{i} + z\hat{j} + xy\hat{k}$ for the surface of the paraboloid $z = 4 - x^2 - y^2$ ($z \geq 0$). **[6]**

OR

Q6) Solve any two.

a) Find the work done by Force $\vec{F}$ in moving a particle once round the ellepse $\dfrac{x^2}{25} + \dfrac{y^2}{16} = 1, z = 0$.

Where $\vec{F} = (2x - y + z)\hat{i} + (x + y - z^2)\hat{j} + (3x - 2y + 4z)\hat{k}$. **[7]**

b) Show that $\iiint_v \left(\phi\nabla^2\psi - \psi\nabla^2\varphi\right)dv = \iint_s (\varphi\nabla\psi - \psi\nabla\phi).d\vec{s}$. **[6]**

c) Evaluate $\iint_s \left(\nabla \times \vec{F}\right)\cdot\hat{n}d\vec{s}$ where 'S' is the curved surface of the paraboloid $x^2 + y^2 = 2z$ bounded by the plane $z = 2$, where $\vec{F} = 3(x - y)\hat{i} + 2xz\hat{j} + xy\hat{k}$. **[6]**

Q7) Solve any two of the following.

a) Solve $\dfrac{\partial^2 y}{\partial t^2} = a^2\dfrac{\partial^2 y}{\partial x^2}$, under the condition. **[7]**

i) $y(0, t) = 0$.
ii) $\left(\dfrac{\partial y}{\partial t}\right)_{t=0} = 0$

iii) $y(\pi, t) = 0$
iv) $y(x, 0) = x, 0 \leq x \leq \pi$

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b) Solve $\dfrac{\partial u}{\partial t} = k\dfrac{d^2u}{\partial x^2}$ if . [6]

 i) u is finite for all t

 ii) $u\,(0,\,t) = 0$

 iii) $u\,(\pi,\,t\,) = 0$

 iv) $u\,(x,\,0) = \pi x - x^2,\ 0 < x < \pi$

c) Solve : $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0,$ subject to the boundary conditions. [6]

 i) $u\,(0,\,y\,) = 0$ ii) $u\,(x,\,0) = 0$

 iii) $u\,(a,\,y) = 0$ iv) $u\,(x,\,b) = 40$

OR

Q8) Solve any two of the following.

a) Solve $\dfrac{\partial^2 y}{\partial t^2} = \dfrac{\partial^2 y}{\partial x^2}$, subject to the. [7]

Conditions.

 i) $y\,(0,\,t) = 0.$ ii) $y\,(l,\,t\,) = 0$

 iii) $\left(\dfrac{\partial y}{\partial t}\right)_{t=0} = 0$ iv) $y\,(x,\,0) = y_0,\ 0 < x < l$

b) Solve $\dfrac{\partial u}{\partial t} = k\dfrac{d^2u}{\partial x^2}$ if . [6]

 i) $u\,(x,\,t)$ is bounded

 ii) $u\,(0,\,t) = 0$

 iii) $u\,(l,\,t\,) = 0$

 iv) $u\,(x,\,0) = \dfrac{u_0 x}{l}\,0 < x < l,\ u_0$ is constant. [6]

c) A rectangular plate with insulated surface is 10cm wide and so long compared to its width, that it may be considered infinite in length without introducing an appreciable error. If the temperature along short edge

$u = 0$ is given $u\,(x,\,0) = 100\sin\left(\dfrac{\pi x}{10}\right), 0 < x < 10$, while two long edges

$x = 0$ and $x = 10$ as well as other short edge are kept at 0°C, find steady state temperature $u\,(x,\,y)$. [6]

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S.E. (Civil)

STRENGTH OF MATERIALS

(2015 Pattern) (Semester - I) (201002)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 ,Q7 or Q8.*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right side indicate full marks.*

4) *Assume Suitable Data, if necessary and state it clearly.*

5) *Use of electronic pocket calculator is allowed.*

Q1) a) A cast iron pillar of 200mm square section carries an axial compressive load of 2400 kN. Taking $E = 120 \times 10^2$ N/mm^2 and v = 0.25, find change in the area of cross section of pillar. **[6]**

b) A 6 m long cantilever is subjected to a uniformly distributed load throughout its length and an upward point load of 10 kN at its free end. The properties of the section are shown in the figure. Determine the maximum tensile and compressive stresses induced. Take $I_{XX} = 3997500$ mm^4. **[6]**
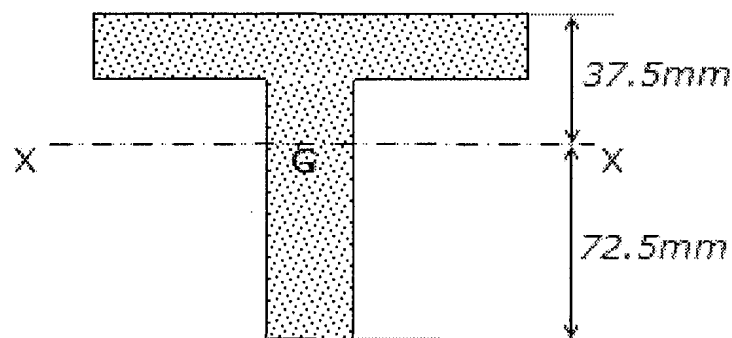
Figure 1-b

OR

Q2) a) A steel rod 20 mm diameter, 200 mm long is heated through 100°K and at the same time subjected to a pull P. If the total extension of the rod is 0.3 mm, what is the magnitude of force P? Take for a. steel as 12×10^{-6}/°K and E = 215 GN/m^2. **[6]**

b) For the cross section of beam shown in figure, draw shear stress distribution diagram across the section, if a shear force of 100 kN acts across the section. **[6]**
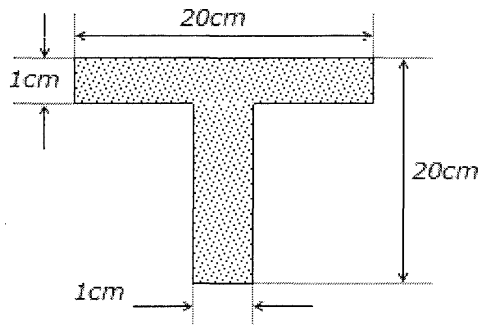
Figure 2-b

Q3) a) An element in a stressed body is subjected to stresses on two mutually perpendicular planes as shown. Determine normal and tangential stresses developed on a plane P-P inclined as shown. **[6]**
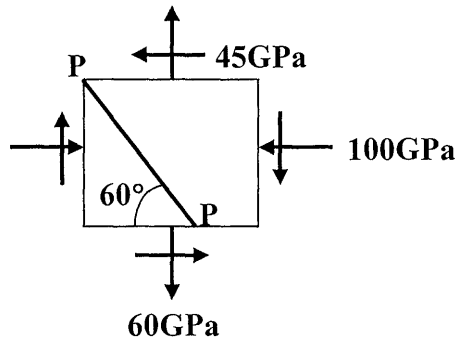
Figure 3-a

b) A horizontal steel shaft ACDB of hollow circular section external diameter 150 mm internal diameter 80 mm is fixed at ends A and B. AC = CD = DB = 2 m. Twisting moments of 360 kN-mm and 270 kN-mm are applied at points C and D as shown. Determine the maximum shear stress in the shaft. Take $G = 80 \times 10^9$ N/mm^2. **[6]**
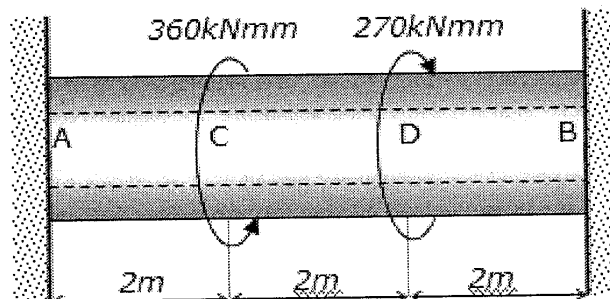
Figure 3-b

OR

Q4) a) A composite shaft consists of copper rod 30 mm diameter enclosed in a steel tube of 40 mm external diameter and 5 mm thickness. There is no relative motion between the two. Determine the shear stresses developed in copper and steel if both the shaft and the tube have equal lengths. Take G_{COPPER} = 40GPa, G_{STEEL} = 80GPa and torque to be transmitted as 5kNm. **[6]**

b) For the element of a stressed body shown in Figure 3-a above, determine principal planes, principal stresses, planes of maximum shear stress and maximum shear stresses developed. **[6]**

Q5) a) For the beam loaded and supported as shown in figure, draw SFD and BMD indicating all the important points. **[6]**
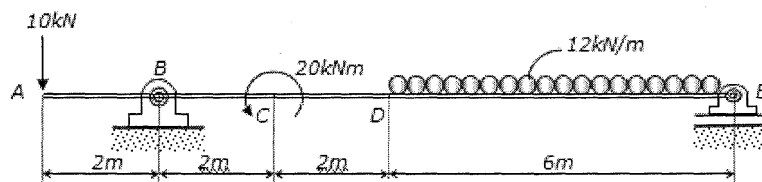
Figure 5-a

b) Draw the shear force and bending moment diagram for the beam shown in figure. B and D are internal hinges. **[7]**
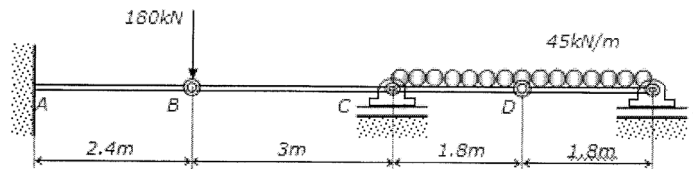
Figure 5-b

OR

Q6) a) Draw SFD and BMD for the beam loaded and supported as shown.**[6]**
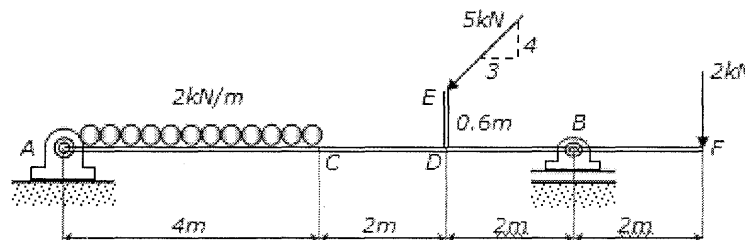
Figure 6-a

b) Shear force diagram for a beam is shown in figure. Draw the load diagram and bending moment diagrams. Take AB = BC = CD = 1 m, DE = 2 m.

[7]
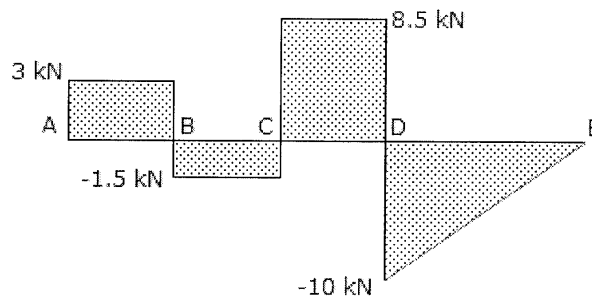
Figure 6-b

Q7) a) Find the greatest length for which a mild steel strut with area 3×10^3 mm² and the least moment of inertia 4×10^6 mm⁴ may be used with one end fixed and other end free in order to carry an axial load that will produce a working stress of 70N/mm², the working stress being one forth the stress at crippling load. Rankine constants for the mild steel are $\alpha = 1/7500$ and $f_C = 320$ MN/m². **[7]**

b) What is core of a section? Derive the condition for permissible eccentricity of an axial load, if a rectangular section of a column is not to carry in tensile stress. **[6]**

OR

Q8) a) Find Euler's critical load for a hollow cylindrical cast iron column 150 mm internal diameter and 25 mm thick, if it is 6 m long and hinged at both ends. Take $E = 8 \times 10^4$ N/mm². Compare Euler's critical load with Rankine's critical load by taking $f_c = 550$ N/mm² and $\alpha = 1/1600$. For what length of the column would the critical loads by Euler's and Rankine's formulae will be equal to each other? **[7]**

b) Determine the magnitude and nature of stresses generated in four corners of 420 mm × 230 mm section of a column shown in figure, when subjected an eccentric load of 1000 kN as shown, Take $e_x = 50$ mm, $e_y = 100$ mm.

[6]

Figure 8-b

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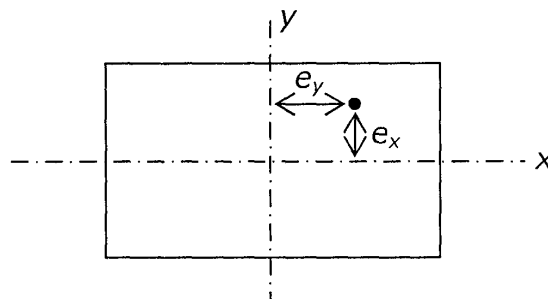
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S.E. (Civil)

SURVEYING

(2015 Pattern) (Semester - I) (201006)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

  1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
  2) *Neat sketches must be drawn wherever necessary.*
  3) *Figures to right indicate full marks.*
  4) *Assume suitable data if necessary.*
  5) *Use of electronic pocket calculator is allowed.*
  6) *Use of cell phone is prohibited in examination hall.*

Q1) a) Describe the various methods of plane table surveying. Under what conditions each is preferred? **[6]**

  b) The following reciprocal levels were taken with one level **[6]**

Instrument Station	Reading on		Remarks
	A	B	
A	1.884	2.896	Distance between A & B = 500 M
B	0.537	1.890	R.L. of A = 250 M

  Determine :   i)   The true difference in elevation Between A & B.

  ii) The reduced level of B.

  iii) The error in collimation adjustment of the level.

OR

Q2) a) State the Characteristic of contour lines? **[3]**

  b) Find the distance to the visible horizon from the top of a light house 60 m high what is the dip of the horizon, assuming the radius of the earth to be 6731 km? **[3]**

  c) Find which station is free from local attraction and work out correct bearings: **[6]**

Line	AB	BC	CD	DE	EA
F.B.	191°45'	39°30'	22°15'	242°45'	330°15'
B.B.	13°	222°30'	200°30'	62°45'	147°45'

Q3) a) The measured length and bearing of the sides of a closed traverse ABCDEA run in an anticlockwise direction and are tabulated below. Calculate length of line CD & DE? **[6]**

Line	AB	BC	CD	DE	EA
Length (m)	298.7	205.7	L1	L2	213.4
Bearing	0°0'	N 25°12'E	S 75°6'W	S 56°24'E	N 35°36'E

b) Explain with sketch the fixed hair method of tacheometry, when line of sight is inclined downward (depression) and staff is held vertical? **[6]**

OR

Q4) a) Define the following terms : **[5]**

  i) Trunnion axis

  ii) Transiting

  iii) Telescope Normal

  iv) Departure

  v) Face left

b) A tacheometer with analytic lens. Having the value of constant 100 was used and the following observations were made on staff held vertical.**[7]**

Instrument station	H.I. (m)	Vertical Angle	Staff at	Staff Reading
P	1.8	+2°40'	M	1.25, 1.93, 2.56
P	1.8	–4°40'	Q	1.45, 1.85, 2.30

R.L. of station M is 50.00 m. Calculate the R.L. of P & Q, distance PQ and gradient?

Q5) a) Write a note on necessity and types of transition curves. **[6]**

b) Tabulate the data required for setting out the circular curve by the deflection angle method using the following information? **[6]**

  i) Chainage of intersection pt. 1580 m

  ii) Angle of intersection = 145°

  iii) Degree of curve = 5°

  iv) Peg Interval = 30 m

OR

Q6) a) Two tangents intersects at a chain age of 1320.5 m the deflection angle 24° calculate the following quantities for setting out all curves of radius 275 m. Calculate : **[7]**

    i) Tangent length

    ii) Length of long chord

    iii) Length of the curve

    iv) Chainage of Curve point and tangency point

    v) Apex Distance

    vi) Versed sine of curve

  b) Enlist various linear methods of setting out curves and explain any one with sketch? **[6]**

Q7) a) Enlist the limitations of the prevalent survey techniques and also give advantages of Space Based positioning System? **[7]**

  b) Write a note on setting out a building? **[6]**

<div align="center">OR</div>

Q8) a) State different names of satellites and write a note on GLONASS (Global Navigation and Surveying System). **[7]**

  b) Write a short note on survery for drainage line work? **[6]**

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S.E. (Civil)
GEOTECHNICAL ENGINEERING
(2015 Pattern) (Semester-I) (201003)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, or Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Use of calculator is allowed in the examination.*
5) *Neat diagrams must be drawn wherever necessary.*

Q1) a) The initial void ratio of inorganic clay is found to be 0.65, while the Specific gravity of soilds is 2.68. Determine the dry density of soil. Also determine the bulk density and moisture content if soil is 50% saturated. **[6]**

b) What is flow net? Write down the characteristics and applications of flow net. **[6]**

OR

Q2) a) Write short note on transported soils with examples. **[6]**

b) To find out coefficient of permeability of clay the permeability test was carried out in a variable head permeameter having the diameter of the sample container to be 100 mm. The initial head of water in the stand pipe was found to be 450 mm and it was observed to drop 300 mm 3 in minutes 15 seconds. If the sample be 150 mm high and the diameter of the stand pipe be 19mm, determine the coefficient of permeabilty of the clay in meter per day. **[6]**

Q3) a) Write a short note on Vane Shear Test with neat sketch and the formulae involved. **[6]**

b) A water tower is supported only on three pillars forming an equilateral triangle with 10m side, The total weight of tower is 1177.2 KN. Calculate vertical stress 10m below the ground level under any one of the pillar. **[6]**

OR

Q4) a) Explain the process of field compaction and its control using proctor needle. **[6]**

b) In a consolidation drained triaxial test a specimen of clay fails at a cell pressure of 60 KN/m². The effective shear strength parameters are c'=15 KN/m² and ϕ'= 20⁰ Determine the deviator stress of soil. **[6]**

Q5) a) Explain Coulomb's Wedge theory for determination of earth pressure. **[6]**

b) Determine the active resultant thrust at a depth of 7m in sand whose angle of friction is 25° and density of 17 kN/m³ in dry state. **[7]**

OR

Q6) a) Discuss Culmann's graphcical method for the determination of active earth pressure. **[6]**

b) Compute the intensity of passive earth pressure at a depth of 8m in cohesion less sand with an angle of internal friction of 30° when water rises to the ground level. Saturated unit weight of sand is 21 KN/m³, γ_w=9.81 KN/m³. **[7]**

Q7) a) Discuss the role of soil in geoenvironmental applications and state the process governing containment transport. **[6]**

b) Discuss the criteria for slope classification and explain the modesof failure for all these slopes. **[7]**

OR

Q8) a) Explain the vacuum extraction technique for in situ treatment of soil contamination. **[6]**

b) What is stabilization-Solidification? How is chemical decontamination carried out? **[7]**

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S.E. (Computer / IT Engineering)

ENGINEERING MATHEMATICS - III

(2015 Pattern) (Semester - II) (207003)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates :

1) *Neat diagrams must be drawn wherever necessary.*
2) *Figures to the right indicate full marks.*
3) *Your answers will be valued as a whole.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Solve any two **[8]**

   i) $\dfrac{d^2y}{dx^2} - 3\dfrac{dy}{dx} + 2y = e^{e^{-x}}$

   ii) $\dfrac{d^2y}{dx^2} - 4y = \cos(2x)$

   iii) Solve by Method of variation of parameters $\dfrac{d^2y}{dx^2} - y = x$

b) Find the Fourier transform of $f(x) = 1 \quad |x| < 1$
$$= 0 \quad |x| > 1$$

   Hence, find the value of $\displaystyle\int_0^\infty \dfrac{\sin x}{x}\,dx.$ **[4]**

OR

Q2) a) Solve : $\dfrac{dx}{dt} = 5x + y; \dfrac{dy}{dt} = y - 4x$. **[4]**

b) Solve any one : **[4]**

    i)   find z-transform of $f(k) = k^2, k \geq 0$

    ii)   find the inverse z-transform of

$$\dfrac{z}{(z-2)(z-3)}, |z| > 3$$

c) Solve the following difference equation

$f(k + 2) - 5f(k + 1) + 6f(k) = 36; f(0) = f(1) = 0.$ **[4]**

Q3) a) Find first four moments about mean, if the first four moments about median are 1, 2, 4 & 6, also find β_1 & β_2. **[4]**

b) Fit least squares straight line to the following data and use it to find y at $x = 8$ **[4]**

x	1	3	5	6	10
y	2	0	4	7	8

c) A manufacturer knows from experience that the resistance of resistors he produces is normally distributed with mean 100 ohms and standard deviation 2 ohms. What percentage of resistors will have resistance between 98 ohms to 102 ohms? (Area between 0 to 1 is 0.3413). **[4]**

OR

Q4) a) A can hit the target 1 out of 4 times

B can hit the target 2 out of 3 times

C can hit the target 2 out of 4 times

find the probability that at least two hit the target. **[4]**

b) In a sample of 1000 cases, the mean of certain test is 14 and standard deviation is 2.5 Assuming the distribution to be normal find how many students score between 12 and 15.

(Given : Z = 0.8, A = 0.2881, Z = 0.4, A = 0.1554). **[4]**

c) Obtain the regression lines for the following data **[4]**

x	6	2	10	4	8
y	9	11	5	8	7

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Q5) a) Find the directional derivative of $\phi = xy^2 + yz^3$ at $(1, -1, 1)$ along the vector $\bar{i} + 2\bar{j} + 2\bar{k}$. **[4]**

b) Show that $\bar{F} = (6xy + z^3)\bar{i} + (3x^2 - z)\bar{j} + (3xz^2 - y)\bar{k}$ is irrotational. Find scalar ϕ such that $\bar{F} = \nabla\phi$. **[4]**

c) Find the work done in force field

$\bar{F} = 3x^2 y\bar{i} + (x^3 + 2yz)\bar{j} + y^2\bar{k}$ in moving object from $(1, -2, 1)$ to $(3, 1, 4)$. **[5]**

OR

Q6) a) Find the directional derivative of $\phi = e^{2x} \cos yz$ at$(0, 0, 0)$ in the direction of tangent to the curve $x = a\sin t; y = a\cos t; z = at, at\ \ t = \dfrac{\pi}{4}$. **[4]**

b) Show that (any one) : **[4]**

i) $\nabla^2 f(r) = \dfrac{d^2 f}{dr^2} + \dfrac{2}{r}\dfrac{df}{dr}$ ii) $\nabla^2\left(\nabla \cdot \dfrac{\bar{r}}{r^2}\right) = \dfrac{2}{r^4}$

c) Evaluate $\displaystyle\int_c \bar{F} \cdot d\bar{r}$ for $\bar{F} = 3x^2\bar{i} + (2xz - y)\bar{j} + z\bar{k}$ along the curve

$x = 2t^2, y = t, z = 4t^2 - t$ from $t = 0$ to $t = 1$. **[5]**

Q7) a) If $u = 3x^2 - 3y^2 + 2y$, find V such that $f(z) = u + iv$ is analytic. Determine $f(z)$ interims of z. **[4]**

b) Find the bilinear transformation which maps the points $z = 1, i, 2i$ on the points $w = -2i, 0, 1$ respectively. **[4]**

c) Evaluate $\displaystyle\oint_c \dfrac{4z^2 + z}{z^2 - 1}dz$, where c is the contour $|z - 1| = \frac{1}{2}$. **[5]**

OR

Q8) a) Determine the analytic function $f(z) = u + iv$ if $u = xy^2 - 3x^2y$. **[4]**

b) Find the bilinear transformation, which maps the points $0, -1, i$ of the

z - plane on to the points $2, \infty, \dfrac{1}{2}(5 + i)$ of the w - plane. **[4]**

c) Evaluate $\displaystyle\oint_c \dfrac{z^2 - z + 1}{z - 1}dz$, where c is the circle $|z| = \frac{1}{2}$. **[5]**

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S.E. (Computer)
COMPUTER GRAPHICS
(2015 Pattern) (210251) (Semester - II)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
  1) *Answer Question No. Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
  2) *Neat diagrams must be drawn wherever necessary.*
  3) *Figures to the right side indicate full marks.*
  4) *Use of Calculator is allowed.*
  5) *Assume Suitable data if necessary*

Q1) a) Write recursive algorithms to fill the polygon area by using 4- connected
method of Boundary fill algorithm and Flood fill algorithm. **[6]**

b) Interpret Bresenham's algorithm to find which pixel are turned ON for
the line segment between (1,2) and (7,6). **[6]**

OR

Q2) a) State and explain different methods of character generation. **[6]**

b) Explain cohen-sutherland out-code algorithm with the help of suitable
example. **[6]**

Q3) a) Consider the square A(1,0), B(0,0), C(0,1), D(1,1) Rotate the square by
45 degree anticlockwise direction about point A(1,0). **[6]**

b) What is Animation? What are the various methods of controlling
animation? **[6]**

OR

Q4) a) Explain HSV and CMY Color models. **[6]**

b) Explain in detail rotation of an object about an arbitrary axis in 3D. **[6]**

Q5) a) Explain Z-buffer algorithm with its advantages and disadvantages **[7]**

b) Describe diffuse illumination and point source illumination. **[6]**

OR

Q6) a) What is surface rendering? Explain Gouraud method of shading. **[6]**

b) Explain how Binary Space Partition (BSP) algorithm be used for removal of hidden surfaces? **[7]**

Q7 a) Write short note on: Bezier Curve with properties. **[6]**

b) Explain gaming platform i860 with a block diagram. **[7]**

OR

Q8) a) Explain B-splines techniques for generating the curves with an example. **[6]**

b) What is OpenGL? Explain OpenGL data processing method. **[7]**

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Total No. of Questions : 8]

SEAT No. :

PA-1344

[Total No. of Pages : 2

[5925]-523

S.E. (Computer Engineering)
MICROPROCESSOR AND INTERFACING TECHNIQUES
(2015 Pattern) (Semester - II) (210248)

Time : 2 Hours]

*[Max. Marks : 50*

Instructions to the candidates:

1) Answer Q. No. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.

2) Neat diagrams must be drawn whenever necessary.

3) Figures to the right indicate full marks.

4) Assume suitable data, if necessary.

Q1) a) Explain difference between near and for procedure of 8086 microprocessor. **[6]**

b) Explain the command words of 8259 in detail. **[6]**

OR

Q2) a) Draw and explain block diagram of 8259 PIC. **[6]**

b) Explain the following assembler directives with example each: **[6]**

i) Public

ii) Extern

iii) EQU

Q3) a) Draw and explain in brief 8279 internal block. **[7]**

b) Explain different operating modes of 8255 PPI. **[5]**

OR

Q4) a) Explain difference between synchronous & asynchronous communication. **[3]**

b) Explain different operating modes of 8237 DMA controller. **[3]**

c) Draw and explain interfacing of 8-bit DAC with 8255. **[6]**

P.T.O.

