2023-24
B.TECH I SEMESTER EXAMINATION
APPLIED CHEMISTRY
(ACS 1110)

Maximum Marks: 60 **Credits: 04** **Duration: 2Hrs**

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)	Explain any two of the followings: (i) Reactions involved in deionization and regeneration of ion-exchange resin (ii) Prevention of scale formation by phosphate conditioning (iii) Desalination of brackish water by electrodialysis	(CO1)	[2×2]
1.(b)	A sample of water contains following impurities: $Mg(HCO_3)_2$ = 70 mg/L; $CaCl_2$ = 219 mg/L; $MgSO_4$ = 117 mg/L; $Ca(NO_3)_2$ = 161 mg/L; NaCl = 60 mg/L and Fe_2O_3 = 40 mg/L. Calculate the quantity of lime (74% pure) and soda (90% pure) needed for softening 20,000 L of water. Also calculate temporary, permanent and total hardness.(Atomic weights: Mg = 24; Ca = 40; N = 14; C = 12; O = 16; H = 1; Cl = 35.5; S = 32; Na = 23; Fe = 56)	(CO1)	[5]
1.(c)	Mention the different reasons for boiler corrosion. Explain any one of these.	(CO1)	[3]
1.(d)	Differentiate between sedimentation and sedimentation with coagulation. Explain the role of copperas and alum in the removal of suspended impurities.	(CO1)	[3]
	OR		
1.(d')	What is disinfection of water? Draw a neat and labelled break-point chlorination curve and give its significance.	(CO1)	[3]
2.(a)	0.82g of a fuel containing 70% carbon, when burnt in bomb calorimeter, increased the temperature of water from 27.1 to 29.3 °C. If the calorimeter contains 450g of water and its water equivalent is 150g, calculate the HCV of the fuel. Give your answer in kJ/Kg.	(CO2)	[3]
	OR		
2.(a')	Using Dulong's formula, calculate the gross and net calorific value of	(CO2)	[3]

contd....2.

ethane (C_2H_6) and ethanol (C_2H_5OH). (Atomic weights: C=12; O=16; H=1)

2.(b)	Explain the reason for the difference in the percentage carbon determined from the proximate analysis and ultimate analysis.	(CO2)	[2]
2.(c)	What is synthetic petrol? With the help of a labelled diagram, describe its synthesis by Bergius process.	(CO2)	[5]
2.(d)	Define lubricant and write any four of its important functions. Discuss the mechanism of extreme pressure lubrication.	(CO2)	[5]
3.(a)	Giving suitable example differentiate between wet and dry corrosion. Write the mechanism of wet corrosion by absorption of oxygen.	(CO3)	[5]
3.(b)	Give suitable reasons to explain **any three** of the following: i) A copper equipment should not possess a small iron bolt. ii) Aluminium doors are usually not painted for corrosion control. iii) In electrochemical corrosion of iron, corrosion occurs at anode and rust get deposited at or near cathode. iv) Iron corrodes faster than aluminum, even though Iron is placed below Aluminum in the electrochemical series.	(CO3)	[2×3]
3.(c)	Write short note on **any two** of the followings: i) Microbial corrosion ii) Functions of vehicle in paint iii) Characteristics of a good varnish	(CO3)	[2×2]
4.(a)	Define polymers. Give the classification of polymers on the basis of their origin and method of synthesis.	(CO4)	[5]
4.(b)	Explain the mechanism of addition polymerisation.	(CO4)	[4]
4.(c)	Discuss the preparation, properties and uses of Teflon or polystyrene.	(CO4)	[3]
4.(d)	Write the chemical structure of monomer(s) of the polymers given under: (i) PVC (ii) Nylon-6,6 (iii) Neoprene	(CO4)	[3]

2023-24

B. TECH./B.ARCH. (ODD SEMESTER) EXAMINATION

APPLIED MATHEMATICS-I

AMS-1110

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

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

Q.No.	Question	CO	M.M.
1(a)	Attempt **THREE** parts:	(CO1)	[09]

i. Let $P = \left\{\begin{pmatrix} a \\ b \end{pmatrix},\ a, b \geq 0\right\}$ with usual addition and scalar multiplication. Check whether the set P is a vector space.

ii. Find the values of λ and μ for which the system of equations

$$x + y + z = 6$$
$$x + 2y + 3z = 10$$
$$x + 2y + \lambda z = \mu$$

is consistent and has a unique solution.

iii. Let A be 2×2 real matrix with $\det A = 1$ and $trace\ A = 3$. Compute the value of $trace\ A^2$.

iv. Consider a matrix $A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 4 & -2 \\ 0 & 1 & 1 \end{pmatrix}$. The matrix A satisfies the equation $6A^{-1} = A^2 + cA + dI$, where c and d are scalars and I is an identity matrix. Find the value of $(c + d)$ using Cayley Hamilton Theorem.

1(b) Find the Eigen values and Eigen vectors of the matrix (CO1) [06]

$$A = \begin{pmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{pmatrix}$$

Is it possible to find a matrix P such that $P^{-1}AP$ is a diagonal matrix?

