

2019-2020
I YEAR B.TECH. (AUTUMN SEMESTER) EXAMINATION
All Branches
APPLIED CHEMISTRY (ACS-1110/AC-111)

Maximum Marks: 60

Time: 02 Hours

Note:

- (i) Attempt all questions. Assume any suitable data, if needed.
- (ii) Symbols have their usual meanings.
- (iii) Marks allotted to each question and course outcome (CO) covered are indicated against each question.

Q. No.	Question	CO	M. M.
1(a)	Answer any Five of the followings.	CO	5×2
(i)	List four important requirements of municipal water.	CO1	
(ii)	With the help of suitable chemical equation explain the role of (a) Alum and (b) Copperas in removal of colloidal impurities from municipal water.	CO1	
(iii)	With the help of suitable chemical equation/s explain the role of disinfection action by (a) chloramine and (b) ozone.		
(iv)	From the list of impurities given below find out the impurity/impurities producing temporary hardness, permanent hardness and no hardness in water. FeSO_4 , NaHCO_3 , CaCl_2 , Fe_2O_3 , $\text{Ca}(\text{HCO}_3)_2$, KCl	CO1	
(v)	Write the chemical reactions of lime with (a) temporary Mg hardness and (b) NaHCO_3 .	CO1	
(vi)	Give reason/s for the following: (a) Sludge is precipitated in the colder region of boiler whereas scales are deposited on the inner wall of the boiler. (b) Hydrazine is preferred over other chemicals for the removal of dissolved oxygen in the high pressure boiler.	CO1	
(vii)	List different internal treatment methods for boiler. With the help of chemical equations explain Calgon conditioning.	CO1	
(viii)	List four important points showing the superiority of zeolite process over lime-soda process of water softening.	CO1	
1(b)	A sample of water contains the following impurities. Calculate the temporary and permanent hardness of water in the sample and also calculate the amount of lime (purity 95%) and soda (purity 90%) required for softening 10,000 litre of water. $\text{Ca}(\text{HCO}_3)_2 = 4.05 \text{ mg/l}$, $\text{CaSO}_4 = 27.2 \text{ mg/l}$, $\text{MgSO}_4 = 2.4 \text{ mg/l}$, $\text{MgCl}_2 = 9.5 \text{ mg/l}$, $\text{KCl} = 5.85 \text{ mg/l}$, $\text{NaHCO}_3 = 8.4 \text{ mg/l}$ (Atomic weights of Ca=40, Mg=24, K=39, S=32, H=1, O=16, C=12, Cl=35.5)	CO1	5

contd....2

- 2 (a) Define higher and lower calorific value for a chemical fuel. CO2 2
- 2 (b) Differentiate between proximate and ultimate methods of coal analysis. CO2 2
- 2 (c) Calculate the minimum amount of oxygen and air (in Kg) required for complete combustion of 2 Kg of coal sample containing 90% of carbon and remaining incombustible matter. Also calculate the w/w and v/v composition of dry flue gases. CO2 5

OR

- 2 (c)' With the help of a labelled block diagram describe the Bergius process for the production of synthetic petrol. CO2 5
- 2(d) With the help of suitable diagram discuss the mechanism of Hydrodynamic lubrication OR Boundary lubrication. CO2 4
- 2 (e) Define viscosity index. Give the difference between *H-oils* and *L-oils*. CO2 2
- 3(a) Write down the reactions involved in oxidation corrosion of a metal M. With the help of a diagram explain the oxidation mechanism of the metal. CO3 4

OR

- 3(a)' What are the necessary conditions for electrochemical corrosion to occur? Explain the mechanism of rusting of iron in NaCl solution. CO3 4
- (b) With the help of a diagram explain the method of cathodic protection by impressed current. CO3 3
- (c) List **three** important difference between anodic and cathodic metallic coatings. CO3 2
- (d) List **four** important functions of pigments in paint. CO3 3
- (e) Calculate the emf of the following cell: CO3 3
- $$\text{Zn(s)} \mid \text{Zn}^{2+} (0.2\text{M}) \parallel \text{Cu}^{2+} (1.75\text{M}) + \mid \text{Cu (s)}$$
- $$E^{\circ}_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V} \text{ and } E^{\circ}_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$$
- 4 (a) Give the preparation, properties and uses of **any 03** of the followings: CO4 4x3
- (i) Cellulose acetate (ii) Polyester (iii) Buna-N (iv) Polystyrene
- 4 (b) List the types of molecular mass of polymers. Discuss any one of them. CO4 3

2019-20
B.TECH. (AUTUMN SEMESTER) EXAMINATION
MATHEMATICS-I (OLD COURSE)
AM111

Maximum Marks: 60**Credits: 04****Duration: Two Hours****Note: (i) Answer all questions.****(ii) Marks allotted to each question are indicated against each question.**

Q. No.	Question	M.M.
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1 (a) For what values of a and b the system of equations [07]

$$x + y + z = 6; \quad x + 2y + 3z = 10; \quad x + 2y + az = b$$

has (i) no solution (ii) a unique solution and (iii) infinite number of solutions.

(b)' Verify Cayley-Hamilton theorem for the matrix [08]

$$A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}.$$

Hence find A^{-1} .

OR

(b) Find eigen values and eigen vectors of the matrix [08]

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}.$$

2(a) If $y = \sin^{-1} x$ show that [08]

$$(1 - x^2)y_{n+2} - (2n + 1)x y_{n+1} - n^2 y_n = 0.$$

OR

(a)' Describing salient features, trace the curve [08]

$$y(x^2 + 4a^2) = 8a^3.$$

(b) Expand $\log x$ in powers of $(x - 1)$ up to fourth degree terms by Taylor's [07]

theorem. Hence find the value of $\log 1.1$.

contd.... 2

- 3(a)** Show that the intrinsic equation of the cycloid [07]

$$x = a(t + \sin t), y = a(1 - \cos t)$$

is $s = 4a \sin \psi$.

- (b)** Find the volume generated by the revolution of the loop of the curve [08]
 $y^2 = x^4(x + 2)$ about x-axis.

OR

- (b)'** Find the area of the curved surface of the cup formed by the revolution about its [08]
axis of the smaller part of the parabola $y^2 = 4ax$ cut off by the line $x = 3a$.

- 4(a)** Solve any two of the following differential equation: [08]

$$(i) \quad (x^2 - ay)dx = (ax - y^2)dy$$

$$(ii) \quad \frac{d^2y}{dx^2} + \frac{dy}{dx} + y = \sin 2x.$$

$$(iii) \quad x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = 2x^2.$$

- (b)** Solve the simultaneous equations $\frac{dx}{dt} - y = t$, $\frac{dy}{dt} + x = 1$. [07]

OR

- (b)'** The circuit with a resistance R , inductance L and a battery of constant E.M.F. E is [07]
switched on at $t = 0$. If the initial current be zero, find the current at time t .

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2019-20

B.TECH. II SEMESTER EXAMINATION
(CIVIL/COMPUT./CHEM./ELECTRI./ELECTRO./MECH./ PET. STUD. ENGINEERING)
MATHEMATICS - II
(AM-112)

Maximum Marks: 60**Duration: Two Hours**

- Note: (i) Answer all the questions
(ii) Programmable calculator is not allowed

Q.No.	Question	CO	M.M.
1(a)	If $u = \tan^{-1} \frac{(x^2+y^2)}{(x-y)}$, show that $\tan u$ is a homogeneous function of x and y of degree one. Use Euler's theorem to prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{1}{2} \sin 2u$.	[CO1]	[07]
1(b)	If $x = e^u \cos v$, $y = e^u \sin v$, then prove that	[CO1]	[08]
	$\left(\frac{\partial z}{\partial u} \right)^2 + \left(\frac{\partial z}{\partial v} \right)^2 = e^{2u} \left\{ \left(\frac{\partial z}{\partial x} \right)^2 + \left(\frac{\partial z}{\partial y} \right)^2 \right\}$		
	OR		
1(b')	Prove that the functions $u = \frac{x+y}{x-y}$ and $v = \frac{xy}{(x-y)^2}$ are functionally dependent. Also find the relation between them.	[CO1]	[08]
2(a)	Expand $\sin(xy)$ near the points $(1, \frac{\pi}{2})$ using Taylor's series up to the quadratic terms.	[CO2]	[07]
2(b)	If the base radius and height of a cone are measured as 4 inches and 8 inches with a possible error of 0.04 and 0.08 inches respectively, calculate the percentage error in calculating volume of cone.	[CO2]	[08]
	OR		
2(b')	If $\frac{3}{x} + \frac{4}{y} + \frac{5}{z} = 6$, find the values of x, y, z which makes $x + y + z$ minimum.	[CO2]	[08]
3(a)	Find the area between the curves $y^2 = 4x$ and $2x - 3y + 4 = 0$.	[CO3]	[07]
	OR		
3(a')	Find by double integration the area lying inside the cardioid $r = a(1 + \cos \theta)$ and outside the circle $r = a$.	[CO3]	[07]

Contd... 2.

- 3 (b) Prove that the volume enclosed by the cylinders $x^2 + y^2 = 2ax$ and $z^2 = 2ax$ is $128a^3/15$. [CO3] [08]

- 4(a) Trace the conic [CO4] [09]

$$16x^2 - 24xy + 9y^2 + 77x - 64y + 95 = 0$$

and find the coordinates of its foci.

OR

- 4(a') Trace the conic [CO4] [09]

$$3(x^2 + y^2) + 2xy = 4\sqrt{2}(x + y)$$

Determine the foci and show that the origin lies at an extremity of its principal axes.