Q5) a) Draw and explain the read cycle timing diagram of 8086 in maximum mode. **[7]**

b) Draw and explain block diagram of 8087. **[6]**

OR

Q6) a) Explain the status and control word of 8087. **[7]**

b) Explain difference between minimum & maximum mode of 8086. **[6]**

Q7) a) Draw block diagram of intel is mother board. **[7]**

b) List features of 82801 JIR I/O Controller hub. **[6]**

OR

Q8) a) List features of intel X58 express chipset. **[6]**

b) Write short note on Intel I/O Controller hub IO. **[7]**

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[5925]-524

S.E. (Computer)

ADVANCED DATA STRUCTURES

(2015 Pattern) (Semester - II) (210252)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   *Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*

    2)   *Neat diagrams must be drawn wherever necessary.*

    3)   *Figures to the right indicate full marks.*

    4)   *Assume suitable data, if necessary.*

Q1) a)   Write an algorithm to delete node from BST.   **[6]**

    b)   Draw the minimum cost spanning tree using Kruskal for the graph given below. Also find its cost. Show all steps.   **[6]**
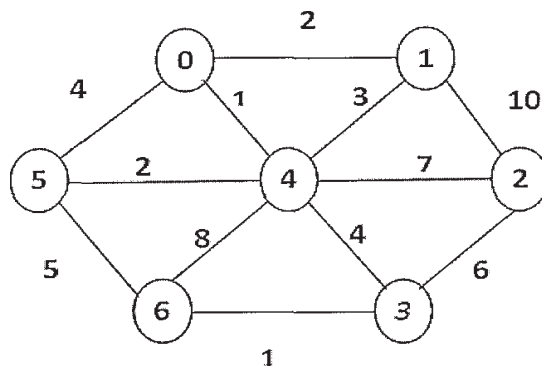
OR

Q2) a)   Generate binary tree for the following pre-order and in-order traversals.**[6]**

    In-order: E A C K F H D B G

    Pre-order: F A E K C D H G B

    b)   Draw any directed graph with minimum 6 nodes and represent graph using adjacency matrix, adjacency list, adjacency multilist and inverse adjacency list.   **[6]**

Q3) a) Construct the AVL tree for the following sequence of keys: **[6]**
10 20 15 12 25 30 14 22 35 40

b) What is collision? What are different collision resolution techniques?**[6]**

<center>OR</center>

Q4) a) Construct hash table of size 10 using linear probing without replacement strategy for collision resolution. The hash function is h(x)=x%l0. Consider slot per bucket is 1. **[6]**
31, 3, 4, 21, 61, 6, 71, 8, 9, 25

b) Explain following: **[6]**
   i) Static and dynamic tree table with suitable example
   ii) Dynamic programming with principle of optimality

Q5) a) What is B+ tree? Construct a B+ tree of order 4 for the following data**[7]**
1, 4, 7, 10, 17, 20, 31, 25, 19, 20, 28, 42

b) Explain following trees using suitable example: **[6]**
   i) Red black tree
   ii) Splay-tree

<center>OR</center>

Q6) a) Explain following trees using suitable example: **[6]**
   i) Trie tree
   ii) AA-tree

b) Write an algorithm to arrange numbers in ascending order using heap sort. Arrange the following numbers in ascending order using heap sort:**[7]**
48, 0, –1, 82, 10, 2, 100

Q7) a) Explain linked organization of a file. Describe inverted files and cellular partitions w.r.t. Liked organization. **[6]**

b) Write pseudo code for two-way merge sort. **[7]**

<center>OR</center>

Q8) a) Define sequential file organization. Explain advantages of indexing over sequential file. **[7]**

b) Explain any two types of indices. **[6]**

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[5925]-525

S.E. (Computer)

MICROPROCESSORS

(2015 Pattern) (Semester - II) (210253)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates :

   1)   *Neat diagrams must be drawn wherever necessary.*

   2)   *Figures to the right side indicate full marks.*

   3)   *Use of calculator is allowed.*

   4)   *Assume suitable data, if necessary.*

Q1) a)   Explain in short MSW with neat diagram.   **[2]**

    b)   Explain Paging Mechanism in 80386 with diagram.   **[4]**

    c)   Explain the following instructions, mention flags affected :   **[6]**

       i)   LIDT

       ii)   CLD

       iii) MOVS

OR

Q2) a)   Explain Immediate and Register Addressing Mode.   **[2]**

    b)   Explain with example SHL and ROL instructions.   **[4]**

    c)   Explain in detail the Control Registers of 80386.   **[6]**

Q3) a)   When does a page fault occur?   **[2]**

    b)   Explain any two I/O Privilege Instructions.   **[4]**

    c)   Explain what happens when an interrupt calls a procedure as an interrupt handler.   **[6]**

OR

Q4) a)   What is CPL and RPL?   **[2]**

    b)   Differentiate between Memory Mapped I/O and I/O Mapped I/O.   **[4]**

    c)   Draw and briefly explain Task State Segment.   **[6]**

Q5) a) Write short note on "Instruction Address Breakpoint". **[3]**

b) What all initializations required to start processor in real mode after reset? **[4]**

c) With neat diagram explain "Entering and leaving V86 mode". **[6]**

OR

Q6) a) What are the contents of various registers of processor 80386 after reset? **[3]**

b) How many Debug Registers are present in 80386? List and draw all of them. **[4]**

c) With neat diagram explain the process of Linear Address Formation in V86 mode. **[6]**

Q7) a) Explain following signals : **[3]**
   i) NMI
   ii) INTR
   iii) RESET

b) Draw and explain 80387 register stack. **[4]**

c) Draw "Write Cycle with Pipelined Address Timing". **[6]**

OR

Q8) a) Explain HOLD and HLDA signals of 80386DX. **[3]**

b) List various bus states when address pipelining is used. **[4]**

c) Draw "Read Cycle with Non-pipelined Address Timing". **[6]**

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S.E. (Computer Engineering)
PRINCIPLES OF PROGRAMMING LANGUAGES
(2015 Pattern) (Semester-II) (210254)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, or Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Explain the following with Example   **[6]**

   i)   Abstract Syntax Tree

   ii) Semantic of programming language

   iii) Interpretation and compilation

   b) Explain the following with example with respect to data types   **[6]**

   i)   User-defined types and abstract data types

   ii) Static versus dynamic program checking

   iii) Monomorphic versus polymorphic type systems,

OR

Q2) a) Explain the following with example for variables in programming language.
                                                                                [6]

   i)   Scope of variable

   ii) Binding of the variable

   iii) Unnamed varibles

   b) Explain the following with example in various structure of programming languages   **[6]**

   i)   Routines,

   ii) Style issues: side effects and aliasing,

   iii) Exceptions,

Q3) a) Explain the following with example in program **[6]**

    i) Modularity,

    ii) Encapsulation,

    iii) Interface and implementation,

  b) Explain the following Programming Paradigms with example **[7]**

    i) Procedural,

    ii) Object oriented,

    iii) Functional,

    iv) Logic & rule based.

<div align="center">OR</div>

Q4) a) What is generic data type in programming language? Explain Generic units, Generic data structures **[6]**

  b) Grouping of units, Encapsulation, Interface and implementation, Abstract data types, classes, and modules **[7]**

Q5) a) Explain the following with Java Programming with example **[6]**

    i) declaring objects,

    ii) assigning object reference variables,

    iii) adding methods to a class,

  b) Explain the following with respect to inheritance in Java member access and inheritance, super class references, Using super multilevel hierachy **[6]**

<div align="center">OR</div>

Q6) a) Explain the following with Java Programming with example declaring objects, assigning object reference variables, constructors, this keyword, garbage collection, finalize () method. **[6]**

  b) Explain the following with respect to packages in Java defining a package, finding packages and CLASSPATH, access protection, importing packages **[6]**

Q7) a) Explain the following with respect to Exceptions in Java Programming
language **[6]**
   i) Fundamental, exception types
   ii) Uncaught exceptions
   iii) Try, catch, throw, throws,

b) Explain with respect to I/O handling in Java Streams, Byte Streams and
Character Streams, Predefined Streams, Reading console Input, **[7]**

OR

Q8) a) Explain the following with respect to Exceptions in Java Programming
language **[6]**
   i) Fundamental, exception types, uncaught exceptions,
   ii) Multiple catch clauses, nested try statements,
   iii) Built-in exceptions, custom exceptions

b) Explain the Java Applet with respect to following **[7]**
   i) Applet Architecture Applet Skeleton,
   ii) Passing parameters to Applets,
   iii) Difference between Applet and Application Program.

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[5925]-527

S.E. (Computer)

DISCRETE MATHEMATICS

(2015 Pattern) (Semester - I) (210241)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*

Q1) a) Prove the following formula using mathematical induction.

$$1+3+6+...+\frac{n(n+1)}{2}=\frac{n(n+1)(n+2)}{6}$$ **[5]**

b) Find transitive closure of relation R by Warshalls algorithm.

$A=\{1,2,3,4\}$ and $R=\{(1,2),(2,1),(2,3),(3,4)\}$ **[5]**

c) Define multiset **[2]**

OR

Q2) a) It is observed that in second year class of 80 students 50 knew C++, 55 know Java and 46 know Python. It was also know that 37 know C++ and Java, 28 Java and Python and 25 C++ and Python and 7 students not know any of the language then find **[5]**

i) How many knew all the three languages?

ii) How many knew exactly two languages?

iii) How many knew exactly one language?

b) Let $f(x)=x+2, g(x)=x-2, h(x)=3x$ find gof, fog, fof, hog, gog, foh, hof, fohog. **[5]**

c) Define equivalence relation. **[2]**

Q3) a) In how many ways can 10 examination papers be arranged so that the best and worst paper never come together. **[4]**

b) Determine the number of triangles that are formed by selecting points from a set of 12 points out of which 5 are collinear. **[4]**

c) Define Graph, Bipartite graph, complete graph, regular graph with examples. **[4]**

OR

Q4) a) An 8 member's team is to be formed from group of 01 men and 15 women. In how many ways can be team be chosen so that **[4]**

   i) The team must contain 4 men and 4 women

   ii) Threre must be more men than women

b) What is isomorphism of graph? Identify the following graph are isomorphic or not justify your answer. **[3]**
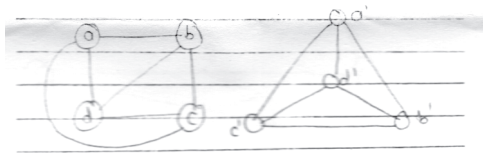
c) Find the shortest path between a and z using Dijkstra algorithm. **[5]**
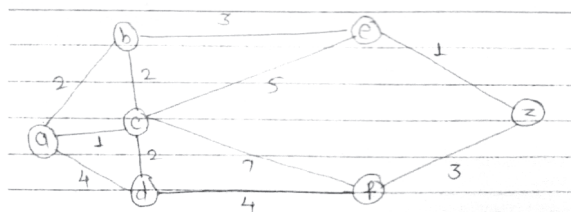
Q5) a) What is minimum spanning tree? Find minimum spanning tree for the graph using prims algorithm. **[7]**
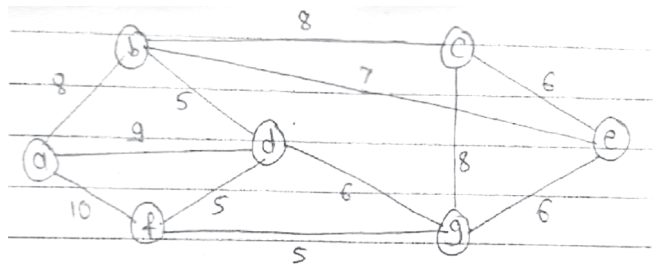
b) For the following sets of weights construct optimal binary prefix code. **[6]**

a	b	c	d	E
5	6	6	11	20

OR

Q6) a) Find maximum flow in transport network. Show that minimum cut is equal to maximum flow. **[7]**
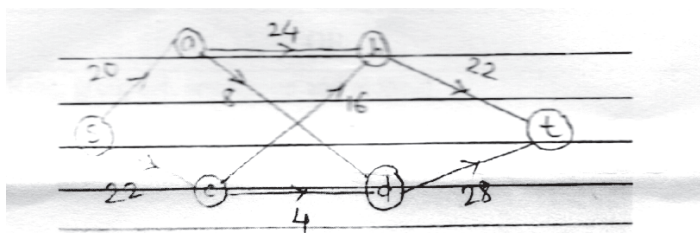
b) Find the fundamental cut sets for given tree. **[6]**
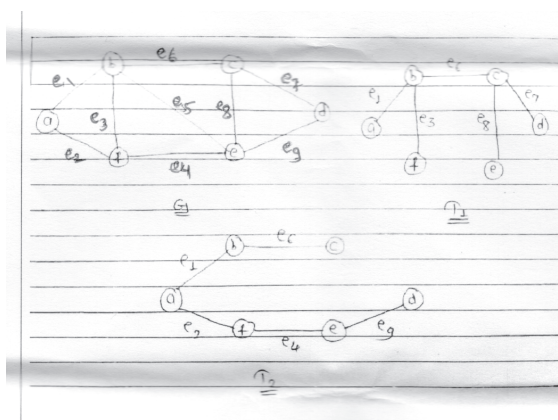
Q7) a) Explain commutative, associative, distributive cancellation properties of binary operations. **[7]**

b) Let (A, *) be monoids such that for every x in A, $x*x = e$, where e is the identity element. Show that (A, *) is an abelian group. **[6]**

OR

Q8) a) What is Ring, groupoid, semigroup and monoid. **[7]**

b) Show that the set G $= \{1, \alpha, \alpha^2\}$ where α is the cube root of the unity is a group with respect to multiplication. **[6]**

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[5925]-528

S.E. (Computer Engineering)
DIGITAL ELECTRONICS & LOGIC DESIGN
(2015 Pattern) (Semester-I) (210242)

Time : 2 Hours] *[Max. Marks : 50*
Instructions to the candidates:
1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
2) Neat diagram must be drawn wherever necessary.
3) Assume suitable data if necessary.

Q1) a) Minimize the following logic function using k-map & realize using logic gates draw the diagram for the output. **[6]**

   $F(A,B,C,D) = \Sigma m(1,3,5,8,9,11,15) + d(2,13)$

   b) Explain the internal diagram of IC-7490 design MOD 68 counter using IC-7490 **[6]**

OR

Q2) a) Simplify the following logic function using the qunie MC-cluskey minimization technique. $F(A,B,C,D) = \Sigma m(0,1,4,6,12,14,15)$ **[6]**

   b) Design a sequence generator to generate the following sequence 10110.... using shift register. **[6]**

Q3) a) Draw a ASM chart & state diagram for 2-bit UP-counter having one enable line E such that **[6]**

   E=1 (Counting enabled)

   E=0 (Counting disabled)

   b) Draw & explain block diagram of PLD device **[6]**

OR

Q4) a) Design & implement full adder circuit using PLA. **[6]**

   b) Write VHDL code for full adder using. **[6]**

   i) Data flow modeling

   ii) Structural modeling

P.T.O.

Q5) a) Compare TTL and CMOS logic family. **[4]**

b) Draw & Explain operation of 2-Input TTL NAND gate. **[5]**

c) Draw & Explain the circuit diagram of CMOS. Inverter. **[4]**

OR

Q6) a) Explain TTL Open collector logic. **[4]**

b) What is tri-state? Explain tri-state buffer in detail. **[5]**

c) Explain wired logic in CMOS. **[4]**

Q7) a) Explain the following instructions with respective to 8051 & also give example of each. **[6]**

   i)   MOVX

   ii)   XRL A,Rn

   iii) Swap A

b) List different addressing modes of 8051 state & Explain any 3 addressing modes with example. **[7]**

OR

Q8) a) Give the significance of the following pins of Micro controller 8051: **[6]**

   i) $\overline{\text{PSEN}}$

   ii)   ALE/PROG

   iii) $\overline{\text{EA}}$ / VPP

   iv) RST

b) Draw & Explain the format of SCON register of Microcontroller 8051**[7]**

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[5925]-529

S.E. (Computer Engineering)
DATA STRUCTURES AND ALGORITHMS
(2015 Pattern) (Semester - I) (210243)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Solve Q. No. 1 or 2, 3 or 4, 5 or 6, 7 or 8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a) Define Algorithm and its characteristics. **[3]**

b) What is Divide and Conquer strategy. **[3]**

c) Write C/C++ pseudocode to perform simple transpose of sparse matrix. Also, discuss its time complexity. **[6]**

OR

Q2) a) Differentiate between Linear and Non-Linear data structure with example.**[3]**

b) Explain polynomial representation using array with suitable example.**[3]**

c) Explain the Asymptotic notations: Big O, Omega and Theta with suitable example. **[6]**

Q3) a) Write an algorithm to delete an intermediate node from Doubly linked list. **[3]**

b) Write Pseudo C/C++ code to reverse the string. **[3]**

c) Convert following infix expression to postfix expression: **[6]**

((a/(b − c + d))*(e − a)*c)

Use stack and show step by step conversion.

OR

Q4) a) What is recursion? Explain use of stack for "Web page visit history in a web browser". **[3]**

b) Write a pseudo C/C++ code to insert node into a singly linked list. **[3]**

c) Write an algorithm for traversing a singly linked list that delete all the nodes having negative key/value. **[6]**

Q5) a) Write a pseudo C/C++ code to implement circular queue using arrays.**[6]**

b) Write pseudo C/C++ code to represent the following operations on double ended queue (dequeue or deque): **[7]**

   i) Create deque

   ii) Insert

   iii) Delete

OR

Q6) a) Explain linear queue and circular queue with suitable example. Also, give advantages of circular queue over linear queue. **[6]**

b) Explain priority queue. Give pseudo C/C++ code for array implementation of priority queue. **[7]**

Q7) a) Explain sequential search and binary search with suitable example and compare their time complexity. **[6]**

b) Explain quick sort and sort the given list using quick sort. **[7]**

15, 08, 20, –4, 16, 02, 01, 12, 21, –2

OR

Q8) a) Write an algorithm for binary search. Derive recurrence relation and find out time complexity of the search. **[6]**

b) Write a short note on stability of sorting. Compare bubble, selection, insertion sort with one example and discuss time complexity. **[7]**

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[5925]-530

S.E. (Computer)
COMPUTER ORGANIZATION AND ARCHITECTURE
(2015 Pattern) (Semester - I) (210244)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q. No. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of Calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Draw and explain the general structure of IAS Computer. **[6]**

    b) Describe the IEEE standards for single precision and double precision floating point numbers. **[6]**

OR

Q2) a) Solve the following problem using restoring division algorithm. **[6]**

       Dividend : 1001

       Divisor : 0011

    b) Draw and explain the memory Hierarchy. What is the general relationship among access time, memory cost, and capacity. **[6]**

Q3) a) List and explain any two DMA data transfer modes. **[6]**

    b) Explain types of instructions according to operations and number of address. Give examples. **[6]**

OR

Q4) a) Explain following addressing modes with one example each. **[6]**

       i) Auto increment

       ii) Auto decrement

       iii) Immediate

    b) Differentiate between Programmed I/O and Interrupt driven I/O. **[6]**

Q5) a) What are various pipelining hazards in instruction pipelining? Explain any one in detail. **[6]**

b) Explain True Data Dependency, Resource Conflict & Procedural Dependency. **[7]**

OR

Q6) a) Enlist and explain Use visible registers and control and status registers.**[7]**

b) Draw and explain the functional block Diagram of 8086. **[6]**

Q7) a) Write a control sequence for the following instruction for single bus organization SUB (R3), R1. **[7]**

b) Compare horizontal and vertical microinstruction format. **[6]**

OR

Q8) a) Explain in detail state table design method for hardwired control design.**[6]**

b) Explain in detail microinstruction sequencing organization. **[7]**

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[5925]-531

S.E. (Computer Engineering)
OBJECT ORIENTED PROGRAMMING
(2015 Pattern) (Semester - I) (210245)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates :

1) *Answer Question 1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) What are inline functions? What are their advantages? Give an example.**[6]**

b) What do you mean by constructor and destructor? **[3]**

c) Write appropriate C++ program which uses copy constructor. **[3]**

OR

Q2) a) What is Multiple Inheritance? What is the ambiguity in Multiple inheritance? Give suitable example to demonstrate Multiple inheritance. **[6]**

b) Explain the concept of class and object with suitable Example. **[4]**

c) What is abstract class? Give suitable example. **[2]**

Q3) a) What is Friend Function? Explain with suitable example. **[4]**

b) Compare and contrast memory allocation and deallocation using new, delete. **[4]**

c) What is the concept of function pointers? Give suitable example in C++.**[5]**

OR

Q4) a) Explain class template and function template with an example. **[4]**

b) Write a suitable C++ Program to illustrate the concept of Generic Programming. **[5]**

c) Explain why we need templates in C++? **[4]**

P.T.O.

Q5) a) Write a program using the opens(), eof() and getline() member functions to open and read file content line by line. **[6]**

b) What are the various functions to manipulate the file pointers? Explain with the help of Suitable examples. **[7]**

OR

Q6) a) Write a C++ program that will accept numbers as command line arguments and Sort the entered Numbers in Ascending order and display the resultant sequence. **[7]**

b) Compare between early binding and late binding in C++. **[6]**

Q7) a) Elaborate forward, bidirectional and random- access iterators with examples. **[6]**

b) What is a stack? How is it implemented using STL? **[6]**

OR

Q8) a) What is a container? List the container classes in C++. Explain any one of container Class using a program. **[6]**

b) Write a program to implement Deque using STL Container. **[6]**

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[5925]-532

S.E. (Electrical)

ELECTRICAL MACHINES - I

(2015 Pattern) (203146) (Semester - II)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates :

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of Non-Programmable Scientific Calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Step by step obtain the approximate equivalent circuit of 1-ph transformer referred on primary side. Draw the circuit diagram and write down the equations during each step. **[6]**

b) The OC/SC test has been conducted on 20 kVA, 2200/220 V, 1-ph transformer is given below. **[6]**

OC test: 220V, 4A, 160 W ---(on LV side)

SC test: 80V, 12A, 380 W ---(on HV side)

Determine i) Full load voltage regulation at pf = 0.8 lagg.

ii) η at full load & pf = 0.8 lagging

OR

Q2) a) What is V-V connection? Obtain the expression for VV Capacity/$\Delta\Delta$ Capacity. State any two advantages & disadvantages. **[6]**

b) The maximum efficiency of 1-ph transformer is 90% at unity pf. Calculate efficiency at half load & unity pf. **[6]**

Q3) a) Draw the circuit diagram of 3-point starter and explain function of (i) No volt coil and (ii) overload coil. **[6]**

b) Sketch the construction diagram of DC machine and label all parts, also state the material used for each part and their functions. **[7]**

OR

Q4) a) With neat connection diagram, explain the method of speed control of DC shunt motor. Draw the connection diagram and necessary plots. **[6]**

b) The armature winding of 4-pole, 240 V, dc shunt motor is lap connected. It has 120 slots with 10 conductors/slots. The Flux/pole is 20mWb and current drawn by the motor is 25A. The armature and shunt field resistances are 0.1 Ω & 120 Ω respectively. The rotational losses are 830 W. Calculate i) Gross Torque ii) Shaft Torque iii) Lost Torque and iv) Efficiency. **[7]**

Q5) a) With necessary phasor diagram, prove that when 3-ph supply is fed to 3-ph stator winding, it produces rotating magnetic field of constant magnitude and rotates at synchronous speed. **[6]**

b) Sketch and explain family of torque-slip characteristics of 3-phase induction motor. **[6]**

OR

Q6) a) Obtain the following relations : **[6]**
   i) ratio of starting torque to maximum torque
   ii) ratio of full load torque to maximum torque

b) A 6 pole 550V, 50 Hz 3-ph induction motor develops gross output power of 32 HP when running at 950 rpm. The mechanical losses are 2 Hp and stator losses equals to 2000 W. Find - **[6]**
   i) % slip
   i) rotor copper loss in Watt
   iii) input power and
   iv) efficiency.

   Take 1 HP = 745.7 Watt

Q7) a) Explain, the 3-ph induction motor as a generalized transformer. Draw the suitable circuit and phasor diagram. **[6]**

b) With neat connection diagram, explain the working of star -delta starter used for 3-phase induction motor. **[7]**

OR

Q8) a) With neat connection diagram explain how to conduct the no load test and block rotor test on 3 ph induction motor. Also draw the observation tables for both the tests. **[6]**

b) Write the general procedure to draw the circle diagram. Show rotor and stator copper losses, fixed losses, full load current, p.f., motor efficiency and torque line on it. **[7]**

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[5925]-533

S.E. (Electrical)

POWER SYSTEMS - I

(2015 Pattern) (Semester - II) (203145)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right side indicate full marks.*

4) *Assume suitable data if necessary.*

Q1) a) What are base load and peak load power stations? Hence state advantages of interconnected grid system. **[6]**

b) Derive the expression for string efficiency of suspension insulators when string consist of 3 discs hence calculate string efficiency of 32 kV line consisting of 3 units in string. If capacitance between each insulator and earth is 14% of self-capacitance and voltage across first and last units are 5.16 kV and 7.42 kV respectively **[6]**

OR

Q2) a) Explain function and list necessary quantities required to be printed on name plate of following equipments in power plant **[6]**

i) Power Transformers.

ii) Circuit Breakers.

b) Define the following terms : **[6]**

i) Load Factor.

ii) Demand Factor.

iii) Plant capacity factor.

Hence calculate load factor and demand factor if

A generating station has connected load of 1500 MW and maximum demand of 650 MW; the units generated being $615 * 10^6$ per annum.

P.T.O.

Q3) a) Explain in brief what are different types of line supports hence state requirements of line supports. **[6]**

b) Find inductive reactance of 3 phase, 50 Hz bundled conductor line placed in horizontal configuration as shown in figure. Diameter of each conductor is 3.5 cm. **[7]**

Fig 3b

OR
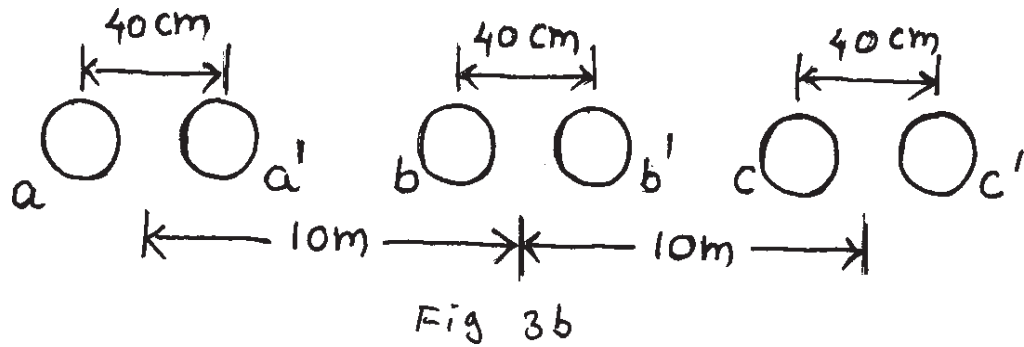
Q4) a) Derive an expression for the inductance of a 3 phase overhead transmission line with unsymmetrical spacing assuming the line is transposed. **[6]**

b) A transmission line conductor at river crossing is supported from two towers at heights 50 m and 80 m above water level. The horizontal distance between the towers is 300 m. If ultimate strength in the conductor is 1500 kg with safety factor of 2. Find distance of tallest point and lowest point on conductor above the water level. Weight of conductor is 0.75 kg/m, hence calculate sag at both ends on conductor. **[7]**

Q5) a) A 3-phase, 50Hz, 132kV overhead line has conductors placed in a horizontal plane 3.5 m apart. Conductor diameter is 1.8 cm. If the line length is 95 km, calculate the charging current per phase assuming complete transposition. **[6]**

b) Derive the expression for capacitance of 1 phase transmission line with out considering effect of earth **[6]**

OR

Q6) a) Derive the expression for capacitance of 3 phase transmission line when conductors are unsymmetrically spaced but transposed. **[6]**

b) What is transposition of line conductors? Explain how unsymmetrical spacing in the line affects capacitance of the conductors. **[6]**

Q7) a) State true or false and justify your answer : **[6]**

i) When load power factor is lagging, voltage regulation of- line is positive?

ii) Capacitive current is always flowing in the line under no load or light load conditions.

iii) Linear, bilateral and passive networks are used to determine generalized circuit constants.

b) Obtain the relationship for the sending end voltage and current in terms of receiving end voltage and current for a medium length transmission line with split condenser method of representation. Draw neat circuit representation and phasor diagram. **[7]**

OR

Q8) a) Classify transmission lines based on length, voltage levels and generalized circuit constants. **[6]**

b) Evaluate ABCD constants of medium transmission line using nominal 'Π' method hence calculate ABCD constants of 66 kV, 3 phase, 50 Hz, transmission line having total resistance of 37.5 Ω, total reactance of 75 Ω and capacitive admittance of $6*10^{-4}$ S. **[7]**

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[5925]-534

S.E. (Electrical Engineering)
NETWORK ANALYSIS
(2015 Pattern) (Semester - II) (203147)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Answers Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of Calculator is allowed.*
5) *Assume Suitable data, if necessary.*

Q1) a)   Simplify the circuit Shown in fig (1) and. Find V   **[7]**
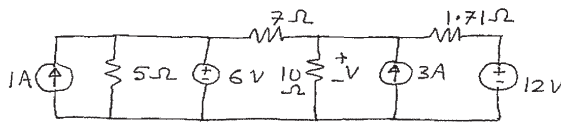
Fig (1)

b)   Find current through each branch as shown in fig (2)   **[6]**
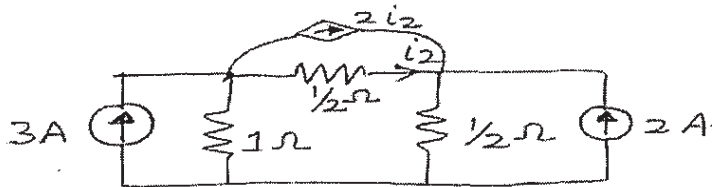
Fig (2)

OR

Q2) a)   Find V$_a$ and V$_b$ by using Superposition Theorem   **[7]**

Fig. (3)

