

2017-18

**B.Tech. (I-SEMESTER) EXAMINATION**  
**All branches**  
**APPLIED CHEMISTRY**  
**ACS-1110/AC-111**

**Maximum Marks: 60****Credits: 04****Duration: Two Hours***Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

<b>Q.No.</b>	<b>Questions</b>	<b>M.M.</b>
1(a)	List the requirements of water for municipal and industrial uses.	[4]
(b)	Give the chemical reactions for the followings:  (i) Removal of temporary calcium hardness by lime. (ii) Reaction of hydrazine with dissolved oxygen (iii) Removal of temporary Mg by boiling. (iv) Regeneration of exhausted zeolite. (v) Removal of calcium sulphate by soda.	[5]
(c)	Calculate the amount of lime (85% pure) and soda (95% pure) required for softening 50,000 litres of water containing the following impurities per litre.  $\text{Ca}(\text{HCO}_3)_2 = 40.5 \text{ mg}$ , $\text{Mg}(\text{HCO}_3)_2 = 36.5 \text{ mg}$ , $\text{MgSO}_4 = 30 \text{ mg}$ , $\text{CaSO}_4 = 34 \text{ mg}$ , $\text{CaCl}_2 = 27.75 \text{ mg}$ , $\text{NaCl} = 10 \text{ mg}$ . (At. Wt.: H = 1; C = 12; O = 16; Na = 23; Mg = 24; S = 32; Cl = 35.5; Ca = 40). Also, calculate temporary, permanent and total hardness in ppm.	[6]
	<b>OR</b>	
(c)'	Write short notes on <u>any two</u> of the followings:  (i) Break-point chlorination and its advantages (ii) Calgon conditioning and phosphate conditioning (iii) Caustic embrittlement	[6]
2(a)	Give the definition and classification of fuel.	[2]
(b)	Describe Fischer Tropsch process for the production of synthetic petrol.	[4]
	<b>OR</b>	
(b)'	Define gross and net calorific values of a fuel. Calculate the approximate calorific	[4]

contd.... 2

value by Dulong's formula of a coal sample having the following ultimate analysis:

C = 80%, H = 3.5%, S = 2.8%, O = 5.0%, N = 1.5% and ash = 7.2%.

- (c) Write short notes on any three of the followings: [3x3]
- (i) Mechanism of hydrodynamic lubrication
  - (ii) Types of greases and their preparations
  - (iii) Solid Lubricants
  - (iv) LPG and CNG
- 3(a) Define corrosion. Give the mechanism of wet corrosion by evolution of hydrogen. [3]
- (b) List various methods to control corrosion? Explain corrosion control by impressed current method. [3]
- (c) Write short notes on any three of the followings: [3x3]
- (i) Characteristics of a good varnish
  - (ii) Constituents of paints and the functions of pigments
  - (iii) Difference between electrochemical series and galvanic series
  - (iv) Mechanism of dry corrosion.
- 4(a) Define polymers. Give classification of polymers based on synthesis method. [2]
- (b) Discuss the mechanism of free radical addition polymerization [5]
- (c) Give preparation, properties and use of Bakelite and Buna-N rubber. [8]

OR

- (c)' Give preparation, properties and use of Epoxy resins and Polyesters. [8]

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B.TECH. (AUTUMN SEMESTER) EXAMINATION  
 ALL BRANCHES  
 APPLIED MATHEMATICS I  
 AMS 1110

Maximum Marks: 60

Credits: 04

Duration: Two Hours

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

Q.NO.	QUESTIONS	MARKS
1(a)	Show that the set of all square matrices of order two with usual matrix addition and scalar multiplication is a vector space.	[CO-1] [07]
1(b)	Transfer the matrix $A = \begin{bmatrix} 1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ to its diagonal form using eigen values.	[CO-1] [08]

OR

- 1(b') Show that the matrix  $A = \begin{bmatrix} 1 & -2 & 2 \\ 1 & 2 & 3 \\ 0 & -1 & 2 \end{bmatrix}$  satisfies its own characteristic equation.

Hence find  $A^{-1}$ .

- 2(a) Check the convergence of the following series. [CO-2]  
[08]
- $\sum_{n=1}^{\infty} \frac{2n^2}{3n^4 + 5n^3 + 3}$
  - $\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \dots$

- 2(b) Trace the curve  $x(x^2 + y^2) = a(x^2 - y^2)$  giving its all salient features. [CO-2]  
[07]

OR

- 2(b') Show that Maclaurin's series of the function  $f(x) = \sin(m \sin^{-1} x)$  is

$$f(x) = mx + \frac{m(1^2 - m^2)}{3!}x^3 + \frac{m(1^2 - m^2)(3^2 - m^2)}{5!}x^5 + \dots$$

contd....2

- 3(a) Find the intrinsic equation of the semi cubical parabola  $3ay^2 = 2x^3$ .

[CO-3]  
[08]

OR

- 3(a') Find the curved surface area of the solid generated by the revolution of the curve  $r = 2a \cos \theta$  about initial line.

- 3(b) The part of the parabola  $y^2 = 4ax$  from the vertex to an end of the latus rectum is revolved about its chord. Show that the volume of the solid so generated is  $\frac{2\pi a^3}{5\sqrt{5}}$

[CO-3]  
[07]

- 4(a) Solve the simultaneous differential equations.:

[CO-4]

$$\frac{d^2x}{dt^2} - 4y = t^4, \frac{d^2y}{dt^2} + 4x = 3t^2.$$

[07]

- 4(b) Solve any two of the following :

[CO-4]

i.  $xdx + ydy = \frac{a^2(xdy - ydx)}{x^2 + y^2}$

[08]

ii.  $(2D^2 + 3D + 4)y = \sin 2x + x^2$

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

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B.TECH. (AUTUMN SEMESTER) EXAMINATION  
 ALL BRANCHES  
 MATHEMATICS I  
 AM 111

Maximum Marks: 60

Credits: 04

Duration: Two Hours

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

Q.NO.	QUESTIONS	MARKS
1(a)	Test the consistency of the following system of equations and hence find the solution.  $\begin{aligned} 4x - y &= 12 \\ -x + 5y - 2z &= 0 \\ -2y + 4z &= -8 \end{aligned}$	[CO-01] [07]
1(b)	Find the eigenvalues and eigenvectors of the matrix $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & 3 & 2 \\ 0 & 0 & -2 \end{bmatrix}$	[CO-01] [08]

OR

- 1(b') Verify Cayley-Hamilton Theorem for the matrix  $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$  and hence reduce the following expression to a single matrix.

$$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I.$$

- 2(a) Find all the asymptotes of the curve  $(x+y)^2(x+2y+2) = x+9y-2$  [CO-02]  
[07]

OR

- 2(a') Giving all silent features trace the curve  $ay^2 = x^2(a-x)$

contd...2

2(b) Expand  $\log(1 + x)$  by Maclaurin's theorem up to the fifth degree terms. [CO-02]  
[08]

3(a) Find the perimeter of the curve  $r = a \cos \theta$ . [CO-03]  
[08]

3(b) Find the volume of the solid generated by the revolution of the curve  
 $y = a^3/(a^2 + x^2)$  about its asymptote. [CO-03]  
[07]

OR

3(b') Find the area of curved surface of the solid formed by the revolution of the  
cardioid  $r = a(1 + \cos \theta)$  about the initial line.

4(a) Solve the following differential equations [CO-04]  
[08]

i.  $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 6y = e^x$

ii.  $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0$

4(b) Solve the simultaneous differentials [CO-04]  
[07]

$$\frac{dx}{dt} - \frac{dy}{dt} + 2y = \cos 2t$$

$$\frac{dx}{dt} + \frac{dy}{dt} - 2x = \sin 2t$$

OR

4(b') Find the amount of the ice left after 2 hours if half the quantity melts in 30  
minutes.

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**B.TECH. (AUTUMN SEMESTER) EXAMINATION**

(Civil/Chemical/ Computer/ Electrical/ Electronics/ Mechanical//Petro-Chemical/Arch. Engg.)  
**APPLIED PHYSICS**  
**APS1110/AP111**

**Maximum Marks: 60****Credits: 04****Duration: Two Hours**

- Answer all the questions. Symbols used have their usual meanings.
- Some useful physical constants are given at the end of the question paper.

- 1(a) Discuss Hall effect in the case of a p-type semiconducting sample. Obtain an **6.0** expression for majority carrier concentration in terms of measurable parameters. What are the important applications of Hall probe?
- 1(b) Categorize and discuss semiconductors on the basis of E vs. k diagrams. Give at **6.0** least three examples in each case.

**OR**

- 1'(b) Define mobility of a charge carrier in a material. Obtain an expression of for total **6.0** current density in a semiconductor by taking into consideration the contributions of electrons and holes hence write expression for electrical conductivity.

- 1(c) Calculate the effective densities of states  $N_c$  and  $N_v$  for GaAs at 300K. Also **3.0** calculate intrinsic carrier concentration and compare with given  $n_i = 2 \times 10^6 / \text{cm}^3$ . [Given that  $m_n^* = 0.067 m_0$      $m_p^* = 0.48 m_0$      $E_g = 1.43 \text{ eV}$ ]

- 2(a) Discuss the terms meta-stable state and population inversion. With the help of **6.0** suitable diagrams, explain the principle and working of a Ruby laser.

- 2(b) What is the basic principle of optical fiber communication? Define numerical **6.0** aperture and acceptance angle and also obtain an expression for the same.

- 2(c) A step index fiber has a core refractive index of 1.44 and cladding refractive index **3.0** 1.41. Find (i) the numerical aperture, (ii) the acceptance angle, and (iii) the relative refractive index difference.