2(a) Attempt **ALL** parts: (CO2) [09]

i. If x^n is an integrating factor of $(y - 2x^3)dx - x(1 - xy)dy = 0$ then find n and solve the differential equation.

ii. Solve the nonhomogeneous differential equation

$$y'' + 2y' + y = e^{-x}\left(\frac{1}{x^2} + \cos 2x\right).$$

Contd...2.

iii. Solve the differential equation using the method of variation of parameters

$$y'' - 6y' + 9y = \frac{e^{3x}}{x^2}.$$

2(b) Solve the simultaneous differential equation (CO2) [06]

$$D^2y = x - 2, \quad D^2x = y + 2.$$

OR

2(b') A circuit consists of an inductance of 2 henries, a resistance of 4 ohms, and a capacitance of 0.05 farad. If $q = i = 0$ at $t = 0$, find $q(t)$ and $i(t)$ when there is a constant emf of 100 volts.

3(a) Attempt any **TWO** Parts : (CO3) [10]

i. Find all the asymptotes of the curve

$$y^3 - 5xy^2 + 8x^2y - 4x^3 - 3y^2 + 9xy - 6x^2 + 2y - 2x - 1 = 0.$$

ii. If $y = \frac{\sin^{-1}x}{\sqrt{1-x^2}}$, show that $y = x + \left(\frac{2}{3}\right)x^3 + \frac{2.4}{3.5}x^5 + \frac{2.4.6}{3.5.7}x^7 + \cdots$

iii. Test the convergence of the series:

a) $\frac{1}{1.2.3} + \frac{2}{2.3.4} + \frac{5}{3.4.5} + \cdots$

b) $\sum_{n=1}^{\infty} \sqrt{\frac{n}{n^2+1}}x^n.$

3(b) Trace the curve $y^2(a + x) = (a - x)x^2$ by giving all its salient features. (CO3) [05]

4(a) Attempt any **TWO** parts: (CO3) [10]

i. Find the intrinsic equation of the curve $y = a\ log\ \sec\left(\frac{x}{a}\right)$.

ii. Find the length of one arch of the cycloid
$x = a(\theta + \sin\theta), y = a(1 - \cos\theta)$.

iii. Find the volume of the solid generated by the revolution of the curve
$(a - x)y^2 = a^2x$ about its asymptote.

4(b) Find the surface of the solid formed by the revolution of the curve $r^2 = a^2\cos 2\theta$ about the initial line. (CO3) [05]

Code No. 6466

2023-24

B. Tech. (All Branches)) Odd Semester Examination

Applied Physics

APS1110

Maximum Marks: 60 **Credits: 4** **Duration: Two Hours**

Answer all the questions.

Symbols have their usual meanings, use appropriate notations wherever required.

1(a)	What are semiconducting materials? With the help of a suitable diagram describe the formation of energy bands in silicon.	[4.0]	CO1
(b)	Derive expressions for the electron and hole concentrations at equilibrium in a semiconductor using the concept of effective density of states and show that $n_0 p_0 = n_i^2$.	[4.0]	CO1
	Or		
(b')	Show that the current arising due to a hole shifting in the valence band of a semiconductor is actually due the uncompensated electron motion.	[4.0]	CO1
(c)	With help of suitable plots discuss the temperature dependence of carrier concentrations for the intrinsic and extrinsic semiconductors.	[4.0]	CO1
(d)	For a given semiconductor, why is the electron mobility always higher than the hole mobility? The intrinsic carrier concentration of Si is 1.5×10^{16} m^{-3}. If the mobility of electron and holes are 0.13 and 0.15 $m^2 V^{-1} s^{-1}$, calculate the conductivity.	[3.0]	CO1
2(a)	Write the full form of LASER. Define the terms: Stimulated emission, Metastable states, Population inversion and cavity.	[4.0]	CO2
(b)	Discuss the principle and working of He-Ne laser with the help of suitable diagrams. Write various important characteristics and applications of laser.	[5.0]	CO2
(c)	On what principle does an optical fiber work? Obtain an expression for the numerical aperture of an optical fiber in terms of the refractive indices of its core and cladding and hence define its acceptance angle. Briefly describe the phenomena of signal distortion and transmission losses in an optical fiber.	[6.0]	CO2
	Or		
(c')	Draw a block diagram showing an optical fiber communication system. Mention the applications of the fiber optics in medical and industry. Give important merits of fiber optic transmission.	[6.0]	CO2
3(a)	State and prove Heisenberg uncertainty principle.	[3.0]	CO3
(b)	Distinguish between phase and group velocities. Obtain an expression for group velocity, and show that the group velocity associated with a moving particle is always equal to the particle velocity.	[6.0]	CO3

Contd…..2

(c) Solve the Schrodinger equation for a particle trapped in a one dimensional box of width – L to + L, and obtain the expression for its normalized wave functions. Plot the wave functions and probability destines for the first four quantum states. [6.0] CO3

Or

(c') Discuss tunnel effect qualitatively? Support your answer by considering the α-decay of radioactive nuclei. Electrons with energies of 1.0 eV and 2.0 eV are incident on a barrier 10.0 eV high and 0.50 nm wide. [6.0] CO3

(i) Find their respective transmission probabilities.