P.T.O.
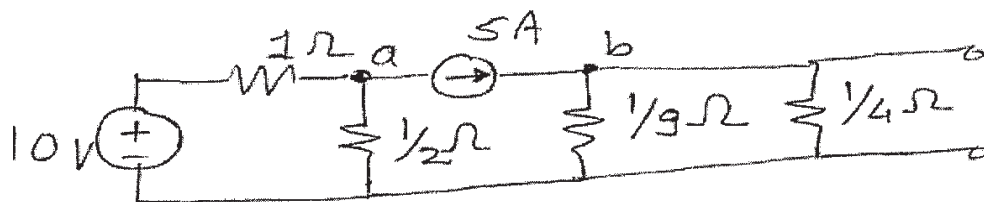
b) Develop the Tie Set B matrix, Consider 1,4,5 Branches are forming Tree. **[6]**
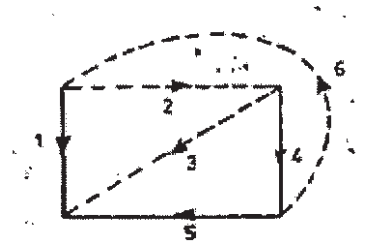
Q3) a) In the circuit, the switch S_1 is closed at time $t = 0$, and switch S_2 is closed at time $t = 0.1$ sec find the transient current by using classical theory & also draw this current for two intervals. **[7]**
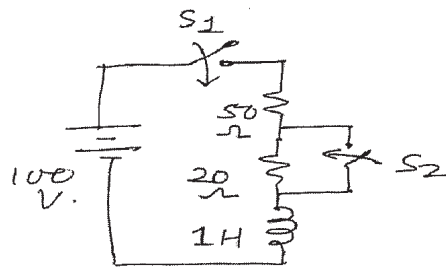
Fig (5)

b) R-L-C circuit is excited by DC voltage source. Find Current i(t) using conventional method. The switch is closed at time $t = 0$. **[6]**
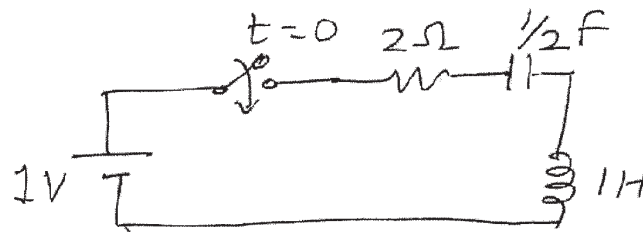

Fig (6)

OR

Q4) a) After being on position 1 for long time, the switch is thrown on position 2 at time $t = 0$, find current using Laplace Transform technique. **[7]**
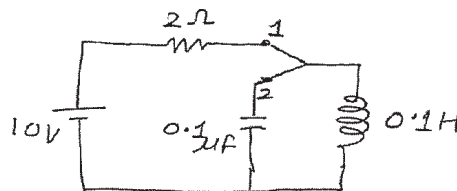
Fig (7)

b) Obtain f(t) for the function f(s) , using Convolution Integral

$$F(S) = 10/(S^2+7S+12)$$ **[6]**

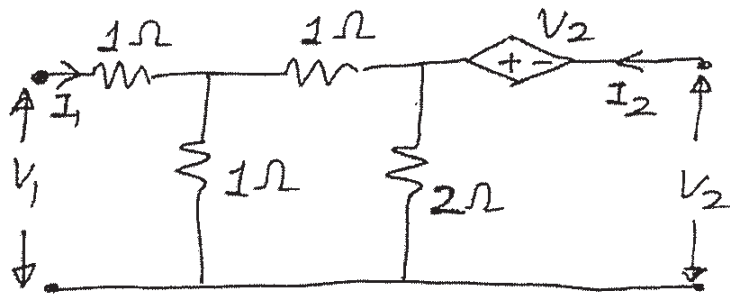*Q5)* a) Find Z parameter for the circuit as shown in fig. (8)   **[6]**

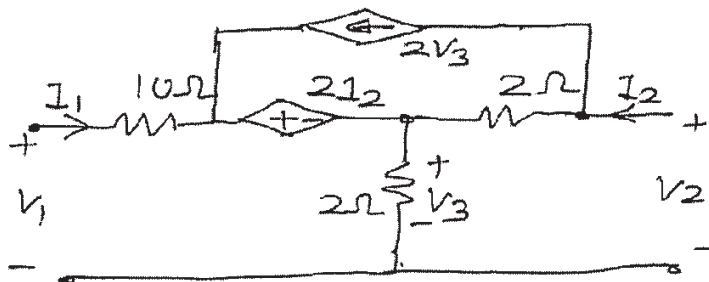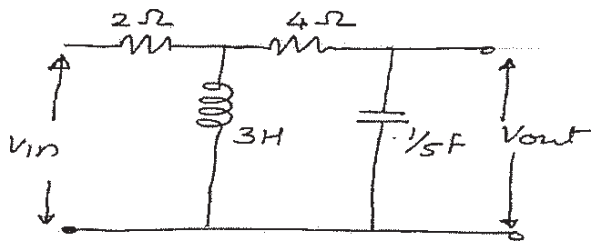
Fig (8)

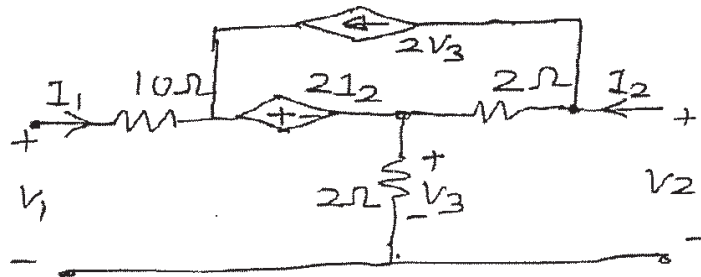b) Obtain Z parameter of network as shown in Fig (9)   **[6]**

Fig (9)

OR

Q6) a) Find Transfer Function of network as shown in fig   **[6]**

b) Obtain Z parameter of network as shown in Fig   **[6]**

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Q7) a) Design the high pass filter & develop relation of inductance & capacitance in terms of cut-off frequency & design resistance. **[6]**

b) A low pass filter is composed of symmetrical. π section. Each series arm and shunt arm is 0.04 Henery and 3 microfarad. Find cut off frequency and design Resistance. **[6]**

OR

Q8) a) Design the High pass filter & develop relation of inductance & capacitance in terms of cut- off frequency & design resistance. **[6]**

b) A HPF section is constructed from two capacitors 1.5 microfarad each and 15 milli henery find cutoff frequency and design Resistance. **[6]**

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[5925]-536

S.E. (Electrical)

NUMERICAL METHODS AND COMPUTER PROGRAMMING
(2015 Pattern) (Semester-II) (203148)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of Calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a)   State following theorems: **[6]**
  i)   Intermediate value theorem
  ii) Strum's theorem

  b)   Explain the following instructions used in C programming   **[6]**
  i)   printf
  ii) scanf
  iii) getch

<div align="center">OR</div>

Q2) a)   For the polynomial $f(x) = 2x^3 - 6x + 13,$ find $f(3), f'(3), f''(3)$ and
    $f'''(3).$ **[6]**

  b)   Explain different types of Operators and its Precedence.   **[6]**

Q3) a)   Use Lagrange's interpolation formula to find f(9) for the given data. **[6]**

X	5	7	11	13	17
Y	150	392	1452	2366	5202

  b)   Use Secant method to obtain $\sqrt{12}$. Use initial guess 3 and 4. Perform
    three iterations.   **[7]**

<div align="center">OR</div>

Q4) a)   Derive the formula for Newton backward interpolation formula.   **[6]**

  b)   Use bisection method to obtain $\sqrt[3]{29}$. Use initial guess 3 and 4. Perform
    six iterations.   **[7]**

Q5) a) Apply RK 4th order method to find y for x = 0.2 Given $\dfrac{dy}{dx} = x + y^2$,

Given $x_0 = 0$, $y_0 = 1$, $h = 0.1$ **[6]**

b) Derive the equation for Simpson's 3/8 th rule for numerical integration using Newton's Cotes formula. **[7]**

<div align="center">OR</div>

Q6) a) Explain Taylor's series method for solution of ordinary differential equations. **[6]**

b) A curve is passing through the points as given in following table. **[7]**

x	1	2	3	4	5	6	7	8	9
y	0.2	0.7	1	1.3	1.5	1.7	1.9	2.1	2.3

Find

i) The area bounded by the curve, the x-axis, $x = 1$ and $x = 9$.

ii) The volume of the soild generated by revolving this area about x-axis. Use Simpson's (1/3)rd method.

Q7) a) Use Jacobi's method to solve the following system of equations at the end of 5th iterations. Use initial values as $x = 0$, $y = 0$ and $z = 0$ **[6]**

$$x + y + 8z = 20$$
$$x + 5y - z = 10$$
$$4x + 2y + z = 14$$

b) Explain Gauss elilmination method for solution of linear simultaneous equation. *(Numerical is not expected)* **[6]**

<div align="center">OR</div>

Q8) a) Find numerically the largest eigen value by power method. Show 5 iterations. **[6]**

$$A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix} X_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

b) Find $[A]^{-1}$ using Gauss-Jordan method. **[6]**

$$A = \begin{bmatrix} 2 & 2 & 3 \\ 2 & 1 & 1 \\ 1 & 3 & 5 \end{bmatrix}$$

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S.E. (Electrical)
FUNDAMENTALS OF MICROCONTROLLER
AND ITS APPLICATIONS
(2015 Pattern) (Semester-II) (203149)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Attempt Ques. 1 or 2, 3 or 4, 5 or 6, 7 or 8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Explain stack organization and enlist stack related instructions. **[6]**

   b) Explain the instructions: **[6]**

   i)   MOVX A, @ DPTR

   ii)   CJNE A, # data, rel

   iii) MUL AB

OR

Q2) a) With neat diagram explain internal RAM organization of 8051 microcontroller. **[6]**

   b) Explain the various addressing modes of 8051 and give one example of each addressing mode. **[6]**

Q3) a) Write a program to clear External data memory location From E800H to E8FFH. **[6]**

   b) Draw & explain SCON register. **[7]**

OR

Q4) a) Draw & explain TMOD register. **[6]**

   b) Write a program to transfer letter 'A' serially at baud rate 4800 continuously. Use serial model. Assume XTAL = 12MHz. **[7]**

Q5) a) Explain following microcontroller development tools: **[6]**

     i)   Assembler

     ii)   Simulator

     iii)   Compiler

    b) Explain the function of following pin of ADC 0809. **[6]**

     i)   SOC

     ii)   EOC

     iii)   ALE

     iv)   Output Enable

     v)   ADD A, ADD B, ADD C

<div align="center">OR</div>

Q6) a) Draw and Explain I/O mode of 8255 PPI. **[6]**

    b) Draw 8051 based system to interface DAC. Write a program to generate triangular wave. **[6]**

Q7) a) Draw & explain Temperature measurement using 8051. **[6]**

    b) Write a program to monitor a status of SW, if SW is connected to Pin P2.1 and do following: **[7]**

     i)   If SW = 0 DC motor rotate in Clockwise direction

     ii)   If SW = 1 DC motor rotate in anticlockwise direction

<div align="center">OR</div>

Q8) a) Draw & explain flow measurement using 8051. **[6]**

    b) Write an assembly language program for 8051 to rotate stepper motor in clockwise and anticlockwise direction with step angle 1.8^0 **[7]**

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S.E. (Electrical/Instrumentation and Control)
ENGINEERING MATHEMATICS - III
(2015 Pattern) (Semester - I) (207006)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a)   Solve any Two   **[8]**

     i) $\left(D^2+1\right)y = e^x\left(1+x^2\right)$

     ii) $\dfrac{d^2y}{dx^2} - y = \dfrac{2}{1+e^x}$ by variation of parameters method.

     iii) $\left(1+x\right)^2\dfrac{d^2y}{dx^2} + \left(1+x\right)\dfrac{dy}{dx} + y = 2\sin\left[\log\left(1+x\right)\right]$

   b)   Solve by Laplace transform method $\dfrac{d^2y}{dt^2} - 3\dfrac{dy}{dt} = 9$ with $y(0)=0=y'(0)$ **[4]**

OR

Q2) a)   A circuit consists of an inductance L and condenser of capacity C in series. An atternating e.m.f. E sin nt is applied to a circuit at time $t = 0$, the initial current and charge on the condenser being zero. Find the current flowing in the circuit at any time for $w \neq n$ where $w^2 = \dfrac{1}{LC}$.   **[4]**

   b)   Solve any one.   **[4]**

     i) $L\left\{t\ e^{3t}\sin 2t\right\}$

     ii) $L^{-1}\left\{\cot^{-1}s\right\}$

   c)   Find Laplace transform of $e^{-t}\cos t\ U(t-\pi)$.   **[4]**

Q3) a) Find Fourier cosine transform of $f(x) = e^{-x} + e^{-2x}, 0 < x < \infty$. **[4]**

b) Solve any One. **[4]**

   i) Find z-transform of $f(k) = \dfrac{2^k}{k}, |< \geq|$

   ii) Find $z^{-1}\left\{\dfrac{z}{z-5}\right\}, |z| > 5$

c) If the directional derivative of $\phi = axy + byz + czx$ at $(1, 1, 1)$ has maximum magnitude 4 in the direction parallel to $x - axis$, find the values of a, b, c. **[4]**

OR

Q4) a) Solve any one **[4]**

   i) $\nabla^2 f(r) = \dfrac{d^2 f}{dr^2} + \dfrac{2}{r}\dfrac{df}{dr}$

   ii) $\nabla \times \left[\bar{a} \times \nabla\left(\dfrac{1}{r}\right)\right] = \dfrac{\bar{a}}{r^3} - \dfrac{3(\bar{a}.\bar{r})}{r^5}\bar{r}$

b) Show that **[4]**

   $\bar{F} = (y \sin z - \sin x)i + (x \sin z + 2yz)j + (xy \cos z + y^2)k$

   is irrotational. Find scalar ϕ such that $\bar{F} = \nabla\phi$.

c) Solve **[4]**

   $f(k+2) + 3f(k+1) + 2f(k) = 0, f(0) = 0, f(1) = 1$

Q5) a) Evaluate $\int_c \bar{F}.d\bar{r}$ for $\bar{F} = (2y+3)\bar{i} + xz\bar{j} + (yz - x)\bar{k}$ along the straight line joining $(0, 0, 0)$ to $(3, 1, 1)$. **[4]**

b) Using stoke's theorem evaluate $\int \bar{F}.d\bar{r}$ where $\bar{F} = y^2\bar{i} + x^2\bar{j} - (x+z)\bar{k}$ and c is the bandary of triangle with vertices $(0, 0, 0)$ $(1, 0, 0)$ $(1, 1, 0)$ **[4]**

c) Use divergence theorem to evaluate $\iint(x^3\bar{i} + y^3\bar{j} + z^3\bar{k}) \cdot d\bar{s}$ where s is the surface of the sphere $x^2 + y^2 + z^2 = 16$. **[5]**

OR

Q6) a) Using Green's lemma evaluate $\int x^2 dx + xy\, dy$ over the boundary of the region R enclosed by $y = x^2, y = x$. **[5]**

b) Evaluate $\iint_s (\nabla \times \overline{F}) \cdot d\overline{s}$ for $\overline{F} = y\overline{i} + z\overline{j} + x\overline{k}$ where s is the surface of the paraboloid $z = 1 - x^2 - y^2, z \geq 0$. **[4]**

c) Prove that $\iint_s (\phi \nabla \psi - \psi \nabla \phi) \cdot d\overline{s} = \iiint (\phi \nabla^2 \psi - \psi \nabla^2 \phi)\, dv$. **[4]**

Q7) a) If $v = 3x^2 y - y^3$, Find u such that $f(z) = u + iv$ is analytic. **[4]**

b) Evaluate $\oint_c \dfrac{4z^2 + z}{z^2 - 1} dz$, where c is the contour $|z - 1| = \dfrac{1}{2}$. **[4]**

c) Find the bilinear transformation, which sends the point 0, 1, 2 from z-plane into the points $1, \dfrac{1}{2}, \dfrac{1}{3}$ of the w-plane. **[5]**

OR

Q8) a) Show that analytic function $f(z)$ with constant modulus is constant. **[4]**

b) Evaluate $\int_c \dfrac{z^2 + 2z}{(z+1)(z^2 - 9)} dz$, where c is $|z - 3| = 5$. **[5]**

c) Find the map of the straight line $y = x$ under the transformation $w = \dfrac{z - 1}{z + 1}$ **[4]**

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[5925]-539

S.E. (Electrical Engineering)
POWER GENERATION TECHNOLOGIES
(2015 Pattern) (Semester - I) (203141)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
   1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
   2) Figures to the right indicate full marks.
   3) Assume suitable data, if necessary.

Q1) a) Explain Carnot cycle with PV and TS Diagram.   **[6]**

   b) Explain site selection of Nuclear Power Plant.   **[6]**

OR

Q2) a) Explain working of Electrostatic precipitator with neat sketch.   **[6]**

   b) Explain Main components nuclear Power Plant with help of neat diagram.

                                                                                      [6]

Q3) a) Derive the expression of power in wind.   **[6]**

   b) Describe small, mini and micro hydro power plant.   **[6]**

OR

Q4) a) Describe functions of Spillway and Dam.   **[6]**

   b) Classify different types of wind turbine. Explain any one with diagram.**[6]**

Q5) a) Draw equivalent circuit diagram and I-V curve of a PV cell.   **[6]**

   b) List the types of collectors. Explain any one with diagram.   **[7]**

OR

Q6) a) Explain impact of temperature and isolation on I-V curve of a PV cell.

[6]

b) What are the Advantage and disadvantages of Solar PV cell. [7]

Q7) a) Write a short note on Tidal energy. [6]

b) Explain fuel cell with neat sketch. [7]

OR

Q8) a) Write a short note on Grid Connected renewable system with diagram.[6]

b) Explain Biomass energy conversion with neat sketch. [7]

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SEAT No. :

[Total No. of Pages : 2

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S.E. (Electrical)
ANALOG & DIGITAL ELECTRONICS
(2015 Pattern) (Semester - I) (203143)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
   1) Answer Q No.1 or Q No.2, Q No.3 or 4 Q No. 5 or 6, Q No. 7 or 8.
   2) Figures to the right indicate full marks.

Q1) a)   Explain binary, octal and hexadecimal system with one example of each.
                                                                             [6]

      b)   Explain the operation of JK flip flop with truth table.   **[6]**

<div align="center">OR</div>

Q2) a)   Minimize the four variable logic function using K map $F(A, B, C, D) = \Sigma m(0, 1, 2, 3, 5, 7, 8, 9, 11, 14)$.   **[6]**

      b)   Design Mod-10 synchronous up counter using JK flip flop.   **[6]**

Q3) a)   Explain the working of OPAMP as ZCD. Also draw the waveforms. **[6]**

      b)   Draw and explain frequency response characteristics of ideal and practical high pass filter.   **[7]**

<div align="center">OR</div>

Q4) a)   Explain working of IC 555 monostable multivibrator.   **[6]**

      b)   Explain the application of OPAMP as triangular wave generator.   **[7]**

Q5) a)   Explain Darlington connection and explain how it improves the current gain.   **[6]**

      b)   Draw & explain the working push pull amplifier.   **[6]**

<div align="center">OR</div>

Q6) a) Explain AC-DC load line analysis using CE configuration of BJT. **[6]**

b) Draw and explain JFET output characteristics. **[6]**

Q7) a) Explain the construction and working of single phase full wave centre tap rectifier connected to R-load with neat diagram. **[7]**

b) Compare single phase half wave rectifier with full wave rectifier. **[6]**

OR

Q8) a) Explain the working of full wave precision rectifier with neat diagrams.**[7]**

b) Explain the construction and working of three phase full wave bridge rectifier connected to R-load with neat diagram. **[6]**

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[5925]-541

S.E. (Electrical)

MATERIAL SCIENCE

(2015 Pattern) (Semester - I) (203142)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8.*
2) *Figures to the right side indicate full marks.*

Physical Constants:

1) Angstrom Unit(AU) = 1×10^{-10} metres

2) Boltzmann's Constant (k) = 1.380×10^{-23} joule.degree -1

3) Charge on Electron (e) = 1.601×10^{-19} coulomb

4) Mass of Electron (m) = 9.107×10^{-31} kg

5) Electron volt (eV) = 1.602×10^{-19} joules

6) Mass of Proton (m_p) = 1.627×10^{-27} kg

7) Velocity of light (c) = 2.998×10^{8} m/sec

8) Dielectric Constant of free space (ε_0) = 8.854×10^{-12} F/m

9) Permeability of free space (μ_0) = $4\pi \times 10^{-7}$ H/m

10) Debye Unit = 3.33×10^{-30} coulomb.metre

Q1) a) Describe polar and non-polar dielectric materials with examples. Hence define permittivity with its unit. **[6]**

b) State the properties and applications of - **[6]**

i) Air

ii) Transformer oil

OR

Q2) a) Write short note on fibre optics with its principle of working. State clearly materials used for fibre optics. **[6]**

b) Explain properties of insulating materials which are used in Cables and Transformers. **[6]**

Q3) a) Define with units **[6]**
   i) Magnetic dipole moment
   ii) Magnetization
   iii) Magnetic susceptibility

b) A filament of a 230V lamp is to be drawn from a wire of having a diameter of 0.025mm and resistivity at 28°C is 5.65×10^{-6} Ω-cm. If the resistance temperature coefficient at 28°C is 5×10^{-3}°C. Calculate the length of the filament to dissipate 40W at filament temperature of at 3003°C. **[6]**

OR

Q4) a) Write short note on magnetic recording materials and compact discs.**[6]**

b) Describe properties and applications of Constantan and Brass. **[6]**

Q5) a) Explain with neat diagram - Single Electron Transistor (SET). **[7]**

b) Explain with neat diagram, chemical reaction and applications of - **[6]**
   i) Lead acid battery
   ii) Sodium Sulphur Battery

OR

Q6) a) Describe with neat diagrams - **[8]**
   i) Boron Nano Tubes
   ii) Carbon clusters

b) What are different types of batteries used in electric vehicles? Write their properties. **[5]**

Q7) a) Explain the method of finding dielectric strength of air using sphere gap voltmeter with a neat diagram as per IS 2584. **[7]**

b) Explain the step by step method of finding dielectric strength of solid insulating materials with a neat diagram as per IS. **[6]**

OR

Q8) a) With neat circuit diagram and phasor diagram, explain measurement of dielectric loss angle (tan δ) by Schering Bridge as per IS 13585-1994.**[7]**

b) With neat sketch, explain how flux density is measured with the help of Gauss meter. **[6]**

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[5925]-542

S.E. (Electrical)
ELECTRICAL MEASUREMENTS & INSTRUMENTATION
(2015 Pattern) (Semester - I) (203144)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
5) *Assume suitable data if necessry.*

Q1) a) Derive the torque equation for moving iron instruments and also state the error in MI instruments. **[6]**

b) Explain loss of charge method for high resistance measurement. **[6]**

OR

Q2) a) With a circuit diagram derive the equation for balance in the case of Anderson bridge. **[6]**

b) A moving coil instrument gives a full scale deflection of 10 mA when the potential difference across its terminal is 100 mV. Calculate **[6]**

i) the shunt resistance for a full scale deflection corresponding to 100A,

ii) the series resistance for full scale reading with 1000 V. Calculate the power dissipation in each case.

Q3) a) When two wattmeter method is used for measurement of power in a three phase balanced circuit, comments upon the readings of the two wattmeters under following conditions. **[6]**

i) When the power factor is unity

ii) When the power factor is zero

iii) When the power factor is 0.5 lagging.

b) A 230 v single phase watt hour meter has a constant load of 4 A passing through it for 6 hours at unity power factor. If the meter disc makes 2208 revolutions during this period, what is the meter constant in revolutions per kwh. Calculate the power factor of the load if the number of revolutions made by the meter are 1472 when operating at 230 V and 5A for 4 hours.

[7]

Q4) a)   With a neat phasor diagram, derive the torque equation for induction
          type single phase energymeter.   **[7]**

     b)   With a neat diagram explain the construction and working of
          electrodynamometer type instrument.   **[6]**

Q5) a)   Describe how the following measurements can be made with the use of
          CRO: **[6]**
          i)   Voltage measurement
          ii)   Current measurement
          iii) Frequency measurement

     c)   Explain pressure capacitance transducer with a neat diagram. Write
          advantages and disadvantages of capacitive transducer.   **[6]**

OR

Q6) a)   Explain Pirani guage for measurement of low pressure. Also state
          advantages and disadvantages.   **[6]**

     b)   Draw and explain block diagram of digital storage oscilloscope. **[6]**

Q7) a)   With suitable diagram explain electrical methods of level measurement.
                                                                          [6]
     b)   Give types of strain gauges. Explain Semiconductor strain gauge. **[7]**

OR

Q8) a)   Explain construction and working of RVDT with neat diagram.   **[6]**

     b)   With suitable diagram explain ultrasonic and nucleonic method of level
          measurement.   **[7]**

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SEAT No. :

[Total No. of Pages : 4

[5925]-543

S.E. (Electronics/E & TC)
ENGINEERING MATHEMATICS - III
(2015 Pattern) (Semester - II) (207005)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   *Attempt Q. No.1 or Q. No.2, Q. No.3 or Q. No.4, Q. No.5 or Q. No.6, Q. No.7 or Q. No.8.*

    2)   *Neat diagrams must be drawn wherever necessary.*

    3)   *Figures to right indicate full marks.*

    4)   *Use of electronic pocket calculator is allowed.*

    5)   *Assume suitable data, if necessary.*

Q1)   a)   Solve any two of the following :   **[8]**

            i) $\dfrac{d^2y}{dx^2} + y = \sec x \tan x$ (using method of variation of parameters).

            ii) $\dfrac{d^2y}{dx^2} + \dfrac{2dy}{dx} + y = e^{-x}\cos 3x$

            iii) $x^2\dfrac{d^2y}{dx^2} - \dfrac{xdy}{dx} + 4y = \cos(2\log x)$

   b)   Solve the integral equation   **[4]**

$$\int_0^\infty f(x)\cos\lambda x\, dx = 1 - \lambda,\ 0 \le \lambda \le 1$$

$$= 0,\ \lambda > 1$$

<p align="center">OR</p>

Q2)   a)   A capacitor (C) 10^{-3} farad is in series with an e.m.f (E) of 20 volts and an inductor (L) of 0.4 henries. At $t = 0$ the charge Q and current I are zero. Find charge Q at any time t.   **[4]**

b) Solve any one of the following : **[4]**

   i) Find inverse Z-transform of $F(z) = \dfrac{z}{\left(z - \dfrac{1}{4}\right)\left(z - \dfrac{1}{5}\right)}, |z| > \dfrac{1}{4}$

   ii) Find Z-transform of $f(k) = \dfrac{2^k}{k}, k \geq 1$

c) Solve the difference equation : **[4]**

$$f(k+1) + \frac{1}{2}f(k) = \left(\frac{1}{2}\right)^k, k \geq 0, f(0) = 0$$

Q3) a) Find Lagrange's interpolating polynomial passing through the set of points: **[4]**

x	0	1	2
y	3	0	−1

Use it to find y at $x = 3$.

b) Use Range-Kutta method of fourth order to obtain the numerical solutions

of $\dfrac{dy}{dx} = \dfrac{1}{x+y}$, $y(0) = 1$ to find y at $x = 0.2$ with $h = 0.2$. **[4]**

c) Find the directional derivative of $\phi = xy^2 + yz^3$ at $(1, -1, 1)$ along the direction of $4\bar{i} + 4\bar{j} + 4k$. **[4]**

OR

Q4) a) Show that (any one) : **[4]**

   i) $\nabla\left(\dfrac{\bar{a}.\bar{r}}{r^3}\right) = \dfrac{\bar{a}}{r^3} - \dfrac{3(\bar{a}.\bar{r})\bar{r}}{r^5}$

   ii) $\nabla.\left(r\nabla\dfrac{1}{r^3}\right) = \dfrac{3}{r^4}$

b)   Show that $\overline{F} = (x^2 - yz)\overline{i} + (y^2 - xz)\overline{j} + (z^2 - xy)\overline{k}$ is irrotational. Find scalar ϕ such that $\overline{F} = \nabla\phi$.   [4]

c)   Evaluate $I = \int\limits_{1}^{2} \dfrac{dx}{x^2}$ by dividing the integral into equally spaced intervals of width 0.25 by using Simpson's $\dfrac{1}{3}^{rd}$ rule.   [4]

Q5) a) Using Green's theorem, evaluate $\int\limits_{c}\overline{F}.d\overline{r}$ for the vector field $\overline{F} = x^2\overline{i} + xy\overline{j}$ over the region R enclosed by $y = x^2$ and $y = x$.   [4]

b)   Using Gauss-Divergence theorem, evaluate $\iint\limits_{S}(x^3\overline{i} + y^3\overline{j} + z^3\overline{k}).d\overline{s}$ where S is the surface of the sphere $x^2 + y^2 + z^2 = 1$.   [5]

c)   Evaluate $\iint\limits_{S}(\nabla \times \overline{F}).d\overline{s}$ where S is the surface of the paraboloid $x^2 + y^2 = 2z$ bounded by the plane $z = 2$ and $\overline{F} = 3(x - y)\overline{i} + 2xz\overline{j} + xy\overline{k}$.   [4]

OR

Q6) a) Evaluate $\oint\limits_{C}\left[\cos y\overline{i} + x(1 - \sin y)\overline{j}\right].d\overline{r}$ over the closed curve $\dfrac{x^2}{4} + \dfrac{y^2}{9} = 1, z = 0$.   [4]

b)   Using Gauss-Divergence theorem, prove that   [4]

$$\iint\limits_{S}(\phi\nabla\psi - \psi\nabla\phi)\bullet d\overline{s} = \iiint\limits_{V}(\phi\nabla^2\psi - \psi\nabla^2\phi)dV,$$ where S is a closed surface containing volume V.

c) Using Stoke's theorem, evaluate $\iint_S (\nabla \times \overline{F}) \cdot d\overline{s}$

where $\overline{F} = (x^3 - y^3)\overline{i} - xyz\overline{j} + y^3\overline{k}$ and S is the surface $x^2 + 4y^2 + z^2 - 2x = 4$ above the plane $x = 0$. [5]

Q7) a) Determine k such that the function, $f(z) = e^x \cos y + i\, e^x \sin ky$ is analytic. [4]

b) Evaluate, $\oint_C \dfrac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-4)} dz$, where C is the circle $| z | = 3$ using Cauchy's integral formula. [5]

c) Find bilinear transformation which maps the points $z = -i, 0, 2 + i$ on to the points $w = 0, -2i, 4$. [4]

OR

Q8) a) If $u = 3x^2 - 3y^2 + 2y$, find v such that $f(z) = u + iv$ is an analytic function. [4]

b) Evaluate, $\oint_C \dfrac{2z^2 + 3}{(z-2)(z-1)^3} dz$, where C is $|z - 1| = \dfrac{1}{2}$. [5]

c) Show that the map $w = \dfrac{z - i}{1 - iz}$ maps upper half of z-plane onto interior part of unit circle in w-plane. [4]

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SEAT No. :

[Total No. of Pages : 2

[5925]-544

S.E. (E&TC/ Electronics)
INTEGRATED CIRCUITS
(2015 Pattern) (Semester-II) (204187)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q.5 or Q6, Q7 or Q.8,*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figure to the right side indicate full marks.*
4) *Use of calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a)   Draw and explain block diagram of op-amp and explain each block operation in detail?   **[6]**

b)   Explain inverting summing amplifier with neat circuit diagram in detail with suitable example?   **[6]**

OR

Q2) a)   Explain Voltage series feedback amplifier using op-amp and derive expression for its voltage gain?   **[6]**

b)   Draw practical differentiator circuit along with frequency response and explain its operation.   **[6]**

Q3) a)   Draw and explain inverting Schmitt trigger circuit in detail, draw necessary waveforms.   **[6]**

b)   Explain voltage to current coverter circuit with grounded load.   **[6]**

OR

Q4) a)   Draw and explain symmetric square wave generator circuit, Draw necessary waveforms.   **[6]**

b)   Write a short note on : 2 Bit Flash type ADC.   **[6]**

Q5) a) Explain frequency multiplier circuit using PLL. **[6]**

b) Draw wein bridge oscillator circuit using op-amp. The resistor contributing in frequency generation connected is 10 KΩ calculate capacitor value if frequency is 15.9 Hz and then changed to 15.915 KHz. **[7]**

OR

Q6) a) Explain the terms " Lock range", "Capture range" and "Free running frequency" related to PLL **[6]**

b) Draw RC Phase shift oscillator circuit using op-amp? The oscillator frequency is 6.5 KHz and capacitor is 0.01μ F calculate resistor required to achieve oscillations. **[7]**

Q7) a) Explain with circuit diagram first order high pass filter. If the cutoff frequency is 10 KHz and resistor is 1KΩ calculate capacitor required for the circuit. **[7]**

b) Draw and explain wide band pass filter with its frequency response. **[6]**

OR

Q8) a) Draw and explain narrow band pass filter with suitable circuit diagram and frequency response. **[7]**

b) Design a first order non-inverting low pass filter with cut-off frequency 1 KHz with pass gain of 2. Draw the designed circuit diagram. Assume C=0.01μF and R_F=5KΩ **[6]**

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[5925]-545

S.E. (Electronics/E & TC)
CONTROL SYSTEMS
(2015 Pattern) (Semester - II) (204188)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of logarithmic tables, slide rule, electronic pocket calculator and steam tables is allowed.*
5) *Assume suitable data required.*

Q1) a) Explain the rules of Block Diagram Reduction technique. **[6]**

b) For a system with closed loop transfer function: **[6]**

$$G(s)H(s) = \frac{25}{s^2 + 5s + 25}.$$

Determine rise time, peak time, maximum overshoot, and settling time.