- 4(b) In any conic prove that the sum of reciprocals of two perpendicular focal chords [CO4] [06] is constant.
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2019-20
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ALL BRANCHES
APPLIED MATHEMATICS-I
AMS1110

Maximum Marks: 60**Credits: 04****Duration: Two Hours****Note: (i) Answer all questions.****(ii) Marks allotted to each question and course outcome (CO) covered are indicated against each question.**

Q. No.	Question	M.M.
1 (a)	For what values of the parameter t the system of equations $t x + y + z = 1; \quad x + t y + z = 1; \quad x + y + t z = -2$ fails to have unique solution? Solve the system if it has any solution for these values of t .	[07] CO-1
(b)	Obtain a matrix P such that $P^{-1}AP$ is a diagonal a matrix, given $A = \begin{bmatrix} 2 & -1 & 0 \\ 9 & 4 & 6 \\ -8 & 0 & -3 \end{bmatrix}$	[08] CO-1
	OR	
(b')	Is the following set of vectors $\{v_1 = (2, -1, 3, 2), v_2 = (1, 3, 4, 2), v_3 = (3, -5, 2, 2)\}$ form a basis for R^4 ? If not, find relationship among these vectors.	[08] CO-1
2(a)	If $y = \sin(a \sin^{-1}x)$, prove that $(1 - x^2)y_{n+2} - (2n + 1)x y_{n+1} - (n^2 - a^2)y_n = 0.$ Hence find $(y_n)_0$.	[07] CO-2
	OR	
(a)'	Describing salient features, trace the curve $x^2 = y^2(x + 1)^3$.	[07] CO-2
(b)	(i) Expand $\sin x$ in powers of $(x - \frac{\pi}{2})$ up to first three non-zero terms. (ii) Test for convergence the following series	[4+4]

contd...-2

*Batch: 04/12/19
10 To 12 = NOON*

$$x + \frac{3}{5}x^2 + \frac{8}{10}x^3 + \cdots + \frac{n^2 - 1}{n^2 + 1}x^n + \cdots$$

CO-2

- 3(a) Show that the intrinsic equation of the semi-cubical parabola [07]

$$3ay^2 = 2x^2 \text{ is } 9s = 4a(\sec^3\psi - 1).$$

CO-3

- (b) Show that the volume of the solid generated by the revolution of the curve [08]
 $(a - x)y^2 = a^2x$ about its asymptote is $(\pi^2 a^3)/2$. CO-3

OR

- (b)' The part of the parabola cut off by the latus rectum revolves about the tangent at [08]
vertex. Find the curved surface of the reel thus generated. CO-3

- 4(a) Solve any two of the following differential equations: [4+4]

(i) $(1 + xy)y \, dx + (1 - xy)x \, dy = 0$ CO-4

(ii) $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \sin 3x + xe^x$

(iii) $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} - 3y = x^2 \log x$

- (b) Solve the following Simultaneous differential equations: [07]

$$\frac{dx}{dt} + \frac{dy}{dt} - 2y = 2\cos t - 7\sin t \quad \text{CO-4}$$

$$\frac{dx}{dt} - \frac{dy}{dt} + 2x = 4\cos t - 3\sin t.$$

OR

- (b)' An electrical circuit with, inductance L , resistance R and a battery with e.m.f. E is *switched on* at $t=0$. If the initial current be zero, find the current i at time t . [07]

CO-4

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2019-20

B. TECH. (ODD SEMESTER) EXAMINATION
(Civil/Chemical/Computer/Electrical/Electronics/Mechanical/Petro-Chemical)
APPLIED PHYSICS

APS1110/AP111**Maximum Marks: 60****Credits: 04****Duration: Two Hours***Attempt all questions.**Notations and symbols have their usual meaning.*

Q.No.	Question	CO	M.M.
1(a)	Discuss the energy band formation in a semiconductor with the help of a suitable energy level diagram.	(CO1)	[03]
1(b)	Obtain the expressions for electron and hole contributions to the conductivity of a semiconductor.	(CO1)	[04]
1(c)	Illustrate the concept of effective mass of charge carriers in a semiconductor. Can the effective mass of a charge carrier be negative?	(CO2)	[04]
1(d)	In a Hall effect experiment, a p-type semiconductor bar of width 1 cm and length of 5 cm is placed in the magnetic field of 0.5 Tesla. A potential difference of 10 volts is applied across the length of the bar. Determine the Hall coefficient R_H and the hole concentration p_0 (Given that the hall voltage developed in the bar is 0.05 V).	(CO2)	[04]
2(a)	What are step-index and graded index optical fibres? Why the signal distortion is less in a graded index optical fibre?	(CO1)	[04]
2(b)	Define the numerical aperture and acceptance angle of an optical fibre and obtain mathematical expressions for them.	(CO2)	[04]
2(c)	What is laser? Why maintaining population inversion is easier in a four level laser as compared to a three level laser.	(CO2)	[03]
2(d)	With the help of suitable diagrams, explain the construction and working of a helium-neon laser.	(CO2)	[04]

OR

2(d')	Mention important characteristics of laser light. Give the important applications of laser in the field of science and technology.	(CO1)	[04]
3(a)	What is Compton shift? Derive an expression for it and hence define Compton wavelength.	(CO2)	[06]
3(b)	What do you mean by a wave function in quantum mechanics? Discuss the properties of a well behaved wave function. Starting from the time dependent Schrödinger equation in one-dimension, obtain time independent Schrodinger equation.	(CO3)	[06]

PTO

Contd....2.

06/12/19

Morning 10 - 12 noon

- 3(c) The lowest energy for a particle trapped in a box is 1.00 eV. (CO3) [03]
(i) What are the next two higher energies the particle can have?
(ii) If the particle is an electron, how wide is the box?

OR

- 3(c') Find the expectation values $\langle x \rangle$ and $\langle x^2 \rangle$ for the first two states of a particle in a box. (CO3) [03]
- 4(a) Obtain an expression for molecular energy distribution and plot the graph $n(\varepsilon)$ versus ε . Calculate the average energy of oxygen molecule at 27°C . (CO4) [07]
- 4(b) Distinguish bosons and fermions on the basis of quantum mechanics. (CO4) [03]
- 4(c) Derive an expression for average electron energy at $T = 0\text{K}$. (CO4) [05]

Some Useful Physical Constants

$$h = 6.63 \times 10^{-34} \text{ J.s}, \quad k = 1.38 \times 10^{-23} \text{ J/K}, \quad m_e = 9.1 \times 10^{-31} \text{ kg}, \quad m_p = 1.67 \times 10^{-27} \text{ kg}, \quad c = 3 \times 10^8 \text{ m/s}$$

2019-20

**B.ARCH. (AUTUMN SEMESTER) EXAMINATION
B. ARCH I-YEAR
PRINCIPLES & PHILOSOPHY OF ARCHITECTURE
ARC-1010**

Maximum Marks: 60**Credits: 04****Duration: Two Hours***Answer all the questions.**Draw sketches to support your answer.*

Q.No.	Question	M.M.
1	What are the aspects an architect must consider while designing a building?	[10]
	OR	
1'	Explain with suitable examples how architecture is an amalgamation of both art and science?	
2	Explain the role of different elements in architecture, justify your answer with neat sketches?	[10]
	OR	
2'	What are the different principles of architecture, explain rhythm with suitable examples?	
3	Why architecture of buildings vary from region to region, explain with neat sketch the salient features of the building in cold region?	[10]
4	Explain with suitable sketches how chemistry is germane in architecture?	[15]
5	Define Architect Lauri Baker and his philosophy, explain with neat sketches how he incorporated his philosophy in designing the buildings?	[15]

2019-20
B.ARCH. (FIRST SEMESTER) EXAMINATION
Architectural Drawing -I
ARC 1310

Maximum Marks: 40

Credits: 5

Duration: 2 Hours

Answer all the questions.

Assume suitable data if missing.

All dimensions are in mm.

Neat and good drafted drawings will be credited more.

Q.No.

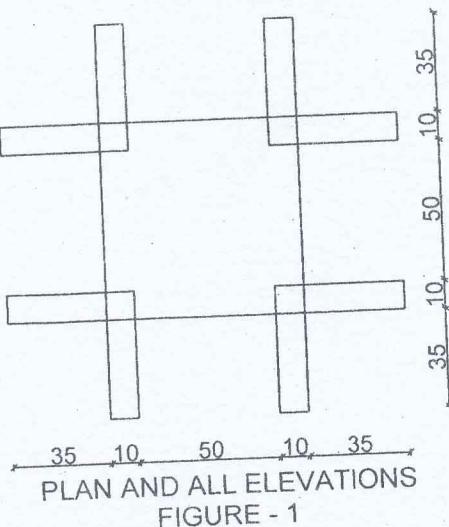
Question

M.M.

- 1 A square prism, side of base 25 mm and axis 50 mm long, has its axis inclined at 60° to H.P. It has an edge of its base in H.P. and inclined at 45° to V.P. Draw its orthographic projections. [10]
- 2 Draw the development of the lateral surface of the lower portion of a cylinder of diameter 30 mm height 70 mm when cut by a plane inclined at 50° to H.P. and perpendicular to V.P. and bisecting the central longitudinal axis. [10]
- 3 A square prism, base 30 mm side and axis 60 mm long, has its base on the H.P. and all the edges of the base equally inclined to the V.P. It is cut by a sectional plane, perpendicular to the V.P., inclined at 45° to the H.P. and bisecting the central longitudinal axis. Draw its sectional top view and true shape of the section. [10]

OR

- 3' A square prism, side of base 30 mm and axis 55 mm long. Rests with its base on H.P. such that one of its rectangular faces is inclined at 30° to V.P. A sectional plane perpendicular to H.P. and inclined at 60° to V.P. passes through the prism such that a rectangular face which is making 60° with V.P. is cut into two halves. Draw top view, sectional front view and true shape of the section. [10]
- 4 Draw isometric view of the object shown in figure-1 [10]



2019-2020

B.ARCH. (ODD SEMESTER) EXAMINATION**BASIC DESIGN AND VISUAL APPRECIATION ARC-1610****Maximum Marks: 40****Credits: 07****Duration: Four Hours***Answer all the questions.**Assume suitable data if missing.**Use sketches and drawings to support your answers*

1. Discuss the importance of Anthropometrics in design, and illustrate the application of anthropometrics in the designing of a bathroom cum toilet. [10]

OR

- 1' Discuss the importance of ergonomics in designing. Explain using any product of your choice.

2. Design a kiosk for a milk booth contained within the size of 3m x 3m. Use materials of your choice, and explain your design through: [30]

- a) Concept note and sketches (05)
- b) Plan (rendered and to scale) (15)
- c) Two elevations (rendered and to scale) (10)

2019-20
B.TECH. (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
ENVIRONMENTAL STUDIES
CEA-1110

Maximum Marks: 60**Credits: 03****Duration: Two Hours***Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q. No.	Question	M.M.
1. (a)	What do you understand by the ozone layer depletion? Briefly explain the proposed ozone layer depletion theories.	(5) (CO1)
1. (b)	Explain the heating of the earth and the phenomenon of air circulation.	(5) (CO3)
OR		
(b')	Briefly explain the causes and effects of deforestation.	(5) (CO3)
1. (c)	What are the alternate energy sources? Write the short notes about the use of alternate energy sources.	(5) (CO2)
2. (a)	Explain in detail structure and function of ecosystem with suitable example.	(5) (CO1)
2. (b)	Discuss in detail the various effects and control measures of air pollution.	(5) (CO4)
(b')	Discuss in detail the various effects and control measures of marine pollution.	(5) (CO4)

contd....2

2. (c) What do you understand by MSWM? Describe the stages required for its proper management. (5)
(CO4)
3. (a) Briefly explain any three of the following: (2x3)
- (i) Ex-situ and in-situ conservation of biodiversity (CO1)
 - (ii) Man-animal conflict and its causes
 - (iii) Biodiversity pattern
 - (iv) Biodiversity services
3. (b) What is a nature reserve? Discuss the main objectives of nature reserve conservation. (3)
(CO1)
3. (c) What is carbon foot print? If your car consumes 5.5 litre diesel per 100 km. Calculate the amount of CO₂ in kg generated from a drive of 1100 km distance which adds in your personal carbon footprint (carbon footprint of 1L diesel = 2.7 kg CO₂). (6)
(CO3)
4. (a) Explain Forest Conservation Act and Water (Prevention and control of pollution) Act. (5)
(CO2)

OR

- (a') Explain wildlife protection Act and Air (Prevention and control of pollution) Act. (5)
(CO2)
4. (b) Write the name of some International agreements and write the short notes about Montreal and Kyoto protocols. (5)
(CO3)
4. (c) Discuss in detail about the role of an individual in pollution prevention. (5)
(CO3)
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2019-20
B.TECH. (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
STRENGTH OF MATERIALS
CEA 1120

Maximum Marks: 60**Credits: 03****Duration: Two Hours****Answer all the questions.****Assume suitable data if missing.****Notations used have their usual meaning.**

Q. No.	Question	M.M.
1(a)	Answer the following:	[5] CO1
	i. Show the modulus of toughness in mild steel stress-strain curve under uniaxial tension. ii. How does a ductile material fails in tension? iii. What is principle of superposition? iv. Define Poisson's effect? v. What do you mean by state of stress?	
1(b)	The slender rod shown in Fig. 1 is subjected to an increase of temperature along its axis, which creates a normal strain in the rod of $\varepsilon_z = 40(10^{-3}) z^{1/2}$, where z is measured in meters. Determine; (a) the displacement of the end B of the rod due to the temperature increase, and (b) the average normal strain in the rod.	[10] CO1

OR

- 1(b') Rigid beam AB rests on the two short posts shown in Fig. 2. AC is made of steel and has a diameter of 20 mm, and BD is made of aluminum and has a diameter of 40 mm. Determine the displacement of point F on AB if a vertical load of 90 kN is applied over this point.