(ii) How are these affected if the barrier is doubled in width?

4(a) Compare Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distribution functions. [4.0] CO4

(b) Show that the probability of occupancy of a quantum state by two bosons to be in the same state is twice that for two classical particles and zero for two fermions. [4.0] CO4

(c) Consider a system of electron gas having number of electrons (N) and total energy (E) at temperature T. Find the expression for the number of electrons in the energy range $\epsilon \rightarrow \epsilon + d\epsilon$ and the average electron energy at T = 0 K. [7.0] CO4

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Useful Physical Constants:

h = 6.63×10^{-34}J.s; k=1.38×10^{-23}J/K; m_e= 9.1×10^{-31}kg; m_p= 1.67×10^{-27} kg, c= 3×10^{8} m/s; n_i= pi for Si at 300K = $1.5\times10^{16}/m^3$.

2023-24
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	Define the role of an Architect in a building construction industry?	[10]
	OR	
1'	Explain the need of an Architect in present day situation?	[10]
2	What are the basic Principles of Architectural Design, explain the use of 'Axis' as an indispensable Principle of architectural compositions?	[10]
3	What are the elements of architectural design, explain how different planes are employed in any architectural symphony?	[10]
4	How do Geography play an important role in architecture, what are the various considerations which have been taken care in buildings of different geographic conditions?	[15]
5	Explain why Falling Water has become one of the most important building of Frank Lloyd Wright, explain the salient features and philosophy used by FLW in designing this buildings?	[15]
	OR	
5'	Explain why Zaha Hadid is considered as a trend setting architect, explain with neat sketches the salient features of her philosophy in designing buildings?	[15]

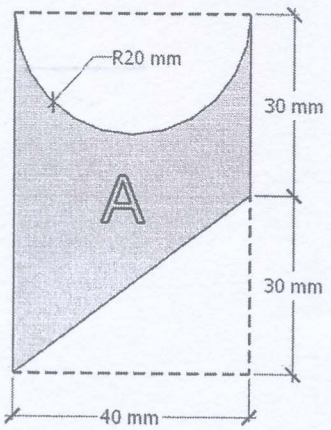
(6469)

2023-24
B.ARCH. (FIRST SEMESTER) EXAMINATION
ARC 1310, Architectural Drawing -I
Credits: 5

Maximum Marks: 40 **Duration: 2 Hours**

Answer all the questions.
Suitable assume any missing data.
All dimensions are in mm.
Neat and good drafted drawings will be credited more.

Q.No.	Question	M.M.
1	A hexagonal pyramid base 20mm side and height 45 mm has an edge of its base on ground. Its axis is inclined at 30° to the ground and parallel to the VP. Draw its orthographic projections.	10
	OR	
1'	Draw orthographic projections of a regular hexagon of 25mm side, having one of its sides in the HP and inclined at 60° to the VP, and its surface making an angle of 45° with the HP.	10
2	A square pyramid of 30 mm side and 80 mm height is lying on its base on H.P. such that the edges of the base are equally inclined to V.P.. It is cut by a plane inclined at 45° to H.P. and perpendicular to V.P.. The cutting plane bisects the axis of the prism. Draw sectional top view and true shape of the section.	10
3	A cube of side 30 mm rests on its square base on HP in such a way that its two vertical faces are parallel to VP. It is cut by a plane perpendicular to VP and inclined at 45° to HP. Cutting plane is passing through the center of the cube. Develop the complete surface of the lower part of the truncated cube.	10
	OR	
3'	Draw the development of the lateral surface of part 'A' of the truncated cylinder, front elevation of the same is shown in following figure: -	10



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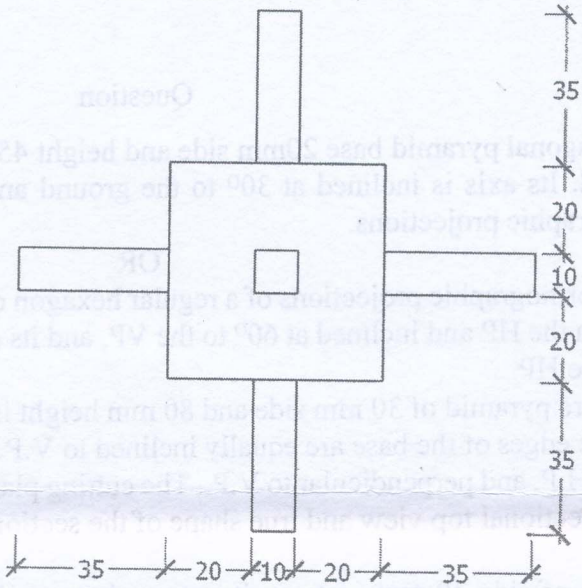
4 Draw isometric view of the object shown in Figure -1 10



PLAN FRONT AND SIDE ELEVATIONS
(All dimensions are in mm)