OR

Q2) a) Determine the overall transfer function of the system shown in Fig. 1 using block diagram reduction rules. **[6]**

Fig. 1
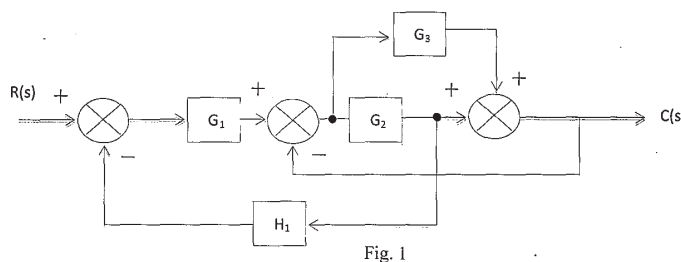
b) A unity feedback system has the following forward transfer function:**[6]**

$$G(s) = \frac{1000(s+8)}{(s+7)(s+9)}$$ Evaluate the type of system, Kp, Kv, Ka. Also

find the steady state error for the standard step, ramp and parabolic inputs.

P.T.O.

Q3) a) Determine the stability of the system with characteristic equation: **[4]**

$Q(s) = s^8 + 5s^6 + 2s^4 + 3s^2 + 1 = 0.$

b) Draw Bode plot of the system with open loop transfer function:

$$G(s) = \frac{100}{s(s+0.5)(s+10)}$$

and determine gain crossover frequency, phase cross over frequency, gain margin, phase margin. **[8]**

OR

Q4) a) Determine the resonant peak, resonant frequency for the system. **[4]**

$$\frac{C(s)}{R(s)} = \frac{5}{(s^2 + 2s + 5)}$$

b) Sketch the root locus of unity feedback system having: **[8]**

$$G(s)H(s) = \frac{K}{s(s^2 + 2s + 2)}$$

Q5) a) Determine state model in controllable canonical and observable canonical form. **[6]**

$$G(s) = \frac{s^3 + 2s^2 + 5s + 1}{s^4 + 4s^3 + 4s^2 + 7s + 2}$$

b) Derive the expression for state transition matrix by Laplace transform method and state properties of state transition matrix. **[7]**

OR

Q6) a) Obtain the state transition matrix for the following system. **[7]**

$$\left[\dot{X}\right] = \begin{bmatrix} 0 & -3 \\ 1 & -4 \end{bmatrix} x(t)$$

b) Find state controllability and observability of the system if **[6]**

$$A = \begin{bmatrix} -2 & 1 & 0 \\ 1 & -3 & 2 \\ 10 & 0 & -8 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 0.1 \\ 1 \end{bmatrix}, C = \begin{bmatrix} 1 & 0 & 1 \end{bmatrix}, D = \begin{bmatrix} 0 \end{bmatrix}$$

Q7) a) Draw and explain block diagram of Digital control system. **[6]**

b) Draw the ladder diagrams for Ex-OR, NOR and NAND gates. **[7]**

OR

Q8) a) Draw and explain block diagram of PLC. **[6]**

b) Find Pulse transfer function for the error sampled closed loop system in Fig 2. **[7]**
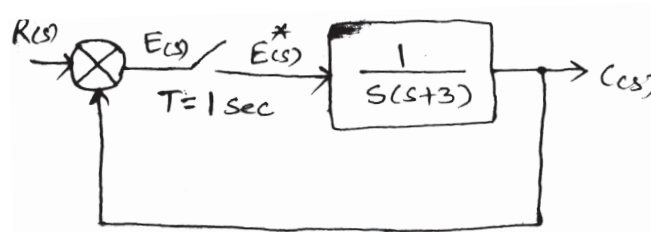
Fig : 2

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[5925]-546
S.E. (Electronics/E&TC)
ANALOG COMMUNICATION
(2015 Pattern) (Semester - II) (204189)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

   1)   *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6 and Q.No.7 or Q.No.8.*

   2)   *Neat diagrams must be drawn wherever necessary.*

   3)   *Figures to the right indicate full marks.*

   4)   *Use of logarithmic talbes, slide rule, Mollier charts, electronics pocket calculator and steam table is allowed.*

   5)   *Assume suitable data if necessary.*

Q1) a)   Derive expression for AM wave and explain power relations for DSB FC.   **[6]**

     b)   Compare different SSB generation methods.   **[6]**

OR

Q2) a)   Describe Vestigial side band modulation in detail and its applications. **[6]**

     b)   Draw and explain block diagram of Superheterodyne receiver for FM reception.   **[6]**

Q3) a)   Explain Armstrong method of FM generation.   **[6]**

     b)   An AM transmitter has carrier of 500 W which is modulated up to a depth of 40%. Find the total power in the transmitted wave for: **[6]**

       i)   Standard AM

       ii)   DSBSC

OR

Q4) a)   With the help of waveform explain AM detection using envelope detection method.   **[6]**

     b)   With the help of equations show that FM and PM are inseparable.   **[6]**

Q5) a) Explain performance of SSBSC in presence of noise. **[6]**

b) Two resistors of 20 KΩ and 50 KΩ are operating at room temperature (290° K) at bandwidth of 100 KHz. Calculate thermal noise voltage generated by:

  i) each resistor

  ii) Resistors in series

  iii) resistors in parallel. **[7]**

OR

Q6) a) Explain the following: **[6]**

  i) Thermal Noise

  ii) Shot Noise

  iii) Partition Noise

b) An amplifier circuit having noise figure of 9 dB and power gain of 25 dB is followed by mixer having noise figure of 16 dB. Calculate overall noise figure and equivalent noise temperature at the input of the combination. **[7]**

Q7) a) Describe types of sampling with their merits and demerits. **[6]**

b) Draw and explain PCM with neat block diagram. **[7]**

OR

Q8) a) What is Nyquist criteria? Explain distortions in the process of sampling and its remedial solutions. **[7]**

b) With the help of waveform explain how PWM and PPM can be generated. **[6]**

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[5925]-547

S.E. (E & TC/Electronics)
OBJECT ORIENTED PROGRAMMING
(2015 Pattern) (Semester - II) (204190)

*Time : 2 Hours]*   *[Max. Marks : 50*
Instructions to the candidates:
 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
 2) *Neat diagram must be drawn wherever necessary.*
 3) *Figures to the right, indicate full marks.*
 4) *Use of calculator is allowed.*
 5) *Assume suitable data if necessary.*

Q1) a) What are the differences between C++ and Java?   **[6]**

 b) What is operator overloading? What are all the operators that cannot be overloaded?   **[3]**

 c) How does a main() function in C++ differ from main( ) in C?   **[3]**

OR

Q2) a) What is Dynamic or Run Time Polymorphism?   **[3]**

 b) What is a constructor? What are the types of constructor? Does a class inherit the constructors of its Superclass?   **[3]**

 c) Write a C++ program to create a class circle having data members radius, member functions to

 i)   read radius,

 ii) to calculate & display area

 iii) to calculate & display circumference. Create two objects of class. **[6]**

Q3) a) Why Java is platform independent? What is Java Literals?   **[6]**

 b) What is this keyword in Java? What are the main uses of this keyword? Can use assign the reference to this variable?   **[4]**

 c) What does it mean that a method or field is "static"?   **[3]**

OR

Q4) a) Difference between method overloading and overriding. **[3]**

b) How is final different from finally? **[3]**

c) Write short notes on: **[7]**
   i) Control statements in Java
   ii) Command line Arguments

Q5) a) Why is inheritance used in Java? Why is multiple inheritance not supported in Java? **[6]**

b) What is the difference between on Interface and an Abstract class? **[6]**

OR

Q6) a) What is the package? How to create packages in Java? **[6]**

b) Write a program in Java to create a Transistor class. Inherit the classes BJT and MOSFET from Transistor class. **[6]**

Q7) a) What is Multithreading? Explain in detail. **[7]**

b) What are the two types of Exceptions in Java? Which are the differences between them? **[6]**

OR

Q8) a) Explain the life cycle of an Applet. What happens when an applet is loaded? What is the deffence between an Applet and a Java Application?**[7]**

b) In Java, How many ways you can take input from console? **[6]**

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[5925]-548

S.E. (Electronics / E & TC)
SIGNALS & SYSTEMS
(2015 Pattern) (Semester - I) (204181)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) A signal $x(t)$ is shown in Fig 1. Sketch the following signal. **[4]**

   i) $x(2t+3)$

   ii) $x(-2t+3)$

Fig. 1
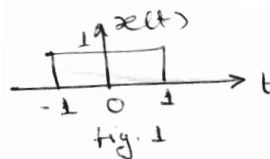
   b) Find the value of following function $\int_{-\infty}^{\infty} t^3 \delta(t-10)\ dt$ **[2]**

   c) For the following impulse response, determine whether the corresponding system is static, causal and stable. Justify your answer. **[3]**

   $$h(t) = e^{-2|t|}$$

   d) Evaluate the step response for the LTI system represented by following impulse response and sketch the step response

   $$h(t) = \delta(t) + \delta(t-1) + \delta(t-2)$$ **[3]**

OR

Q2) a) Determine whether the following signals are periodic. If periodic find the period. **[4]**

   i) $x(t) = \left[\cos(2\pi t)\right]^2$

   ii) $x[n] = (-1)^{n^2}$

b) The systems that follow have input $x(t)$ and output $y(t)$. Determine whether the corresponding system is **[2]**
   i) Memoryless
   ii) Stable
   iii) Causal
   iv) Linear

   $$y(t) = x(t/2)$$

c) Find the expression for the impulse response relating the input $x(t)$ to the output $y(t)$ for the system shown in Fig 2. **[3]**
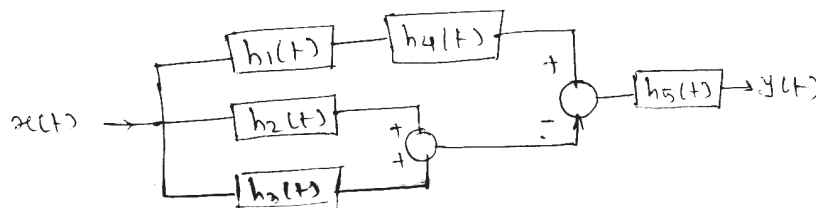
Fig. 2 Interconnection of LTI system

d) Find the output response of the LTI system if input $x(t)$ and impulse response $h(t)$ are given by **[3]**

$$x(t) = u(t)$$
$$h(t) = e^{-2(t-1)}u(t-1)$$

Q3) a) Find the trignometric Fourier series for the signal $x(t)$ shown in Fig. 3.**[3]**
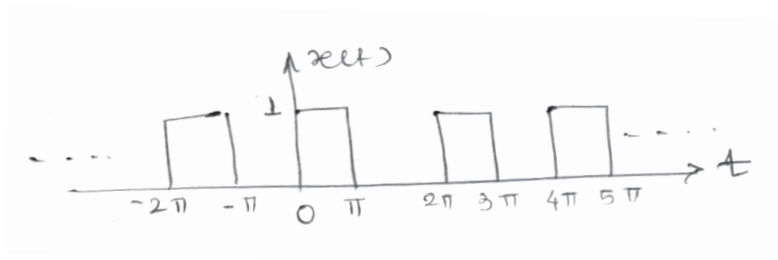
b) Find the Fourier transform of **[6]**
   i) $e^{-2t}u(t-10)$
   ii) $t^2 e^{-2t}u(t)$

c) Find the fourier transform of $x(t) = \dfrac{d}{dt}\left(e^{-2t}u(t)\right)$ **[3]**

OR

[5925]-548   2

Q4) a) Find Fourier transform of following signal and sketch magnitude and phase spectrum. **[6]**
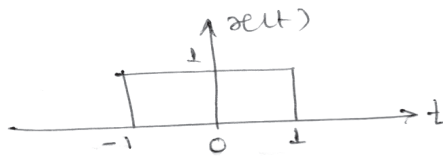
b) Find exponential Fourier series of the Signal shown in Figure. **[3]**
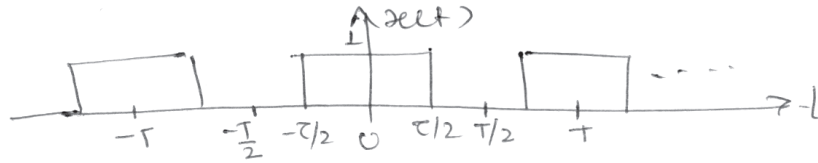
c) State the dirichlet conditions for existance of Fourier transform. **[3]**

Q5) a) Find the Laplace transform of following signal. **[6]**

i) $x(t) = t^2 e^{-5t} u(t)$

ii) $x(t) = \dfrac{d^2}{dt^2}\left(e^{-2t} u(t)\right)$

if initial conditions are zero

b) Find the inverse Laplace transform if **[4]**

$$x(s) = \frac{1}{(s+5)(s+1)(s+2)}; -5 < \mathrm{Re}(s) < -1$$

c) Find the transfer function of the following **[3]**
i) An ideal differentiator
ii) An ideal integrator

OR

Q6) a) Find the unilater Laplace transform of following signal. **[6]**
i) $x(t) = \left(-e^{3t} u(t) * (tu(t))\right)$
ii) $x(t) = t^2 e^{-2t} u(t)$

b) Find initial and final value of a signal $x(s)$ given by $x(s) = \dfrac{7s+10}{s(s+2)}$. **[4]**

c) Plot pole-zero diagram and check the system is causal and stable.

$$x(s) = \frac{1}{(s+5)(s+1)(s+2)}$$ **[3]**

Q7) a) If a single (fair) die is rolled, determine the probability of each of the following event. **[3]**
i) Obtaining the number 6.
ii) Obtaining a number greater than 5.
iii) Obtaining a number less than 3 and greater than or equal to 2.

b) A random variable has probability density function given by **[4]**

$$fx(x) = \begin{cases} 0.1 & ; -3 \leq x \leq 7 \\ 0 & ; elsewhere \end{cases}$$

i) Find the mean value
ii) Find the mean square value
iii) Find the variance
iv) Standard deviation

c) State and explain properties of CDF. **[3]**
d) Draw and explain uniform probability distribution model. **[3]**

OR

Q8) a) The pdf of uniform distribution model is shown in fig. **[3]**
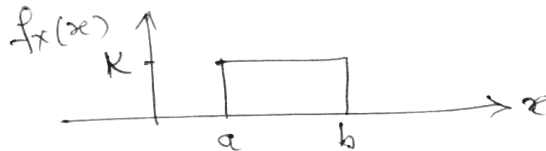
Find
i) Value of k
ii) Mean value
iii) Variance

b) Draw and explain Gaussian probability distribution model. **[3]**
c) The PDF of Random variable is **[4]**

$$f_x(x) = \begin{cases} k\,x & : 0 < x \leq 3 \\ 0 & ; else \end{cases}$$

compute the following
i) value of k
ii) $p(1 < x < 2)$
iii) Find CDF

d) Define the following terms. **[3]**
i) Auto correlation
ii) Cross correlation
iii) Energy Spectral Density

[5925]-549

S.E. (E& TC/Electronics)
ELECTRONIC DEVICES AND CIRCUITS
(2015 Pattern) (Semester-I) (204182)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) Answer Q1 or Q2, Q3 or Q4, Q5, or Q6, Q7 or Q8.

2) Neat diagram must be drawn wherever necessary.

3) Use of logarithm tables slide rule, mollier charts, electronic pocket calculator and steam table is allowed.

4) Assume suitable data, if necessary.

Q1) a) What is thermal runaway? Explain the thermal stability conditions. **[6]**

b) Consider single stage CE amplifier with R1=50KΩ, R2=5KΩ, RC=3.9KΩ, RL=2KΩ, hfe=50, hre=2.5×10^{-4}, hoe=25uA/V and hie=1.1KΩ **[7]**

Calculate : Av, Ri, Ro.

OR

Q2) a) Draw and explain the diode bias compensation technique. **[6]**

b) How the input resistance of amplifier circuit can be improved? Explain with suitable diagram. **[7]**

Q3) a) Draw and explain RC phase shift oscillator and calculate output frequency with R=10 KΩ and C=0.01uF **[6]**

b) Explain the general characteristics of negative feedback amplifier. **[6]**

OR

Q4) a) Draw and explain the hybrid- $\prod$ model of common emitter (CE) amplifier model. **[6]**

b) Compare the different types of feedback topologies. **[6]**

Q5) a) What is crossover distortion? Explain the method to overcome the crossover distortion. **[6]**

b) Class A power Amplifier has zero signal collector current of 100mA. If the collector supply voltage is 10V, determine. **[7]**

   i) Maximum ac power output

   ii) Power rating of transistor

   iii) Maximum collector circuit efficiency

OR

Q6) a) Draw and explain the vertically oriented structure of power BJT. **[6]**

b) Draw and explain the complementary symmetry class B power amplifier. State the merits and Demerits of it. **[7]**

Q7) a) Explain the following non-ideal characteristics of MOSFET: **[6]**

   i) Finite output resistance

   ii) Breakdown effects

   iii) Temperature effect

b) Draw and explain the constant current source biasing circuit using MOSFET. **[6]**

OR

Q8) a) Draw the common source E-MOSFET amplifier & explain its modes of operation in detail with equation. **[6]**

b) For the circuit shown in figure1. Calculate IDQ, V_{DSQ} **[6]**
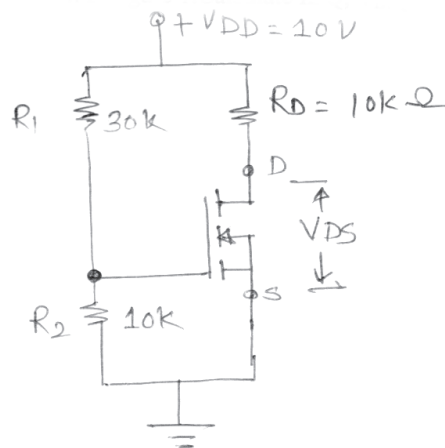
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[5925]-550

S.E. (E &TC and Electronics)
ELECTRICAL CIRCUITS AND MACHINES
(2015 Pattern) (Semester - I) (204183)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
   1)   *Draw neat diagrams wherever necessary.*
   2)   *Use of non-programmable electronics pocket calculator is allowed.*
   3)   *Assume suitable data if necessary.*

Q1) a)   Using current source shifting and source transformation technique obtain equivalent voltage across the terminals a–b in the circuit shown below. All resistors are in ohms. **[6]**
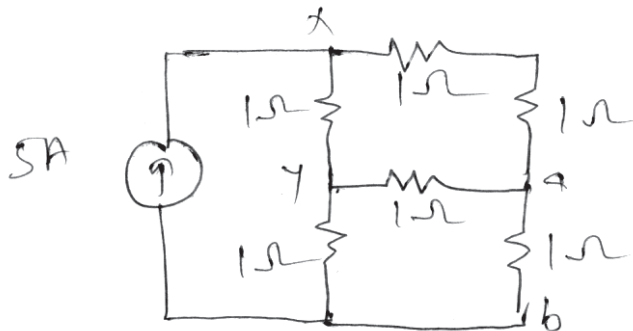
    b)   Explain OC and SC test to be performed on transformer with neat circuit diagram. **[6]**

OR

Q2) a)   State and Explain Maximum Power Transfer Theorem. **[6]**
    b)   Write a short note on Isolation Transformer. **[6]**

Q3) a)   Derive EMF equation of DC generator. **[7]**
    b)   Explain working principle of Synchronous Motor. **[6]**

OR

Q4) a)   Explain Torque - Slip characteristics of three phase induction motor. Explain the effect of rotor resistance on its characteristics with near diagram. **[7]**
    b)   Explain the difference between squirrel age induction motor and slip ring induction motor. **[6]**

Q5) a) Explain the construction and working of BLDC motor. Also draw the speed - torque characteristics. **[7]**

b) Write a short note on reluctance motor. **[6]**

OR

Q6) a) Explain the construction and working principle of Universal motor. **[7]**

b) Distinguish between BLDC and Conventional DC motor. **[6]**

Q7) a) Write a short note on Servo Motors. **[6]**

b) Compare variable reluctance motor with permanent magnet stepper motor. **[6]**

OR

Q8) a) Explain construction & working of AC Servomotor. State its applications. **[6]**

b) Write a short note on Stepper Motor. **[6]**

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[5925]-551

S.E. (E & TC/ Electronics)
DATA STRUCTURES AND ALGORITHMS
(2015 Pattern) (Semester - I) (204184)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answers Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Explain the following.   **[6]**

    i)   Call by value

    ii) Call by reference

  b) Explain any three bitwise operators with example.   **[6]**

                                OR

Q2) a) Write a C-function for binary scarch. Discuss its time complexity. **[6]**

  b) Sort the following data using bubble sort and insertion sort.

    27, 5, 37, 16, 3, 10   **[6]**

Q3) a) Evaluate the following postfix expression using stack:

    6 2 3 + – 3 8 2 / + * 2 ^

    (Note: ^ - stands for power and all operands are single digits.) **[6]**

  b) Define Doubly linked list, write node structure for DLL and an algorithm to create DLL. **[7]**

                                OR

Q4) a) Explain the following.   **[6]**

    i)   Circular queue

    ii) Stack as ADT

  b) Define singly linked list. Write a C-function to delete a note from SLL.

                                                                  [7]

Q5) a) Define Binary search tree. Construct BST for following elements: **[7]**
12, 8, 25, 14, 9, 6, 18
Also how pre-order, in-order and post - order traversal for the same

b) Explain following terms related to tree. **[5]**
   i) Root
   ii) Sub-tree
   iii) Level of Node
   iv) Siblings
   v) Height of tree

<div align="center">OR</div>

Q6) a) Write a C-function to scarch an element in Binary search tree. **[6]**

b) Explain Binary tree. Explain any two types of binary trees with suitable figures. **[6]**

Q7) a) Explain the following. **[6]**
   i) Graph
   ii) Weighted graph
   iii) Out-degree of a vertex

b) Explain Depth first serach (DFS) algorithm for graph traversal. Write a C-function for graph traversal using DFS. **[7]**

<div align="center">OR</div>

Q8) a) With the help of suitable example explain adjacency matrix and adjacency list representation of a graph. **[6]**

b) What is minimum spanning tree (MST) of a graph? Find MST of the following graph using prim's and Kruskal's Algorithm. **[7]**
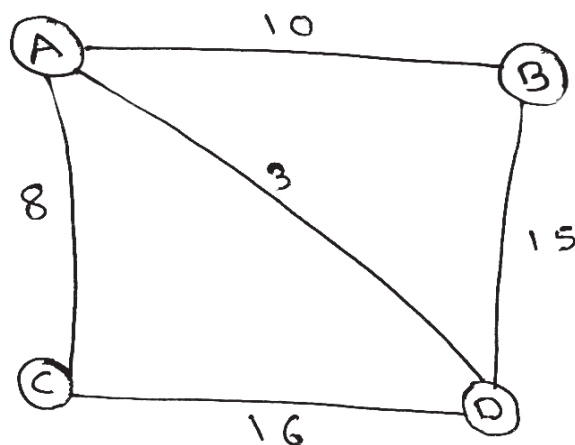
[5925]-552

S.E. (E & TC/Electronics)
DIGITAL ELECTRONICS
(2015 Pattern) (Semester - I) (204185)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

   1)   *Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*

   2)   *Neat diagrams must be drawn wherever necessary.*

   3)   *Figures to the right indicates full marks.*

   4)   *Use of calculator is allowed.*

   5)   *Assume suitable data if necessary.*

Q1) a)   Draw and explain 1:4 DEMUX-block diagram, truth table, working and logic diagram using basic gates. **[6]**

    b)   Explain SR-Flip flop with neat block diagram, Truth table. **[4]**

    c)   Compare Encoder and decoder. **[2]**

<p align="center">OR</p>

Q2) a)   Define K-map with example. **[4]**

    b)   Design 3-bit parity generator ciruit. **[5]**

    c)   Explain 2's compliment method with example. **[3]**

Q3) a)   Design the sequential ciruit for the given state diagram using D Flip flop **[6]**
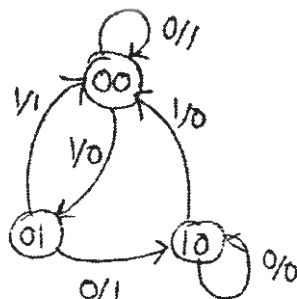
    b)   Explain with neat diagram 2 input CMOS INVERTER gate. **[6]**

<p align="center">OR</p>

P.T.O.