Take $E_{st} = 200$ GPa, $E_{al} = 70$ GPa

- 2 A beam ABC with an overhang at one end supports a uniform load of intensity 12 kN/m and a concentrated moment of 3 kNm magnitude at C (see Fig. 3). Draw the shear-force and bending-moment diagrams for the

contd... 2.

beam. Show the point of contraflexure (if any), location of zero shear (if any) and location of maximum bending moment.

- 3(a) State the assumptions of bending theory and derive the flexure formula. [5] CO3
- 3(b) The beam shown in Fig. 4 is made from two boards. Determine the maximum shear stress in the glue necessary to hold the boards together along the seam where they are joined. [10] CO3
- OR
- 3(b') The aluminium rod AB (shear modulus $G = 27 \text{ GPa}$) is bonded to the brass rod BD ($G = 39 \text{ GPa}$), as shown in Fig. 5. Knowing that portion CD of the brass rod is hollow and has an inner diameter of 40 mm, determine the angle of twist at A . [10] CO3
- 4(a) Describe the rules for identifying zero force member in a truss. For each of the pin jointed trusses subjected to force(s) P as shown in Fig. 6a & 6b, identify zero force members and draw their simplified form. [6] CO4
- 4(b) Determine the forces in the members BC , CD and DE of the pint jointed truss shown in Fig. 7. [9] CO4

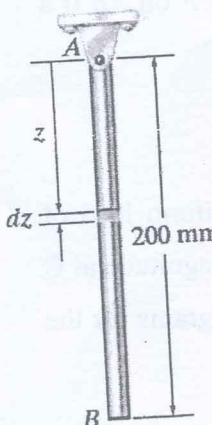


Fig. 1

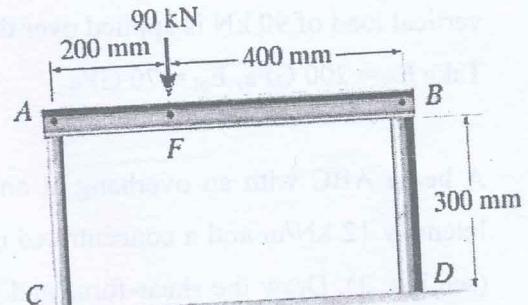


Fig. 2

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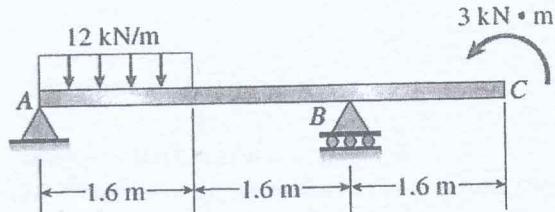


Fig. 3

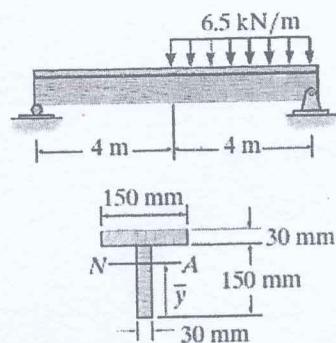


Fig. 4

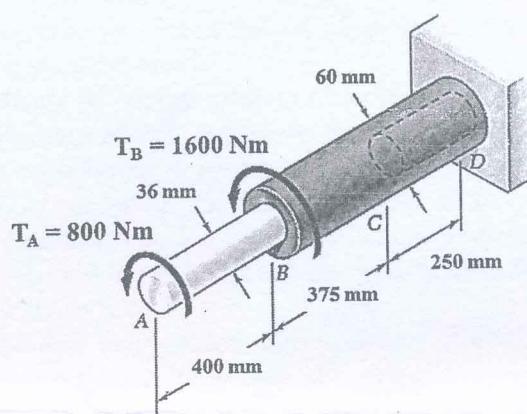
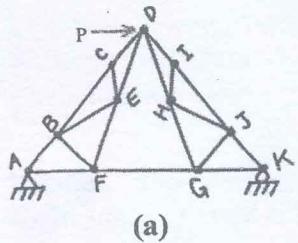
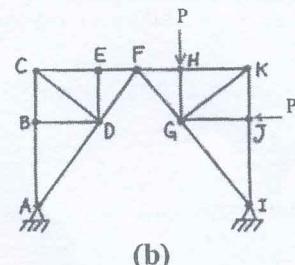


Fig. 5



(a)



(b)

Fig. 6

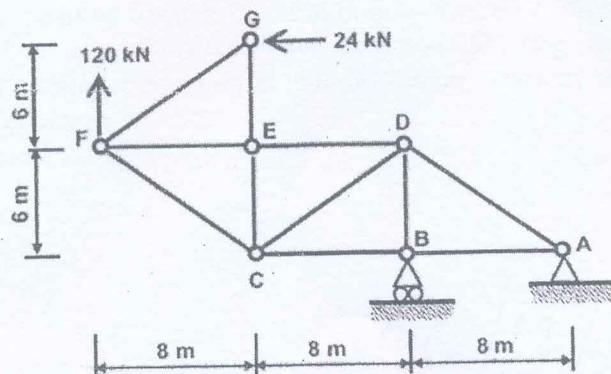


Fig. 7

2019-2020

B.ARCH./ B. TECH. WINTER (I SEMESTER) EXAMINATION**(ELECT./ MECH./CIVIL./ CHEM./ELECTRONICS/ COMPUTER/ PETRO-CHEMICAL ENGINEERING)****ENGLISH****(EZII-1110)****CREDITS: 03****Maximum Marks: 60****Duration: Two Hours****NOTE: Attempt all questions****Unit-I**

Read the following passage critically and answer the questions given below. 5x2 = 10

Q.1 a. All the things men are surrounded with today have become possible only due to the rapid development of science and technology. So, no wonder that it plays a significant role in the modern life of people. Thanks to this development, we have entered another level of human civilization, having everything to arrange happy and comfortable living. It can even be said that modern way of life and culture are dependent on some products of science and technology, as they have become an integral part of existence, taking into account needs and requirements of people. Thanks to new technologies, people now have many opportunities and choices. For example, they can study online sitting at home by using Internet benefits and available sources of information. They can even study at university on distance learning basis. The same thing is about work. There are many freelance options, which help people to provide for the living without going to offices each morning. Scientists have made it possible to take the highest benefits from technologies. In general, development of the country is strongly connected with the growth and development in science and technology. These three words, development, science and technology, always go together and are very necessary for people and their better living. We can say that our life depends on new inventions and scientific creations. Technology has changed people's life to a very great extent. Alongside with many advantages, some people also consider science and technology to be harmful for humans. The idea is that it is also used for some destructive purposes. Scientifically created weapons like atom or hydrogen bombs are able to destroy the whole world in just few minutes. Some people also think that it is not environmentally friendly to use all the advantages of scientific progresses. People should just learn how to use everything in a proper way. Therefore, it must be admitted that science and technology can lead human civilization to a perfection in living. At the same time, everything should be done in wise perspectives and to some extent, not to harm and destroy the world.

Earth has a voice for those who listen.

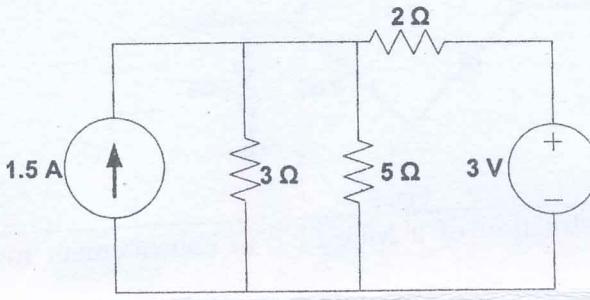
- I. Explain the causes of apprehension about technological development. (2)
- II. How does the writer see technology and economy? (2)

Contd... 2

2019-20

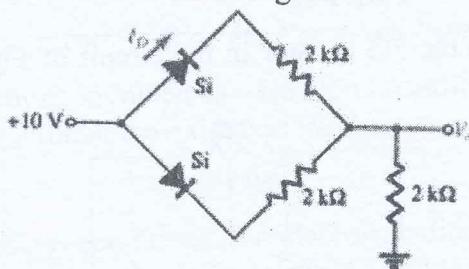
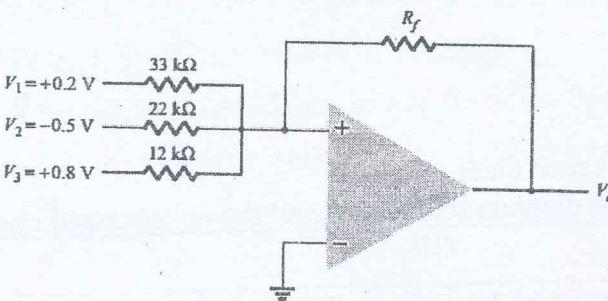
**B. TECH. (AUTUMN SEMESTER) END SEMESTER EXAMINATION
BACKLOG
BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING
EE 111**

Maximum Marks: 60**Credits: 03****Duration: Two Hours***Answer all the questions.**Assume suitable data if missing.**Notations and symbols used have their usual meaning.*

Q.No.	PART A	COs	M.M.
1(a)	<p>Determine the current through the 3Ω resistor in the circuit of Fig. 1 by using Thevenin's Theorem.</p>  <p>Fig. 1</p>	CO1	6
1(b)	<p>A series circuit consisting of 5Ω resistor, 50 mH inductor and $20 \mu\text{F}$ capacitor, is connected to a 110 V, 50 Hz single phase supply.</p>	CO1	9
	<p>Find the</p> <ol style="list-style-type: none"> current power factor power delivered voltage drop across each element. 		
	<p>Also draw the scaled phasor diagram representing all the voltages and current.</p>		
	OR		
1(b')	<p>A 100 KVA, transformer has core loss of 800 Watts and full load ohmic loss of 1000 Watts. Calculate (a) the efficiency at full load and 0.8 power factor (b) the maximum efficiency at 0.8 power factor.</p>	CO1	9
2(a)	<p>Discuss the layout of a power system showing the typical voltage level.</p>	CO2	6
2(b)	<p>Develop analytically the expression for the rotating magnetic field when the stator of a three phase induction motor is fed from a three phase balanced supply.</p>	CO2	9
	OR		
2(b')	<p>Mention two advantages and two disadvantages of renewable sources of energy. With the help of appropriate diagram explain the operation of a Nuclear Power Plant.</p>	CO2	9

Contd... 2.