FIGURE - 1

2023-24
B.ARCH. (AUTUMN SEMESTER) EXAMINATION
B. ARCH I- YEAR
BASIC DESIGN AND VISUAL APPRECIATION
ARC-1610

Maximum Marks: 40 **Credits: 07** **Duration: Four Hours**

Q.No.	Question	M.M.
1	Derive anthropometrically the optimum size required for any one of the spaces given below, showing in plan the furniture / product, movement area and other necessary activities required: A- Dining Area for 8 persons. **OR** A'- Parking Area for a Sedan Car.	[10]
2	Design a double occupancy hostel room with an attached toilet on a scale of 1:20, showing the necessary furniture and fixtures? A- Viva [05] B- Plan [15] C- Elevation/ View [10]	[30]

2023-24
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.	CO
1(a)	Draw a neat diagram of engineering stress-strain curve for mild steel material under uniaxial tension and discuss important stages in the curve.	[5]	CO1
1(b)	The steel pipe is filled with concrete and subjected to a compressive force of 80 kN (Fig. 1). Determine the average normal stress in the concrete and the steel due to this loading. The pipe has an outer diameter of 80 mm and an inner diameter of 70 mm. E_{st} = 200 GPa, E_c = 24 GPa.	[10]	CO1
	OR		
1(b')	The rod has a slight taper and length 'L'. It is suspended from the ceiling and supports a load 'P' at its end (Fig. 2). Show that the displacement of its end due to this load is $\delta = PL/\pi E r_2 r_1$. Neglect the weight of the material. The modulus of elasticity is 'E'.	[10]	CO1
2	A beam ABC with an overhang at one end supports a uniform load of intensity 20 kN/m in AB segment and a concentrated load of 20 kN magnitude at C (Fig. 3). Draw the shear-force and bending-moment diagrams for the beam. Show the point of contraflexure (if any), location of zero shear (if any) and location of maximum bending moment.	[15]	CO2
3(a)	State the assumptions of bending theory and derive the flexure formula.	[5]	CO3

Contd.....2.

3(b)	If the beam is subjected to a bending moment of M = 20 kNm, determine the maximum bending stress in the beam (Fig. 4).	[10]	CO3
	OR		
3(b')	The pipe shown in Fig. 5 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 shear stress developed in the material at the inner and outer walls along the central portion of the pipe when the 80-N forces are applied to the wrench.	[10]	CO3
4	Determine the force in each member of the truss using Method of Joints and state whether it is in tension or compression (Fig. 6).	[15]	CO4
	OR		
4'	Determine the resultant forces at the pins A, B, and C of the three-hinged arched roof truss (Fig. 7).	[15]	CO4

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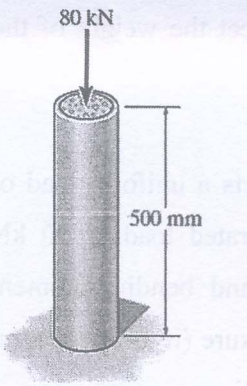

Fig. 1

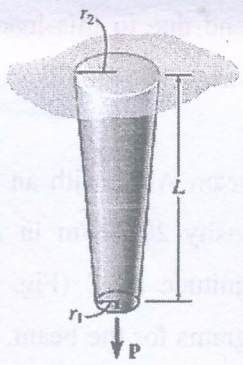

Fig. 2

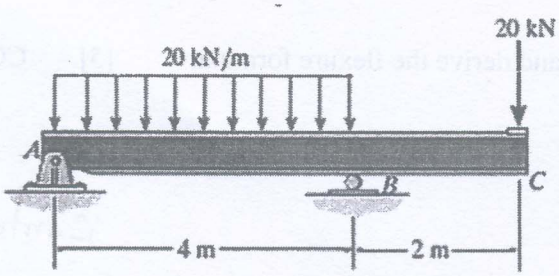

Fig. 3

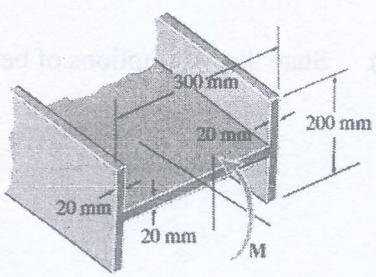

Fig. 4

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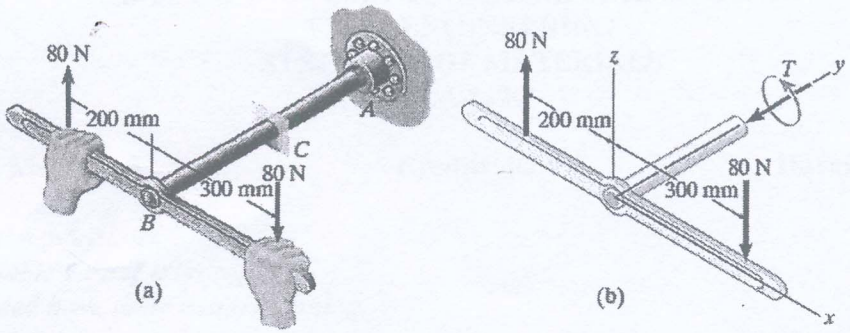