- 3(a) Write the steady state form of Schrodinger equation and solve it for the energy and **8.0** the normalized wave function of a particle trapped in a box (infinite square potential well) L wide. Plot the wave function and the corresponding probability densities for the three lowest quantum states.

**OR**

- 3'(a) Explain the terms-phase velocity and group velocity. Obtain an expression for **8.0** group velocity,  $v_g = (dw/dk)$  and show that the group velocity,  $v_g$  associated with a moving particle is always equal to the velocity of the particle, v.

Contd... 2.

- 3(b) Explain the physical significance of the wave function,  $\Psi$  and discuss the necessary conditions for it to be physically acceptable. 4.0
- 3(c) Find the shortest wavelength present in the radiation from an x-ray machine whose accelerating potential is 50,000 V. 3.0
- 4(a) Discuss the physical significance of Fermi energy. Use the expression for number of quantum states,  $g(\epsilon)d\epsilon$  of free electrons in metals to obtain an expression for Fermi energy. Show that average electron energy at 0 K is  $3/5 \epsilon_F$ . 8.0
- 4(b) Write speed distribution of ideal gas molecules and show that most probable speed of ideal gas molecules is given by  $(2kT/m)^{1/2}$ . 4.0
- 4(c) Find the Fermi energy of tungsten on the assumption that each tungsten atom contributes two free electrons to the electron gas. The density of tungsten is 19.3 g cm<sup>-3</sup> and its atomic mass is 183.8 amu. 3.0
- OR**
- 4'(c) Find the root-mean-square, average and most probable speed of oxygen molecules at 27 °C. 3.0

#### Some Useful Physical Constants

$$\begin{aligned} h &= 6.63 \times 10^{-34} \text{ J.s}, & k_B &= 1.38 \times 10^{-23} \text{ J/K}, \\ m_o &= 9.1 \times 10^{-31} \text{ kg}, & m_p &= 1.67 \times 10^{-27} \text{ kg}, & m(O_2) &= 32 \text{ amu}, & c &= 3 \times 10^8 \text{ m/s} \\ n_i(\text{Si}) &= 1.5 \times 10^{16} \text{ m}^{-3} & q_e &= 1.6 \times 10^{-19} \text{ C}, & 1 \text{ amu} &= 1.66 \times 10^{-27} \text{ kg} \end{aligned}$$

(3342)

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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	Explain how Architecture as a profession is good to choose as a carrier?	[10]
	OR	
1'	Explain the role of an Architect in Indian context, what are the responsibilities of an architect while designing a building?	
2	What are the elements of architecture, explain, how line work as one of the important element in an architectural symphony?	[10]
	OR	
2'	What are the principles of architecture, explain with neat sketches different type of balance?	
3	Define with suitable sketches how can we change the ambience of any interior space by the change of colour, texture and material of the planer element?	[10]
4	Explain with neat sketches how history plays an important role in architecture?	[15]
5	Define in brief about Antoni Gaudi and his philosophy, explain with neat sketch one of the building designed by him and also explain how he has incorporated his philosophy in that building?	[15]

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B.Arch. FIRST SEMESTER EXAMINATION  
ARC-1310, ARCHITECTURAL DRAWING - I

Maximum Marks: 40

Credits 5

Duration: Two

Hours

## Note:-

- Answer all Questions.
- All questions carry equal marks.
- Assume suitable data if missing.
- All dimensions are in mm.
- Neat and good drafted drawings will be credited more.

Q.1 A square pyramid, base 35 mm and height 65 mm, has its axis inclined (10) at  $45^\circ$  to H.P. and has an edge of its base on the H.P. and inclined at  $30^\circ$  to the V.P. Draw its orthographic projections.

OR

A hexagonal pyramid, base 30 mm and height 60 mm, has a triangular face on ground and the vertical plane containing the axis makes an angle of  $45^\circ$  with the V.P. Draw its orthographic projections.

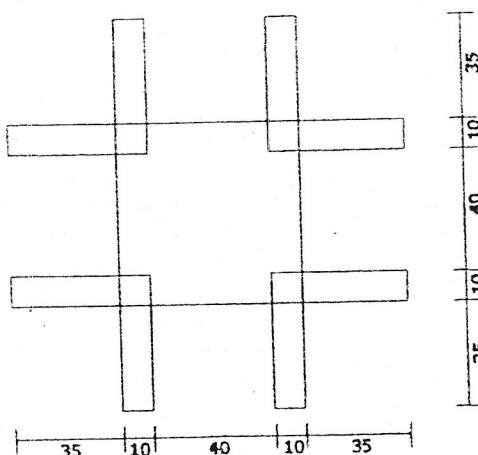
Q.2 A cube of 30 mm long edges is resting on the H.P. on one of its face in (10) such a way that its two vertical faces are parallel to V.P. It is cut by a sectional plane which is inclined at  $45^\circ$  to H.P., perpendicular to the V.P. and passing through the centre of cube. Draw sectional top view and true shape of the section.

Q.3. A cylinder of base 30 mm and height 60 mm is resting on H.P. on its base. (10) It is cut by a sectional plane which is inclined at  $45^\circ$  to H.P., perpendicular to the V.P. and passing through middle of central longitudinal axis. Draw development of lateral surface of lower part of truncated cylinder.

OR

A cube of 30 mm long edges is resting on the H.P. on one of its face in such a way that its two vertical faces are parallel to V.P. It is cut by a sectional plane inclined at  $45^\circ$  to H.P., perpendicular to the V.P. and passing through the centre of cube. Draw development of surface of lower part of truncated cube.

Q.4. Draw isometric view of the object shown in Figure -1. (10)



PLAN AND ALL ELEVATION  
All dimensions are in mm

FIGURE - 1

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**B.ARCH. ODD SEMISTER EXAMINATION  
BASIC DESIGN AND VISUAL APPRECIATION**

**ARC 1610**

**Maximum Marks: 40**

**Credits: 07**

**Duration: Four Hours**

*Use befitting sketches, thumbnails, drawings and illustrations to support your answers.  
Assume and write the missing data/situation/dimensions.*

- |   |   |    |
|---|---|----|
| 1 | Explain the Design Process and its various stages.  | 5  |
| 2 | Write a critical account on the Workshop area of the Mechanical Engineering Department of AMU. Your write-up should be a balanced appraisal of the volumetric/spatial quality and architectural experience of the space.                      | 10 |
| 3 | Design a <i>chowkidaar's</i> post for a housing society in Aligarh at its gated entrance. The maximum area of this 8 feet high structure should not be more than 100 sqft. Supplement your design with plans, elevations, sections and views. | 25 |

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(3340)

B.TECH. (AUTUMN SEMESTER) EXAMINATION  
ELECTRONICS/COMPUTERS/ELECTRICAL/MECHANICAL/CIVIL/CHEMICAL/  
PETROCHEMICAL  
ENVIRONMENTAL STUDIES  
CEA1110 / CE 111

Maximum Marks: 60

Credits: 04

Duration: Two Hours

*Answer all the questions.*

*Assume suitable data if missing.*

*Notations used have their usual meaning.*

*Use separate answer booklets against each Part*

Q.No.	Question	M.M. 60
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**Part A**

1. Using diagram, write about Hydrological cycle and Sulphur cycle in terms of flow [10] of compounds/nutrients/minerals and discuss the impact of human activities.

OR

- 1'. Explain the general functioning and process of ecological succession? What are [10] different types of ecological succession?
2. Define Environmental pollution. Write about Land pollution and Air pollution in [10] terms of: Causes, Effects and Control measures.

**Part B**

3. What do you mean by value of biodiversity? Discuss consumptive use and ethical [06] values of biodiversity.

OR

- 3'. Describe in-situ and ex-situ of conservation of biodiversity. [06]
4. Explain any TWO of the following: [3.5x2]
- (a) Unsustainable to sustainable development
  - (b) Urban problems related to energy
  - (c) Water conservation
5. How will you describe carrying capacity and population growth? In 1980, the [07] population in Lane County was 250,000 units. This grew to 280,000 units in 1990. What is the annual percentage growth rate for Lane County?

**Part C**

6. Attempt any 4 of the following Questions: [10]

Contd.... 2

- (a) Discuss the food Problems in India and measure taken to solve this Problem?
  - (b) What are the factors contribute to Success of Modern Agriculture and discuss its Favourable Impact?
  - (c) Briefly explain the effects of Land Slides and measure taken to minimize the adverse effect of land slides.
  - (d) Write down the adverse effect and the cause of soil erosion.
  - (e) Elaborate any two conventional source of Energy.
7. Discuss the following: [10]
- (a) Environment Protection Act.
  - (b) Air (Prevention and control of Pollution) Act.
  - (c) Forest Conservation Act.
  - (d) Need for public awareness of environmental problems
-

**Department of Civil Engineering**  
**End-Semester Examination: Autumn 2017-18**  
**CEA 1120: Strength of Materials**

**Time: Two Hrs.**

**Max. marks: 60**

**Attempt all the questions.**

**Notations have their usual meanings.**

- Q 1 (a)** What do you mean by the terms 'Yield Stress' and 'Proof Stress' in engineering stress-strain curve? [2]
- (b)** Define the following terms: [4]  
 i. Brittleness  
 ii. Ductility  
 iii. Hardness  
 iv. Toughness
- (c)** Derive the relationship between Young's Modulus ' $E$ ' & Bulk Modulus ' $K$ ' of elasticity. [3]
- (d)** For a given state of stress shown in Fig. 1, determine principal stresses:  $\sigma_1$  &  $\sigma_2$ , maximum shear stress:  $\tau_{max}$ , average stress:  $\sigma_{avg}$  and angles of the planes:  $\theta_p$  &  $\theta_s$  on which they are acting from  $x$ -axis. [6]