Q4) a) Explain the following characteristics of digital IC's: **[6]**

    i) V_{IH} and V_{OH}

    ii) Noise immunity

    iii) Figure of Merit.

  b) Write short note on state diagram and state table with suitable example.**[6]**

Q5) a) Differentiate between ROM and RAM? **[6]**

  b) Illustrate the features of a ROM cell? **[7]**

<div align="center">OR</div>

Q6) a) Design and implement full substractor using PAL? **[7]**

  b) Explain FPGA architecture. **[6]**

Q7) a) Explain memory organization of 8051 microcontroller. **[5]**

  b) Draw and explain block diagram of 8051 in detail. **[5]**

  c) Explain following instructions of 8051. **[3]**

    i) ADD A,B

    ii) DIV AB

    iii) JNZ

<div align="center">OR</div>

Q8) a) Write short note on internal memory organization of 8051. **[5]**

  b) Draw and explain timer counter of 8051 in detail. **[5]**

  c) Explain following pins of 8051. **[3]**

    i) EA

    ii) RXD

    iii) TXD

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S.E. (Information Technology)
COMPUTER GRAPHICS
(2015 Pattern) (Semester-II) (214450)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Neat diagram must be drawn wherever necessary.*
2) *Figure to right indicate full marks.*
3) *Assume suitable data, if necessary.*

Q1) a) Rasterize a line from (1,1) to (5,3) using Bresenham's line drawing algorithm. **[6]**

  b) What is aliasing and antialiasing? What are the techniques used to remove aliasing problems. **[6]**

OR

Q2) a) Illustrate the steps involved in scan line polygon filling algorithm with example. **[6]**

  b) Magnify the triangle P(0,0) Q(2,2),R(10,4) to four times its size while keeping R(10,4) fixed. **[6]**

Q3) a) Explain the term
  i) Screen coordinates
  ii) World coordinates
  iii) Window
  iv) Viewport. **[6]**

  b) Explain different types of parallel projections. **[6]**

OR

Q4) a) Explain Cohen sutherland line clipping method with suitable example.**[6]**

  b) Explain 3D reflection about xy,yz and xz plane. **[6]**

Q5) a) What are the rules required for different types of animation. **[7]**

b) Explain OpenGL with respect to functions and features. **[6]**

OR

Q6) a) Draw and explain block diagram of i860 microprocessor. **[7]**

b) Enumerate and explain different shading methods in detail. **[6]**

Q7) a) Compare Bezier and B-spline curve generation. Give advantages of B-spline over Bezier curve. **[7]**

b) Write short note on fractal and topological Dimensions. **[6]**

OR

Q8) a) Explain how koch curves are generated. Also calculate fractal and topological dimensions. **[7]**

b) What is Interactive Graphics? Explain features of Maya graphics Tool.**[6]**

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S.E. (Information Technology)

PROCESSOR ARCHITECTURE AND INTERFACING

(2015 Pattern) (Semester - II) (214451)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicates full marks.*
4) *Assume suitable data if necessary.*

Q1) a) State any four features of 80386 microprocessor. **[2]**

b) Differentiate between Macro and Procedure. **[4]**

c) Explain the functionality of following pins of 80386: **[6]**

BUSY#   D/C#   LOCK#

OR

Q2) a) Explain any three addressing modes of 80386 microprocessor with one example. **[6]**

b) Explain with neat diagram interprivilege level transfer using call gates:**[6]**

Q3) a) Draw and explain internal memory organization of 8051 microcontroller. **[6]**

b) Draw and Explain machine status word (MSW) of 80386 microprocessor. **[6]**

OR

Q4) a) Draw and explain block diagram of 8051 microcontroller. **[6]**

b) Draw and explain support registers CR0 - CR3 of paging operation of 80386 microprocessor. **[6]**

Q5) a) List 4 operating modes of timer and explain SFRs related to Timer/ Counter in 8051 microcontroller. **[6]**

b) Draw interrupt structure of 8051 and explain the same. List priority of all interrupt sources. **[7]**

OR

Q6) a) Explain significance of IE and IP registers with format. **[7]**

b) Explain SBUF and SCON registers of 8051 mic'rocontroller. **[6]**

Q7) a) Explain BSR control word format of PPI 8255. Write instructions to set and clear PC5. (Assume CWR address 67H) **[7]**

b) How to configure port 1 and port 2 for 2 digit seven segment display. Explain with diagram & instructions. **[6]**

OR

Q8) a) Explain ADC interfacing with 8051. Explain significance of any 2 interfacing control signals. **[6]**

b) Draw and explain block diagram of PPI 8255. **[7]**

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[5925]-555

S.E. (I.T.)

DATA STRUCTURES AND FILES

(2015 Pattern) (Semester-II) (214452)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:
1) *Answer four questions.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a) Convert following Infix expression to Postfix and Prefix form. Make use of appropriate data structure which can be used for conversion. **[6]**

(A–B)* (C+D–E*F) * G

b) Traverse a given tree in Preorder, and Inorder using appropriate data structure. Show step by step insertion and deletion of node in used data structure. **[6]**

OR
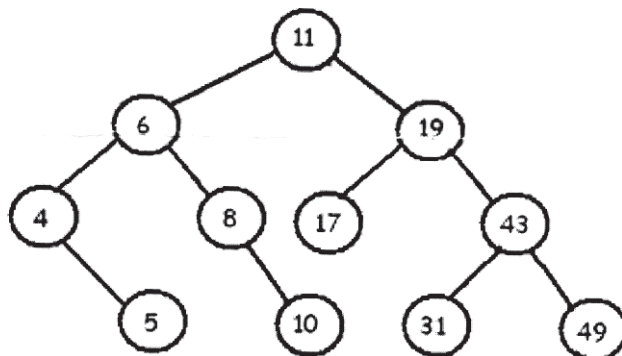
Q2) a) Explain the concept of input restricted and output restricted double ended queue with example. **[6]**

b) Construct Binary Search Tree for given strings. JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC. After construction of BST, delete the node "MAR" from the tree with detail explanation. **[6]**

Q3) a) For a given weighted graph, find shortest path from vertex '0' to all remaining vertices using Dijkastr'a Shortest Path Algorithm. **[6]**
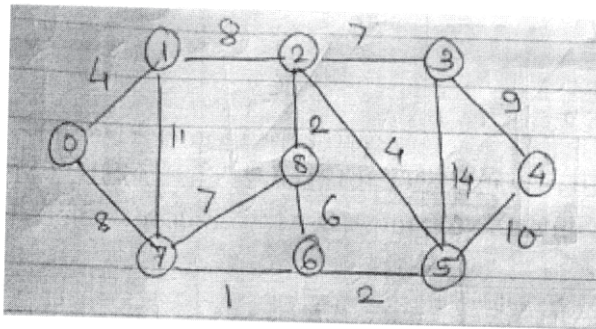
b) For the given set of frequencies, build Huffman tree and generate Huffman codes. **[6]**

Character	Frequency
A	5
B	9
C	12
D	13
E	16
F	45

OR

Q4) a) For a given adjacency matrix, draw weighted graph and find out Minimum Spanning Tree by applying Kruskal's Algorithm and Prim's (Consider Starting Vertex as 'a') Algorithm. **[7]**

	a	b	c	d	e
a	0	1.5	0	0	0
b	1.5	0	3.8	0	2.5
c	0	3.8	0	2.2	0.7
d	0	0	2.2	0	0.5
e	0	2.5	0.7	0.5	0

b) For the given values, construct hash table of size 10. If collision occures, use Liniar probing with chaining with replacement method to resolve the collision. (Mention step wise insertion in the table and hightight collision and its resolution)

Values are : 12, 100, 33, 42, 95, 104, 25, 57 **[5]**

Q5) a) Justify. "All AVL tress are binary search trees but all binary search trees need not be AVL tree" **[6]**

b) Write short note on **[8]**
   i) Red and Black Tree
   ii) B+ Tree

OR

Q6) a) For a given tree, Identify whether it is an AVL tree or not? If it is not an AVL tree, convert it into balanced AVL tree. After conversion, insert node 15 and 24 in the tree. Delete node 20 and 22 from the tree. After insertion and deletion operation, if the tree is imbalanced, make it balanced AVL tree. **[8]**
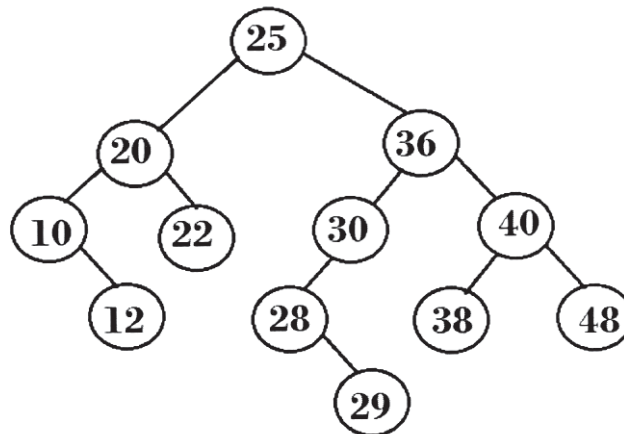
b) Write short note on **[6]**
   i) Threaded Binary Tree
   ii) Splay Tree

Q7) a) What primary operations can be performed on files? Explain all of them w.r.t. file handing in C++. **[6]**

b) What are advancements in Indexed Sequential file structure over Sequential file structure? Write and explain an application where Indexed sequential file is more suitable than the use of sequential file. **[6]**

OR

Q8) a) Explain file opening function in C++ with different file opening modes **[4]**

b) Explain stream class in C++. Which class can be used for input and output purpose? Is there any more class is avilable with which both input and output purpose get fulfill? If yes, then explain that class in detail. **[4]**

c) How records are logically deleted from file. Explain it with suitable example. **[4]**

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S.E. (Information Technology)
FOUNDATIONS OF COMMUNICATION & COMPUTER NETWORK
(2015 Pattern) (Semester-II) (214453)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Attempt Ques. 1 or 2, 3 or 4, 5 or 6, 7 or 8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) List & explain network to pologies along with schematics. Applications advantages & disadvantages. **[6]**

b) Explain the amplitude modulation with waveforms of modulating signal, carrier singal & amplitude modulated carrier signal & expression. **[6]**

OR

Q2) a) Write a note on any one guided media w.r.t. subtypes, construction, applications, merits & demerits. **[6]**

b) State for frequency modulation the waveforms expression & bandwidth. **[6]**

Q3) a) In a system, two bits 0 & 1 are transmitted with probabilities 0.25 & 0.75, calculate the information carried by each one. **[6]**

b) Find the minimum Hamming distance in a code having code words 00000, 01011, 10101 & 11110. How many errors can this code detect & how many errors can it correct. **[6]**

OR

Q4) a) Explain the concept of delta modulation, with the help of waveforms. **[6]**

b) Explain stops wait ARQ protocol for noisy channel w.r.t. various cases such as succesful frame transmission, frame either lost or received with errors, frame received but ACK lost. **[6]**

P.T.O.

Q5) a) Explain CSMA/CD with types of persistent & flow diagram. **[6]**

b) What is multiplexing? Describe WDM with waveforms, block schematic of WDM MUX & D EMUX. **[7]**

<div align="center">OR</div>

Q6) a) Elucidate FDMA with schematic. **[6]**

b) Explain the controlled access network types with suitable diagrams. **[7]**

Q7) a) Give Specifications of Gigabit ethernet versions; 1000 Base SX, 1000 t_X & 1000 Base TX, such as media, maximum length, encoding technique. **[6]**

b) State the functions of switch, router & gateway. **[7]**

<div align="center">OR</div>

Q8) a) Give specifications of fast ethernet versions; 100 Base TX, 100 Base FX & 100 Base Th, suchas media, maximum length, encoding used **[6]**

b) Describe circuit switching with the help of schematic, three phases, efficiency, delay & applications. **[7]**

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S.E. (I.T.)

COMPUTER ORGANISATION AND ARCHITECTURE

(2015 Pattern) (Semester-I) (214442)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

   1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
   2) *Figures to the right indicate full marks.*
   3) *Assume suitable data, if necessary.*

Q1) a)   Multiply using Booths algorithm (101011) and (110011).   **[6]**

   b)   Explain with suitable block diagram Harvard and Von Neumann architecture.   **[6]**

<div align="center">OR</div>

Q2) a)   Perform the division using Restoring method Dividend=17, Divisor = 03.**[6]**

   b)   Explain following addressing modes
   i)   Direct Addressing
   ii)   Register Addressing
   iii) Immediate Addressing
   iv)   Indexed Addressing   **[6]**

Q3) a)   Explain single Bus Processor organisations with diagram.   **[7]**

   b)   Which are the different instruction cycle states of a processor? Explain.**[6]**

<div align="center">OR</div>

Q4) a)   Explain any two cache mapping techniques with suitable diagram.   **[7]**

   b)   Differentiate between Hard wired control unit and Microprogram control unit.   **[6]**

Q5) a)   Explain the following pipeline hazards.   **[6]**
   i)   Resource conflict
   ii)   Data Dependancy conflict
   iii) Branch Hazards

   b)   Explain stages in instruction pipelining.   **[6]**

<div align="center">OR</div>

Q6) a)   How virtual memory is managed using paging and TLB.   **[6]**

b)   Explain events of Fetch cycle of MIPS.   **[6]**

Q7) a)   Explain multithreading in detail.   **[6]**

b)   Write short note on multicare architecture.   **[7]**

<div align="center">OR</div>

Q8) a)   Write short note on: **[7]**

i)   NUMA

ii)   UMA

iii)   CC-NUMA

b)   With the help of suitable diagram explain Flynn's Taxonomy for multiple processor arganisation.   **[6]**

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S.E. (Information Technology)
DIGITAL ELECTRONICS AND LOGIC DESIGN
(2015 Pattern) (Semester-I) (214443)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*

Q1) a)   Convert the following hexadecimal numbers into octal and binary numbers:
[6]

   i)   A72D   ii)   BD6.7   iii)   DF

   b)   Minimize the four variable logic function using K-map. F (A,B,C,D)=m
   (0,1,2,3,5,7,8,9,11,14)   **[6]**

                                        OR

Q2) a)   Define TTL? Define any five standard TTL characteristics & mention
   their value.   **[6]**

   b)   Imlement the following function using 4:1 multiplexer and logic gate:
   F(A,B,C,D)=m(0,2,5,8,10,15)   **[6]**

Q3) a)   How will you convert SR-flip-flop into JKflip-flop?.   **[6]**

   b)   Draw & Explain universal shift register and list applications of shift registers? **[7]**

                                        OR

Q4) a)   Design a MOD-10 counter using IC74191.   **[6]**

   b)   Design a sequence generator to generate the binary sequence ....
   1101011........   **[7]**

Q5) a)   Define PLA? Implement the following functions using PLA:

   F1 (A, B, C) = Σ (1,2,4,6)   **[6]**

   b)   Draw & Explain Basic architecture of FPGA.   **[6]**

                                        OR

P.T.O.

Q6) a) Draw and explain internal architecture of CPLD. **[6]**

b) Implement the following functions using PAL: **[6]**

F2 (A, B, C, D)=Σ (0,1,3.15)

Q7) a) List and explain different data types used in VHDL. **[6]**

b) Compare sequential & concurrent statements in VHDL with suitable examples. **[7]**

<div align="center">OR</div>

Q8) a) What is VHDL? Declare entity for 2 bit. AND and OR gate. **[6]**

b) Differentiate Data flow, Behavoiral and structural type of modeling in VHDL. **[7]**

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[5925]-559

S.E. (Information Technology)
FUNDAMENTALS OF DATA STRUCTURES
(2015 Pattern) (Semester - I) (214444)

Time : 2 Hours]
[Max. Marks : 50

Instructions to the candidates:
1) *Answers Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) What is pointer? What is the need of pointer variable? List any 4 advantages of using pointers. **[6]**

b) Write a pseudo C code to concatenate, copy two strings using user defined function. **[6]**

OR

Q2) a) Write a pseudo C code to accept and display elements of a 2D Array using dynamic memory allocation. **[6]**

b) List all relational operators and explain each with suitable example. **[6]**

Q3) a) What is an algorithm? Explain the characteristics of an algorithm. **[6]**

b) Write the output of each pass of Quick-sort for the following list:

26, 5, 77, 61, 59, 1, 15, 11, 48, 19 **[6]**

OR

Q4) a) What do you mean by frequency count? What is it's importance in the analysis of algorithm? **[6]**

b) Compare Bubble sort and selection sort w.r.t. **[6]**

i) Time complexity

ii) Storage requirement

iii) Sort stability

P.T.O.

Q5) a) Give the sparse representation for the following matrix. Write a C pseudocode to perform addition of 2 sparse matrices. **[8]**

0	1	0	0
2	0	0	3
4	0	0	2

b) Illustrate with example the different storage representations and address calculation for 2D arrays. **[6]**

OR

Q6) a) Define Linear Data structure. Represent the following polynomials using sequential organization. **[8]**

i) $x^2 + 8x^3 - x + 16$

ii) $x^5y^4 - 6x^3y^3 + 10x^2 + y^2 - 10$

iii) $8x^4y^3z^3 + x^3y^2 - 7x^2z^2 + y^2z^2 - 3y$

b) Explain the implementation of the stack data structure, using sequential organization. Why is stack used in recursion? **[6]**

Q7) a) Consider a SLL consisting of numeric values. Write a C pseudocode to find the number of even elements, no. of elements divisible by 5 and average of all elements. **[6]**

b) Discuss the advantages & disadvantages of the linked organization. Represent the following polynomials using linked organization. **[6]**

i) $5x^4y^2 + 10x^3y^2 - 7x^2y^2$

ii) $5x^2 + 9xy - 3y - 8$

OR

Q8) a) Explain the concept of GLL and represent the following list using GLL.**[6]**

i) (L, M, (N, (O, P)), Q), R, (S, T), (A, (B, C)))

ii) (m, n, (o, p, q, (r, (s, t), u, (v), w), x))

b) Compare sequential and linked memory organization. Give applications of SLL, DLL and CLL. **[6]**

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[5925]-560

S.E. (Information Technology)

PROBLEM SOLVING AND OBJECT ORIENTED PROGRAMMING

(2015 Pattern) (Semester - I) (214445)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*

Q1) a)   What are the different types of operators? Give precedence of operators.**[6]**

   b)   How would you contrast three types of loop structures?   **[6]**

                                        OR

Q2) a)   How would you compare positive logic over negative logic?   **[6]**

   b)   Demonstrate six steps of problem solving.   **[6]**

Q3) a)   Write C++ program to demonstrate function overloading.   **[4]**

   b)   Define the terms: variable and constant.   **[4]**

   c)   Enlist the properties of static data members and static member function.**[4]**

                                        OR

Q4) a)   Write C++ program to overload unary minus (–) operator.   **[4]**

   b)   Explain the syntax of operator overloading using friend function.   **[4]**

   c)   What is inheritance? Explain different types of inheritance.   **[4]**

Q5) a) What is the need of virtual destructor. **[4]**

b) Write a C++ program to swap two numbers using concept of function template. **[6]**

c) Explain virtual base class with example. **[3]**

OR

Q6) a) What is STL? Explain components of STL. **[6]**

b) Explain early binding and late binding. **[4]**

c) List the rules of virtual function. **[3]**

Q7) a) What is exception handling mechanism in C++? Write a program in C++ to handle divide by zero exception. **[6]**

b) Write a short note formatted I/O and unformatted I/O. **[7]**

OR

Q8) a) What are the rules for namespace. **[7]**

b) Explain briefly classes for file stream operations. **[6]**

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[5925]-561

S.E. (Information Technology)
DISCRETE STRUCTURES
(2015 Pattern) (Semester-I) (214441)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
  1)   Attempt all questions.
  2)   Figures to the right indicate full marks.
  3)   Assume suitable data if necessary.

Q1) a)   10 different M1 books, 3 different M2 books, 5 different M3 books and 7 different DS books are to arrange on a self. How many different arrangements are possible if,

  i)   The books in each subject must all be together.   **[6]**

  ii) Only M3 books must be together.

  b)   In the class of 55 students the number of studying different subject are as given below. Maths 23, Physics 24, Chemistry 19, Maths and Physics 12, Maths and Chemistry 9, Physics and chemistry 7, all three subject 4. Find the number of students, who have taken,   **[6]**

  i)   Atleast one subject

  ii) Exactly one subject

  iii) Exactly two subjects

OR

Q2) a)   A bag contains 10 white and 15 black balls. Two balls are drawn in succession, what is the probability that,   **[6]**

  i)   One of the balls is black and other white

  ii) Both of them are black

  b)   A survey was conducted among 1000 people of these 595 are democrats, 595 wear glasses, and 550 like ice-cream. 395 of them are democrats who wear glasses, 350 of them are democrats who like ice-cream, and 400 of them wear glasses and like ice-cream. 250 of them are democrats who wear glasses and like ice-cream. Determine,   **[6]**

  i)   How many of them are not democrats, do not wear glasses, and do not like ice- cream?

  ii) How many of them are democrats who do not wear glasses and do not like ice-cream?

Q3) a) Let R = {(a, d), (b, a), (b, d), (c, b), (c, d), (d, c)}. Use warshall's algorithm to find the matrix of transitive closure, where A = {a, b, c, d}. **[6]**

b) Whether that the following graphs are isomorphic? **[6]**
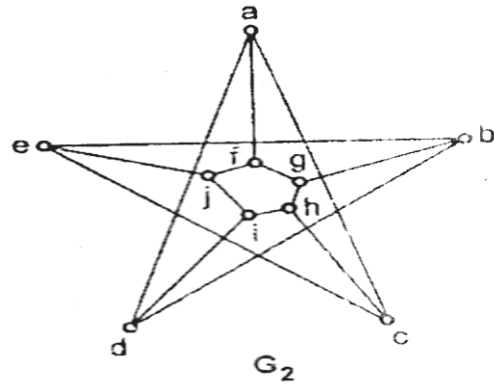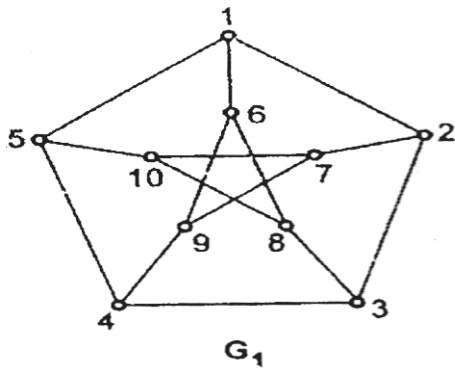
OR

Q4) a) Show that the set of all divisors of 36 forms a lattice? **[6]**

b) Find the shortest path from S to all other vertices of the given graph usng Dijkstra's algorithm. **[6]**
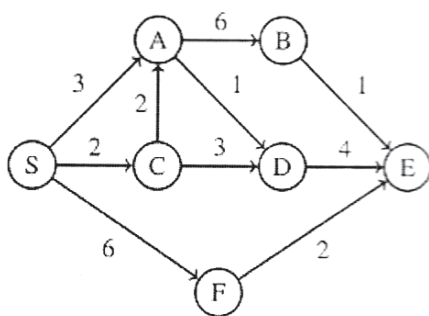
Q5) a) For the following set of weights, construct optimal binary prefix code. For each weight in the set, give the corresponding code words.
8, 9, 12, 14, 16, 19. **[7]**

b) Obtain the minimum spanning tree for the following graph using Kruskal's algorithm. Obtain the total cost of minimum spanning tree. **[6]**
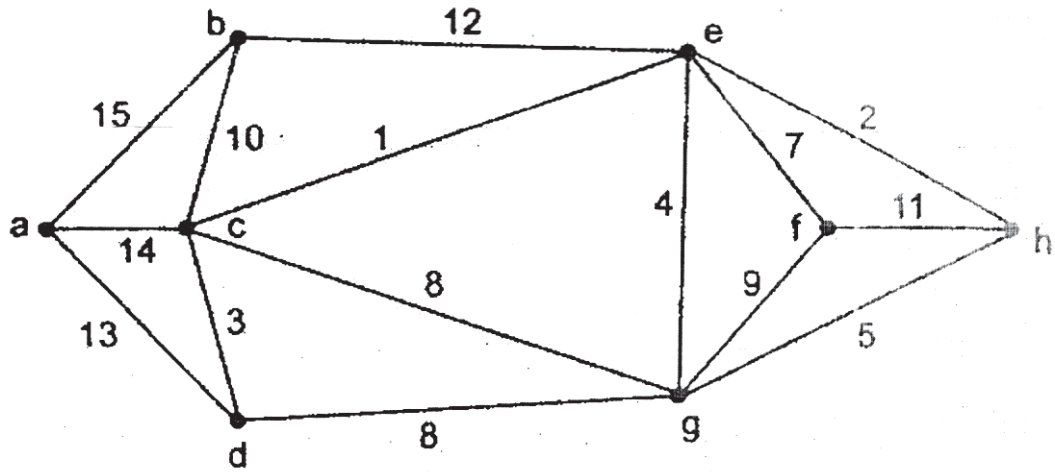
OR

Q6) a) What is binary tree? Write preorder, inorder, postorder traversals of following binary tree. **[7]**
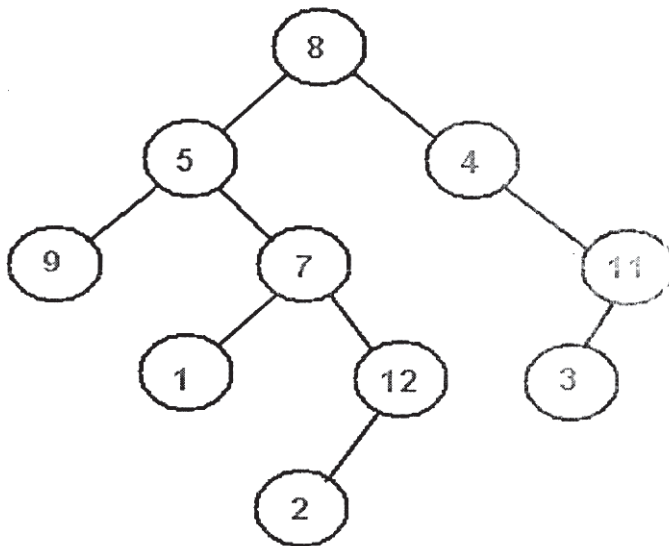
b) What is the total number of nodes in a Strictly binary tree with 20 leaves? Draw such tree. **[6]**

Q7) a) Show that G = {1,5,7,11) is a group under multiplicaiton modulo 12. **[7]**

b) Define the following with suitable example. **[6]**
    i) Semigroup
    ii) Ring
    iii) Field

<div align="center">OR</div>

Q8) a) Check whether the following is commutative and associative. **[7]**
    i) a*b=a+b+2
    ii) a*b=ab+2b

b) What is hamming distance? **[6]**
    Find hamming distance between code words of:
    S={(0000), (0101), (1011), (0111)}.
    Retrieve the message by adding even parity check bit.

<div align="center">☝ ☝ ☝</div>

PA-1378

[5925]-562

S.E. (Instrumentation & Control Engineering)
SENSORS & TRANSDUCERS - II
(2015 Pattern) (Semester - II) (206267)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicates full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) With the help of neat diagram explain the electromagnetic type flow measurement. **[6]**

    b) Explain the capacitive type level measurement with neat diagram. **[6]**

OR

Q2) a) Write a note on Laminar and turbulent flows. **[6]**

    b) Explain with neat diagram solid level detectors for level measurement. **[6]**

Q3) a) Explain the humidity sensor with neat diagram. **[6]**

    b) How to measure the density by using Oscillating Coriolis meter? **[6]**

OR

Q4) a) Explain Saybolt type viscosity measurement. **[6]**

    b) Explain the pH sensor with neat diagram. **[6]**

Q5) a) Determine how many bits a D/A converter must have to provide output increment of 0.2 V or less with reference of 5V. **[7]**

    b) Explain signal level and bias change with neat example. **[6]**

OR

Q6) a) Explain general practical guidelines for designing low pass filter. **[7]**

b) Explain the following stages of signal conditioner : **[6]**

   i)   Linearization

   ii) Signal conversions

Q7) a) A Potentiometric displacement sensor is to be used to measure work-piece motion from 0 to 10 cm. The resistance changes linearly over this range from 0 to 1 kΩ. Develop signal conditioning to provide a linear, 0 to 10 V output. **[7]**

b) With neat diagram explain cold junction compensation for thermocouple. **[6]**

OR

Q8) a) An RTD has $\alpha_0 = 0.05/°C$, R = 500Ω, and a dissipation constant of $P_D = 30$ mW/°C at 20°C. The RTD is used in a bridge circuit such as that $R_1 = R_2 = 500\Omega$ and R_3 a variable resistor used to null the bridge. If the supply is 10V and RTD is placed in a bath at 0°C, find the value of R_3 to null the bridge. **[7]**

b) Design a signal conditioning scheme for capacitive level sensor. **[6]**

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[5925]-563

S.E. (Instrumentation & Control)
AUTOMATIC CONTROL SYSTEM
(2015 Pattern)(Semester-II) (206268)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

Assume suitable data if necessary.