Fig. 5

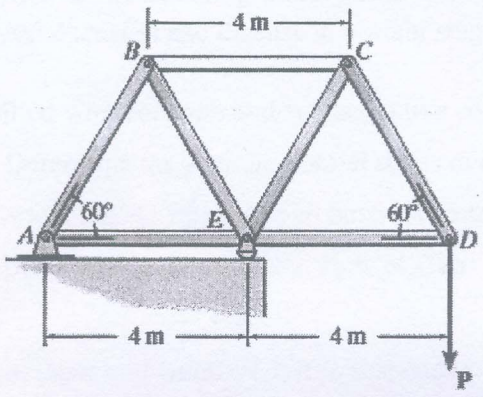


Fig. 6

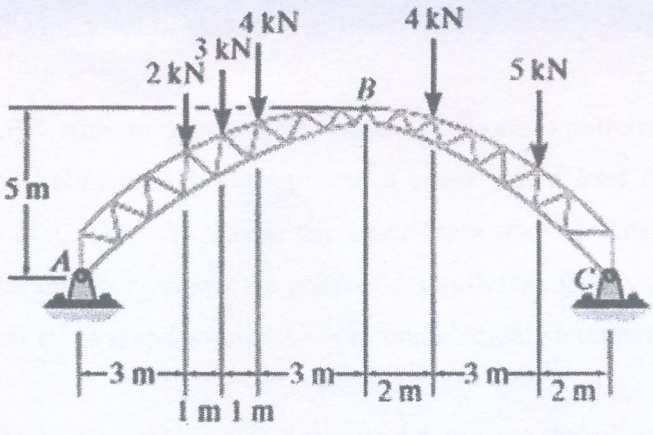


Fig. 7

2023-24

B.TECH. (AUTUMN SEMESTER) EXAMINATION

ENVIRONMENTAL STUDIES

CEU-1110/CEA-1110

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

Answer all the questions.

Q.No.	Question	COs	M.M.
1(a)	Discuss the benefits of using renewable energy sources for the conservation of energy resources & protecting the environment.	CO1	7.5
1(b)	Explain the importance of water as a resource along with rising national and international water conflict. Support your answer with suitable examples.	CO1	7.5
2(a)	Discuss the steps taken for Disaster management and its mitigation. Also write about its major consequences.	CO2	7.5
	OR		
2(a)	Write in detail about causes and effects of ozone layer depletion. Also discuss the relevant international agreement undertaken to address this situation.	CO2	7.5
2(b)	Discuss the structure and classification of an ecosystem? Explain marine ecosystem in detail	CO2	7.5
3(a)	Write a detailed note on ecosystem and biodiversity services.	CO3	7.5
3(b)	Explain the exponential & logistic growth of human population and factors that affect the human population growth.	CO3	7.5
	OR		

Contd ....2.

3(a)	Discuss the strategies and methods of biodiversity conservation in detail.	CO3	7.5
3(b)	Explain the concept of carbon footprint, its types and methods to reduce carbon footprints.	CO3	7.5
4(a)	Discuss in brief about the importance & objectives of "Air (Prevention and control of pollution) act, 1981". Also discuss the functioning of State board under this act.	CO4	7.5
4(b)	Discuss the term "Resettlement & Rehabilitation" with some natural and man- made causes	CO4	7.5

OR

4(b)	How did the Chipko movement contribute to environmental protection, and what were the key principles and strategies employed by the activists to address deforestation and promote sustainable forestry practices?	CO4	7.5

2023-2024

B. TECH. (ODD SEMESTER) EXAMINATION

(ELECTRICAL ENGINEERING)

PRINCIPLES OF ELECTRICAL ENGINEERING

(EEA1110)

Maximum Marks: 60 **Duration: 2 Hours**

Note:

Assume suitable data if missing.

Notations and symbols used have their usual meaning.

Q.No.	Question	COs	M.M.
Q1(a)	Define the following terms in brief: a) Form Factor and Peak Factor b) Transient and Steady State	CO1	**[04]**
Q1(b)	A balanced star-connected load having a 30 Ω resistance in each leg is connected to a three-phase, delta-connected generator having a line voltage of 208 V. Find the magnitude of **(a)** the phase voltage of the generator, **(b)** the phase voltage of the load **(c)** the phase current of the load **(d)** the line current.	CO1	**[05]**
Q1(c)	State superposition theorem. Using Norton's theorem, find the current through the impedance Z3 in the network shown in Figure 1.	CO1	**[06]**

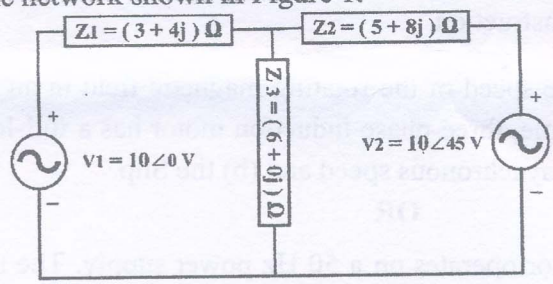


Figure 1: Circuit diagram for Q.1(c)

OR

Q1(c')	State superposition theorem. Find the Thevenin equivalent circuits for the network in the enclosed region shown in Figure 2. Also find the current flowing through the load resistance of 1kΩ.	(CO1)	**[06]**