**OR**

- (d')** A piece of plastic is originally rectangular. Determine the shear strain at corners  $A$ ,  $B$ ,  $C$  and  $D$ , if the plastic distorts as shown by the dashed lines. (Fig. 2) [6]

- Q 2 (a)** If a simply supported beam of uniform cross-section and length ' $L$ ' is subjected to a uniformly distributed load ' $w(x)$ ', show that  $w(x) = \frac{dV(x)}{dx}$  and  $V(x) = \frac{dM(x)}{dx}$ . [5]

- (b)** Draw the shear force and bending moment diagrams for the compound beam which is pin connected at  $B$ . (Fig. 3) [10]

**OR**

- (b')** Draw the shear force and bending moment diagrams for the beam shown in Fig. 4. [10]

- Q 3 (a)** The beam is made from three boards nailed together as shown in Fig. 5. If the moment acting on the cross section is  $M = 600$  Nm, determine the maximum bending stress in the beam. Also, sketch the stress distribution acting over the cross section. [6]

- (b)** Determine the maximum shear stress acting at section  $a-a$  of the cantilever beam shown in Fig. 6. Also, sketch the stress distribution acting over the cross section. [9]

**OR**

contd... 2

- (b') The aluminium rod  $AB$  is bonded to the brass rod  $BD$ . Knowing that portion  $CD$  of the brass rod is hollow and has an inner diameter of 40 mm, determine the angle of twist at  $A$ . Take  $G_{\text{brass}} = 39 \text{ GPa}$  and  $G_{\text{alum.}} = 27 \text{ GPa}$ . (Fig. 7) [9]

- Q 4 (a) Determine the force in each member of the roof truss shown in Fig. 8. State whether the members are in tension or compression. [9]
- (b) Determine the resultant forces at the pins  $A$ ,  $B$ , and  $C$  of the three-hinged arched roof truss. (Fig. 9) [6]

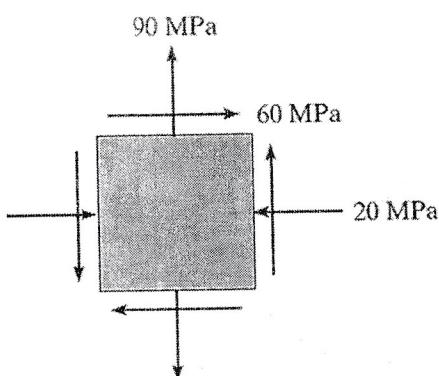


Fig. 1

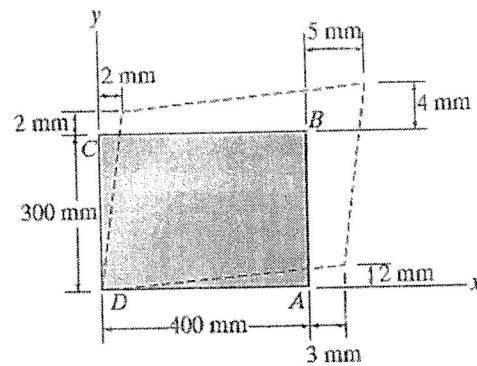


Fig. 2

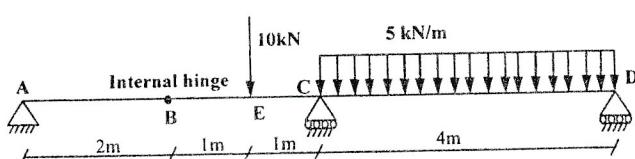


Fig. 3

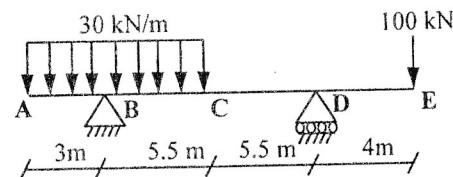


Fig. 4

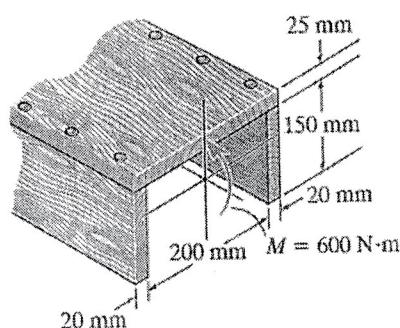


Fig. 5

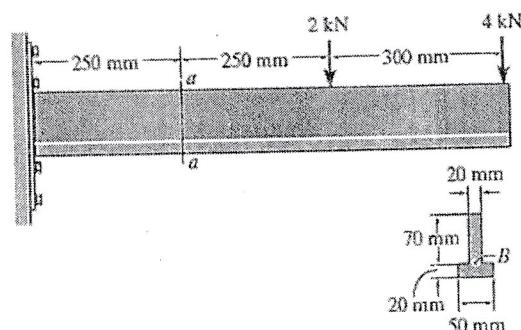


Fig. 6

Contd... 3.

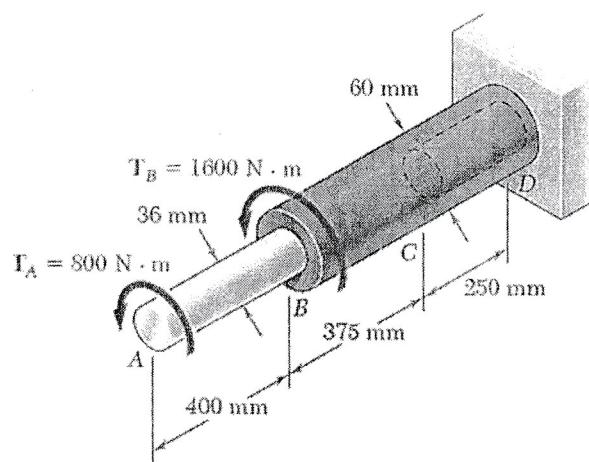


Fig. 7

2 kN

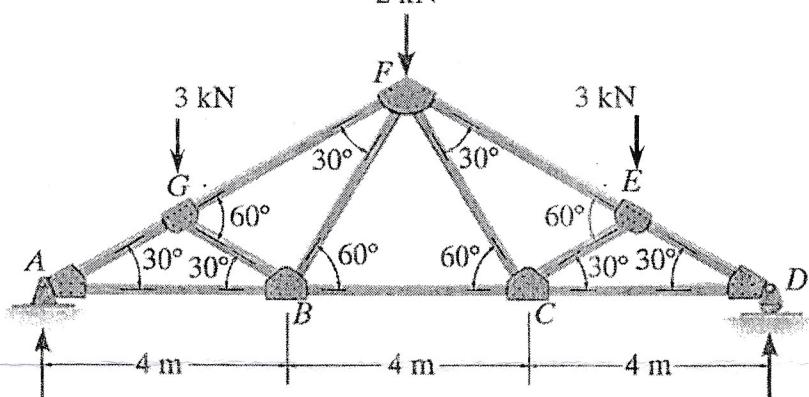


Fig. 8

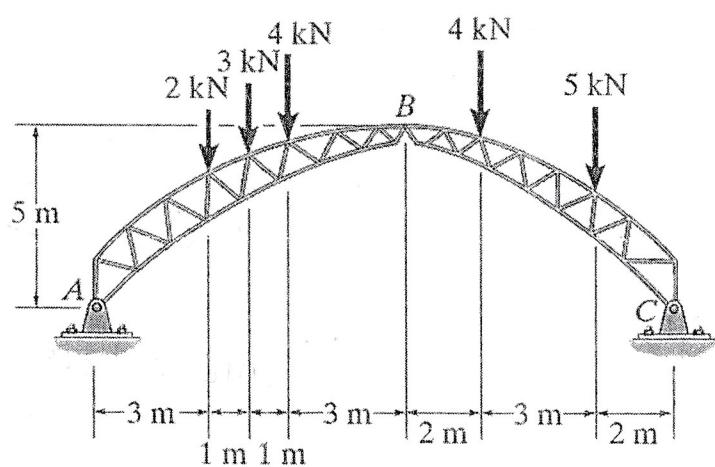


Fig. 9

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**B.TECH. (FIRST SEMESTER) EXAMINATION  
PRINCIPLES OF ELECTRICAL ENGINEERING  
COURSE CODE: EEA1110**

**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.****Questions**

- 1 (a)** For the circuit shown in Figure 1, find the current through  $6\ \Omega$  resistor using Norton's theorem. [07]

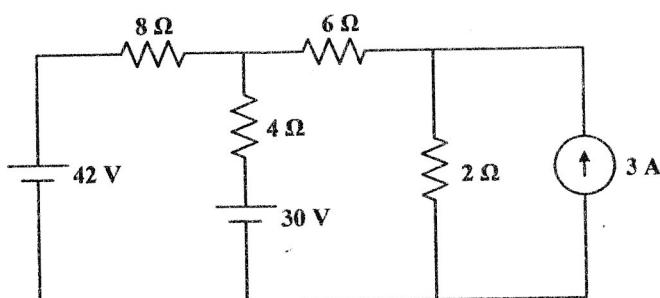


Figure 1

**OR**

- 1'(a)** For the circuit shown in Figure 2, find the current through  $3\ \Omega$  resistor using Superposition's theorem. [07]

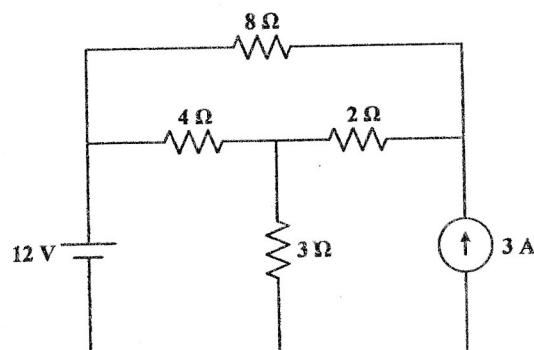


Figure 2

- 1(b)** Show that the total instantaneous three phase power of a three phase balanced circuit is free from second harmonics. [07]

Contd.... 2.