Q1) a) Define stability. Write the concept of poles and zeros. How the stability can be defined with respect to pole zero. **[6]**

b) The transfer function of a system is given below:

$$G(S) = \frac{8(s-3)(s+4)}{s(s+1)(s-5)}$$

Determine the poles & zeros & show the pole zero configurations in S-plane. Also comment on stability. **[6]**

OR

Q2) a) Elaborate brief classification of control system with example. **[6]**

b) Solve the following: **[6]**
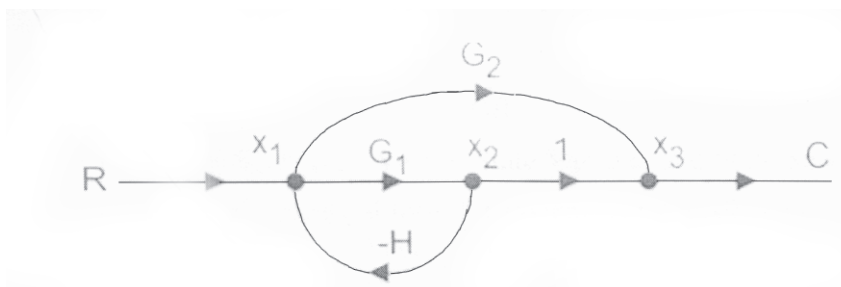
Q3) a) Differentiate between open loop & closed loop system with example.**[6]**

b) Obtain inverse laplace transform of the following:

i) $\dfrac{1}{s^2 + 4s + 8}$

ii) $\dfrac{s+2}{s^2 + 4s + 6}$ **[6]**

OR

P.T.O.

Q4) a) Elaborate the steps to plot time domain analysis method. **[4]**

b) The transfer function of unity feedback control system is given by :

$$G(S) = \frac{K}{s(s+4)}$$

Plot the Root Locus & determine the value of K where ε is 0.707 **[8]**

Q5) a) Explain frequency domain analysis method in brief. **[4]**

b) Solve the following by Bode plot analysis method. **[8]**

$$G(S)H(S) = \frac{4}{s(1+0.5S)(1+0.08S)}$$

Determine gain crossover, phase crossover, again margin & phase margin. Also comment on stability.

OR

Q6) a) State properties of polar plot. **[4]**

b) Solve the following with polar plot method. $G(S) = \dfrac{1}{1+0.4s}$ **[8]**

Q7) a) Obtain transfer function of system whose state model is **[6]**

$$\begin{bmatrix} \&_1 \\ \&_2 \end{bmatrix} = \begin{bmatrix} -2 & -3 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 3 \\ 5 \end{bmatrix} u \text{ and } y = \begin{bmatrix} 1 & 1 \end{bmatrix} x$$

b) Decompose the transfer function $\dfrac{Y(s)}{U(s)} = \dfrac{s^2 + 6s + 8}{s(s+1)(s+3)}$ by cascade

decomposition. **[8]**

OR

Q8) a) Explain the terms state, Sate Vector, State Variable and State Space. **[4]**

b) Determine different canonical form for system with transfer function. **[10]**

$$\frac{Y(s)}{U(s)} = \frac{10(s+4)}{s(s+1)(s+3)}$$

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[5925]-564

S.E. (Instrumentation and Control)
ELECTRONIC INSTRUMENTATION
(2015 Pattern) (Semester - II) (206269)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right side indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Use of Calculator is allowed.*
5) *Assume Suitable data if necessary.*

Q1) a) State the advantages and limitation of true RMS meter. **[4]**

b) What is sine wave synthesis? Explain direct synthesis. **[8]**

OR

Q2) a) What is Q meter? Explain about its application and discuss in detail about any one method of measurement using Q meter? **[8]**

b) Explain pulse waveform characteristics. **[4]**

Q3) a) With a neat diagram explain working and application of PLL using IC LM565. **[6]**

b) Draw digitalramp ADC and write down its operation. **[6]**

OR

Q4) a) Define quantization error and conversion time for ADC. **[6]**

b) Write short notes on a Synchronous VFC. **[6]**

Q5) a) Define telemetry and with neat block diagram, explain telemetry system.**[7]**

b) Explain in detail about software in virtual instrumentation system. **[6]**

OR

Q6) a) List and explain various types of modulation method. **[6]**

b) With a neat block diagram describe the architecture of virtual instrumentation system. **[7]**

Q7) a) Draw the block diagram of Spectrum analyzer and explain its working with help of spectrum. **[7]**

b) With a neat diagram, describe the construction, working principle of wave analyser. **[6]**

OR

Q8) a) With a neat diagram, describe the construction, working, principle of FFT analyser. **[6]**

b) With a neat diagram, describe the construction, working, principle and application of logic analyser. **[7]**

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PA-1381

[5925]-565

S.E. (Instrumentation & control)
DIGITAL TECHNIQUES
(2015 Pattern) (Semester-II) (206270)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume Suitable and if necessary.*

Q1) a) Convert the following   **[6]**
     i) $(6DE)_{16}$ to Decimal
     ii) $(1001100)_2$ to decimal
     iii) $(58)_{10}$ to Binary

   b) Define the following term   **[6]**
     i)   Fan-in
     ii)   Fan-out
     iii)   Propagation Delay
     iv)   Noise Margin
     v)   Speed Power Product
     vi)   Power dissipation

<div align="center">OR</div>

Q2) a) Convert the following   **[6]**
     i)   (01011100) BCD into Binary
     ii)   Convert $(0101110011)_2$ to Excess-3
     iii)   Convert gray code (001110111) to Binary code

   b) Explain CMOS Invertor with neat Sketch   **[6]**

Q3) a) Design 4:1 Multiplexer for the following Boolean function   **[6]**
     $f(A,B,C,D) = \Sigma m(0,1,2,3,6,8,9,10,13,15,17,20,24)$

   b) Design Boolean function using a 3:8 Decoder and external gates.   **[6]**

<div align="center">OR</div>

Q4) a) Convert JK flip flop to D Flip Flop. [6]

b) Design Hexadecimal to binary Decoder. [6]

Q5) a) Design MOD-9 Counter using IC 7493 [8]

b) Design a ripple counter for the state diagram shown below. [5]
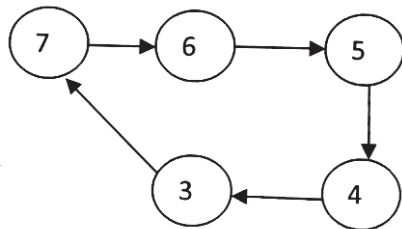
OR

Q6) a) Design a Synchronous Counter from the state diagram and Avoid Lockout Condition. [8]
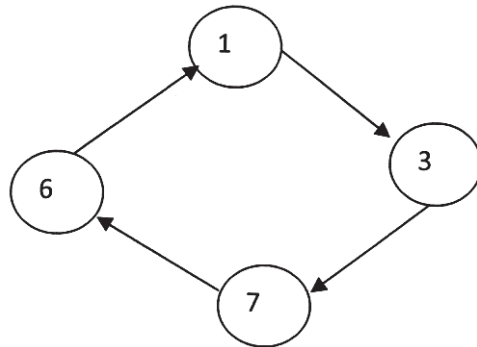
b) Design MOD-96 Counter using IC 7490. [5]

Q7) a) Explain Alarm Announciator with neat sketch. [8]

b) What is PLD? What is the difference between PAL And PLA. [5]

OR

Q8) a) Design the PLA for the following function. [8]

$A(X,Y,Z) = \Sigma m(1,2,4,6)$

$B(X,Y,Z) = \Sigma m(0,1,6,7)$

$C(X,Y,Z) = \Sigma m(0,2,6)$

b) Write a short notes on (any one) [5]

i) AND Matrix

ii) OR Matrix

[5925]-567

S.E. (Instrumentation & Control)
SENSORS AND TRANSDUCERS-I
(2015 Pattern)(Semester-I) (206261)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
   1)   *Neat diagram must be drawn wherever necessary.*
   2)   *Figures to the right indicate full marks.*
   3)   *Assume suitable data, if necessary.*

Q1) a)   Define transducer. Explain any four static characteristics of transducer.**[6]**

    b)   Define the following terms: **[6]**

        i)   Gauge factor

        ii)   Eddy current

        iii) Piezoelectricity

OR

Q2) a)   What is calibration? Discuss the need of calibration of a transducer. **[6]**

    b)   Explain LVDT in detail with neat diagram and draw its characteristics.**[6]**

Q3) a)   Explain the toothed rotor variable reluctance tachometer with a neat diagram. **[6]**

    b)   List four techniques for force measurement. Explain the load cell for measurement of force.   **[6]**

OR

Q4) a)   Explain the magnetic pickup sensor for speed measurement.   **[6]**

    b)   Define piezoelectric effect. Explain piezoelectric sensor for force measurement with neat diagram.   **[6]**

Q5) a) List different types of elastic transducer for pressure measurement. Explain the working of any one of them. **[7]**

b) Explain any one secondary pressure sensor with a neat diagram. **[6]**

OR

Q6) a) List techniques for differential pressure measurement. Explain the working of any one of them. **[7]**

b) Give units of pressure. Explain the working of bellows with neat diagram. **[6]**

Q7) a) Explain the principle and working of pyrometer for measurement of temperature. **[7]**

b) Explain the working principle and construction details of RTD. **[6]**

OR

Q8) a) Explain bimetallic thermometer with neat diagram. **[6]**

b) Explain working principle of thermocouple and necessity of cold junction compensation for temperature measurement. **[7]**

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[5925]-568

S.E. (Instrumentation and Control)
BASIC INSTRUMENTATION
(2015 Pattern) (Semester - I) (206262)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

　1)　Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8.

　2)　Figures to the right side indicate full marks.

　3)　Neat diagrams must be drawn wherever necessary.

　4)　Use of non programmable calculator is allowed.

　5)　Assume Suitable data, if necessary.

Q1) a)　Derive the expression for loading effect due to shunt connected instrument with neat diagram. Comment on the input impedance of shunt connected instrument for maximum power transfer.　**[6]**

　　b)　A milliammeter of 3 ohms resistance reads a maximum current of 150 miliampere. How can it be used as　**[6]**

　　　i)　A voltmeter to read up to 15 Volts.

　　　ii)　An ammeter to read up to 30 Amperes.

　　　Draw circuit diagrams.

OR

Q2) a)　In a voltmeter, the moving coil consists of 100 turns wound on a square former which has a length of 3 cm and the flux density in the air gap is 0.06 Wb/m^2. Calculate the deflecting torque on the coil when it is carrying a current of 12 milliamperes.　**[3]**

　　b)　State the general remedies to minimize the errors in measurements with analog indicating instruments.　**[3]**

　　c)　Discuss the construction and working of PMMC instrument with neat diagram.　**[6]**

Q3) a) A Maxwell's Inductance capacitance bridge shown in fig below is used to measure an unknown inductance in comparison with capacitance. The various values at balance $R_2 = 400\ \Omega$; $R_3 = 600\ \Omega$; $R_1 = 1000\ \Omega$; $C_1 = 0.5\ \mu F$. Calculate the values of R_x and L_x. Calculate also the storage (Q) factor of coil if frequency is 1000 Hz. **[6]**

Maxwell's Inductance Capacitance Bridge
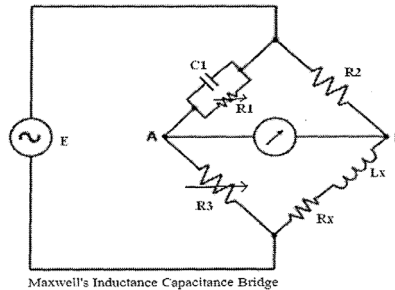
b) Draw neat diagram of Cathode Ray Tube in oscilloscope. Discuss the function of each part of cathode ray tube. **[6]**

OR

Q4) a) Draw and explain the block diagram of Digital Storage Oscilloscope. **[6]**

b) Derive the equations to determine the values of unknown components in Maxwell's Inductance bridge. **[6]**

Q5) a) Explain the digital single phase energy measurement system with neat block diagram. **[7]**

b) Draw and explain the generalised block diagram of digital instrumentation system. Suggest suitable real time component with reference to the function of each block. **[6]**

OR

Q6) a) Develop and explain the digital block diagram system for human body temperature measurement. State minimum five advantages of digital instruments over analog instruments. **[7]**

b) Describe the digital block diagram of ultrasonic distance measurement system with neat diagram. **[6]**

Q7) a) Explain the architecture of virtual Instrumentation with neat block diagram.

[7]

b) Draw the neat diagram of function generator and explain the circuit operation with its waveforms. **[6]**

OR

Q8) a) Suggest the suitable recorder for measurement of two process variables. Explain it with neat diagram. State its different applications. **[8]**

b) Define single channel and multichannel recorder. **[2]**

c) Distinguish between Y-t recorder and X-Y recorder. **[3]**

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[5925]-569

S.E. (Instrumentation and Control)
LINEAR INTEGRATED CIRCUITS
(2015 Pattern) (Semester - I) (206263)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8.*
2) *Figures to the right indicate full marks.*

Q1) a) Explain the difference between open loop and closed-loop OP-AMP with based on different performance parameters and neat diagrams. **[6]**

b) If the feedback factor (β) of a closed-loop non-inverting OP-AMP is 11000×10^{-06} and open-loop gain is of 2, 50,000. Find out closed-loop gain(A_{CL}). **[6]**

OR

Q2) a) An non-inverting OP-AMP has gain bandwidth product (UGB) = 2.1 MHz.

Calculate the cut-off frequency (F_C) at –3 dB, if the OP-AMP is designed at a voltage gain of 2200×10^{-3}. **[6]**

b) Derive the voltage equation for the feedback non-inverting amplifier with neat circuit diagram. **[6]**

Q3) a) Elaborate a typical current to voltage converter circuit. Assume a photodiode connected to op-amp input side. Also assume appropriate feedback resistor. **[6]**

b) State Barkhausen criteria for suitable oscillation. Design wein-brigde oscillator for the output frequency of F_O=1.2 kHz with neat circuit diagram. Assume suitable data if any. **[6]**

OR

Q4) a) What is called precision rectifiers? Explain Precision half-wave rectifier with neat circuit diagram using OP-AMP. **[6]**

b) Explain positive feedback comparator with neat circuit diagram, waveforms and hysteresis graph. **[6]**

Q5) a) Explain Astable Multivibrator using IC 555 with neat circuit diagram and waveforms **[6]**

b) Design High voltage regulator (HVR) using IC 723 neat circuit diagram for 12.5V regulated output. Assume suitable data. **[7]**

OR

Q6) a) Design Monostable multivibrator using IC 555 for the pulse width of 3.95ms. **[6]**

b) What is voltage regulation? List advantages of switching regulator over linear regulators **[7]**

Q7) a) Explain first order Butterworth high-pass filter and also draw circuit diagram. **[6]**

b) What is "Q" factor of filter? Draw detailed ideal and practical output responses for all types of filters. **[7]**

OR

Q8) a) Draw the circuit diagram of Butterworth Twin-T filter explain its response. **[6]**

b) Design and draw first order Butterworth non-inverting low-pass filter for the cut- off frequency of 950 Hz. Assume suitable data with neat circuit diagrams. **[7]**

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S.E. (Instrumentation & Control)
NETWORK THEORY
(2015 Pattern) (Semester-I) (206264)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

1) *Figures to the right indicate full marks.*
2) *Use of Calculator is allowed.*
3) *Steps to the problems carry marks.*

Q1) a) Explain sign connections to be used in KCL & KVL. Calculate the voltage through 2A source. **[6]**
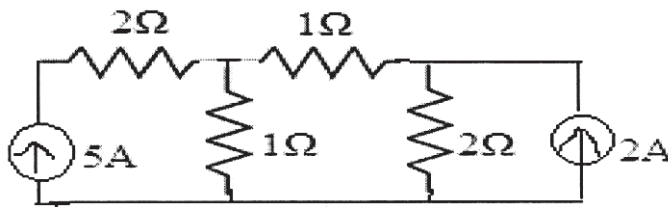
b) Solve the following circuit. Use Norton's theorem. **[6]**
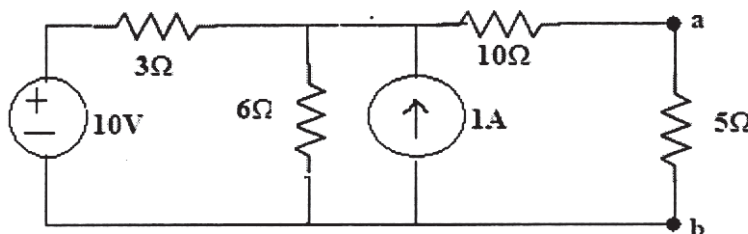
OR

Q2) State & explain Thevenin's theorem. Obtain Thevenin's equivalent resistance & current of circuit given below. Also find power loss in 1Ω resistance. **[6]**
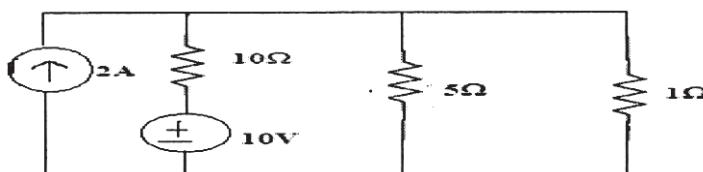
Q3) a) In the circuit below, find z_{in} (S). Also find the voltage transfer function. **[6]**
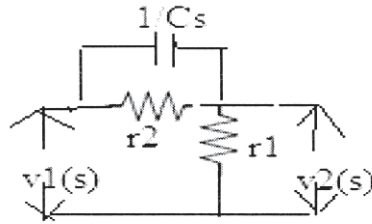
b) Derive ABCD parameter in terms of all other parameters. **[6]**

OR

Q4) a) Check the stability by Routh's criteria. **[6]**

i) $S^4+2S^3+4S^2+12S+10$

ii) $S^3+2S^2+2S+40$

iii) $S^4+2S^3+3S^2+2S+1$

b) On short circuit test, the currents & voltages were determined experimentally for an unknown two port network as- **[6]**

$I_1= 1mA, I_2 = -0.5mA, V_1 = 25v$ at $V_2=0$

$I_1= -1mA, I_2=-10mA, V_2 = 50v$ at $V_1=0$

Determine y parameters & draw model.

Q5) a) Check positive realness of the following: **[6]**

i) $\dfrac{S^2 + 2S + 20}{S + 10}$

ii) $\dfrac{S^2 + 10S + 4}{S + 2}$

b) State & explain necessary & sufficient conditions for transfer function. **[6]**

OR

Q6) a) State properties of RC driving point impedance function. **[6]**

b) In a series LCR type BPF, L= 50 mH, C=127nF & R_F= 63ohms. Determine Resonance frequency, Band width, Cut off frequencies. **[6]**

Q7) a) Derive expression for symmetrical T attenuator. Obtain design equation for the same. **[6]**

b) Find the second foster form of the admittance function: **[8]**

$$Y(S) = \frac{S(S^2 + 9)}{10(S^2 + 4)(S^2 + 25)}$$

OR

Q8) a) Write technical notes on Hurwitz polynomial. **[6]**

b) Realize the network having impedance function: **[8]**

$$Z(S) = \frac{S^2 + 2S + 10}{S(S + 5)}$$

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PA-1386

[5925]-571

S.E. (Mechanical Sandwich)
THERMAL ENGINEERING
(2015 Pattern) (Semester - II) (202063)

Time : 2 Hours]
[Max. Marks : 50

Instructions to the candidates:

1) *Solve any four questions (Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No. 6, Q. No.7 or Q.No.8).*

2) *All the four questions should be solved in one answer-book and attach extra supplements if required.*

3) *Neat diagrams must be drawn wherever necessary.*

4) *Figures to the right side indicate full marks.*

5) *Use of steam table, mollier charts, scientific calculator is allowed.*

6) *Assume Suitable data if necessary.*

Q1) a) Explain With neat Sketch Roots Blower Compressor and Draw PV diagram. **[6]**

b) An Ideal Vapour Compression refrigeration cycle is working on refrigerant R-134a. The cold region of the cycle is at 0°C and warm region at 26 °C. The mass flow rate of refrigerant is 0.1 kg/sec, Calculate 1) Compressor Work input, 2) Refrigerating capacity, 3) Coefficient of Performance, 4) COP of Carnot refrigerating cycle operating between the same temperature limits. **[6]**

From Refrigeration Tables: at 0°C , h_1=247.22 KJ/kg, S_1 = 0.919 KJ/KgK At 26 °C, P_2 = 6.853 bar, h_{2s} = 264.7 KJ/kg, $h_{f3}=h_4$=85.75 KJ/Kg (Throttling Process)

OR

Q2) a) Differentiate between Centrifugal and axial flow Compressor. **[6]**

b) Find the work required in a single stage reciprocating air compressor to compress air at the rate of 1 kg/sec from 1 bar and 300 k to 8 bar in all three cases of compression i.e. Isothermal, Isentropic and Polytropic with indexa 1.25. **[6]**

Q3) a) A Gas Turbine Unit has a pressure ratio of 6:1 and maximum cycle temperature of 610 °C. The isentropic efficiencies of Compressor and Turbine are 0.8 and 0. 82 respectively. Calculate the power output in KW of an electric generator geared to the turbine; when air enters compressor at 15 °C at the rate of 16 kg/sec. Take Cp=1.005 KJ/Kg K and $\gamma = 1.4$ for Compression; Cp= 1.110 KJ/Kg K and $\gamma = 1.33$ for Expansion **[6]**

b) What are the different methods of governing of internal combustion engine? **[6]**

OR

Q4) a) What are the methods for improvements of thermal efficiency of open cycle gas turbine plant, explain any one with neat sketch. **[6]**

b) Explain Battery or Coil Ignition System with neat sketch. **[6]**

Q5) a) Following observations were recorded during the test on a single cylinder four stroke oil engine,

Bore dia=300 mm, Stroke=450 mm, Speed =300 rpm, i.m.e.p. = 6bar, net brake load=l,5KN, Brake Drum dia. = 1.8 m, Brake rope dia.=2cm, Calculate i) Indicated Power ii) Brake Power iii) Mechanical Efficiency **[6]**

b) Explain Difference between the pre-ignition and. Auto ignition. **[7]**

OR

Q6) a) A Single Cylinder four Stroke diesel Engine running at 1800 rpm has a bore of 85 mm and a stroke of 110 mm. it takes 0.56 k=g of air per minute and develops a brake power output of 6 kw, While the air fuel ratio is 20:1. The C.V. of fuel used is 42550 KJ/Kg, and the Ambient air density is 1.18 Kg/m3, Calculate i) The Volumetric Efficiency, ii) Brake Specific Fuel Consumption (bsfc) **[7]**

b) What are different methods of measuring the Frictional Power (FP), Explain the Willian's Line Method used for C.I. Engine. **[6]**

Q7) a) Explain Four Stages of Combustion in C.I. Engine with neat sketch.**[7]**

b) What are the differences between Cetane number and Octane Number? **[6]**

OR

Q8) a) Write short Note on Emission Norms. **[6]**

b) What are the different Principal Sources of Pollutants from Engine?**[7]**

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[5925]-572

S.E. (Mechanical Sandwich)
METROLOGY AND QUALITY CONTROL
(2015 Pattern) (Semester-II) (202064)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Neat diagrams must be drawn wherever necessary.*
2) *Answer Q.1 or Q.2, Q.3. orQ.4, Q.5 or Q.6, and Q.7 or Q.8.*
3) *Assume suitable data if necessary.*
4) *Use of non-programmable Calculator allowed.*
5) *Figures to the right indicate full marks.*

Q1) a) Enlist linear & Angular measuring instruments. Discuss 'Sine Bar' **[6]**

b) Design a Go-No Go plug gauge for checking of a hole having size 42H7. Diameter 42 mm lies in 30-50 mm range. Standard Tolerance Unit, i=0.45 $(D^{0.333})$+0.001D. IT7=16i Assume Gauge maker's Tolerance (GMT)=10% of work tolerance & Wear Allowance (WA) equal to 10% of GMT. Show it with a diagrammatic representation. **[6]**

OR

Q2) a) Write a note on (any 1) **[6]**

i) 'Surface Roughness'. It's causes & effects.

ii) LVDT

b) Define the terms-precision, Calibration and Traceability **[6]**

Q3) a) Following observations were made while measuring effective diameter of metric threads using two wire method : micrometer reading over standard cylinder with wires=2.4326mm, Micrometer reading over gauge with wires=3.0708 mm. Thread pitch=1.5mm, Best size wire used=0.895mm, standard cylinder diameter=8mm. Calculate effective diameter. **[6]**

b) Explain working of parkinson's gear tester. State it's advantages, limitations and uses. **[6]**

OR

Q4) a) Write note on online & off-line inspection systems. **[6]**

b) Explain working/features of Tool maker's microscope with a diagram.**[6]**

Q5) a) Explain concept of controllability of quality : self control. **[7]**

b) Write note on Juran's triology Approach. **[6]**

OR

Q6) a) Write note (any 1) **[8]**

i) QMS (ISO 9000 & TS 16949)

ii) Eight pillars of TPM

b) Explain failure mode effects and criticality assessment (FMECA). **[5]**

Q7) a) Classify various control charts based on their applications. Explain concept of process capability. **[7]**

b) Table below show the number of defects found in inspection of 10 bundles (bales) of synthetic yarns **[6]**

Bundle No.	1	2	3	4	5	6	7	8	9	10
No. of Defectives	5	2	4	3	1	4	2	3	13	4

i) Determine the control limits for C chart and state whether the process is in control.

ii) If the point that goes outside the control limits is analyzed and eliminated, what will be the value of new control limit?

OR

Q8) a) Define the following elements and show quality regular on OC Curve. **[8]**

i) α-risk

ii) β-risk

iii) AOQ

iv) AOQL

b) Calculate sample size & AOQ for single sampling plan using following data. **[5]**

i) Probability of acceptance of 0.4% defectives in a lot=0.558,

ii) Lot size=10,000

iii) Acceptance number=1,

iv) np' for sample=1.5,

v) Detectives found in the sample are not to be replaced. If defectives found in sample are to be replaced then what will be AOQ?

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[5925]-573

S.E. (Mechanical Sandwich)
MANUFACTURING ENGINEERING
(2015 Pattern) (Semester - II) (202065)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:
1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) What are the different materials used for Pattern? **[6]**

b) Explain different properties of molding sand? **[6]**

OR

Q2) a) What is strain hardening? What is the importance of strain hardening in forming processes? **[6]**

b) Differentiate between Hot and cold working processes. **[6]**

Q3) a) Explain working of TIG welding process with neat sketch. **[6]**

b) What are different Welding defects and their remedies. **[6]**

OR

Q4) a) Explain with neat sketch different attachments for lathe machine. **[6]**

b) A cylindrical stainless steel rod with length L=150 mm, diameter $D_0 = 12$ mm is being reduced in diameter to $D_f = 11$ mm by turning on a lathe. The spindle rotates at N = 400 rpm, and the tool is travelling at an axial speed of 200 mm/min **[6]**

Calculate:

i) The cutting speed

ii) The cutting time

P.T.O.

Q5) a) Explain with neat sketch different types of milling cutter. **[7]**

b) What is dressing and truing, mounting of grinding wheels. **[6]**

OR

Q6) a) Explain different operations performed on drilling machine. **[6]**

b) Explain designation system of grinding wheel? **[7]**

Q7) a) Explain working principle of abrasive jet machining with neat sketch and state its advantages. **[7]**

b) Explain working principle of plasma arc machining with neat sketch.**[6]**

OR

Q8) a) Explain working principle of electro chemical machining with neat sketch and state its advantages. **[7]**

b) Explain working process parameters of ultrasonic machining with neat sketch. **[6]**

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[5925]-574

S.E. (Mechanical Sandwich)
THEORY OF MACHINES
(2015 Pattern) (Semester - II) (202068)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Black figures to the right indicate full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) Write a short note on: **[6]**

   i) Degree of freedom

   ii) Equivalent linkages of mechanism

   b) A connecting rod with mass 3.5 kg oscillates 50 times in one minute when suspended from small end. Find its mass moment of inertia about an axis passing through its C.G., which is located at 350 mm from small end. Also find the length of equivalent simple pendulum. **[4]**

OR

Q2) a) Explain with neat sketch easiest experimental method to determine mass moment of inertia of flywheel. **[5]**

   b) Write a note on elliptical trammel. State and explain the condition for which it will trace a circle. **[5]**

Q3) a) Draw a neat sketch of centrifugal clutch, give one practical applicaiton. **[4]**

   b) Derive an expression for velocity and acceleration of slider as well as angular velocity of connecting rod in single slider crank mechanism by analytical method. **[6]**

OR

P.T.O.

Q4) a) Draw neat and properly labeled polar diagram for single Hookes joint.**[4]**

b) Explain with neat diagram the prony brake dynamometer. **[6]**

Q5) a) Fig. 1 shows a sewing machine needle box mechanism O_1ABO_2CD, in which different diamensions are as follows $O_1A = 16$ mm, $O_2B = 23$ mm, $BC = 16$ mm, $AB = 35$ mm, $CD = 40$ mm, $\angle O_2BC = 90°$, $\angle \theta = 45°$. Horizontal distance between O_1 and $O_2 = 13$ mm. **[12]**

Vertical distance between O_1 and $O_2 = 40$ mm.