PART B

3(a)	Write current equation of PN junction diode, explaining each term.	CO3	7
OR			
3(a')	Draw and explain output characteristics of a common emitter NPN transistor, indicating active, cut-off and saturation regions.	CO3	7
3(b)	Determine V_o and I for the networks of Fig. 3.	CO3	8
			
Fig. 3			
4(a)	Describe briefly the construction of a MOSFET in enhancement mode. Also draw its characteristics.	CO4	8
4(b)	What are different characteristics of an ideal operational amplifier? Also explain the significance of virtual ground in an operational amplifier?	CO4	7
OR			
4(b')	Calculate the output voltage of the circuit shown in Fig. 4 for $R_f = 330 \text{ k}\Omega$	CO4	7
			
Fig. 4			

**B. TECH. (AUTUMN SEMESTER) END SEMESTER EXAMINATION
ELECTRICAL ENGINEERING
PRINCIPLES OF ELECTRICAL ENGINEERING
EEA 1110**

Maximum Marks: 60

Credits: 03

Duration: Two Hours

*Answer all the questions.**Assume suitable data if missing.**Notations and symbols used have their usual meaning.*

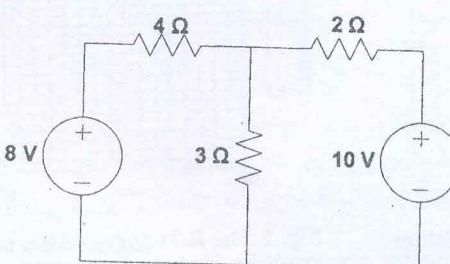
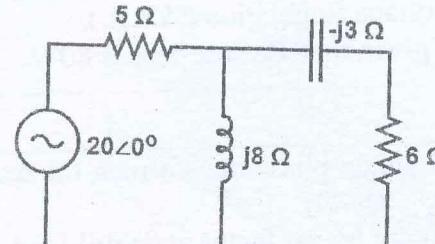
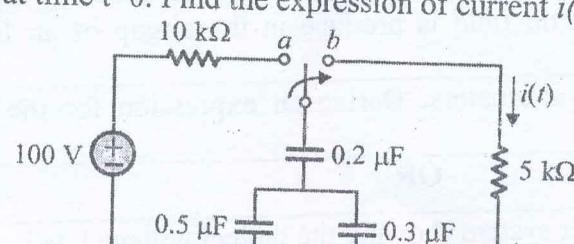
Q.No.	Question	COs	M.M.
1(a)	Determine the current through the 3Ω resistor in the circuit of Fig. 1 by using superposition Theorem. 	CO1	6
1(b)	Determine the voltage across and current through the inductor in Fig. 2 using Thevenin's theorem. 	CO1	6
1(c)	The switch in the circuit shown in Fig. 3 was on position a for a long time and is moved to position b at time $t=0$. Find the expression of current $i(t)$ for $t>0$. 	CO1	8

Fig. 3

OR

contd....2

1(c')	In the circuit shown below, the switch S is open for a long time and is closed at $t = 0$ seconds. find the current $i(t)$ for $t > 0$ seconds.	CO1	8
2(a)	In the magnetic circuit detailed in Fig. 4 with all dimensions in mm, calculate the required current to be passed in the coil having 200 turns in order to establish a flux of 1.28 mWb in the air gap. Permeability of air may be taken as, $\mu_0 = 4\pi \times 10^{-7}$ H/m. The B-H curve of the material is given in Fig. 5.	CO2	10
	Fig. 4 The magnetic circuit with dimensions. Fig. 5 The B-H curve of the material.		
2(b)	A 10 kVA; 50Hz; 2200/220 V single-phase transformer has following parameters. $R_1 = 4 \Omega$; $R_2 = 0.04 \Omega$; $X_1 = 5 \Omega$; $X_2 = 0.05 \Omega$. (a) Find equivalent circuit referred to secondary side. (b) Consider the transformer to give its rated load at 0.8 p.f. (lagging) at the rated voltage. Find the % Voltage Regulation (%V.R.). Find the efficiency for part (b), given that the core-loss is 80W.	CO2	10
	OR		
2(b')	In a 25 kVA, 50Hz, 2000/200 V single-phase transformer, the iron and copper losses are 300 W and 400 W, respectively. (a) Calculate the efficiency on unity power factor at (i) full-load. (ii) half-load. (b) Determine the load for maximum efficiency and the iron and the copper loss for this case.	CO2	10
3(a)	Briefly discuss the operation of a three-phase induction motor. Analytically show how a rotating magnetic field is produced in the airgap of an Induction motor.	CO3	7
3(b)	Classify different types of alternators. Derive an expression for the induced EMF in an alternator.	CO3	6
	OR		
3(b')	Discuss the layout of a power system showing the typical voltage level.	CO3	6
3(c)	Discuss the advantages and disadvantages of non-conventional sources of energy. With the help of appropriate diagram explain the operation of a Thermal Power Plant.	CO3	7

2019-20

**B.TECH/B. ARCH (AUTUMN SEMESTER) EXAMINATION
ALL BRANCHES
PRINCIPLES OF ELECTRONICS ENGINEERING
ELA1110**

Maximum Marks: 60**Credits: 03****Duration: Two Hours***Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.***Q.No.****Question****CO M.M.**

- 1(a) i) Draw the equivalent circuit and characteristics of a PN junction diode for (CO1) [08] piecewise linear model
ii) Determine V_0 and I_D for the network shown in Fig. 1. Use constant voltage drop model for the diode.

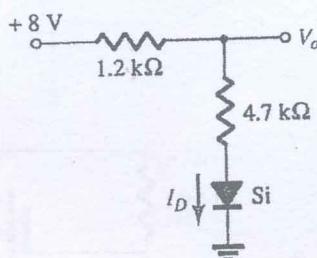


Fig. 1

OR

- 1(a') Determine and draw the output waveform v_0 with proper labels for the circuit (CO1) [08] and input waveform v_i shown in Fig. 2. Also find the
i) V_{rms} and V_{dc} of the output waveform.
ii) PIV rating of each diode

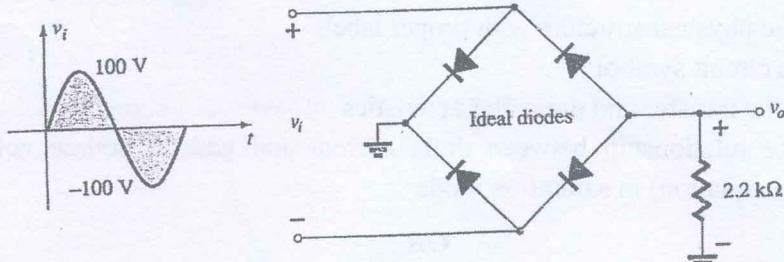
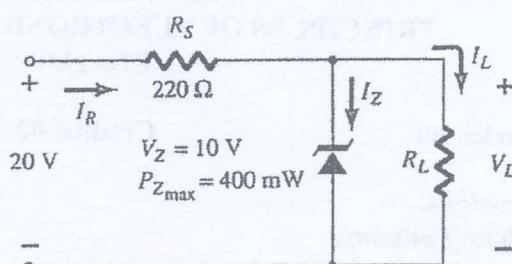


Fig. 2

contd... 2.

- 1(b) For the network shown in Fig. 3, determine

- V_L , I_L , and I_Z if $R_L = 500 \Omega$.
- the minimum value of R_L to ensure that the Zener diode is in the "ON" state.



(CO1) [07]

- 2(a) Given the information appearing in Fig. 4, determine

- I_C
- β
- α
- R_B

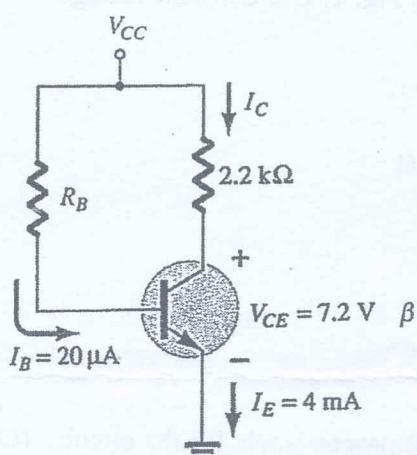


Fig. 4

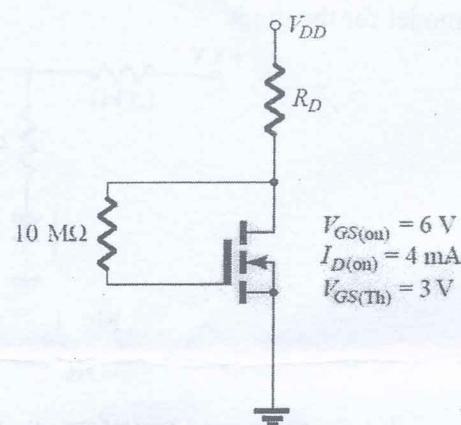


Fig. 5

- 2(b) For an *n*-channel enhancement type MOSFET,

(CO1) [07]

- draw the physical structure with proper labels
- give its circuit symbol
- sketch the transfer and drain characteristics
- give the relationship between drain current and gate to source voltage (current equation) in saturation mode

OR

- 2(b') The levels of V_{DS} and I_D are specified as $V_{DS} = \frac{1}{2}V_{DD}$ and $I_D = I_D(\text{on})$ for the network of Fig. 5. Determine V_{DD} and R_D .

- 3(a) i) Draw the equivalent circuit of the Operational Amplifier. Explain each label used.
ii) Give the characteristics of an ideal OPAMP.

contd... 3

3(b) For the circuit shown in Fig. 6,

(CO2) [07]

- derive the expression for output voltage V_0 in term of input voltages V_1, V_2 , and V_3
- if $R_1 = 30 \text{ k}\Omega, R_2 = 15 \text{ k}\Omega, R_3 = 10 \text{ k}\Omega, R_f = 30 \text{ k}\Omega, V_1 = 1 \text{ V}, V_2 = -1 \text{ V}, V_3 = -2 \text{ V}$, find the output voltage V_0 .