- 1(c) Derive the equation of current in R-L-C series circuit. [06]

OR

- 1'(c) Derive the equation of current in R-L-C parallel circuit. [06]

- 2 (a) Draw and explain the B-H curve for a magnetic material. [06]

- 2 (b) Describe the operation of a single phase transformer. [06]

- 2 (c) A 10 kVA, single phase transformer for 2000/400 V at no load, has [08]

$$r_1 = 5.5 \Omega \quad r_2 = 0.2 \Omega$$

$$x_1 = 12 \Omega \quad x_2 = 0.45 \Omega$$

At full load, 0.8 pf (lagging) and primary applied voltage of 2000 V, determine;

- (i) The approximate value of the secondary voltage

- (ii) Voltage regulation

OR

- 2'(c) A single phase transformer working at unity power factor has an efficiency of 90% at [08] both half load and at the full-load of 500 W. Determine the efficiency at 75% full load and the maximum efficiency.

- 3 (a) Explain the construction details of an alternator. Give reason for making two different [07] types of rotors i.e. salient pole rotor & cylindrical rotor.

OR

- 3'(a) Derive an expression for the induced EMF in an alternator. Discuss the role of [07] different factors appeared in the expression.

- 3 (b) Explain how a rotating magnetic field is produced by a 3-phase stator winding [07] supplied with 3-phase ac supply.

- 3 (c) With the help of suitable diagram, briefly discuss the operation of a thermal power [06] plant.

OR

- 3'(c) Write short note on "concept of green energy". [06]
-

**B.TECH. (AUTUMN SEMESTER) EXAMINATION  
BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (EE-111)**

Maximum Marks: **30**Credits: **04**

Duration: Two Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.**Use separate answer sheet for each part.***PART A (Electrical Engineering)****Q.No.****Question****M.M.**

- 1(a)** Find the Thevenins' equivalent circuit as seen from the terminals A - B in Fig. 1. [07]

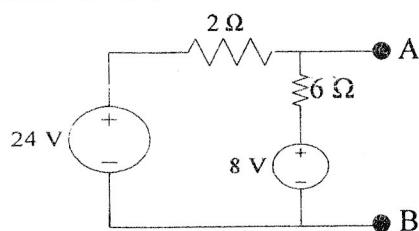


Fig.1

- 1(b)** Derive the relationship between line voltage and phase voltage for a star connected 3-phase balanced system. Also draw the phasor diagram. [08]

**OR**

[08]

- 1(b')** Discuss the construction and working principle of a single phase transformer. How magnetic losses occurs in a transformer? Describe briefly with the help of magnetisation curve.

- 2(a)** Describe the constructional details and principle of operation of a 3- phase induction motor. Discuss its applications. [08]

- 2(b)** What are renewable energy sources? Describe any one method of power generation through renewable energy sources. [07]

**OR**

[07]

- 2(b')** With the help of suitable diagram, explain the operation of a permanent magnet moving coil instrument. Why the scale of moving iron instrument is non-uniform?

Contd... 2

2017-18  
B.TECH. (AUTUMN SEMESTER) EXAMINATION  
EE-111 Part -B

Maximum Marks: ~~30~~ 30

Credits: 04

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 are logic gates? Give circuit realization and truth table of 'OR' and 'AND' gates.	[07]

OR

1(a)',	What is rectification? Draw the circuit for a bridge rectifier, indicating the direction of current paths during positive and negative half cycles of input.	[07]
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1(b)	For the fixed-bias configuration, determine: (a) $I_{BQ}$ . (b) $I_{CQ}$ . (c) $V_{CEQ}$ . (d) $V_C$ . (e) $V_B$ . (f) $V_E$	[08]
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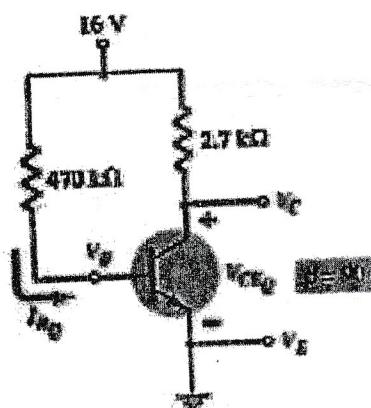


Figure 1

2(a)	Explain the construction, working and characteristics of depletion mode MOSFET. Also explain the difference between enhancement and depletion MOSFET.	[08]
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2(b)	What are different characteristics of an ideal operational amplifier? Also explain the significance of virtual ground in an operational amplifier?	[07]
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OR

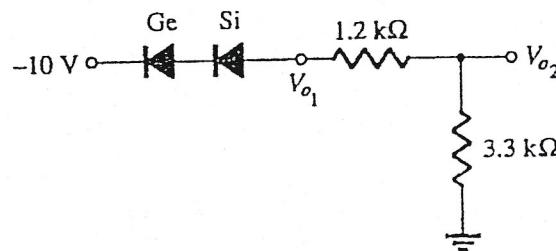
2(b)',	Design an operational amplifier circuit that will produce the output voltage $V_o = 0.5V_1 - 2V_2$ .	[07]
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2017-18

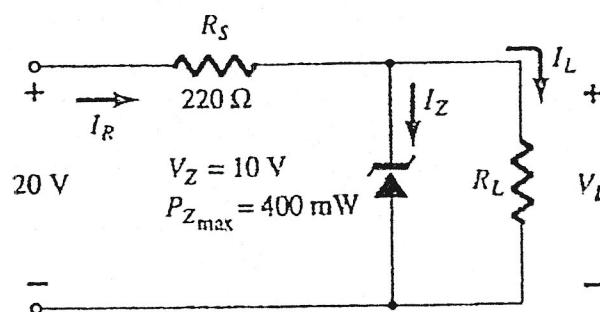
**B.TECH/B. ARCH (AUTUMN SEMESTER) EXAMINATION  
ALL BRANCHES  
PRINCIPLES OF ELECTRONICS ENGINEERING  
ELA1110**

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

<b>Q.No.</b>	<b>Question</b>	<b>M.M.</b>
1(a)	Determine $V_{o_1}$ and $V_{o_2}$ for the network shown in Fig. 1. Use the constant drop (approximate) model for the diodes.	[08] (CO1)

**Fig. 1****OR**

- 1(a') Give the circuit of full wave bridge rectifier (assume ideal diode). If the input to this rectifier is a sinusoidal waveform with  $V_{rms} = 120$  V, then [08] (CO1)
- Draw its output waveform with proper labels.
  - Find the dc voltage of the output waveform.
- 1(b) Determine  $V_L$ ,  $I_L$ , and  $I_Z$  for the network shown in Fig. 2, if  $R_L = 470 \Omega$ . [07] (CO1)

**Fig. 2***Contd.... 2*

- 2(a) Determine  $I_B$ ,  $I_C$ ,  $V_E$  and  $V_C$  for the circuit shown in Fig. 3. Assume common emitter current gain for the BJT to be 100. [08] (CO1)

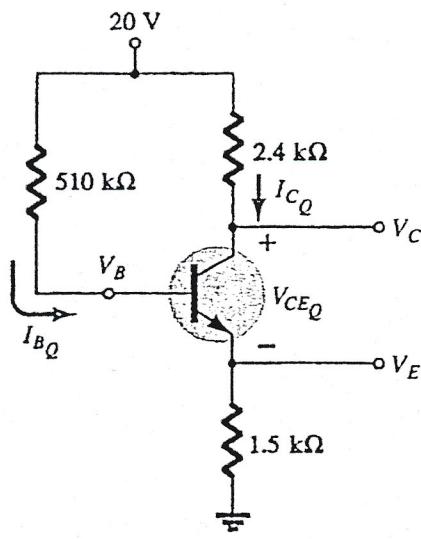


Fig. 3

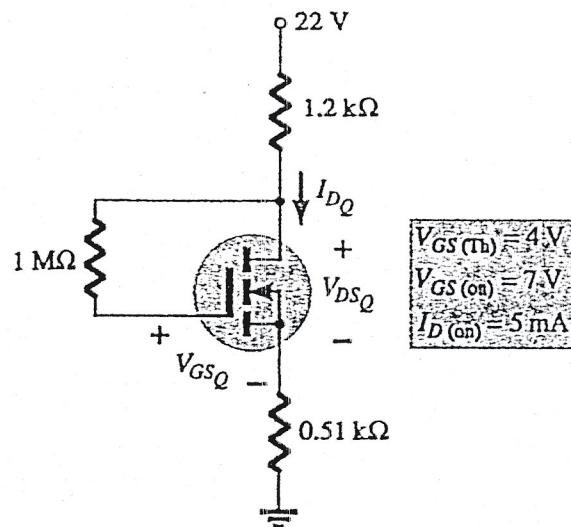


Fig. 4

- 2(b) Draw the physical structure of the *p*-channel and *n*-channel enhancement type MOSFET. [07] Also, give their circuit symbols. (CO1)

OR

- 2(b') For the circuit consisting of *n*-channel enhancement type MOSFET given in Fig. 4, [07] determine  $I_{DQ}$ ,  $V_{GSQ}$ , and  $V_{DSQ}$ . (CO1)

- 3(a) Derive an expression for the output voltage in terms of the resistance and input voltages [08] for the differential amplifier shown in Fig. 5. (CO2)

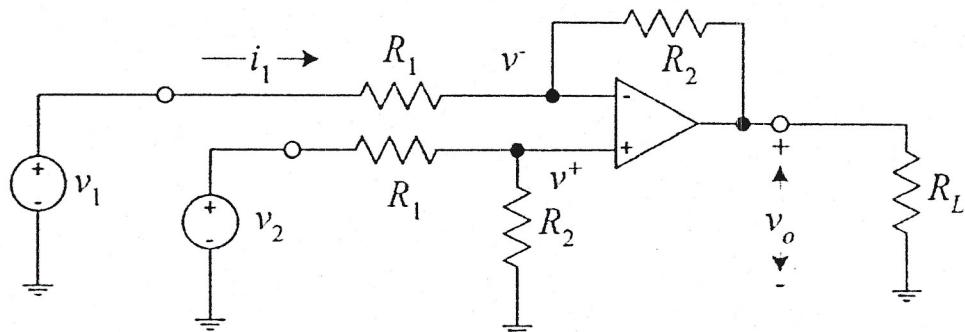


Fig. 5

- 3(b) Draw the circuit diagram of the non-inverting amplifier. Design (to find remaining [07] component value) a non-inverting amplifier that has a voltage gain of 10 and feedback resistor of 27 kΩ using an ideal op-amp. (CO2)

contd.... 3.