D lies vertically below O_1.

When crank O_1A rotates at 400 rpm find the velocity of needle D for the given configuration by instartaneous centre method.
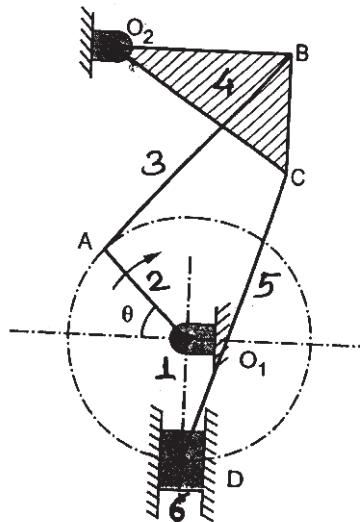
Fig .1 [For Q.5(a)]

b) Explain acceleration image principle. **[3]**

OR

Q6) a) Explain with neat sketches, relative velocity and relative accleration method to determine velocity and acceleration of piston as well as angular velocity and angular acceleration of connecting rod in case of I.C. engine mechanism. When crank is in between 0° to 90° from IDC position and it rotates in clockwise direction. **[11]**

b) State and explain Kennedys theorem. **[4]**

Q7) a)   Explain the procedure to construct Kleins construction to determine the acceleration of a slider crank mechanism when crank rotates with uniform angular velocity. **[4]**

b)   Fig. 2 shows a crank and slotted lever quick return mechanism in which driving crank CP is 105 mm long and it rotates clockwise at 90 rpm. The Slotted link length, OD is 420 mm. Determine for the given configuration velocity and acceleration of point D. **[11]**
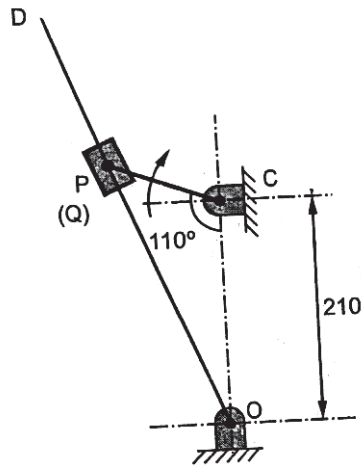

Fig. 2 [For Q. 7(b)]

OR

Q8) a)   The crank of reciprocating engine is 250mm long and connecting rod is 950mm long. The crank rotates at 200 rpm in clockwise direction. Find velocity and acceleration of mid point of connecting rod when the crank makes 120° with IDC. Also determine angular velocity and angular acceleration of connecting rod. Use Kleins construction method. **[10]**

b)   What is Coriolic acceleration? Derive an expression for magnitude of Coriolis component of acceleration. **[5]**

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[5925]-575

S.E. (Mechanical/Mechanical Sandwich & Automobile)
ELECTRICAL AND ELECTRONICS ENGINEERING
(2015 Pattern) (Semester - II) (203152)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
  1) *Attempt Ques. 1 or 2, 3 or 4, 5 or 6, 7 or 8.*
  2) *Neat diagrams must be drawn wherever necessary.*
  3) *Figures to the right indicate full marks.*
  4) *Assume suitable data, if necessary.*

Q1) a) Explain power flow diagram in three phase-induction motor and obtain the relationship between the rotor input, rotor copper loss and gross mechanical power developed in the rotor. **[6]**

   b) A 200 V, 4 pole lap wound DC shunt motor has 800 conductors on its armature. The resistance of armature winding is 0.5 Ω and that of shunt field winding is 200 Ω. The motor takes current of 21A and flux per pole is 30mWb. Find the speed and gross torque developed in motor. **[7]**

OR

Q2) a) Draw and explain following characteristics of DC shunt and DC series motors:
   i) torque-armature current characteristics and
   ii) speed-torque characteristics **[6]**

   b) A 50 Hz, 8 pole, 3 phase induction motor has a full load slip of 4%. The rotor resistance is 0.001 Ω per phase and standstill reactance is 0.005 Ω per phase.
   Find:
   i) ratio of maximum torque to full load torque and
   ii) the speed at which maximum torque occurs **[7]**

Q3) a) Distnguish between a microcontroller and a microprocessor considering significant features. **[6]**

   b) Explain construction and working of shaded pole induction motor with the help of suitable diagrams. Mention its any two applications. **[6]**

OR

Q4) a) Compare brushless DC motor with conventional DC motor. **[6]**

b) What are the elements of a typical n-channel data acquisition system? Draw a neat block diagram of a typical n-channel data acquisition system and state the function of each block in brief. **[6]**

Q5) a) Draw the schematic showing general purpose Arduino Board. **[6]**

b) Explain the following Arduino functions used for serial communication using Arduino IDE:

i) Serial. begin()

ii) Serial. end()

iii) Serial. available() **[6]**

OR

Q6) a) Draw and explain the interfacing of an LED with Arduino board. Write an algorithm to blink an LED. **[6]**

b) Explain in brief the following GPIO functions along with syntax:

i) pinMode()

ii) digitalWrite()

iii) digitalRead() **[6]**

Q7) a) What is an accelerometer? What are various types of accelerometers? Draw the diagram showing the interfacing of 328P based Arduino board with accelerometer. **[6]**

b) What is the principle of operation of strain gauge? Draw a neat sketch showing the interfacing of strain gauge with Atmega 328P based Arduino board given that output voltage from strain gauge after signal conditioning is connected to analog pin 0 of Arduino board.

Write algorithmic steps to display strain on serial monitor. **[7]**

OR

Q8) a) List any six features of in-built ADC in AT mega 328P microcontroller. **[6]**

b) Explain temperature measurement scheme using LM35 temperature sensor interfaced with Arduino UNO board. Draw the diagram and write the algorithm for execution. **[7]**

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[5925]-576

S.E. (Automobile/Mechanical/(Mechanical Sandwich)
ENGINEERING MATHEMATICS - III
(2015 Pattern) (Semester - I) (207002)

Time : 2 Hours]　　　　　　　　　　　　　　　　　　　　*[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a)　Solve any two of the following differential equations.　　　**[8]**

　　　i)　$\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx} + y = x\sin x$

　　　ii)　$x^2\dfrac{d^2y}{dx^2} - 4x\dfrac{dy}{dx} + 6y = x^5$

　　　iii)　$\dfrac{d^2y}{dx^2} + y = \operatorname{cosec} x$

　　　by using method of variation of parameters

　　b)　Solve the integral equation

　　　$\displaystyle\int_0^\infty f(x)\cos\lambda x\; dx = e^{-\lambda}\quad \lambda > 0$　　　**[4]**

<div align="center">OR</div>

Q2) a)　A body of weight 9.8 N is suspended from a spring having constant 4N/m. Prove that the motion is one of resonance if a force $16\sin 2t$ is applied and damping is negligible. Assume that initially the weight is at rest in the equilibrium position.　　　**[4]**

　　b)　Solve any one of the following:　　　**[4]**

　　　i)　$L\left[e^{2t}t\cos 3t\right]$

　　　ii)　$L^{-1}\left[\dfrac{2s+5}{s^2+4s+13}\right]$

c) Solve the differential equation by Laplace transform method. **[4]**

$$\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = 12e^{-2t}, \text{ where } y(0) = 2, y'(0) = 6$$

Q3) a) Find the directional derivative of the function $\varphi = e^{2x-y-z}$ at $(1, 1, 1)$ in the direction of vector $-\bar{i} + 2\bar{j} + \bar{k}$. **[4]**

b) Show that the vector field. **[4]**

$\bar{F} = (y^2 \cos x + z^2)\bar{i} + (2y\sin x)\bar{j} + 2xz\ \bar{k}$ is irrotational and find scalar function φ such that $\bar{F} = \nabla\phi$.

c) Find the coefficient of correlation for the following data: **[4]**

x	6	2	10	4	8
y	9	11	5	8	7

OR

Q4) a) Number of road accidents on a high way during a months follows a poisson distribution with mean 5. Find the probability that in a certain month number of accidents on the high way will be less than 3. **[4]**

b) The first four moments of a distribution about the value 3.5 are 0.058064, 0.451612, 0.082259 & 0.5. Calculate the first four moments about the mean. **[4]**

c) Prove that (Any one) **[4]**

   i) $\nabla \times (\bar{a} \times \bar{r}) = 2\bar{a}$

   ii) $\nabla \circ \left(\dfrac{\bar{a} \times \bar{r}}{r}\right) = 0$

Q5) a) Evaluate $\int_c \bar{F}.d\bar{r}$ for $\bar{F} = (2x + y)\bar{i} + (3y - x)\bar{j}$ and c is the stright line joining the points $(0, 0)$ and $(3, 2)$. **[4]**

b) Evaluate $\iint_S \left(\overline{F} \cdot \hat{n}\right) ds$ where $\overline{F} = x^3 \overline{i} + y^3 \overline{j} + z^3 \overline{k}$ and s is the surface of the

sphere $x^2 + y^2 + z^2 = a^2$ **[5]**

c) By using stoke's theorem, evaluate $\int_c \overline{F} \cdot d\overline{r}$ where $\overline{F} = \sin z \overline{i} + \cos x \overline{j} + \sin y \overline{k}$

and c is the boundary of rectangle $0 \le x \le \pi, 0 \le y \le 1$ and $z = 3$. **[4]**

OR

Q6) a) A vector field is given by $\overline{F} = \cos y\, \overline{i} + x(1 - \sin y)\, \overline{j}$. By using Green's

theorem, evaluate $\int_c \overline{F} \cdot d\overline{r}$ where c is the ellipse $\dfrac{x^2}{25} + \dfrac{y^2}{9} = 1, z = 0$. **[4]**

b) Show that $\iiint_V \dfrac{2}{r} dv = \iint_S \dfrac{\overline{r} \cdot \hat{n}}{r} ds$ **[4]**

c) Evaluate $\iint_S \left(\nabla \times \overline{F}\right) \cdot \hat{n}\, ds$ where s is the curved surface of the parabolid

$x^2 + y^2 = 2z$ bounded by the plane $z = 2$ where $\overline{F} = 3(x - y)\overline{i} + 2xz\overline{j} + xy\overline{k}$

[5]

Q7) a) A string is stretched and fastened to two points L a parts. Motion is

started by displacing the string in the form $u = a \sin\left(\dfrac{\pi x}{L}\right)$ from which it is

released at time $t = 0$. Find the displacement $u\,(x, t)$ from one end. **[6]**

b) Solve $\dfrac{\partial u}{\partial t} = k \dfrac{\partial^2 u}{\partial x^2}$ subject to **[7]**

i) $u\,(0, t) = 0\ \forall t$

ii) $u\,(l, t) = 0\ \forall t$

iii) $u\,(x, t)$ is bounded

iv) $u(x, 0) = \dfrac{u_0 x}{L}$ for $0 \le x \le L$

OR

Q8) a) An infinitely long uniform metal plate is enclosed between lines $y = 0$ and $y = L$ for $x > 0$. The temperature is zero along the edges $y = 0$, $y = L$ and at infinity. If the edge $x = 0$ is kept at a constant temperature u_0. Find the distribution of temperature $u(x, y)$. **[7]**

b) Use Fourier sine transform to solve $\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}$ $0 < x < \infty$, $t > 0$ under the conditions.

i) $u(0,t) = 0$ $t > 0$

ii) $u(x,0) = \begin{cases} 1 & 0 < x < 1 \\ 0 & x > 1 \end{cases}$

iii) $u \to 0$ as $x \to \infty$

iv) $\dfrac{\partial u}{\partial t} \to 0$ as $x \to \infty$ **[6]**

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[5925]-577

S.E. (Mech./Auto.)
THERMODYNAMICS
(2015 Pattern) (Semester - I) (202043)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Solve 4 questions, Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Answer for the four questions should be written in same answer book. Attach supplement if required.*
3) *Neat diagrams should be drawn whenever necessary.*
4) *Use of steam tables, psychometric chart, mollier chart, scientific calculator is allowed.*
5) *Assume suitable data if necessary.*
6) *Figures to the right indicate full marks.*

Q1) a) A certain mass of air, initially at a pressure of 480 kPa and temperature of 190°C is expanded adiabatically to a pressure of 94 kPa. It is then heated at constant volume until it attains its initial temperature, when its pressure is found to be 150 kPa. Shows the cycle on P.V. and T.S. diagram and state the type of compression necessary to bring the system back to its original pressure and volume. Also determine the index of adiabatic expansion and the work done per kg of air. Take R = 0.29 kJ/kg K for air. **[6]**

b) Show that Kelvin Planck statement and Clausius statement are equivalent and lead to the same meaning. **[6]**

OR

Q2) a) The Cop of a Carnot refrigerator is 7 when it rejects heat energy into atmosphere at 27°C. It consumes 150 W of electrical power. Determine the cooling cabinet temperature in degree Celsius and refrigerating effect, in kW. **[6]**

b) Calculate the change in entropy per kg of air in the following cases - **[6]**

i) Air expands isothermally from 6 bar to 3 bar

ii) Air is compressed to half the volume at constant pressure

iii) Heat is supplied to air at constant volume till its pressure becomes threefold.

Assume suitable data.

P.T.O.

Q3) a) Define the following terms related to Air standard cycles : **[3]**

i) Compression Ratio

ii) Load Ratio

iii) Constant volume heat addition pressure ratio

b) Explain the term Mean Effective Pressure. What is its significance? **[4]**

c) With the help of T.S. diagram, explain how the following actions lead to an increase in efficiency of Rankine cycle - **[6]**

i) Lowering the condenser pressure

ii) Super heating the steam to high temperatures

iii) Increasing the boiler pressure

OR

Q4) a) Explain how reversed Carnot cycle can be employed to obtain refrigeration, with the help of a schematic diagram, T.S. an P-h chart.**[7]**

b) A simple Rankine cycle was steam as the working medium and operates between 50 kPa and 2000 kPa. Determine the quality of steam as if leaves the turbine, thermal efficiency of the cycle, and mass flow rate of steam required to produce 10000 kW power. Compare this efficiency with that of a Carnot cycle operating within the same temperature limits. **[6]**

Q5) a) What do you understand by the term "Boiler Draught"? What are the advantages of artificial drought over natural drought? **[7]**

b) Write a list of different boiler accessories and mention the function of each of them. **[6]**

OR

Q6) a) Explain how the boilers can be classified on the basis of following: **[6]**

i) Use

ii) Tube contents

iii) Tube shape and position

iv) Furnace position

v) Circulation

vi) Firing

b)   The following data is recorded during a trial on a boiler.   **[7]**
     Duration of trial :- 8 hours
     Pressure of steam leaving the boiler :- 14 bar
     Conditon of steam leaving the boiler :- 0.973 dry
     Feed water evaporated :- 26700 kg
     Temperature of feed water at inlet :- 50ºC
     Mass of coal fired :- 4260 kg
     Calorific value of coal fired :- 28900 kJ/kg
     Air supplied per kg of coal fired :- 17 kg
     Temperature of flue gas leaving boiler :- 344°C
     Boiler house temperature :- 21°C
     Specific heat of flue gases at constant pressure :- 1.1 kJ/kg K
     Determine -
     i)   Boiler efficiency
     ii)   Equivalent evaporation, and
     iii) Heat lost to flue gases

Q7) a)   Consider a house which contains air at 20°C and 75% relative humidity, while the outside temperature is 10°C. At what temperature of the window, will the moisture in the air start condensing on the inner surfaces of the windows?   **[4]**

     b)   What do you understand by relative humidity of air? What is its significance?   **[2]**

     c)   A 5 m × 5 m × 3 m room contains air at 25°C and 100 kPa at a relative humidity of 75%.   **[6]**
          Determine -
          i)   the partial pressure of dry air
          ii)   the specific humidity of the air
          iii) the enthalpy per unit mass of dry air

                                    OR

Q8) a)   Show the following air conditioning process on a psychometric chart -**[6]**
          i)   Simple heating and cooling
          ii)   Heating with humidification
          iii) Cooling witth dehumidification

     b)   Air enters an evaporative cooler at 1 atm, 35°C and 20% relative humidity. It exists at 80% relative humidity. Determine the exit temperature of the air and the lowest temperature to which the air can be cooled by this evaporative cooler.   **[6]**

Fig. 9(a)   Psychrometric chart on T_{db} - w plane

PSYCHROMETRIC CHART

(AT STANDARD ATMOSPHERIC PRESSURE OF
1.0132 bar OR 1.033 ata OR 760 mm of Hg) IN
SI UNITS WITH SHF

T_{wb} - WET BULB TEMPERATURE °C – – – –

ø   RELATIVE HUMIDITY %

ø   REFERENCE CIRCLE
    (T_{db} = 25° and ø = 50 %)

v   SPECIFIC VOLUME m³/kg of dry air

w   SPECIFIC HUMIDITY OR
    kg/kg of dry air

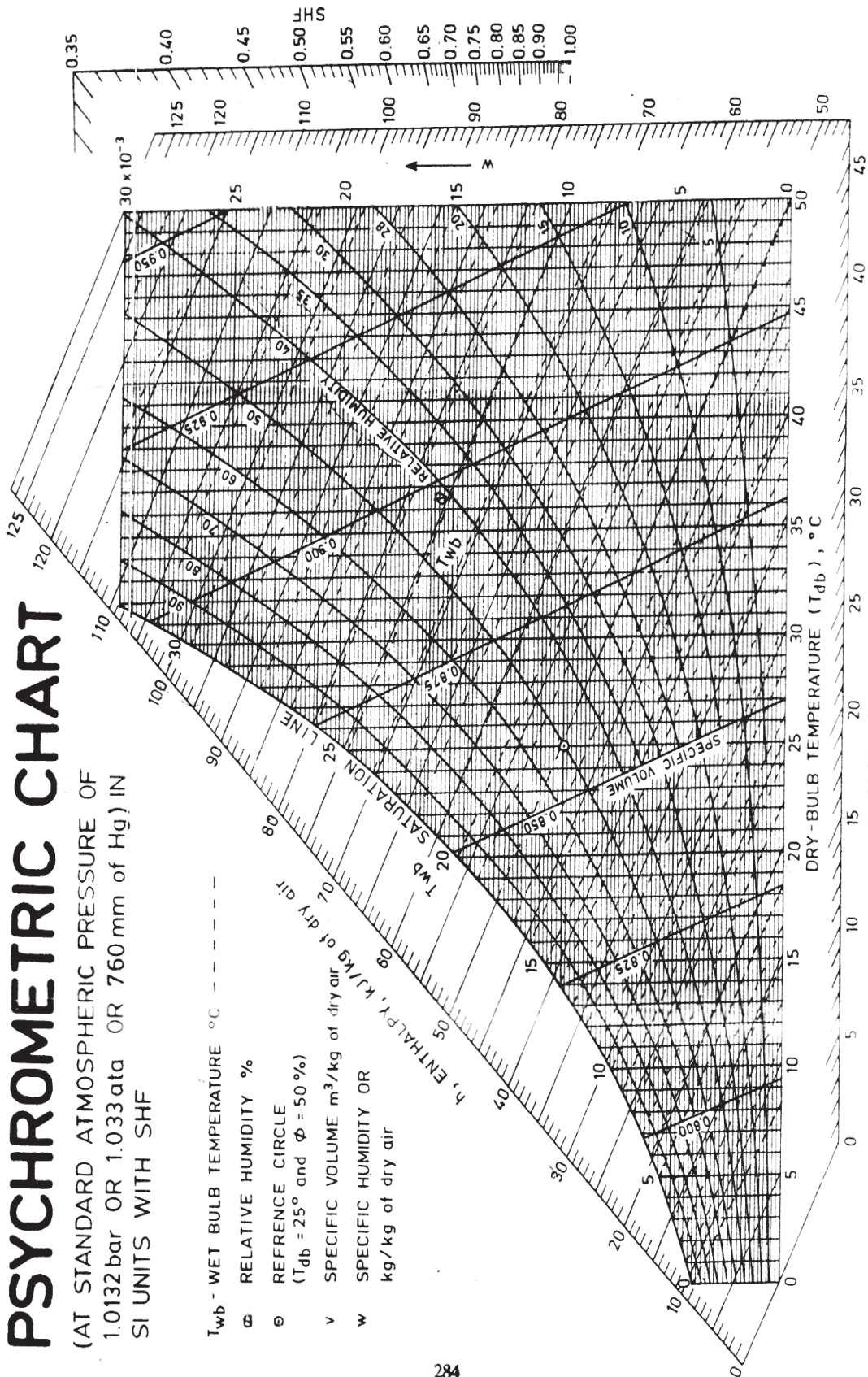**[5925]-578**

S.E. (Mechanical/Automobile) (Mechanical/Sandwich)
STRENGTH OF MATERIALS
(2015 Pattern) (Semester - I) (202051)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 ,Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of Electronic pocket calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a)   The following data refers to tensile test conducted on mild steel bar **[6]**

    i)   Diameter of steel bar = 30mm

    ii)   Gauge length = 200mm

    iii)   Extension of bar at 100 KN = 0.139mm

    iv)   Load at elastic limit = 230 KN

    v)   Maximum load = 360 KN

    vi)   Total extension = 56mm

    vii)   Diameter of rod at failure = 22.25mm

    Calculate

      1)   Young's modulus

      2)   Percentage elongation

      3)   Percentage decrease in area

      4)   Ultimate stress

  b)   Draw SFD and BMD for the beam shown in fig 1. Also find point of contra-flexure if any.   **[6]**
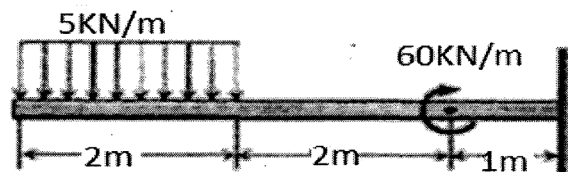

Fig. 1

OR

Q2) a) A steel rod of 30 mm diameter is enclosed in a brass tube of 42 mm external diameter and 32 mm internal diameter. Each is 360 mm long and the assembly is rigidly held between two stops 360 mm apart. The temperature of the assembly is then raised by 50°C. Determine **[6]**

Stresses in the tube and the rod.

E_s =205 GPa; E_b=90GPa

$\alpha_s = 11 \times 10^{-6}$ per °C; $\alpha_b = 19 \times 10^{-6}$ per °C

b) Fig 2 shows SFD. Draw loading diagram and BMD. Also find point of contra flexure if any. **[6]**

Fig2
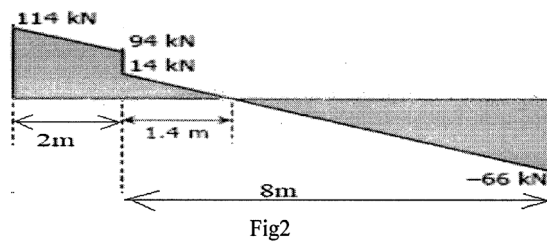
Q3) a) A simply supported beam of 8 m length is loaded as shown in fig 3. Find deflection at point C and D. Take E = 200 GPa and I = 650×10^6 mm⁴.**[6]**
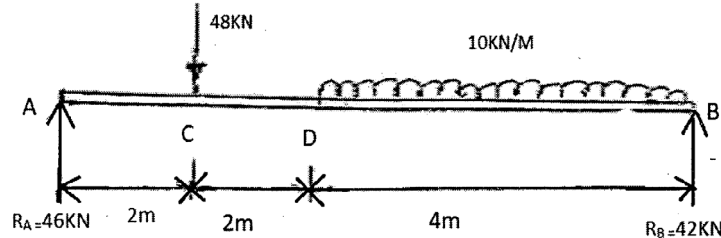

Fig3

b) Design hollow circular section beam whose inner diameter is 0.6 times outer diameter shown in fig 4. If flexural stress in beam should not exceed 20 MPa. **[6]**
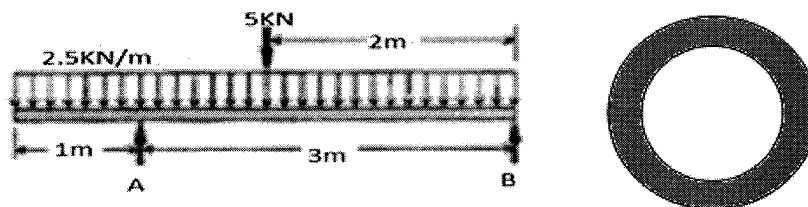

Fig 4

OR

Q4) a) A steel section as shown. in Fig.5 is subjected to a shear force of 20 KN. Determine the shear stress at key points and sketch the shear stress distribution diagram. **[6]**
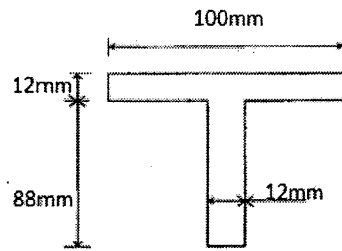

Fig 5

b) Compare the strain energy stored in the two bars of same material shown in fig 6, if gradually applied load is same. Take E = 205 GPa. **[6]**
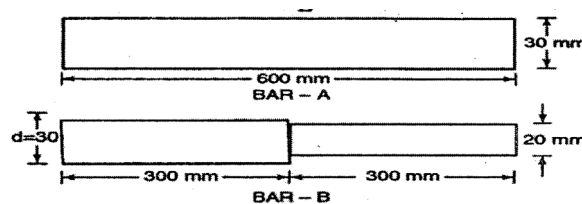

Fig 6

Q5) a) Design diameter of solid shaft for resisting torque of 2500 Nm. Also design cross section of hollow shaft of same material, assuming internal diameter as 0.7 times external diameter for same torque. Hence comment on percentage saving in weight for same length. Assume allowable angle of twist 2° for one metre length of shaft. Also calculate shear stress developed in hollow shaft. Take G=80GPa **[7]**

b) A bar of length 3m when used as simply supported beam of 5KN/m over whole span deflects 15 mm at centre. Determine safe load when it is used as column with both ends fixed using Euler's Formula. Take FS=3. **[6]**

OR

Q6) a) A solid steel shaft is loaded as shown in Fig 7. Using G = 83 GPa, determine the required diameter of the shaft if the shearing stress is limited to 60 MPa and the angle of rotation at the free end is not to exceed 4 deg. **[7]**
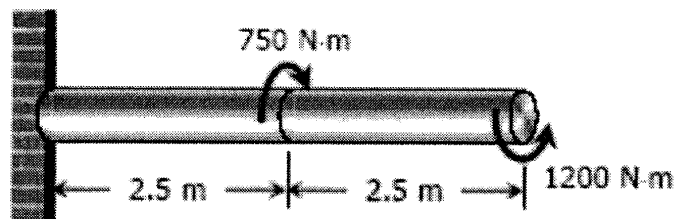

Fig 7

[5925]-578

3

b) Find creeping load for hollow cylindrical steel column of 40 mm external diameter and 2mm thick by using Rankine formulae. Length of column is 3m and hinged at both ends. Take E = 210 GPa. Take σ_c = 335 Mpa and a = 1/7500. **[6]**

Q7) A plane element is subjected to stresses as shown in fig 8. Determine **[13]**

a) Principal stresses and it's directions

b) Maximum shear stress and plane on which it acts

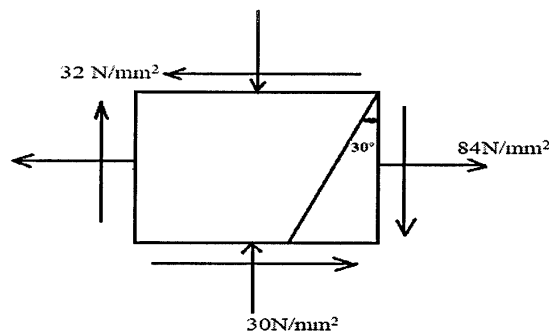c) Normal stress and tangential stress on plane inclined at 30° as shown in fig. using Mohr's circle

Fig 8

OR

Q8) a) If an element in plane stress is subjected to stresses σ_x = 70N/mm^2 tensile, σ_y = 35N/mm^2 compressive, and τ_{xy} = 35N/mm^2. Determine Principal stresses, maximum shear stress and plane on which these act. **[7]**

b) The stresses induced at critical point in machine component made up of steel are as follows **[6]**

σ_x = 80N/mm^2 σ_y = 40N/mm^2 and τ_{xy} = 60N/mm^2

Calculate factor of safety by

i) Maximum Principal stress theory

ii) Maximum distortion energy theory Assume S_{yt} = 280N/mm^2.

✗   ✗   ✗

SEAT No. :

[Total No. of Pages : 2

[5925]-579

S.E. (Mechanical Sandwich)
MATERIAL SCIENCE AND METALLURGY
(2015 Pattern) (Semester-I) (202061)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:
1) *Answer four quesions: Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Neat diagrams should be drawn wherever necessary.*
3) *Use of non programmable electronic pocket calculator is allowed.*
4) *Figures to the right indicate full marks.*

Q1) a) List types Surface defects? Explain Effect of surface defects? **[5]**

b) Define Atomic Packing factor? Find atomic packing factor for FCC structure? **[5]**

c) Differentiate between Charpy Impact test and Izod Impact Test. **[3]**

OR

Q2) a) Define Corrosion. Explain with suitable diagram mechanism of corrosion.**[5]**

b) Explain with neat diagram Magnetic particle inspection? **[5]**

c) Define creep, fatigue and hardness. **[3]**

Q3) a) Draw Iron-Iron caribide equilibrium diagram and indicate various phases and temperatures in to it. **[8]**

b) Suggest suitable type of plain carbon steel with composition for following application **[4]**

i) Shaft

ii) Single point tool

iii) Wires

iv) Nut & Bolts

OR

P.T.O.