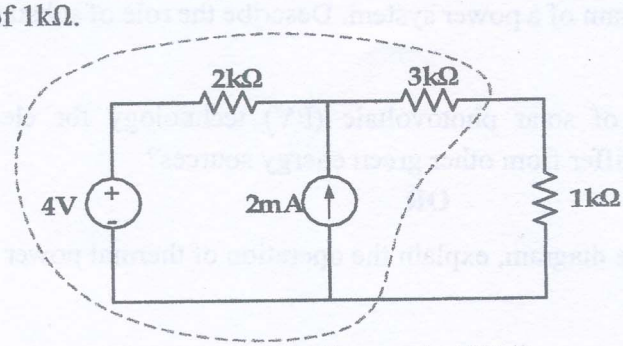


Figure 2: Circuit diagram for Q1(c')

Contd.....2.

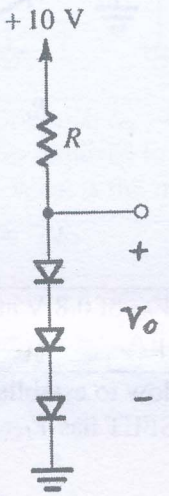
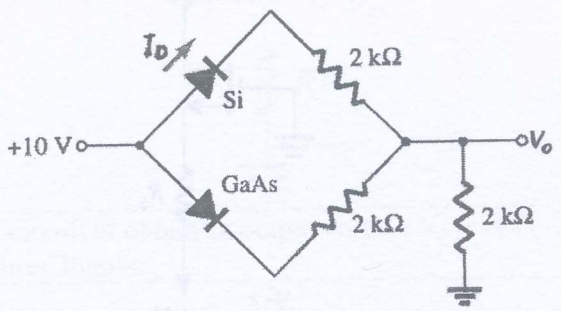
Q2(a)	A closed magnetic circuit of cast steel contains a 6 cm long path of cross-sectional area of 1 cm^2 and a 2 cm long path of cross-sectional area of 0.5 cm^2. A coil of 200 turns is wound around the 6 cm length of the circuit, and a current of 0.4 A flows. Determine the flux density in the 2 cm path if the relative permeability of the cast steel is 750.	CO2	**[04]**
Q2(b)	Derive the expression of induced EMF in a single-phase transformer.	CO2	**[05]**
Q2(c)	A 500 KVA, single phase transformer working at unity power factor has an efficiency of 95% both at full load and 60% of full load. a) Separate out the losses of the transformer b) Determine the efficiency at 75% full load	CO2	**[06]**
	OR		
Q2(c')	A single-phase, 50 Hz transformer has 25 primary turns and 300 secondary turns. The cross-sectional area of the core is 300 cm^2. When the primary winding is connected to a 250 V supply, determine (a) the maximum value of the flux density in the core and (b) the voltage induced in the secondary winding.	CO2	**[06]**
Q3(a)	Discuss the construction and operation of an alternator. Classify different types of alternators based on rotor construction.	CO3	**[07]**
Q3(b)	Derive the expression for the speed of the rotating magnetic field in an induction motor. A 230-V, 60-Hz, 8-pole, three-phase induction motor has a full-load speed of 850 rpm. Calculate (a) its synchronous speed and (b) the Slip.	CO3	**[08]**
	OR		
Q3(b')	A three-phase induction motor operates on a 50 Hz power supply. The motor has six poles and runs at a slip of 3%. Determine the synchronous speed, rotor speed, and the actual speed of the motor. Also, calculate the frequency of the rotor currents.	CO3	**[08]**
Q4(a)	Draw the single-line diagram of a power system. Describe the role of substations in a transmission system.	CO4	**[07]**
Q4(b)	Discuss the advantages of solar photovoltaic (PV) technology for electricity generation. How does it differ from other green energy sources?	CO4	**[08]**
	OR		
Q4(b')	With the help of a suitable diagram, explain the operation of thermal power plant.	CO4	**[08]**

2023-24

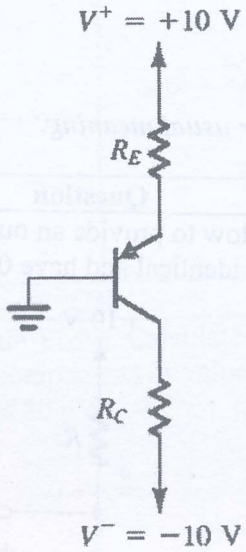
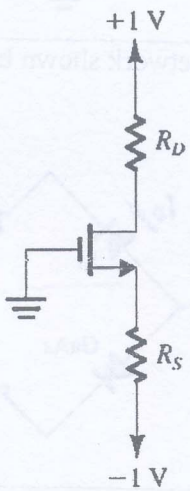
B. TECH. (ODD SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
PRINCIPLES OF ELECTRONICS ENGINEERING
ELA1110