OR

- 3(b') The adjustable resistor of Fig. 6 can be varied from 0 to 100 k $\Omega$ . Calculate the minimum and maximum closed-loop voltage gain. [07] (CO2)

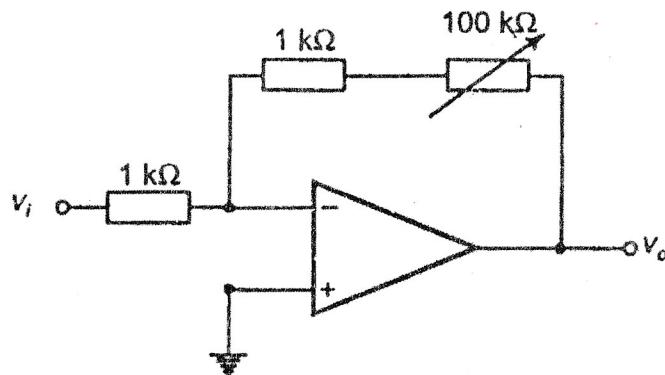


Fig. 6

- 4(a) i) What is the decimal equivalent of  $(011101011)_2$ ? (CO3) [3+3+2]  
ii) Convert  $(10^3)_{10}$  into binary number.  
iii) Convert  $(01110110001110)_2$  into hexadecimal number.

- 4(b) For the inputs shown in Fig. 6, give the truth table and sketch the output waveform for the function  $F(A, B) = A\bar{B} + \bar{A}B$  [07] (CO3)

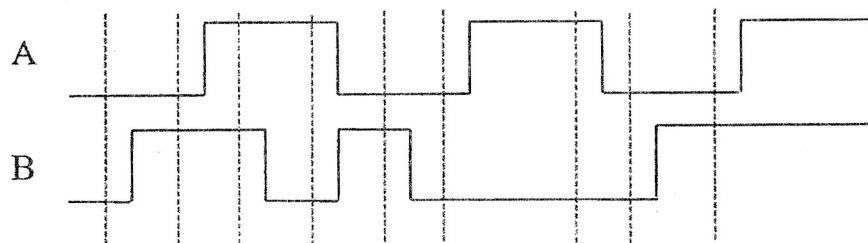


Fig. 6

OR

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

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

2017-2018

**B.ARCH./ B. TECH. AUTUMN (1 SEMESTER) EXAMINATION**

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

**ENGLISH**

**(EZH-1110)**

**CREDITS: 03**

**Maximum Marks: 60**

**Duration: Two Hours**

**NOTE: Attempt all questions**

**UNIT-I**

Read the following passage and answer the questions given below:

- Q1. a. Ours is a golden age of science, which is fine, but it is also a golden age of technology, business, management, an age of over-organisation and dehumanisation, and that is ominous and degrading. It would suffice to admit that material profits are not as desirable as many good people have been led to believe, and that there is infinitely more virtue than glory in creating beauty, justice, happiness than in creating wealth. The world today is at cross-roads of history. For the first time in history, and within the period of less than two centuries, the average span of human life has doubled itself in industrialised countries. The technological era has transformed life in many ways, its effects one can see at different levels of life. Several developing countries today enjoy a level of material prosperity and affluence never attained before; and what is more, the per capita income is rising exponentially. Besides, millions of people are still languishing in degrading poverty. The problem of poverty is no longer natural; it has to do with the economic and political organisation of a society. The increasing gap in wealth often results in social discontent and political instability in different forms. But poverty is not the only menace to mankind in general; the discovery of atomic energy and the subsequent development of lethal ammunitions have added a dehumanising dimension to war. The apprehension of mass extermination induces certain sort of unhappiness in the contemporary man of which his ancestor had no experience. Man is probably the only species in nature whose members kill each other, and in the end for nothing. When one enumerates his achievements one often tends to overlook the fact that the discovery of different forms of crime is also his unique contribution.
- i. Apart from wealth, what else are the requirements of life? (2)
  - ii. What are the threats to the survival of mankind? (2)
  - iii. What are the contradictions that the writer has underlined in the above paragraph? (2)
  - iv. What is suggested by "dehumanising dimension" of war? (2)
  - v. Comment on the author's perception of man? (2)
- b. Write a summary of the above passage. (10)

**UNIT-II**

3337-A

- Q2. Discuss the role of hope and fear in controlling society with reference to *Animal Farm*. (5)

OR

Write a critical note on the manipulation of language by those in power with reference to *Animal Farm*.

- Q3. Critically examine the relation between Eloi and Morlocks as it appears in *The Time Machine*. (5)

OR

Discuss elements of fantasy and realism in *The Time Machine*.

**UNIT-III**

- Q4. Write the process of conducting scientific experiment. (10)

OR

Write a report on Sir Syed Bicentenary Celebrations 2017.

**UNIT-IV**

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

The governments of most of the developed countries have always applied a large proportion of their total resources to the development of destructive apparatus and nowadays many of the newly-independent countries are doing the same. This apparatus and its use has now become exceedingly complex and requires the participation of large numbers of scientists and technologists. Moreover, many types of industry, including the largest aerospace industry, are strongly linked to defence requirements and again depend increasingly on scientific and technical personnel. Governments throughout the world act on the assumption that the welfare of their people depends largely on the economic strength and wealth of the community. Under modern conditions, this requires varying measures of centralised control and hence the help of specialised scientists such as economists and operational research experts. Furthermore, it is obvious that the strength of a country's economy is directly bound up with the efficiency of its agriculture and industry, and that this in turn rests upon the efforts of scientists and technologists of all kind. It also means that governments are increasingly compelled to interfere in these sectors in order to step up production and ensure that it is utilised to the best advantage: for example, they may encourage research in many ways, including the setting up of their own research centres; they may alter the structure of education, or interfere in order to reduce the wastage of natural resources or tap resources hitherto unexploited; or they may co-operate directly in the growing number of international projects related to science, economics and industry.

**UNIT-V**

- Q6. Write an essay on any one of the following in about 300 words. (10)
- Scientific attitude and the health of democracy
  - Education and entertainment
- .....

2017-2018

B.ARCH/B.TECH AUTUMN (I SEMESTER) EXAMINATION  
(ELECT-MECH./CHEM.ELECTRONICS/COMPUTER/  
PETRO-CHEMICAL ENGINEERING)

ENGLISH

(EN- 101)

Credits: 04

Maximum Marks: 60

Duration: Two Hours

Answers all questions.

## Unit -I

1- a. Read the passage and answer the questions that follow:

(5x2=10)

The less credible it seems to you, the most strongly I make the point that it is better to depend on the theory of probability rather than on intuition. All though the subject started out in the seventeenth century with games of chance such as dice and cards, it soon became clear that it had important application to other fields of activity. In the eighteenth century Laplace laid the foundations for a theory of errors, and Gauss later developed this into a real working tool for all the experiments and observers. Any measurement or set of measurements is necessary inexact; and it is a matter of highest importance to know how to take a lot of necessarily discordant data, combine them in the possible ways, and produce in addition some useful estimate of the dependability of the results. Other more modern fields of application are: in life insurance; telephone traffic problems; information and communication theory; game theory with applications to all forms of competition including business, international politics and war; modern statistical theories, both for the efficient design of experiments; decision theories, which aid us in making judgements; probability theories for the process by which we learn; and many more.

- i- What is the 'subject' discussed in the passage?
- ii- How are games of chance related to probability?
- iii- Identify two areas of the application of probability.
- iv- Give the meaning of the phrase 'started out'.
- v- How does probability help the scientist?

b. Write a summary of the passage given above. (10 Marks)

contd...2

**Unit II**

Q2- Write a character sketch of Boxer. (5 Marks)

Or

Give an account of the Battle of the Cowshed.

Q3- Write a brief note on The Palace of Green Porcelain. (5 Marks)

Or

Discuss Wells' view that too much comfort and affluence leads to indolence and laziness and ultimately retards human progress.

**Unit-III**

Q4. Write a report on the Student Union Elections held recently in the University . (10 marks)

Or

Write the process of applying for a Credit Card in your bank.

Or

Write a report on the celebration of Gandhi Jayanti in your Hall.