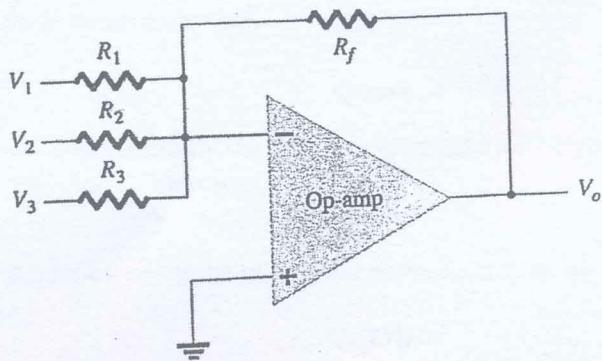


Fig. 6

OR

3(b') Give the circuit of OPAMP based differentiator and derive its output expression (CO2) [07] in time domain. (CO3) [08]

4(a) Find the value of x in the following:

- $(x)_{10} = (10111101.11)_2$
- $(x)_2 = (106)_8 + (\text{A}2\text{F})_{16}$
- $(2^{2x})_{10} = (1000000)_2$
- $(100010)_2 = (x)_{16} + (111)_2$

4(b) Simplify the following expression using De-Morgan's theorem and draw the (CO3) [07] Gate network using AND, OR and NOT gates:

$$F = \overline{\bar{A}\bar{C} + C(B + \bar{D})\bar{B}}$$

OR

4(b') Give the truth table of octal to binary encoder and draw its logic circuit. (CO3) [07]

2019-2020

B.ARCH./ B. TECH. WINTER (1 SEMESTER) EXAMINATION

(ELECT./ MECH./CIVIL./ CHEM./ELECTRONICS/ COMPUTER/ PETRO-CHEMICAL ENGINEERING)

ENGLISH

(EN-101)

CREDITS: 04

Maximum Marks: 60

Duration: Two Hours

NOTE: Attempt all questions

Unit-I

Q.1.a. Read the following passage critically and answer the questions given below. 5x2 10

Developments in science and technology are fundamentally altering the way people live, connect, communicate and transact, with profound effects on economic development. To promote tech advance, developing countries should invest in quality education for youth, and continuous skills training for workers and managers. Science and technology are key drivers to development, because technological and scientific revolutions underpin economic advances, improvements in health systems, education and infrastructure. The technological revolutions of the 21st century are emerging from entirely new sectors, based on micro-processors, tele-communications, bio-technology and nano-technology. Products are transforming business practices across the economy, as well as the lives of all who have access to their effects. The most remarkable breakthroughs will come from the interaction of insights and applications arising when these technologies converge. Through breakthroughs in health services and education, these technologies have the power to better the lives of poor people in developing countries. Eradicating malaria, a scourge of the African continent for centuries, is now possible. Cures for other diseases which are endemic in developing countries are also now possible, allowing people with debilitating conditions to live healthy and productive lives. Access and application are critical. Service and technology are the differentiators between countries that are able to tackle poverty effectively by growing and developing their economies, and those that are not. The extent to which developing economies emerge as economic powerhouses depends on their ability to grasp and apply insights from science and technology and use them creatively. Innovation is the primary driver of technological growth and drives higher living standards. As an engine of growth, the potential of technology is endless, and still largely untapped in Africa and other developing world regions across the globe. Less developed countries not only lack skilled labour and capital, but also use these less efficiently. Inputs account for less than half of the differences in per capita income across nations. The rest is due to the inability to adopt and adapt technologies to raise productivity. Computing for example, through unlocking infrastructure backlogs and managing integrated supply chains, can transform economic performance by enabling affordable and accessible services in education and healthcare. The combination of computers and the Internet, and mobile devices and the "cloud", has transformed human experience, empowering individuals through access to knowledge and markets, changing the relationship between citizens and those in authority, as well as allowing new communities to emerge in virtual worlds that span the globe.

contd....2.

- i. Explain the way modern technology has changed accessibility at different levels of life. (2)
- ii. How does the writer see the role of technology in developing societies? (2)
- iii. How does the writer see the technological revolution in the present century? (2)
- iv. In which sectors is the role of technology of critical importance? (2)
- v. Suggest a suitable title for the paragraph. (2)

Q.1. b. Write a summary of the above passage. (10)

Unit-II

Q2. Write a critical essay on the ending of *Animal Farm*. (5)

OR

Comment on symbolic significance of the dream of Mr Major in *Animal Farm*.

Q3. Write an essay on the condition of Eloi in *The Time Machine*. (5)

OR

Discuss the vision of the future of mankind projected in *The Time Machine*.

Unit-III

Q4. Write the process of generating solar energy. (10)

OR

Write a report on the National Conference recently held at ZHCEI on **The Future of Technical Education.**

Unit-IV

Q5. Read the following passage carefully and write a précis of the same (10)

Population is considered as an important determinant of economic growth. In this respect population is working both as a stimulant as well as hurdles to economic growth. Firstly, population provides labour and

contd... 3

entrepreneurship as an important factor service. Natural resources of the country can be properly exploited with manpower resources. With proper human capital formation, increasing mobility and division of labour, manpower resources can provide useful support to economic development. On the other hand, higher rate of growth of population increases demand for goods and services as a means of consumption leading to increasing consumption requirements, lesser balance for investment and export, lesser capital formation, adverse balance of trade, increasing demand for social and economic infrastructural facilities and higher unemployment problem. Accordingly, higher rate of population growth can put serious hurdles on the path of economic development. Moreover, growth of population at a higher rate usually eat up all the benefits of economic development leading to a slow growth of per capita income. But it has also been argued by some modern economists that with the growing momentum of economic development, standard of living of the general masses increases which would ultimately create a better environment for the control of population growth. Moreover, it is argued that population pressure may favourably affect individual motivation and this may again lead to changes in production techniques. Thus, whether growing population in a country practically retards economic growth or contributes to it, that solely depends on the prevailing situation and balance of various other factors determining the growth in an economy.

Unit-V

Q.6. Write an argumentative essay on any *one* of the following in about 500 words. (10)

- i. Population Poverty
 - ii. Media and Democracy
 - iii. Communication and Personality
-

2019-2020

B.ARCH./ B. TECH. WINTER (I SEMESTER) EXAMINATION**(ELECT./ MECH./CIVIL./ CHEM./ELECTRONICS/ COMPUTER/ PETRO-CHEMICAL ENGINEERING)****ENGLISH****(EZII-1110)****CREDITS: 03****Maximum Marks: 60****Duration: Two Hours****NOTE: Attempt all questions****Unit-I**Read the following passage critically and answer the questions given below. 5x2 10

Q.I a. All the things men are surrounded with today have become possible only due to the rapid development of science and technology. So, no wonder that it plays a significant role in the modern life of people. Thanks to this development, we have entered another level of human civilization, having everything to arrange happy and comfortable living. It can even be said that modern way of life and culture are dependent on some products of science and technology, as they have become an integral part of existence, taking into account needs and requirements of people. Thanks to new technologies, people now have many opportunities and choices. For example, they can study online sitting at home by using Internet benefits and available sources of information. They can even study at university on distance learning basis. The same thing is about work. There are many freelance options, which help people to provide for the living without going to offices each morning. Scientists have made it possible to take the highest benefits from technologies. In general, development of the country is strongly connected with the growth and development in science and technology. These three words, development, science and technology, always go together and are very necessary for people and their better living. We can say that our life depends on new inventions and scientific creations. Technology has changed people's life to a very great extent. Alongside with many advantages, some people also consider science and technology to be harmful for humans. The idea is that it is also used for some destructive purposes. Scientifically created weapons like atom or hydrogen bombs are able to destroy the whole world in just few minutes. Some people also think that it is not environmentally friendly to use all the advantages of scientific progresses. People should just learn how to use everything in a proper way. Therefore, it must be admitted that science and technology can lead human civilization to a perfection in living. At the same time, everything should be done in wise perspectives and to some extent, not to harm and destroy the world.

Earth has a voice for those who listen.

- I. Explain the causes of apprehension about technological development. (2)
- II. How does the writer see technology and economy? (2)

Contd... 2

- III. What transformation has technological development brought in the realms of education and employment? (2)
- IV. "Earth has a voice for those who listen" what does it imply? (2)
- V. Suggest a suitable title for the passage. (2)
- b. Write a summary of the above passage. (10)

Unit-II

Q2. Write a critical essay on the manipulation of language and distortion of facts in *Animal Farm*. (5)

OR

Comment on the relation between memory and democracy in *Animal Farm*.

Q3. Write an essay on the future of human survival in the light of *The Time Machine*. (5)

OR

Discuss the fusion of fantasy and realism in *The Time Machine*.

Unit-III

Q4. Write with an example the process of conducting scientific research. (10)

OR

Write a report on the National Conference recently held at ZHCET on **Technology and Unemployment**.

Unit-IV

Q5. Read the following passage carefully and write a précis of the same. (10)

The place of mathematics as a subject in the school curriculum in India has always been valued and the need for improvement in its content and pedagogy has been emphasized by various commissions on education constituted by the Government of India. The progressive tone that is seen elsewhere in the world is also visible in this country. Time and again a need has been expressed in these documents of taking mathematics

contd... 3.

beyond mechanical computations and focus on understanding basic principles. Educationists have pointed out that "the main object of mathematics education research is to be of help in improvement of classroom learning and teaching. It is therefore natural that a large number of studies should be concerned with different aspects of this problem". They went on to suggest various dimensions of this research, including study of effective teachers, instruction based on the use of computer aided and other technology, error analysis, styles of learning among different groups of students, remedial teaching methods, study of attitudes, socio-economic and other personal factors influencing learning. More than two decades later, many of these issues, in their true sense (in the way we understand the domain and purposes of mathematics education and research in mathematics education), are yet to be researched. There have been many initiatives and interventions in the area of mathematics teaching and learning but they have not been documented and analysed; nor do we have enough illustration of the understanding, thinking and reasoning of students participating in these initiatives. What we know about their success is more anecdotal than based on systematic investigation. However, their contribution to the mathematics education scene in the country is immense. They explicated a philosophy of teaching and learning based on an understanding of the child and his/ her capacities to learn and think. These earlier attempts and deliberations made possible new ways of thinking about teaching and learning of mathematics that are seen today and have become part of the National Curriculum Framework, National Council for Educational Research and Training [NCERT] and the new textbooks developed after this.