Maximum Marks: 60 **Credits: 03** **Duration: Two Hours**

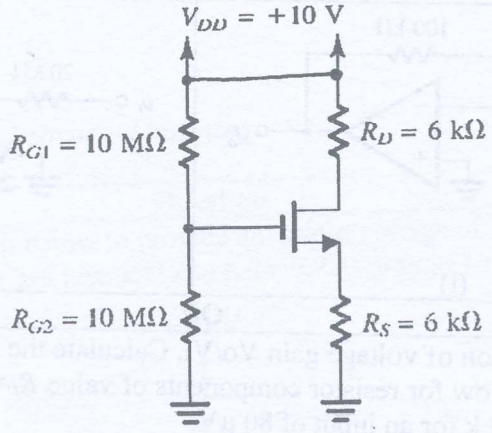
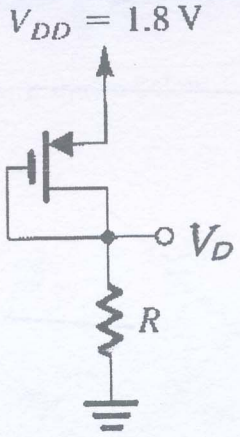
Answer all questions.
Assume suitable data if missing.
Notations and symbols used have their usual meaning.

Q.No.	Question	CO	M.M.
1(a)	Design the circuit shown below to provide an output voltage of 2.4 V. Assume that the diodes available are identical and have 0.7-V drop at 1 mA. 	(CO1)	[7]
1(b)	Determine V_o and I_D for the network shown below. 	(CO1)	[8]

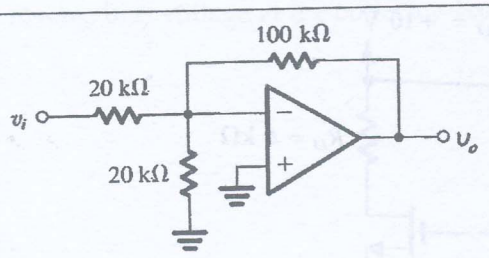
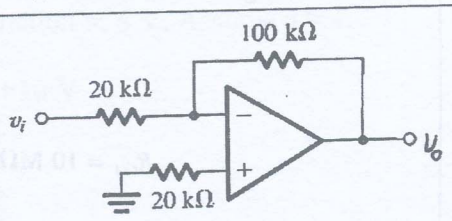
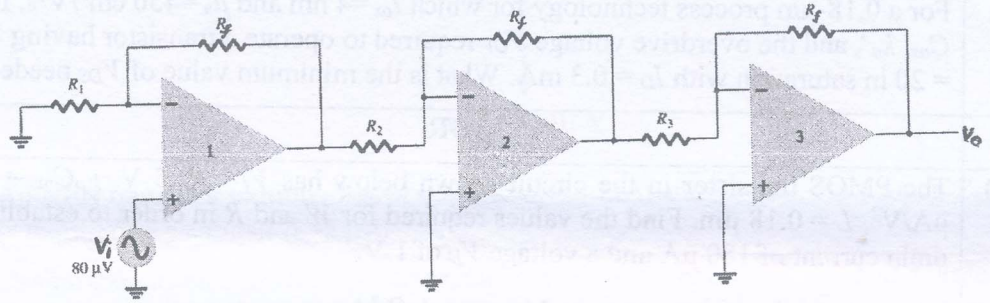
contd....2

2(a)	Draw the circuit configuration, input and output characteristics of common-emitter npn type BJT.	(CO2)	[5]
2(b)	Design the circuit shown below to establish a collector current of 1 mA and a reverse bias voltage at the collector–base junction of 4 V. Assume $\alpha \approx 1$.  	(CO2)	[7]
2(c)	An NPN transistor exhibits V_{BE} of 0.8 V at $I_C = 1$ mA, and $\beta = 100$. How much V_{BE} is required to establish $I_B = 2$ µA.	(CO2)	[3]
3(a)	Design the circuit shown below to establish a drain current of 0.1 mA and a drain voltage of +0.3 V. The MOSFET has $V_t = 0.5$ V, $\mu_n C_{ox} = 400$ µA/V^2, L = 0.4 µm, and W = 5 µm.  	(CO3)	[8]

Contd ....3.

	OR		
3(a')	Analyze the circuit shown below to determine the voltages at all nodes and the currents through all branches. Let $V_{tn} = 1$ V and $k_n'(W/L) = 1$ mA/V^2. 	(CO3)	[8]
3(b)	For a 0.18-μm process technology for which t_{ox} =4 nm and μ_n =450 cm^2/V·s, find C_{ox}, k_n', and the overdrive voltage V_{OV} required to operate a transistor having W/L = 20 in saturation with I_D = 0.3 mA. What is the minimum value of V_{DS} needed?	(CO3)	[7]
	OR		
3(b')	The PMOS transistor in the circuit shown below has V_t = −0.5 V, $\mu_p C_{ox}$ = 100 μA/V^2, L = 0.18 μm. Find the values required for W and R in order to establish a drain current of 180 μA and a voltage V_D of 1 V. 	(CO3)	[7]
4(a)	Design an OPAMP circuit to obtain an output voltage $V_o = -(V_1+2V_2+4V_3)$, where V_1, V_2 and V_3 are three inputs.	(CO4)	[7]
	OR		

Contd....4.