**Unit-IV**

Read the following passage and write a precis of the same. (10)

Our need for water is constantly increasing. There is an automatic increase due to population growth while the overall improvement of living standards, the fight against hunger through the irrigation of more land for food growing and the creation and expansion of new industries, all foretell the need for even greater water supplies throughout the world. Though it is difficult to calculate the exact amount, it is safe to say that in 20 years' time the demand for water will be roughly double. Faced with such a situation it is obvious that we should search as widely as possible and with every available means for sources of fresh water that seem to be least costly. But where do these sources exist? Only a sustained and co-ordinated programme of scientific observation and research in hydrology will tell us the answer.

**Unit-V**

Q6. Write an essay on any one of the following topics in about 400 words. (10)

i- Artificial Intelligence: A boon or bane

ii- Internet Friendships: An invitation to stalkers

2017-18

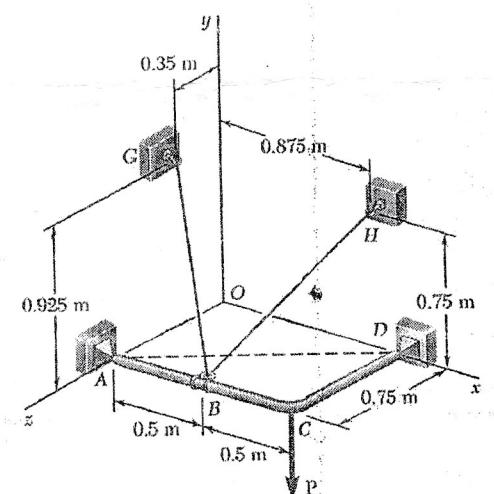
B.TECH. (I<sup>st</sup> SEMESTER) EXAMINATION  
 ALL BRANCHES  
 APPLIED MECHANICS  
 ME-111

**Maximum Marks: 60****Credits: 04****Duration: Two Hours***Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

<b>Q.No.</b>	<b>Question</b>	<b>M.M.</b>
<b><u>SECTION A</u></b>		

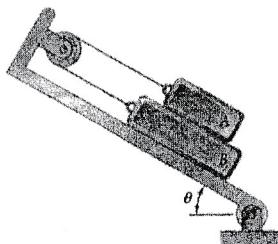
1 Attempt any TWO questions. *parts :*

- 1(a) The frame ACD is hinged at A and D and is supported by a cable that passes through a ring at B and is attached to hooks at G and H. Knowing that the tension in the cable is 450 N, determine the moment about the diagonal AD of the force exerted on the frame by portion BH of the cable. [7.5]

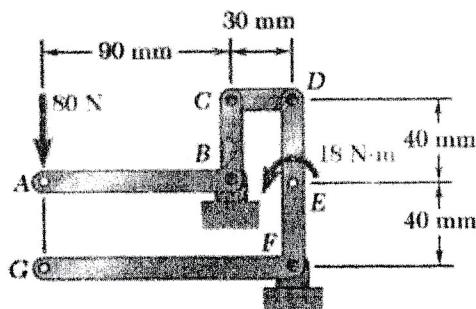


Contd....2.

- 1(b) The 20-N block A and the 30-N block B are supported by an incline that is held in [7.5] the position shown. Knowing that the coefficient of static friction is 0.15 between all surfaces of contact, determine the value of  $\theta$  for which motion is impending.

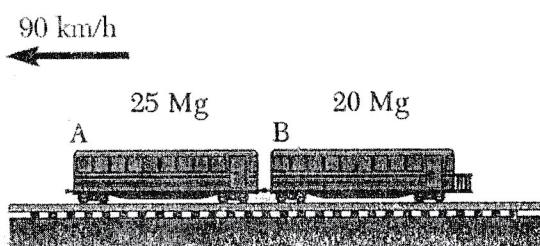


- 1(c) Determine the couple M that must be applied to member DEFG to maintain the [7.5] equilibrium of the linkage.



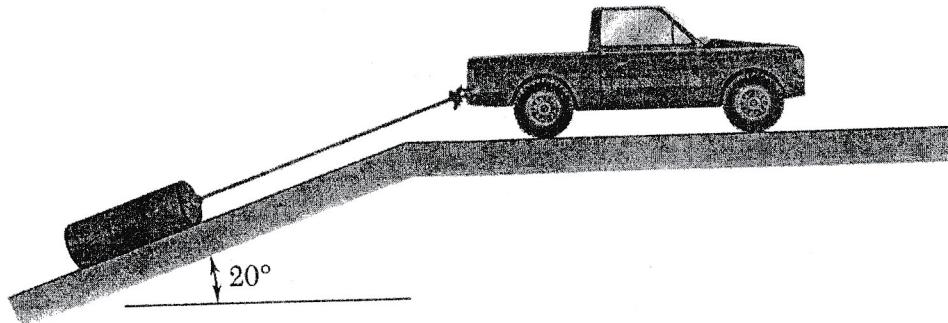
**Q2** Attempt any TWO parts.

- 2(a) A light train made up of two cars is traveling at 90 km/h when the brakes are [7.5] 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 traveled by the train before it comes to a stop, (b) the force in the coupling between the cars while the train is slowing down.

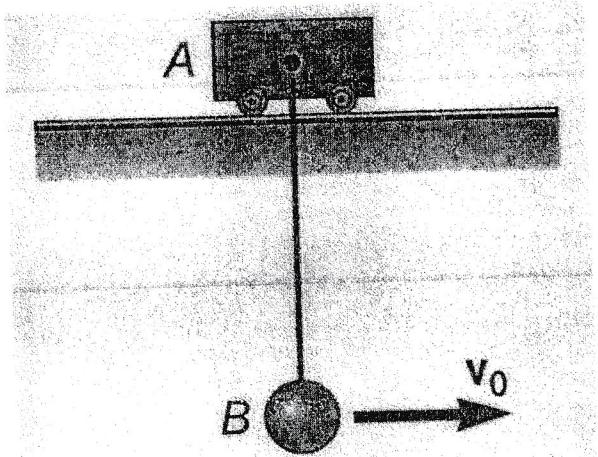


Contd.... 3.

- 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 0.5m/s. [7.5]



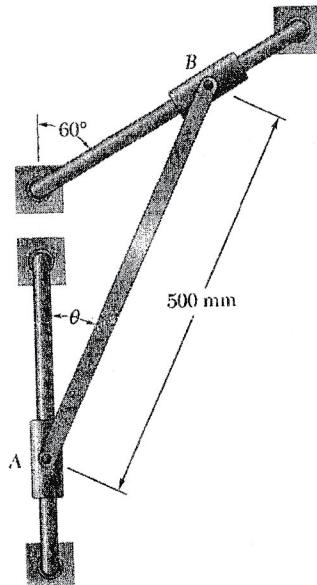
- 2(c) Ball B, of mass  $m_B$ , is suspended from a cord of length  $l$  attached to cart A, of mass  $m_A$ , which can roll freely on a frictionless horizontal track. If the ball is given an initial horizontal velocity  $v_0$  while the cart is at rest, determine (a) the velocity of B as it reaches its maximum elevation, (b) the maximum vertical distance  $h$  through which B will rise. (It is assumed that  $v_0^2 < 2gl$ .) [7.5]



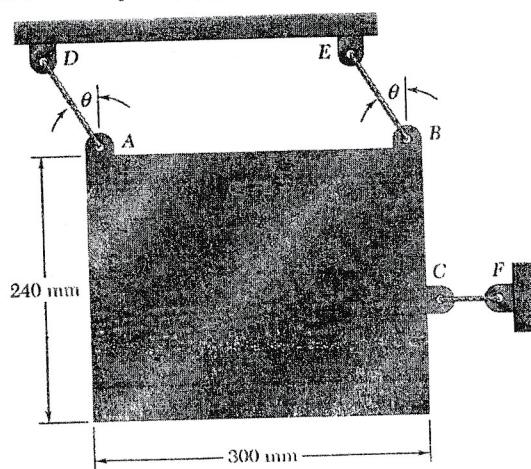
Contd.... 4.

**Q3** Attempt any TWO parts.

- 3(a)** Collar *B* moves downward to the left with a constant velocity of [7.5] 1.6 m/s. At the instant shown when  $\theta = 40^\circ$ , determine (a) the angular velocity of rod *AB*, (b) the velocity of collar *A*.

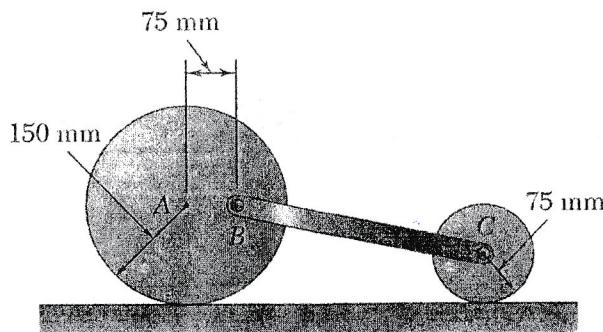


- 3(b)** A uniform rectangular plate has a mass of 5 kg and is held in position by three ropes [7.5] as shown. Knowing that  $\theta = 30^\circ$ , determine, immediately after rope *CF* has been cut, (a) the acceleration of the plate, (b) the tension in ropes *AD* and *BE*.



contd.... 5

- 3(c) The 5-kg rod  $BC$  is attached by pins to two uniform disks as shown. The mass of the [7.5] 150-mm-radius disk is 6 kg and that of the 75-mm-radius disk is 1.5 kg. Knowing that the system is released from rest in the position shown, determine the velocity of the rod after disk  $A$  has rotated through  $90^\circ$ .