Unit-V

Q.6. Write an argumentative essay on any *one* of the following in about 500 words. (10)

- i. Climate crisis goes beyond political initiatives
 - ii. Scientific education and democracy
 - iii. Imagination and technological invention
-

2019-20

B.TECH. (Ist SEMESTER) EXAMINATION

ALL BRANCHES

APPLIED MECHANICS

ME-111

Maximum Marks: 60

Credits: 04

Duration: Two Hours

*Answer all the questions. Use separate Answer sheets for PART-A and PART-B.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q.No.	Question	M.M.
<u>PART-A</u>		
1a	The rectangular plate shown weighs 75 N and is held in the position shown by hinges at A and B and by cable EF. Assuming that the hinge at B does not exert any axial thrust, determine (a) the tension in the cable, (b) the reactions at A and B. (FIG1a)	Co1 [7]

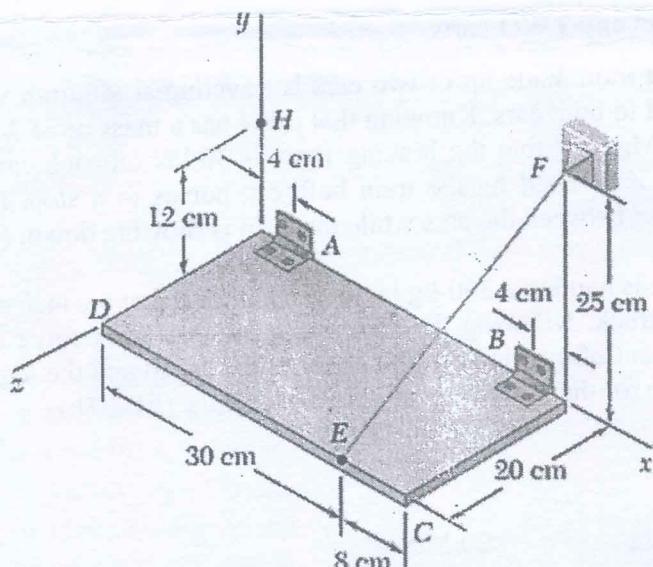


FIG-1a

Contd....2.

- 1b A 10° wedge is used to split a section of a log. The coefficient of static friction between the wedge and the log is 0.35. Knowing that a force P of magnitude 600 N was required to insert the wedge, determine the magnitude of the forces exerted on the wood by the wedge after insertion. (FIG-1b)

C02 [5]

- 1b' Determine the force P required to maintain the equilibrium of the linkage shown. All members are of the same length and the wheels at A and B roll freely on the horizontal rod. (FIG-1b')

C04 [5]

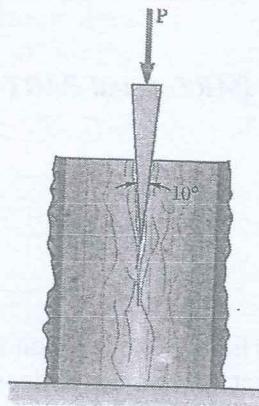


FIG-1b

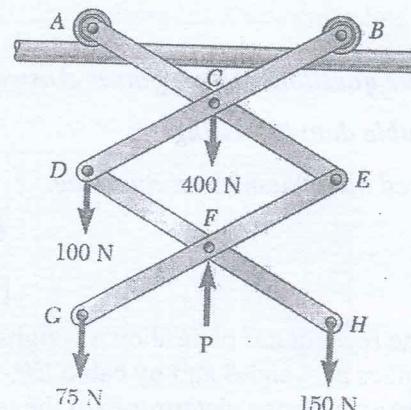


FIG-1b'

- Q2 Attempt any TWO parts.

- 2(a) A light train made up of two cars is traveling at 90 km/h when the brakes are applied to both cars. Knowing that car A has a mass of 25 Mg and car B a mass of 20 Mg, and that the braking force is 30 kN on each car, determine (a) the distance travelled by the train before it comes to a stop, (b) the force in the coupling between the cars while the train is slowing down. (FIG-2a)

C05 [6]

- 2(b) A truck is hauling a 300-kg log out of a ditch using a winch attached to the back of the truck. Knowing the winch applies a constant force of 2500 N and the coefficient of kinetic friction between the ground and the log is 0.45, determine the time for the log to reach a speed of 0.5 m/s. (FIG-2b)

C05 [6]

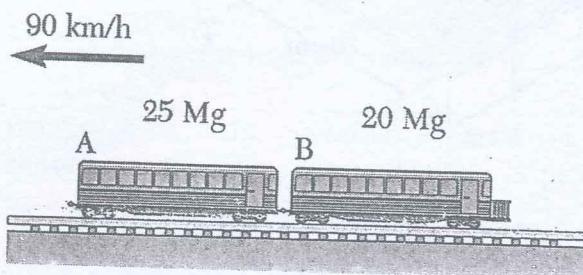


FIG-2a

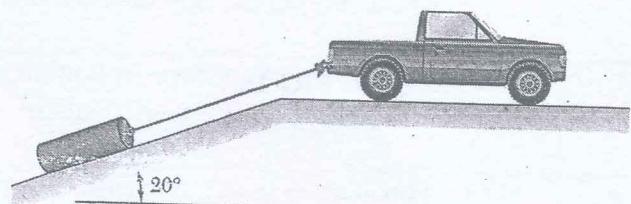
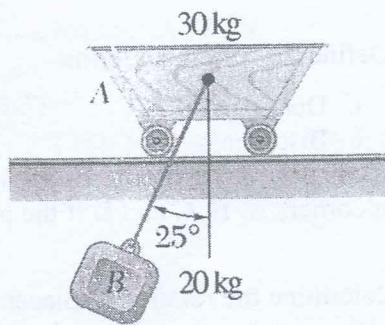


FIG-2b

contd... 3.

- 2(c) A 20-kg block B is suspended from a 2-m cord attached to a 30-kg cart A, which may roll freely on a frictionless, horizontal track. If the system is released from rest in the position shown, determine the velocities of A and B as B passes directly under A.



[6] CO6

Q3 Attempt any TWO parts.

- 3(a) Collar B moves upward with a constant velocity of 1.5 m/s. At the instant when $\theta = 50^\circ$, determine (a) the angular velocity of rod AB, (b) the velocity of end A of the rod. FIG-3a

[6] CO7

- 3(b) A 40-kg vase has a 200-mm-diameter base and is being moved using a 100-kg utility cart as shown. The cart moves freely ($\mu = 0$) on the ground. Knowing the coefficient of static friction between the vase and the cart is $\mu_s = 0.4$, determine the maximum force F that can be applied if the vase is not to slide or tip. FIG-3b

[6] CO7

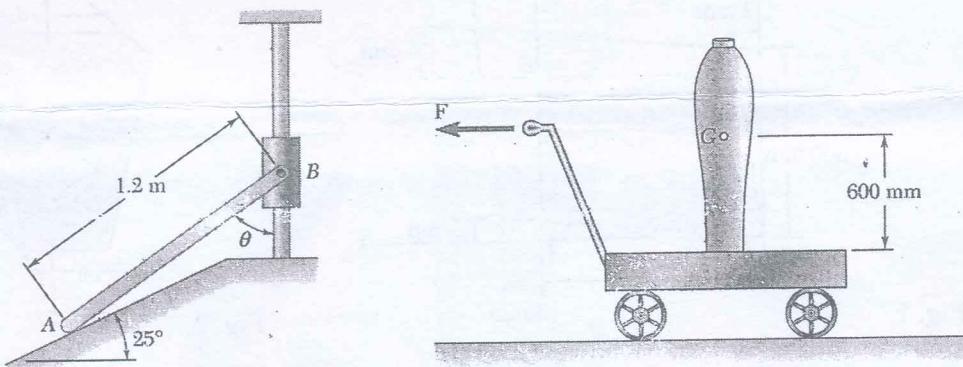
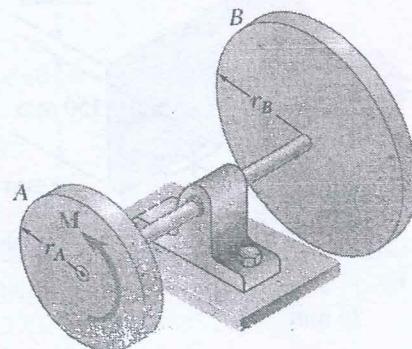


FIG-3a

FIG-3b

- 3(c) Two disks of the same thickness and same material are attached to a shaft as shown. The 3-kg disk A has a radius $r_A = 100 \text{ mm}$, and disk B has a radius $r_B = 125 \text{ mm}$. Knowing that the angular velocity of the system is to be increased from 200 rpm to 800 rpm during a 3-s interval, determine the magnitude of the couple M that must be applied to disk A.

[6] CO8



Contd... 4.

PART-B[4] ~~CO1~~

Q 1a Define the following terms:

- i. Ductility
- ii. Brittleness

- iii. Hardness
- iv. Toughness

[8] ~~CO5~~

Q 1b The piece of plastic shown in Fig. 1 is originally rectangular. Determine the shear strain at corners A, B, C and D if the plastic distorts as shown by the dashed lines.

OR

[8] ~~CO5~~

Q 1b' Determine the relative displacement of one end of the tapered plate (as shown in Fig. 2) with respect to the other end when it is subjected to an axial load P.

[8] ~~CO4~~Q 2a The beam is made from three boards nailed together as shown in Fig. 3. If the moment acting on the cross section is $M = 600 \text{ Nm}$, determine the maximum bending stress in the beam. Sketch a three-dimensional view of the stress distribution acting over the cross section.[8] ~~CO6~~

Q 2b The hollow pipe AB shown in Fig. 4 has an inner diameter of 80 mm and an outer diameter of 100 mm. If its end is tightened against the support at A using a torque wrench at B, determine the maximum shear stress developed in the material at section C in the pipe, when the 80 N forces are applied to the wrench.