Q4) a)   Draw TTT Diagram with Temperature and time? Show CCT curve on it.**[8]**

b)   Differentiate between Carburizing & Nitriding?   **[4]**

Q5) a)   Explain step involve in Powder Metallurgy Manufacturing?   **[5]**

b)   Explain with neat flow chart manufacturing of cemented carbide tips.**[5]**

c)   Compare ferrous and nonferrous alloys on the basis of mechanical strength, corrosion resistance and cost?   **[3]**

OR

Q6) a)   State the advantages, limitations and applicatoins of powder metallury.**[5]**

b)   Differentiate between brass and bronze. List Industrial application of both.**[4]**

c)   Define Sintering, Liquid Phase Sintering, Apparent density, Green strength.**[4]**

Q7) a)   Why Natural Rubber needed Vulcanization? Which chemical material is useful for Vulcanization?   **[4]**

b)   State and explain mechanical and chemical methods of ceramic powder preparation.   **[4]**

c)   Classify composites on the basis of matrix meterial and state their advantages and limitations.   **[4]**

OR

Q8) a)   State the types fo composites on the basis of reinforcement. Compare these composites.   **[4]**

b)   State any four polymer with their applications.   **[4]**

c)   State and explain advantages and limitations of ceramic materials with suitable example.   **[4]**

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[5925]-580

S.E. (Mechanical Sandwich)
FLUID MECHANICS AND MACHINERY
(2015 Pattern) (202062) (Semester - I)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Answer Q.No. Q1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Use of logarithmic tables, slide rule, and electronic pocket calculator is allowed.*
4) *Figures to the right indicate full marks.*
5) *Assume Suitable data if necessary*

Q1) a) In a two-dimensional flow the velocity components are u = 6y and v = – 6x: **[6]**

     i) Is flow possible?

     ii) If so, determine the stream function.

   b) Define Viscosity, Capillary effect and Surface Tension with example **[6]**

<p align="center">OR</p>

Q2) a) Prove that the centre of pressure of a plane surface is always below the centre of gravity when immersed in liquid. **[6]**

   b) Find out the discharge through a venturimeter with inlet diameter of 10 cm and throat diameter of 5 cm carrying oil of sp.gr. 0.8 When the deflection of oil- mercury manometer is 30 cm. Cd=0.95. **[6]**

Q3) a) A 0.2 m diameter pipe carries liquid in laminar regime. A pitot tube placed in the flow at a radial distance of 20 mm from the axis of the pipe indicates velocity of 0.5m/s. Calculate: **[6]**

     i) The maximum velocity

     ii) The mean velocity, and

     iii) The discharge in the pipe

b) Derive an expression for force exerted on a series of flat plate at its centre by a jet also find an expression for power. **[6]**

OR

Q4) a) A Pelton wheel has 2.45m of diameter operates under a following conditions **[6]**

Net Head = 370 rn

Speed ratio = 0.47

Jet deflection angle = 160°

Cv 0.98 Jet Diameter = 0.88m

Relative velocity at outlet = 0.9 times relative velocity at inlet.

Calculate the power delivered by the runner and RPM of wheel

b) What are minor losses? Under what circumstances will they be negligible? **[6]**

Q5) a) A Kaplan turbine working under a head of 25 m develops 16000 kW shaft power. The outer diameter of the runner is 4m and hub diameter is 2 m. The guide blade angle is 35°. The hydraulic and overall efficiency are 90% and 85% respectively. If the velocity of whirl is zero at outlet, determine runner vane angles at inlet and outlet, and speed of turbine.**[7]**

b) Explain classification of Hydraulic Turbine in details (any three) **[6]**

OR

Q6) a) Using Buckingham's πTheorem. show that the velocity through circular orifice is given by: **[7]**

$$V = \sqrt{2gH}\, f\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$$

Where, H = Head causing flow, D = Diameter of orifice

μ = Coefficient of viscosity, p = Mass density, g = Acceleration due to gravity.

b) Write difference between Impulse turbine and Reaction turbine. **[6]**

Q7 a) A centrifugal pump is to discharge 0.12 m^3/s at a speed of 1400rp.m against a head of 30m. The diameter and width of the impeller at outlet are 35 cm and 5 cm respectively. If the manometric efficiency is 75%. determine the vane angle at outlet. **[8]**

b) Define the following terms **[5]**

     i)   Suction head   ii)   delivery head

     iii)   static head   iv)   virtual head

     v)   manometric head

<center>OR</center>

Q8) a) The diameter of an impeller of a centrifugal pump at inlet and outlet are 300 mm and 600 mm respectively. The velocity of flow at outlet is 2.5 m/s and vanes are set back at an angle of 45° at outlet. Determine the minimum starting speed of the pump if the manometric efficiency is 75%. **[6]**

b) Explain working principle of centrifugal pump with figure. **[7]**

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[5925]-581

S.E. (Mechanical/Automobile)
FLUID MECHANICS
(2015 Pattern) (Semester - II) (202045)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

  1) Solve Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No. 6, Q. No.7 or Q.No.8.

  2) Neat diagrams must be drawn wherever necessary.

  3) Figures to the right side indicate full marks.

  4) Assume Suitable data if necessary.

Q1) a) Explain the different types of fluids using stress strain diagram.   **[6]**

  b) If for a two dimensional potential flow, the velocity potential function is given by $\phi = x(2y - 1)$, Determine the velocity at point P (4, 5). Also determine the value of stream function ψ at the point P.   **[6]**

OR

Q2) a) Explain the terms path line, stream line and streak line.   **[6]**

  b) A rectangular plane surface 3m wide and 4 m deep lies in water in such a way that its plane makes an angle of 30 degree with the free surface of water. Determine the total pressure force and position of center of pressure, when the upper edge of the plane is 2 m below the free surface.   **[6]**

Q3) a) Derive Euler's equation for the flow along stream line and deduce the Bernoulli's equation for the same.   **[6]**

P.T.O.

b) An oil of viscosity 0.1 Ns/m² and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and of length 300 m. The rate of flow of fluid through the pipe is 3.5.litres/s. Find the pressure drop in a length of 300 m and also the shear stress at the pipe wall. **[6]**

OR

Q4) a) Derive an expression of shear stress and velocity distribution for laminar flow through circular pipe. **[6]**

b) A horizontal Venturimeter with inlet and throat diameters 20 cm and 10 cm respectively is used to measure the flow of an oil of specific gravity of 0.8. The discharge of oil through venturimeter is 60 litres/s. Draw the sketch of venturimeter and find the reading of oil-mercury differential manometer. Take co-efficient of discharge equal to 0.98.**[6]**

Q5) a) Explain the following dimensionless numbers- **[6]**

i) Froude's Number

ii) Weber Number

iii) Reynold's Number

b) An oil of sp.gr. 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 litres/s. Find the head loss due to friction and power required to maintain the flow for a length of 1000 m. Take kinematic viscosity 0.29 stokes. Consider the co-efficient of friction $f = 0.079 / (Re)^{0.25}$. **[7]**

OR

Q6) a) Derive an expression for Darcy - Weisbach equation. **[6]**

b) Show that the frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by **[7]**

$$T = D^5 N^2 \rho \phi \left[\frac{\mu}{D^2 N \rho} \right]$$

Q7) a) For the following velocity profiles, determine whether the flow has separated or on the verge of separation or will remain attached with the surface : **[6]**

    i) $\dfrac{u}{U} = \dfrac{3}{2}\eta - \dfrac{1}{2}\eta^3$

    ii) $\dfrac{u}{U} = -2\eta + \eta^2$

    iii) $\dfrac{u}{U} = 2\eta^2 - \eta^3$ where $\eta = \dfrac{y}{\delta}$

    b) Write a short note on Separation of boundary layer and its control.**[7]**

OR

Q8) a) Derive an expression for displacement, momentum and energy thicknesses. **[9]**

    b) What is drag and lift? Explain the different types of drag on an immersed body. **[4]**

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[5925]-582

S.E. (Mechanical/Auto Mobile)
ENGINEERING METALLURGY
(2015 Pattern) (Semester-II) (202049)

Time : 2 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
   1)   *Neat diagrams must be drawn wherever necessary.*
   2)   *Figures to the right side indicate full marks.*

Q1) a)   Define   **[4]**
      i)   System
      ii)   Phase
      iii)   Variable
      iv)   Alloy

    b)   List effect of grain size on various mechanical properties?   **[4]**

    c)   Differentiate between Microscopy and Macroscopy with suitable example.**[4]**

OR

Q2) a)   With neat diagram explain transmission electron microscopy (TEM)? List Advantages of it.   **[4]**

    b)   Define solid solution? List points of Hume Ruther's rule of solid solubility.**[4]**

    c)   Explain with diagram and example of eutectic system & partial eutectic system?   **[4]**

Q3) a)   Draw Iron-iron carbide equilibrium diagram?   **[5]**

    b)   List effect of various parameters on structure and properties of cast irons?**[4]**

    c)   State various types of carburizing and explain any one in detail?   **[4]**

OR

Q4) a)   Draw Time Temperature Transformation (TTT) diagram. Show Critical Cooling rate on it?   **[5]**

    b)   Give composition of white cast iron, List properties and application of White cast iron?   **[4]**

    c)   Define hardenability? Explain Jominey End Quech test for measuring hardenability?   **[4]**

P.T.O.

Q5) a) Differentiate between plain carbon steel and Alloy steel with example & applications? **[4]**

b) Define Red hardness? Write short note on Tool steel? **[4]**

c) Explain various heat affected zone with neat sketch? **[4]**

OR

Q6) a) Explain properties changes and use of alloy steel with following alloying elements phosphorous, Nikel, Silicon and chromium? **[4]**

b) Write short note on super alloys? (Composition, properties, types and specific application) **[4]**

c) According to AISI designation system write composition of following steels? **[4]**

i) 1050   ii) 2430   iii) 7070   iv) 4120?

Q7) a) Write short note on Babbit-Bearing material? (Composition, properties, Types and specific application) **[4]**

b) Give classification of Copper Alloys? Differentiate between brasses and bronze? **[4]**

c) Write composition and properties and applications of Dura Nickel, monel and Invar? **[5]**

OR

Q8) a) Write short note on Tin and Lead base alloys? (composition, Properties,) Types and specific application) **[4]**

b) Compare Non ferrous metals with ferrous from mechanical properties point of view? **[4]**

c) Write composition and properties and applications of Duraalumin and Y-Alloy? **[5]**

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[5925]-583

S.E. (Mechanical/Automobile)
THEORY OF MACHINES - I
(2015 Pattern) (Semester - II) (202048)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1)   Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.

2)   Neat diagrams must be drawn wherever necessary.

3)   Use of calculator is allowed.

4)   Assume suitable data, if necessary.

Q1) a)   Define 'Inversion'. Explain with the help of neat sketches any two inversions of double slider crank chain. [5]

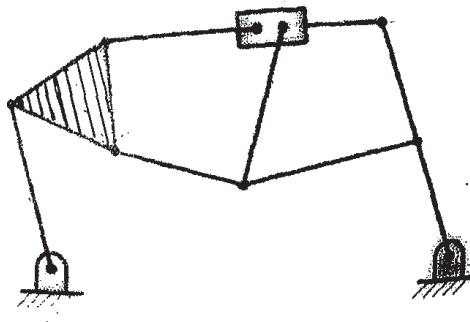b)   Find the degrees of freedom for the mechanism as shown in the following figures [5]

Fig 1

OR

Q2) a)   With the help of neat schematic diagram, derive frequency of bifilar suspension system. **[4]**

b)   The connecting rod having length equal to 800 mm between centers and has mass equal to 5 Kg. Its C. G. is at 300 mm from big end and radius of gyration about C. G. is 250 mm. Its angular acceleratiqn is 80 rad/sec², anticlockwise. The connecting rod is replaced by two mass system having 3 Kg and 2 Kg at distance of 400 mm and 100 mm from C. G. respectively Check whether system is dynamic equivalent with connecting rod. If not what should be done to make the system dynamically equivalent keeping masses at the same position. **[6]**

P.T.O.

Q3) a) What do you mean by brakes and dynamometer? State the types of brakes and Dynamometers. **[6]**

b) What is clutch? State the function of clutch and give classification of clutch. **[4]**

OR

Q4) a) Explain complex number method of acceleration analysis. **[4]**

b) Establish the relation between input and output speed of 'single Hooke's joint in which the angle between the shaft is α°. **[6]**

Q5) a) Fig.2 shows a whitworth quick return motion mechanism. The various dimensions are as follows:

OQ = 100 mm, OA = 200 mm, QC = 100 mm and CD = 500 m. The crank OA makes an angle of 60° with the vertical and rotates at 120 rpm in the clockwise direction. Locate Instantaneous centers of rotation and find the velocity of ram D. Crank makes an angle of 60° with vertical reference line. **[10]**
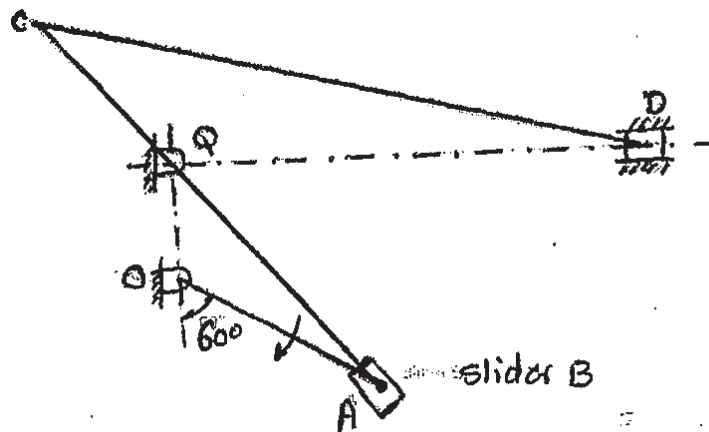

Fig 2

b) Explain different types of instantaneous centre of rotation. **[5]**

OR

Q6) a) In the mechanism, shown in fig. 3 the slider D is constrained to move on a horizontal path. The crank CB is rotating at 180 rpm counter - clockwise. Various dimensions are: CB = 240 mm, BD = 540 mm. Use relative velocity method. **[10]**

For the given configuration find:

i) Velocity of slider D,

ii) Angular velocity of links CB and BD.

iii) Velocity of rubbing at B, Take pin diameter 30 mm.
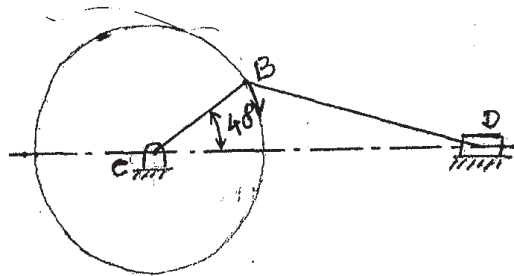
Fig 3

b) State and explain velocity image principle. **[5]**

Q7) a) The kinematic diagram of one of the cylinders of rotary engine is shown in fig.4. The crank OA which is vertical and fixed is 50 mm long. The length of the connecting rod is 125 mm. The line of the stroke OB is inclined at 50° to the vertical. The cylinders are rotating at a uniform speed of 300 rpm in a clockwise direction, about the fixed centre O. Determine: **[12]**

Acceleration of piston inside the cylinder.
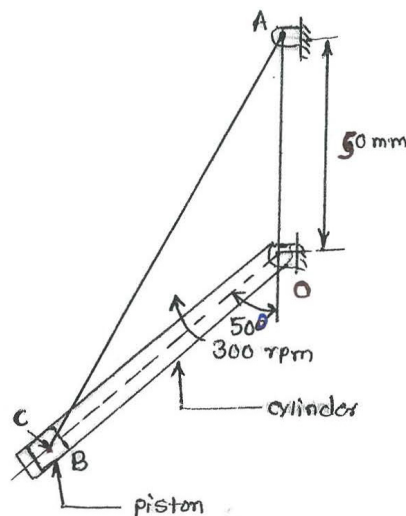
b)   Explain velocity Analysis using klien's construction.   **[3]**

<div align="center">OR</div>

Q8) a)   In a reciprocating engine, crank length is 25 cm and obliquity ratio is 4. The crank rotates at uniform angular velocity of 300 rpm clockwise. Crank is at 30° from IDC, Using Klien's construction method determine: **[12]**

i)   Velocity of piston

ii)   Acceleration of piston and

iii) Angular velocity and angular acceleration of connecting rod.

b)   Explain the procedure to find out the coriolis component of acceleration vector.   **[3]**

<div align="center">✗   ✗   ✗</div>

[5925]-584

S.E. (Mechanical/Automobile)
APPLIED THERMODYNAMICS
(2015 Pattern) (Semester - II) (202050)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Use of steam tables, slide rule, electronic calculator is allowed.*
4) *Assume suitable data if necessary.*

Q1) a) Enlist various components of Internal Combustion Engine and write their suitable materials. Also write suitable processes for manufacturing of these components. **[6]**

b) Explain Simple carburetor with neat sketch. **[6]**

OR

Q2) a) Explain Air Standard cycle & its assumptions. **[6]**

b) Explain any three types of combustion chambers in SI engine. **[6]**

Q3) a) How induction swirl created compare it with compression swirl. **[6]**

b) What is friction power? Explain any one method to measure friction power. **[6]**

OR

Q4) a) Explain main stages of combustion in CI engine. **[6]**

b) A single cylinder 4 stroke cycle oil engine works on Diesel engine. The following readings were taken when engine was running at full load condition. Area of indicator diagram = 3 cm², Length of indicator diagram = 4 cm, mean effective pressure = 7.5 bar, Engine speed = 400

P.T.O.

RPM, Load on brake = 380 N, Spring reading = 50 N, Diameter of brake drum = 120 cm, Fuel consumption = 2.8 kg/hr, Calorific Value of Fuel = 42,000 kJ/kg, Diameter of cylinder = 16 cm, Stroke of piston = 20 cm, From above data find : **[6]**

    i)   Friction Power

    ii)   Mechanical Efficiency

    iii) Brake Thermal Efficiency

Q5) a) Explain wet sump lubrication system used in IC engine. **[6]**

    b) Explain Battery ignition system. **[7]**

<div align="center">OR</div>

Q6) a) Explain in detail any one type of Governing in IC engine. **[6]**

    b) What are Euro Norms and Bharat Stage Norms? Give pollution limits for acceptable emissions in Bharat Stage 6. **[7]**

<div align="center">OR</div>

Q7) a) Explain methods for improving Isothermal efficiency of reciprocating air compressor. **[6]**

    b) A single stage single acting reciprocating air compressor has air entering at 20°C and 1 bar. The compression follows a polytropic process with index of compression = 1.2 upto a delivery pressure of 12 bar. The compressor runs at a speed of 240 rpm with L/D ratio of 1.8. Mechanical Efficiency = 88%. Determine Isothermal Efficiency. **[7]**

<div align="center">OR</div>

Q8) a) Explain Isothermal efficiency, volumetric efficiency, FAD for Compressor. **[6]**

    b) A single cylinder air compressor delivers 9 kg of air per min. The air is compressed from 1 bar and 27 deg. to 7 bar. The compression process follows the law $PV^{1.25} = C$. Find Work done the Brake Power required if Mechanical Efficiency is 85%. **[7]**

<div align="center">□□□</div>

SEAT No. :

[Total No. of Pages : 2

[5925]-585

S.E. (Machanical/Automobile Engineering)
MANUFACTURING PROCESS-I
(2015 Pattern) (Semester-I) (202041)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
   1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
   2) *Figures to the right indicate full marks.*
   3) *Assume suitable data if necessary.*
   4) *Neat diagrams must be drawn wherever necessary.*

Q1) a)   Explain different characteristics of molding sand.   **[6]**

   b)   Briefly explain the rotary swaging process.   **[6]**

                                    OR

Q2) a)   A slab of size 300mm×300mm×50mm is required to be cast from a
        molten steel using a top riser of 170mm dia. If (d/n) =2 for riser, calculate
        the freezing ratio.   **[6]**

   b)   Describe with neat sketch the operations of Tube drawing?   **[6]**

Q3) a)   Explain with neat sketch type of extrusion : calendering?   **[6]**

   b)   Explain oxyacetylene welding with neat sketch?   **[6]**

                                    OR

Q4) a)   Explain Resistance welding with neat sketch? State its advantages,
        limitations, and applications?   **[6]**

   b)   Explain compression molding with suitable sketch. State its advantages,
        limitations and applications?   **[6]**

Q5) a)   What is vacuum forming? Explain with proper sketch.   **[6]**

   b)   Explain any three sheet metal working operations with sketch.   **[7]**

                                    OR

                                                                            P.T.O.

Q6) a) A cup of 5cm diameter and 7.5 cm depth is to drawn from 1.5 mm thick drawing sheet with a tensile strength of $312^N/mm^2$. The Corner radius is negligible. **[6]**

Determine :

i) Blank diameter

ii) No. of drawing operations

iii) Force and Energe for the first draw with 40% reduction

b) Explain Hydroforming in detail with neat sketch? **[7]**

Q7) a) Explain with neat sketch steady rest and follower rest in lathe machine?**[6]**

b) Explain tuper turning attachement with neat sketch? **[7]**

OR

Q8) a) Calculate machining time for a work piece of 60mm diameter and 120mm length turned in 2 passes if the approach length is 12 mm and over travel is 5 mm Given cutting speed = 30 m/min and feed 0.3 mm/rev. **[6]**

b) Explain thread cutting operations performed on Lathe machine with suitable sketch. **[7]**

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S.E. (Mechanical/Automobile)
MATERIAL SCIENCE
(2015 Pattern) (Semester-I) (202044)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

   1)   *Solve Q.No.1 or Q.No.2 Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*

   2)   *Figures to the right indicate full marks.*

   3)   *Draw the neat sketch wherever necessary.*

Q1) a)   Draw Lattice planes for the following Millar indices,   **[4]**

     i)   (2 2 1)

     ii)   (1 1 0)

   b)   Differentiate between BCC and FCC structure on the basis of following,   **[4]**

     i)   Atomic packing factor

     ii)   Average no of atoms per unit cell

     iii)   Relation between radius of atom and lattice parameter.

     iv)   Example of Material

   c)   What do you mean by the term "imperfections in crystal structure'? Give one examples with neat sketch for point, line and planer defects.   **[4]**

<div align="center">OR</div>

Q2) a)   Differentiate between slip and twinning on the basis of following parameters,   **[4]**

     i)   sketch

     ii)   definition

     iii)   required stress to produce slip / twinning

     iv)   direction of the slip/twinning

   b)   Discuss the Dislocation theory of work hardening with neat sketch. **[4]**

   c)   Define "Volume density" of a metal. Calculate the X ray density of aluminum. Given: Lattic constant: 4.049Å, atomic weight 26.98 gm/mole and Avogadro's number = 6.02×10^{23} atoms/mole.   **[4]**

Q3) a) Identify the type of mechanical testing for the following (any five) **[5]**
      i)   Determination of strength, resilience, toughness etc. of material.
      ii)   Susceptibility of materials for brittle failures under the existence of stress, temperature, strain rate etc.
      iii) Failure of material at a stress level far below its ultimate tensile strength when acted upon by frequent stress fluctuations.
      iv) The slow and progressive deformation of a material with time under a constant stress and high temperature.
      v)   Material inspection for detecting internal defects such as cracks, porosity, and laminations in matallic and non metallic components during or after production.
      vi) Non Destructive Testing of many components at the same time.

    b) Explain "Ultrasonic inspection method" with neat sketch, advantages and disadvantages. **[4]**

    c) Explain any four corrosion prevention and control methods. **[4]**

OR

Q4) a) Explain the reason for the following types of corrosion, (any five) **[5]**
      i)   Pitting corrosion
      ii)   Stress corrosion
      iii) Cavitation corrosion
      iv) Intergranular corrosion
      v)   Crevice corrosion
      vi) Galvanic corrosion
      vii) Caustic embrittlement

    b) What do you mean by the term "Fatigue in material"? List out various methods to increasing the fatigue life? **[4]**

    c) What are the various points should be consider before selecting the matrials for a particular service environment. **[4]**

Q5) a) Explain with neat sketch, advantages and disadvantages the Ion Implantation method of surface modification. **[5]**

    b) Describe the following terms with neat sketches (any two). **[4]**
      i)   Shot Blasting
      ii)   Plasma nitriding
      iii) Anodizing

    c) Explain with neat, sketch the process of electroplating? List out the various factors which affect the electroplating. **[4]**

OR

Q6) a) Explain with neat sketch, advantags and disadvantages the Ion vapor deposition method of surface modification. **[5]**

b) Draw self explanatory figure of Physical vapor deposition and chemical vapor deposition of method of surface modification. **[4]**

c) List out any four coatings defects with its probable causes. **[4]**

Q7) a) Define the term 'powder metallurgy and explain basic steps and applications. **[4]**

b) Explain any two powder manufacturing processes for following types, **[4]**

    i)   Mechanical processes

    ii)   Chemical processes.

c) Explain manufacturing of 'cemented carbide' with neat flow chart? **[4]**

OR

Q8) a) Explain the types of methods for measurement of powder size and distribution in powder metallurgy. **[4]**

b) What are the various compacting or pressing properties of powder in powder metallurgy? **[4]**

c) What is a 'self lubricated bearing'? Explan the roll of powder metallurgy for manufacturing of 'Self lubricated bearings? **[4]**

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[5925]-601

S.E. (Computer Engineering)
MICROPROCESSOR AND INTERFACING TECHNIQUES
(2012 Pattern) (Semester - IV) (210248)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Question No. 1 or 2, 3 or 4, 5 or 6 and 7 or 8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Draw and explain functional block diagram of the 8086 microprocessor.**[6]**

b) Explain the command words/control words of 8259 in detail.   **[6]**

OR

Q2) a) Explain the difference between synchronous and asynchronous communication.   **[6]**

b) Explain the following assembler directives with one example each: **[6]**

     i) PUBLIC

     ii) EXTRN

     iii) LABEL

Q3) a) Draw and explain in brief 8279 internal block.   **[7]**

b) Explain different operating modes of 8255 PPI.   **[5]**

OR

Q4) a) Draw and explain functional block diagram of 8254.   **[6]**

b) Draw & explain interfacing of 8-bit DAC with 8255.   **[6]**

Q5) a) Draw and explain the read write cycle timing diagram of 8086 in maximum mode. **[7]**

b) Draw and explain block diagram of 8087. **[6]**

OR

Q6) a) Explain the status and control word of 8087 NDP. **[7]**

b) Explain the difference between minimum and maximum mode of 8086.**[6]**

Q7) a) Draw the block diagram of Intel is motherboard. **[6]**

b) List features of 82801 JIR I/O Controller Hub. **[7]**

OR

Q8) a) List the features of Intel X58 express chipset. **[3]**

b) Write a short note on Intel I/O controller Hub 10. **[4]**

c) Explain the various components of Intel X58 chipset. **[6]**

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[5925]-602

S.E. (Computer Engineering)
OPERATING SYSTEM AND ADMINISTRATION
(2012 Pattern) (Semester - III) (210244)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates :

    1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

    2) *Neat diagrams must be drawn wherever necessary.*

    3) *Figures to the right indicate full marks.*

    4) *Assume suitable data, if necessary.*

Q1) a) What do you mean by user perspective of operating system? **[6]**

    b) What are the different functions of kernel? **[6]**

OR

Q2) a) What is Shell? Explain any 5 Commands? **[6]**

    b) Draw and Explain 4 State Process Diagram. **[6]**

Q3) a) Write a Short Note on : **[6]**

    i) Boot Strapping

    ii) Perl Scripting

    b) Write Short Note on : **[6]**

    i) File Attributes

    ii) File Organization

OR

Q4) a) Explain Directory Structure in Detail. **[6]**

    b) Explain Bash Scripting. **[6]**

P.T.O.

Q5) a) Define User Mode and Kernel Mode. Give difference between Them.**[7]**

b) Explain Runaway processes sudo command and su command with Example. **[6]**

OR

Q6) a) Differentiate between program and process. Explain with neat diagram contents of a UNIX process image. **[7]**

b) What do you mean by nice and renice value? What is dynamic monitoring with top? **[6]**

Q7) a) What are the different steps of the disk partitioning? What are the advantages and disadvantages of the multiple partitions? **[7]**

b) Give the entries of / etc / shadow and / etc / group file. **[6]**

OR

Q8) a) Explain the Process of mounting and unmounting a USB drive. **[7]**

b) Explain the Modern access control with traditional unix access control.**[6]**

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