## SECTION B

- Q 1a Define the following terms: [4]

- i. Ductility
- ii. Brittleness
- iii. Hardness
- iv. Toughness

- Q 1b The square plate is deformed into the shape shown by the dashed line. Determine [8] the average normal strain along diagonal  $AC$  and the shear strain of point  $E$  with respect to the  $x$  and  $y$  axes. (Fig. 1)

OR

- Q 1b' A bar made of mild steel has the dimensions shown in Fig. 2. If an axial force of  $P = 80 \text{ kN}$  is applied to the bar, determine the change in its length and the change in the dimensions of its cross section after applying the load. The material behaves elastically. (Take Young's modulus,  $E_{\text{steel}}$ : 200 GPa and Shear modulus,  $G_{\text{steel}}$ : 75.76 GPa)

- Q 2a Draw the shear force diagram for the beam given in Fig. 3. Also, draw shear stress [8] distribution at section passing through point  $C$ .

contd... 6.

- 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]

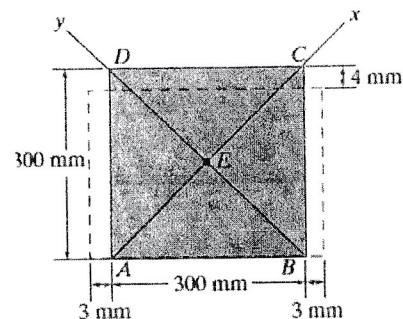


Fig. 1

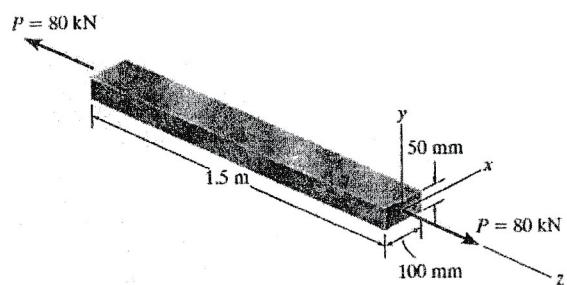


Fig. 2

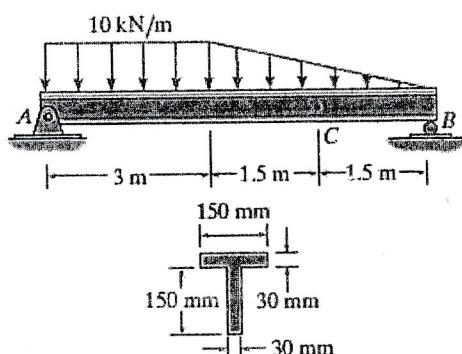


Fig. 3

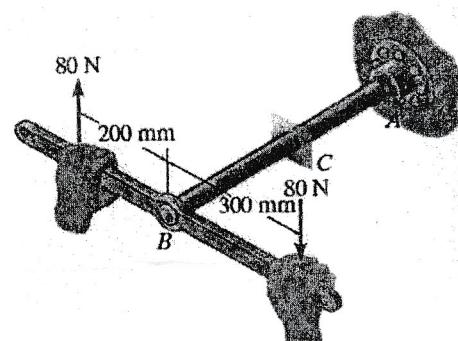


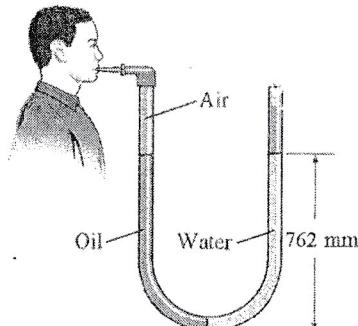
Fig. 4

2017-18

**B.Tech. (AUTUMN SEMESTER) EXAMINATION  
ALL BRANCHES  
ENGINEERING THERMODYNAMICS / THERMAL SCIENCES  
MEA 1110 / ME101**

**Maximum Marks: 60****Credits: 04****Duration: TWO Hours***Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q.No.	Question	M.M.
<b>1(a)</b>	Fill in the following blanks:	[05]
(i)	An isolated system is one, which permits the passage of _____	
(ii)	When two bodies are in thermal equilibrium there is no change in _____	
(iii)	For a system to be in thermodynamic equilibrium, do the temperature and pressure have to be the same everywhere? _____ (Yes/No)	
(iv)	Two examples of path function are _____	
(v)	Compressor of an air conditioner is an example of _____ system.	
<b>1(b)</b>	Consider a U-tube whose arms are open to the atmosphere (Figure 1). Now equal volumes of water and oil ( $\rho = 790 \text{ kg/m}^3$ ) are poured from different arms. A person blows from the oil side of the U-tube until the contact surface of the two fluids moves to the bottom of the U-tube, and thus the liquid levels in the two arms are the same. If the fluid height in each arm is 762 mm, determine the gage pressure the person exerts on the oil by blowing.	[06]

Figure 1*Contd... 2.*

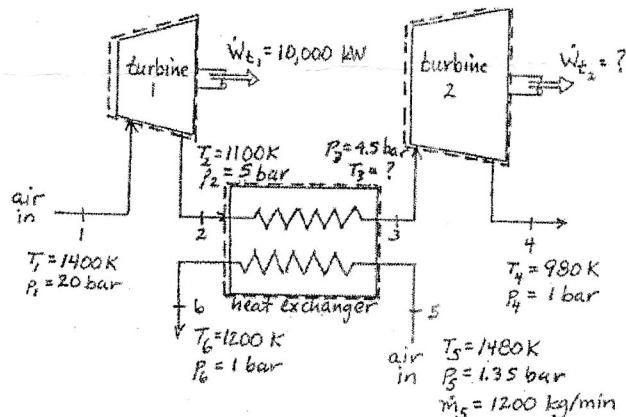
1(c) Define the following: [04]

- (i) Continuum
- (ii) Quasi-equilibrium process

2(a) The electric motor of a crane is supplied with a current of 14 Amperes from a 200 Volt DC supply for a period of 15 seconds while the crane lifts a machine of mass 200 kg through a vertical distance of 2 m. The weight of the inextensible cable and the resistance of the pulleys over which the cable passes are negligible. Evaluate the work done by the underlined systems. [05]

2(b) Air flows through two turbine stages and an interconnecting heat exchanger (Figure 2). A separate hot air stream passes in counter-flow through the heat exchanger. Data are known at various locations. Neglecting changes in velocities and elevation, determine the temperature of the main air stream exiting the heat exchanger and the power output of the second turbine. For air, take  $C_p = 1005 \text{ J/kg K}$  and assume that the enthalpy of air is a function of temperature only. [10]

Figure 2



OR

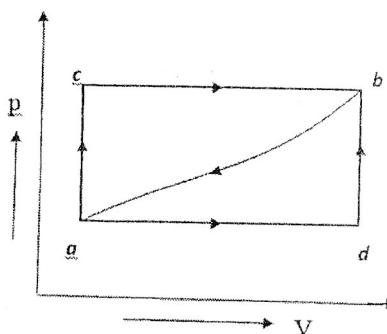
2(b') (i) Prove that energy is a property. [05]

(ii) When a system is taken from state 'a' to state 'b', as shown in Figure 3, along path 'acb', 84 kJ of heat flows into the system, and the system does 32 kJ of work. (a) Determine the amount of heat flowing into the system along path 'adb'. [05]

contd....3.

if the work done is 10.5 kJ? (b) When the system is returned from 'b' to 'a' along the curved path, the work done on the system is 21 kJ. During this process how much does the system absorb or liberate heat? (c) If  $U_a = 0$  and  $U_d = 42$  kJ, find the heat absorbed in the processes 'ad' and 'db'.

Figure 3



- 3(a) A rigid closed tank of volume  $3 \text{ m}^3$  contains 5 kg of wet steam at a pressure of 200 kPa. The tank is heated until the steam becomes dry saturated. Determine the final pressure and the heat transfer. [05]
- 3(b) Steam at a pressure of  $2 \times 10^6 \text{ N/m}^2$  and a temperature of  $250^\circ\text{C}$  flows steadily into a turbine with negligible velocity. The steam leaves the turbine at a pressure of  $15 \times 10^3 \text{ N/m}^2$  with a velocity of 200 m/s. The heat transfer rate from the turbine casing to the atmosphere is  $160 \times 10^3 \text{ W}$ . The power developed by the turbine is 3430 kW. The mass flow rate is 6.1 kg/s. Determine the dryness of the steam leaving the turbine and the cross-sectional area of the exit section. [10]

OR

- 3(b') (i) Steam at 0.8 MPa,  $250^\circ\text{C}$  flowing at the rate of 1 kg/s adiabatically mixes with wet steam at 0.8 MPa, 0.95 dryness fraction. After mixing, the flowrate is 2.3 kg/s. Determine the state of steam after mixing. [05]
- (ii) Explain the working of a throttling calorimeter with the help of a schematic diagram of the apparatus and an enthalpy-pressure property diagram.

Answer any three (03) questions from the following:

[05]  $\times 3$

- 4(a) State Kelvin-Planck and Clausius statements of second law of thermodynamics and establish their equivalence.

contd...4.

- 4(b) What are the processes occurring in a 4-stroke SI engine? Also show the air standard Otto cycle on a P-v and T-s diagram.
- 4(c) A heat engine is used to drive a heat pump. Heat transferred from the heat engine and heat pump is used to heat water circulating through the radiators of a building. The efficiency of heat engine is 27% and the coefficient of performance of heat pump is 4. Evaluate the ratio of the heat transfer to circulating water to the heat transfer to heat engine.
- 4(d) A heat engine operates steadily on the following cycle. Saturated water at a temperature of  $200^{\circ}\text{C}$  is pumped into a boiler and leaves as dry saturated steam at a temperature of  $200^{\circ}\text{C}$ . After adiabatic expansion through a turbine to a pressure of  $100 \times 10^3 \text{ N/m}^2$  the dryness fraction is 0.90. The exhaust steam from the turbine passes to a condenser and is partially condensed, leaving at a pressure of  $100 \times 10^3 \text{ N/m}^2$  with a dryness fraction of 0.15. The wet steam leaving the condenser is then compressed adiabatically in the feed pump before re-entering the boiler as saturated water at  $200^{\circ}\text{C}$ .
- Determine the specific entropy values around the cycle.
  - State whether the turbine and pump processes are reversible or irreversible; give reason.