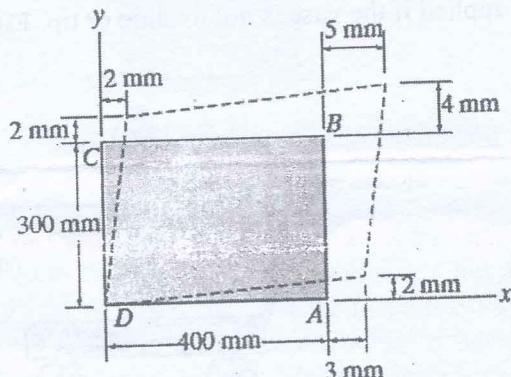
[4] ~~CO9~~

Fig. 1

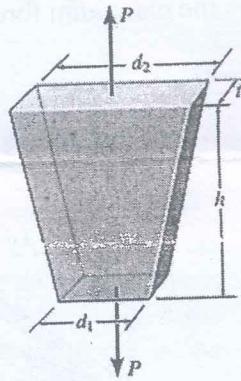


Fig. 2

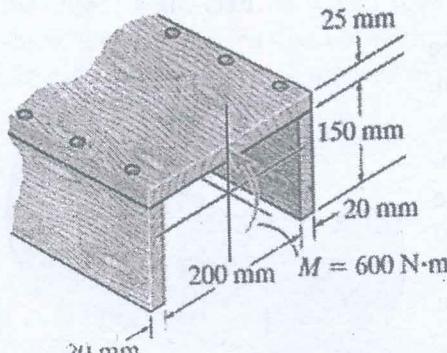


Fig. 3

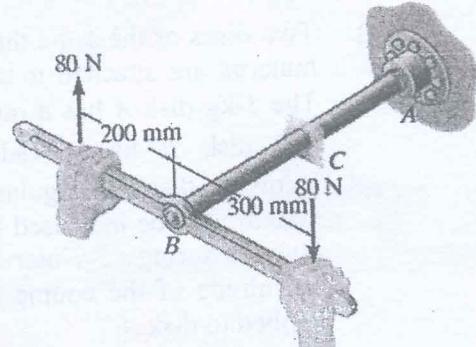


Fig. 4

2019-20

B. TECH. (AUTUMN SEMESTER) EXAMINATION

ALL BRANCHES

MEA1110 / ME101

ENGINEERING THERMODYNAMICS / THERMAL SCIENCES

Maximum Marks: 60

Credits: 04

Duration: Two Hours

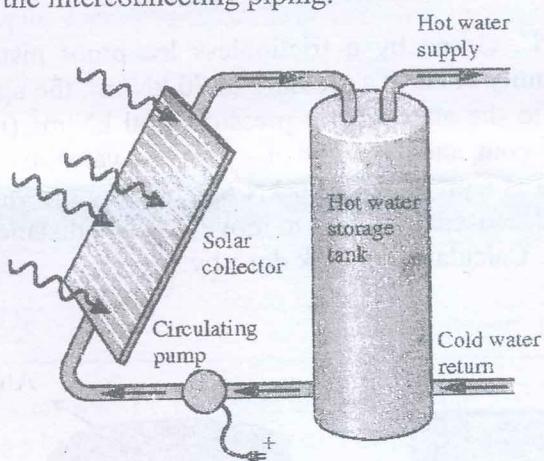
*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.**Programmable calculators (with extra memory storage) are not permitted.**Steam Tables are allowed.*

Q.No.

Question

COs M. M.

- 1a) As illustrated in figure below, water circulates between a storage tank and a solar collector. Heated water from the tank is used for domestic purposes. Considering the solar collector as a system, identify locations on the system boundary where the system interacts with its surroundings and describe events that occur within the system. Repeat for an enlarged system that includes the storage tank and the interconnecting piping.



- 1b) The temperature t on a thermometric scale is defined in terms of a property K CO1 [05] by the relation

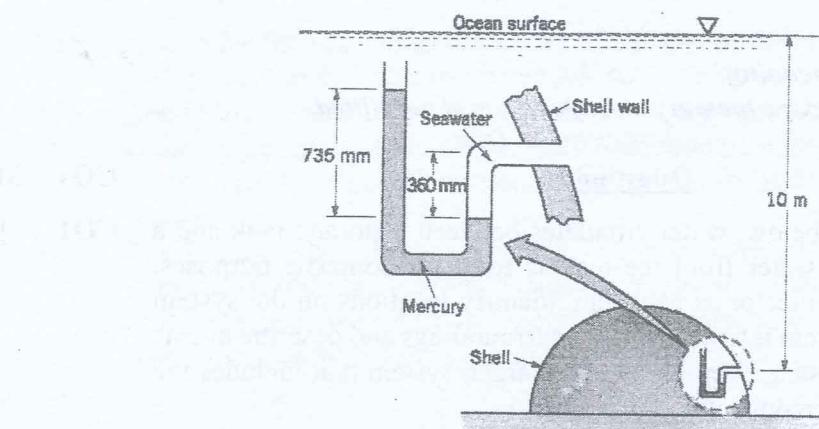
$$t = a \ln K + b,$$

where a and b are constants.

The values of K are found to be 1.83 and 6.78 at the ice point and the steam point, the temperatures of which are assigned the numbers 0 and 100 respectively. Determine the temperature corresponding to a reading of K equal to 2.42 on the thermometer.

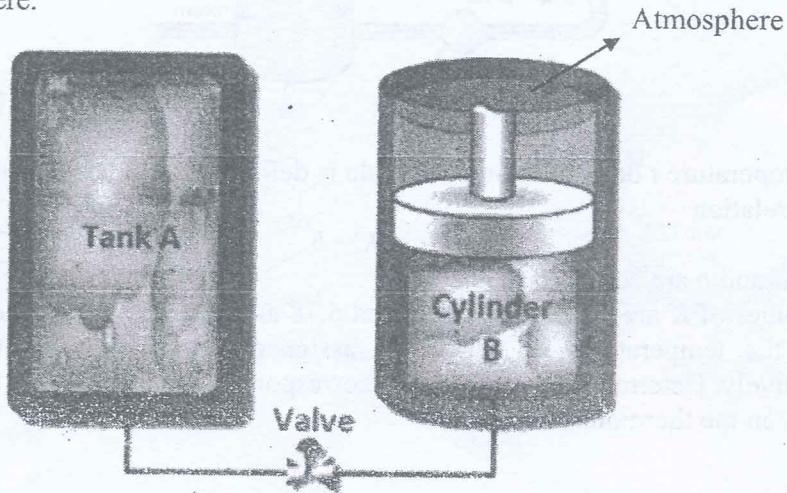
contd...-2

- 1c) An air-filled, hemispherical shell is attached to the ocean floor at a depth of 10 m as shown in figure below. A mercury barometer located inside the shell reads 765 mm Hg, and a mercury U-tube manometer designed to give the outside water pressure indicates a differential reading of 735 mm Hg as illustrated. Based on these data what is the atmospheric pressure at the ocean surface? Take $\gamma_{\text{Hg}} = 133 \text{ kN/m}^3$ and $\gamma_{\text{seawater}} = 10.1 \text{ kN/m}^3$.



- 2a) A vertical cylinder 'B', closed by a frictionless leakproof piston of area 20 cm^2 , contains a quantity of air at a pressure of 70 kN/m^2 ; the upper face of the piston is exposed to the atmospheric pressure, 100 kN/m^2 (refer figure below). The cylinder is connected, by way of a pipe and valve, to a rigid tank 'A' containing nitrogen at a pressure of 20 kN/m^2 ; initially the valve is shut. The valve when opened, caused the piston to move slowly a distance of 10 cm from its initial position. Calculate the work done by:

- (a) Piston
(b) Atmosphere.



Contd.... 3.

- 2b) In water cooling tower, air enters at a height of 1 m above the ground level and leaves at a height of 7 m. The inlet and outlet velocities are 20 m/s and 30 m/s respectively. Water enters at a height of 8 m and leaves at a height of 0.8 m. The velocity of water at entry and exit are 3 m/s and 1 m/s respectively. Water temperatures are 80°C and 50°C at the entry and exit respectively. Air temperatures are 30°C and 70°C at the entry and exit respectively. The cooling tower is well insulated and a fan of 2.25 kW drives the air through the cooler. Find the amount of air per second required for 1 kg/s of water flow. The values of c_p of air and water are 1.005 and 4.187 kJ/kg K respectively.
- CO2 [9]

OR

- 2b') Steam at 5 MPa and 400°C enters a nozzle steadily with a velocity of 80 m/s, and it leaves at 2 MPa and 300°C. The inlet area of the nozzle is 50 cm², and heat is being lost at a rate of 120 kJ/s. Determine (a) the mass flow rate of the steam, (b) the exit velocity of the steam, and (c) the exit area of the nozzle.
- 3a) A 0.3-m³ rigid vessel initially contains saturated liquid – vapor mixture of water at 150°C. The water is now heated until it reaches the critical state. Determine the mass of the liquid water and the volume occupied by the liquid at the initial state.
- CO2 [9]
- CO3 [05]

OR

- 3a') Complete the table below for water and mark each state on a P-v diagram.
- | T, °C | P, kPa | v, m ³ /kg | Phase description |
|-------|--------|-----------------------|-------------------|
| 140 | | 0.05 | |
| | 550 | | Saturated liquid |
- CO3 [05]

- 3b) Steam expands isentropically in a nozzle from 1 MPa, 250°C to 10 kPa. The steam flow rate is 1 kg/s. Neglect the velocity of steam at the inlet to the nozzle. Find the following:
- The velocity of steam at the exit from the nozzle
 - The exit area of the nozzle.
 - The exhaust steam from the nozzle flows into a condenser and exits as saturated water. The cooling water enters the condenser at 25°C and leaves at 35°C. Determine the mass flow rate of cooling water.
- CO3 [10]

OR

- 3b') Steam at 10 bar, 250°C flowing with negligible velocity at the rate of 3 kg/min mixes adiabatically with steam at 10 bar, 0.75 quality, flowing also with negligible velocity at the rate of 5 kg/min. The combined stream of steam is
- CO3 [10]

contd...4.

throttled to 5 bar and then expanded isentropically in a nozzle to 2 bar.
Determine:

- (a) The state of steam after mixing.
- (b) The state of steam after throttling.
- (c) The increase in entropy due to throttling.
- (d) The velocity of steam at the exit from the nozzle.

- 4a) Explain the equivalence of the Clausius and Kelvin–Planck statements of the Second law of thermodynamics. CO4 [04]
- 4b) Prove that the efficiency of a reversible engine is independent of the nature of the engine working between same source and sink. CO4 [05]
- 4c) Using suitable diagrams explain the processes involved in an Otto cycle used for Spark Ignition Engines. CO4 [06]

OR

- 4c') A boiler supplies heat Q_1 , at the high temperature T_1 . This heat is absorbed by a heat engine, which extracts work W , and rejects the waste heat Q_2 , into the house at T_2 . Work W , is in turn used to operate a mechanical refrigerator or heat pump, which extracts Q_3 from outdoors at temperature T_3 and rejects Q'_2 into the house. As a result of this cycle of operation, a total quantity of heat equal to $(Q_2 + Q'_2)$ is liberated in the house, against Q_1 which would be provided directly by the ordinary combustion of the fuel. Thus, the ratio $(Q_2 + Q'_2)/Q_1$ represents the heat multiplication factor (M. F.) of this method. Determine this M. F. if $T_1 = 200^\circ\text{C}$, $T_2 = 20^\circ\text{C}$ and $T_3 = 0^\circ\text{C}$. CO4 [06]

2019-20

B.TECH. (I SEMESTER) EXAMINATION

ALL BRANCHES

ENGINEERING MECHANICS

MEA-1120

Maximum Marks: 60

Credits: 03

Duration: Two Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.**Course outcome (CO) are indicated against each question.*

- | Q.No. | Question | CO | M.M. |
|-------|--|-----|------|
| 1a | Four forces are applied to the machine component ABDE as shown. Replace these forces with an equivalent force-couple system at A (FIG-1a). | CO1 | [8] |

OR

- | | | | |
|-----|---|-----|-----|
| 1a' | A 200-mm lever and a 240-mm-diameter pulley are welded to the axle BE that is supported by bearings at C and D. If a 720-N vertical load is applied at A when the lever is horizontal, determine (a) the tension in the cord, (b) the reactions at C and D. Assume that the bearing at D does not exert any axial thrust (FIG-1a'). | CO1 | [8] |
|-----|---|-----|-----|