2017-18

B.TECH. (I<sup>ST</sup> SEMESTER) EXAMINATION  
 ALL BRANCHES  
 ENGINEERING MECHANICS  
 MEA-1120

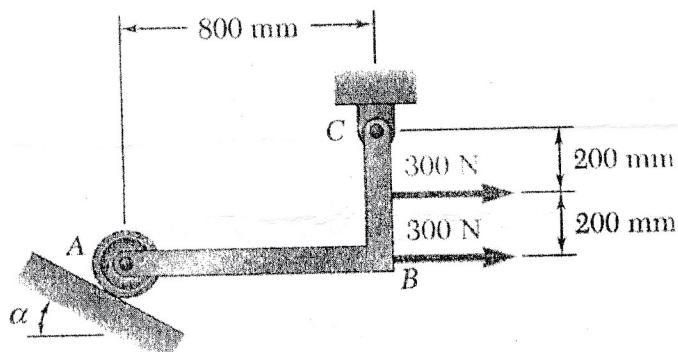
Maximum Marks: 60

Credits: 04

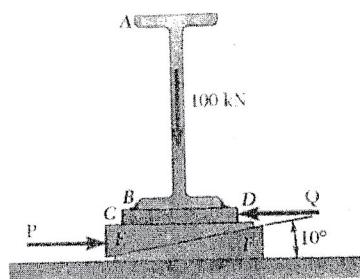
Duration: Two Hours

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

Q.No.	Question	M.M.
Q1	Attempt any TWO parts.	
1(a)	Determine the reactions at A and C when (a) $\alpha = 0$ (b) $30^\circ$ .	[7.5]

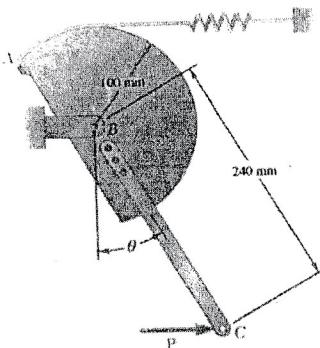


- 1(b) The elevation of the end of the steel beam supported by a concrete floor is adjusted by means of the steel wedges E and F. The base plate CD has been welded to the lower flange of the beam, and the end reaction of the beam is known to be 100 kN. The coefficient of static friction is 0.30 between two steel surfaces and 0.60 between steel and concrete. If the horizontal motion of the beam is prevented by the force Q, determine (a) the force P required to raise the beam, (b) the corresponding force Q. [7.5]

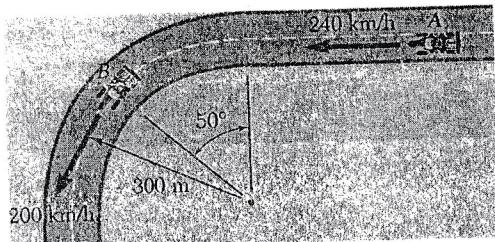


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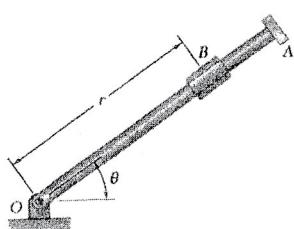
- 1(c) A horizontal force  $P$  of magnitude 200 N is applied to the mechanism at C. The constant of the spring is  $k = 2.25 \text{ kN/m}$  and the spring is unstretched when  $\theta = 0$ . Neglecting the weight of the mechanism, determine the value of  $\theta$  corresponding to equilibrium. [7.5]



- 2(a) Race car A is travelling on a straight portion of the track while racecar B is traveling on a circular portion of the track. At the instant shown, the speed of A is increasing at the rate of  $10 \text{ m/s}^2$ , and the speed of B is decreasing at the rate of  $6 \text{ m/s}^2$ . For the position shown, determine (a) the velocity of B relative to A, (b) the acceleration of B relative to A. [7.5]



- 2(b) Rod OA oscillates about O in a horizontal plane. The motion of the 2.5 kg collar B is defined by the relations  $r = 250/(t + 4)$  and  $\theta = (2/\pi) \sin \pi t$ , where  $r$  is expressed in mm,  $t$  in seconds, and  $\theta$  in radians. Determine the radial and transverse components of the force exerted on the collar when (a)  $t = 1 \text{ s}$ , (b)  $t = 6 \text{ s}$ . [7.5]

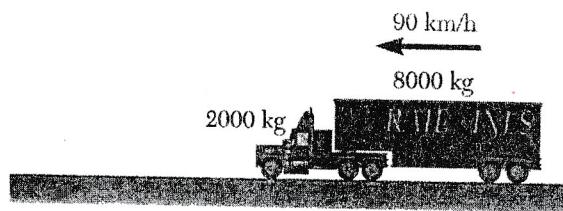


OR

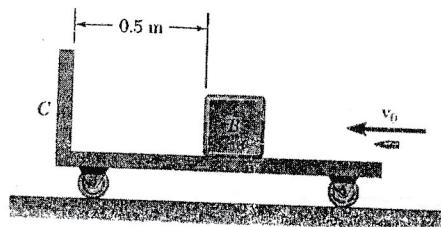
- 2'(a) A trailer truck with a 2000-kg cab and an 8000-kg trailer is travelling on a level road at 90 km/h. The brakes on the trailer fail and the antiskid system of the cab provides the largest possible force which will not cause the wheels of the cab to slide. [7.5]

Contd... 3

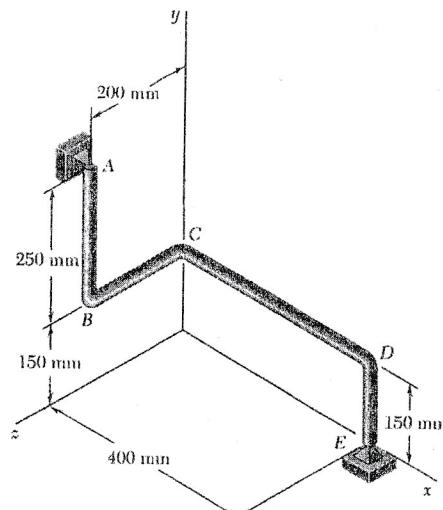
Knowing that the coefficient of static friction is 0.65, determine (a) the shortest time for the rig to come to a stop, (b) the force in the coupling during that time.



- 2'(b) A 30-g bullet is fired with a horizontal velocity of 450 m/s and becomes embedded in block *B* which has a mass of 3 kg. After the impact, block *B* slides on 30-kg carrier *C* until it impacts the end of the carrier. Knowing the impact between *B* and *C* is perfectly plastic and the coefficient of kinetic friction between *B* and *C* is 0.2, determine (a) the velocity of the bullet and *B* after the first impact, (b) the final velocity of the carrier. [7.5]



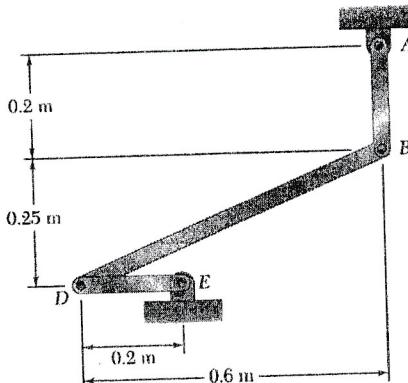
- 3(a) The bent rod *ABCDE* rotates about a line joining Points *A* and *E* with a constant angular velocity of 9 rad/s. Knowing that the rotation is clockwise as viewed from *E*, determine the velocity and acceleration of corner *C*. [7]



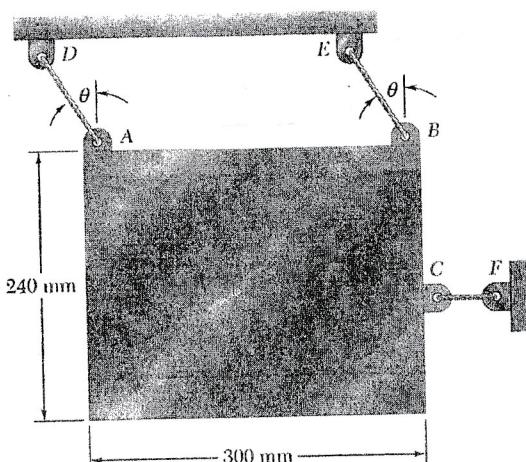
OR

contd.... 4.

- 3(a') Knowing that at the instant shown the angular velocity of rod  $AB$  is  $15 \text{ rad/s}$  [7] clockwise, determine (a) the angular velocity of rod  $BD$ , (b) the velocity of the midpoint of rod  $BD$ .



- 3(b) A uniform rectangular plate has a mass of  $5 \text{ kg}$  and is held in position by three ropes as shown. Knowing that  $\theta = 30^\circ$ , determine, immediately after rope  $CF$  has been cut, (a) the acceleration of the plate, (b) the tension in ropes  $AD$  and  $BE$ . [8]



- 4 A slender rod of length  $l$  and weight  $W$  is pivoted at one end as shown. It is released from rest in a horizontal position and swings freely. (a) Determine the angular velocity of the rod as it passes through a vertical position and determine the corresponding reaction at the pivot, (b) Solve Part a for  $W = 10 \text{ N}$  and  $l = 1 \text{ m}$ . [15]