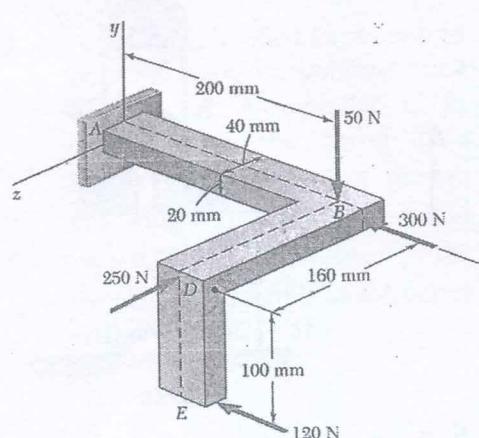


Fig-1(a)

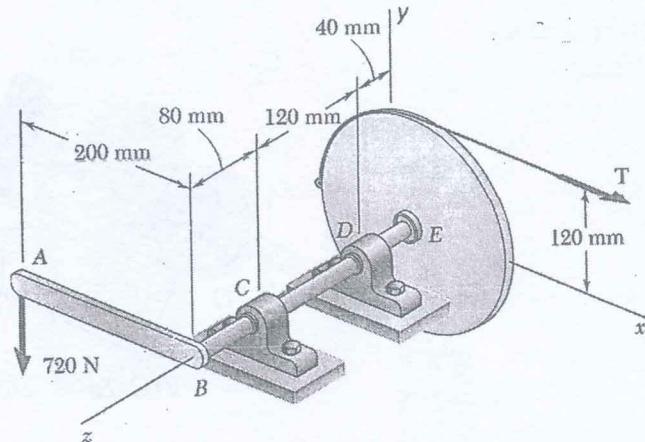


Fig-1 a'

contd.... 2.

- 1b Knowing that the maximum friction force exerted by the bottle on the cork is 300 N, determine (a) the force P that must be applied to the corkscrew to open the bottle, (b) the maximum force exerted by the base of the corkscrew on the top of the bottle. Solve using Virtual work method. (FIG-1b).

CO1 [7]

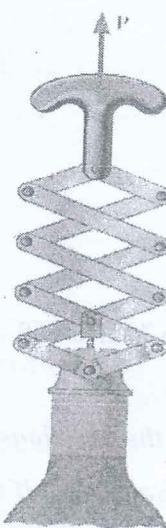


FIG-1b

- 2a The 3-kg collar B slides on the frictionless arm AA'. The arm is attached to drum D and rotates about O in a horizontal plane at the rate $\dot{\theta} = 0.75t$, where $\dot{\theta}$ and t are expressed in rad/s and seconds, respectively. As the arm-drum assembly rotates, a mechanism within the drum releases cord so that the collar moves outward from O with a constant speed of 0.5 m/s. Knowing that at $t = 0$, $r = 0$, determine the time at which the tension in the cord is equal to the magnitude of the horizontal force exerted on B by arm AA' (FIG-2a).

CO2 [6]

OR

- 2a' Blocks A and B have masses of 11 kg and 5 kg, respectively, and they are both at a height $h = 2$ m above the ground when the system is released from rest. Just before hitting the ground, Block A is moving at a speed of 3 m/s. Determine (a) the amount of energy dissipated in friction by the pulley, (b) the tension in each portion of the cord during the motion (FIG-2a').

CO2 [6]

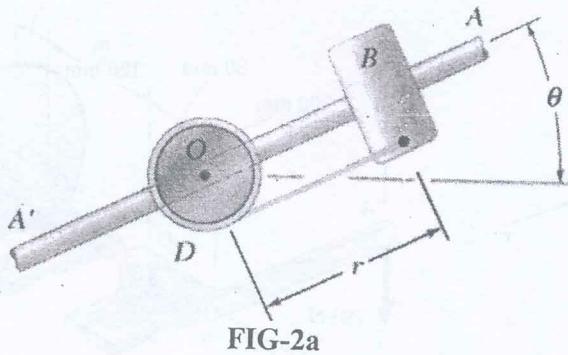


FIG-2a

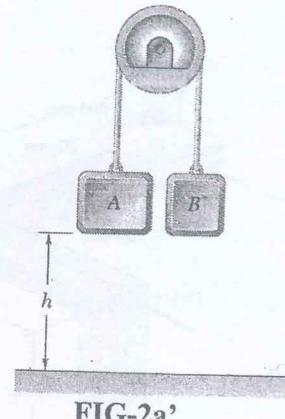
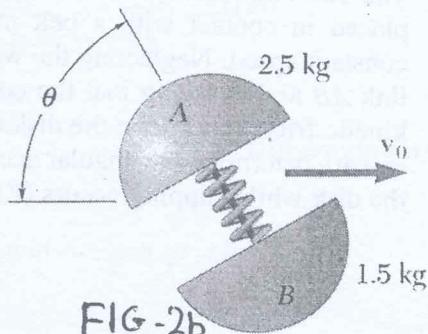


FIG-2a'

contd ... 3.

- 2b Two hemispheres are held together by a cord which maintains a spring under compression (the spring is not attached to the hemispheres). The potential energy of the compressed spring is 120 J and the assembly has an initial velocity v_0 of magnitude $v_0 = 8 \text{ m/s}$. Knowing that the cord is severed when $\theta = 30^\circ$, causing the hemispheres to fly apart, determine the resulting velocity of each hemisphere (FIG-2b).

CO2 [9]



- 3a In the engine system shown, $l = 160 \text{ mm}$ and $b = 60 \text{ mm}$. Knowing that the crank AB rotates with a constant angular velocity of 1000 rpm clockwise, determine the velocity of the piston P and the angular velocity of the connecting rod when (a) $\theta = 0$, (b) $\theta = 90^\circ$.

CO3 [7.5]

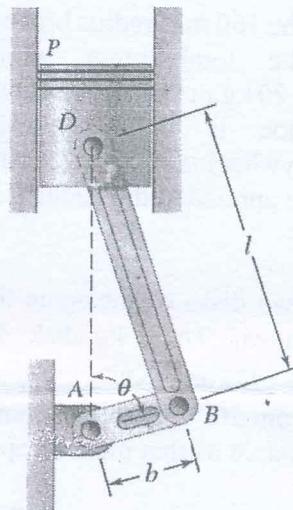


FIG-3a

- 3b A completely filled barrel and its contents have a combined mass of 90 kg. A cylinder C is connected to the barrel at a height $h = 550 \text{ mm}$ as shown. Knowing $\mu_s = 0.40$ and $\mu_k = 0.35$, determine the maximum mass of C so the barrel will not tip (FIG-3b).

CO3 [7.5]

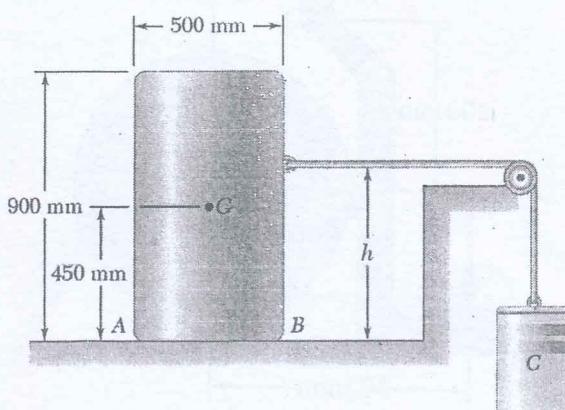


FIG-3b

OR

Contd.... 4.

- 3b' The 180-mm radius disk is at rest when it is placed in contact with a belt moving at a constant speed. Neglecting the weight of the link AB and knowing that the coefficient of kinetic friction between the disk and the belt is 0.40, determine the angular acceleration of the disk while slipping occurs (FIG-3b').

CO4 [7.5]

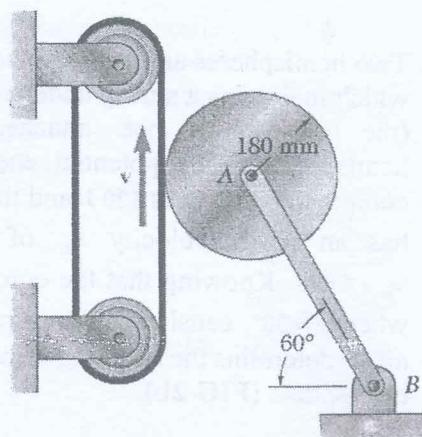


FIG-3b'

- 4a The 160 mm-radius brake drum is attached to a larger flywheel that is not shown. The total mass moment of inertia of the flywheel and drum is 20 kg.m^2 and the coefficient of kinetic friction between the drum and the brake shoe is 0.35. Knowing that the initial angular velocity of the flywheel is 360 rpm counter clockwise, determine the vertical force P that must be applied to the pedal C if the system is to stop in 100 revolutions (FIG-4a).

CO4 [15]

OR

- 4b Two disks of the same thickness and same material are attached to a shaft as shown. The 3-kg disk A has a radius $r_A = 100 \text{ mm}$, and disk B has a radius $r_B = 125 \text{ mm}$. Knowing that the angular velocity of the system is to be increased from 200 rpm to 800 rpm during a 3-s interval, determine the magnitude of the couple M that must be applied to disk A (FIG-4b).

CO4 [15]

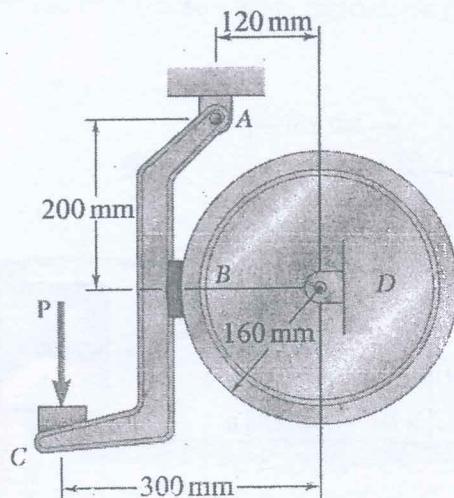


FIG-4a

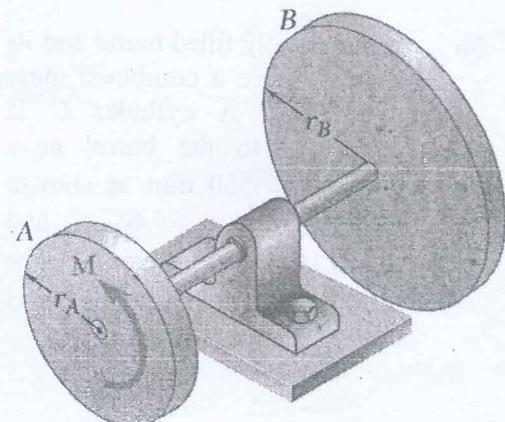


FIG- 4b