4(a')	Draw the circuit of OPAMP Differentiator. Determine the expression for output voltage in time domain as well as in frequency domain.	(CO4)	[7]
4(b)	Assuming ideal OPAMPs, find the voltage gain v_o/v_i for the circuits shown below.	(CO4)	[8]
	 (i)  (ii)		
	OR		
4(b')	Find the expression of voltage gain Vo/Vi. Calculate the output voltage using the circuit shown below for resistor components of value $R_f = 470$ k, $R_1 = 4.3$ k, $R_2 = 33$ k, and $R_3 = 33$ k for an input of 80 μV. 	(CO4)	[8]

Paper Code: 6594

2023 -2024

B.ARCH./ B. TECH. (ODD SEMESTER) EXAMINATION

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

ENGLISH

(EZH-1110)

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. The question of the origin and evolution of the universe is perhaps one of the most mysterious ones that has always preoccupied the imagination of man. The reason probably lies in the being of man. Astrophysicists still seek to unravel the mysteries of the universe and believe that they would find the final answer some day in the future. What change this ultimate discovery will bring in man's perception about himself and his position in this world is very difficult to speculate. Such preoccupation is perhaps neither materialistic nor has it necessarily a utilitarian end. It is, rather, driven by the belief that there is value in the very process of exploration. The real pleasure of such pursuit lies in one's ability to communicate with clarity in simple and precise ways complex phenomena. The flair for communicating science comes from one's struggle to understand; one has to work hard to achieve that understanding. No wonder then, it leads to the realisation that understanding is a kind of ecstasy that comes from the struggle that often ends in failure and frustration. To ponder and puzzle over something, to grapple with a problem or with a dense text, to figure out how something works, to repeat an exercise over and over until one gets it right, to practice a move a dozen times or more to achieve fluid perfection. It is the struggle that leads one out of confusion into wonder. For many of students, the idea of struggle is off-putting. All talk of making education and learning fun seems to suggest some kind of innocuous pursuit. In short, the idea of working has got a bad rap. Of course, movies have unnecessarily romanticised the process of achieving mastery in some areas, but the struggle associated with achieve mental and intellectual clarity often remains unseen. In much of education – through school and college- the responsibility for making something understood lies with the teacher. The idea that students too must work toward that understanding is not sufficiently emphasised. We enjoy the difficulty that games present, and we are even willing to get higher levels of challenge for ourselves and feel a thrill when we meet those challenges. But when it comes to grappling with complex and difficult subjects we want to outsource that process, we look to the textbook or the teacher to simplify it for us, instead of using our own mental tools. The teacher's role is to sharpen those tools. The demand of the intellectual struggle requires one to get rid of the idea that learning has to be easy. Thus, the most valuable kind of understanding, one that makes one ecstatic, usually comes with intense struggle.

Contd....2.

I. What understanding does the paragraph offer about the modern perception of learning? (2)

II. Comment on the relation between games and learning. (2)

III. How does the writer underline the ecstasy of learning? (2)

IV. What does the phrase 'innocuous pursuit' imply? (2)

V. What is peculiar about astrophysicist's approach to knowledge? (2)

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

Unit-II

Q2. Critically examine the theme of falsification of facts in *Animal Farm*. (5)

OR

Comment on the elements of hope and fear in *Animal Farm*.

Q3. Explain the fusion of reality and fantasy in *The Time Machine*. (5)

OR

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

Unit-III

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

OR

Write a report (in 250 words) on the National Conference recently held at ZHCET on **Scientific Education and Development of Society.**

Contd.... 3.

6594

Unit-IV

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

Technology impacts on our daily lives. Our environments are all so full of technology to the point that most of the time we take it for granted and never actually notice the level of impact that it has on us until when we have no telephone, transport, water or electricity. Advancements in technology have greatly increased our living standards. Despite the fact that we are currently experiencing very high inflation rates and the rates of unemployment are very high, generally, people are feeding better, are dressing better and are as a matter of fact living more comfortable lives. Technology also has a great impact on all the fundamental aspects of all our cultures including laws and how they are enforced, language, art, health care, mobility, education and religion. For instance the great technological improvements in health care have given a chance to doctors to treat their patients in an environment that is virtual through the use of mediums such as video conferencing which has also greatly benefited the legal environment as it allows the judges to still listen to the cases of hard core criminals who cannot be allowed to get into the court rooms due to security reasons. With every advancement that is made in the technological world, creative destruction results. For example, television impacts negatively on the movies and synthetic fibers impact the cotton fibers negatively. The coming in of new types of technology also results in a negative impact on the growth of the economy at times; television at times consumes all the productive hours that a man has in a day. Every new form of technology gets into the market together with long term consequences that are most of the time not foreseeable. For instance is there really a justification for nations coming up with bombs, nuclear weapons and missiles to maintain security?

Unit-V

Q6. Write a critical essay on any *one* of the following in about 400 words. (10)

i. Ecology and human health
ii. Language and individuality
iii. Progress in science is not entirely dependent on technical resources

2023-24

B. TECH. (AUTUMN SEMESTER) EXAMINATION

BACKLOG

ALL BRANCHES

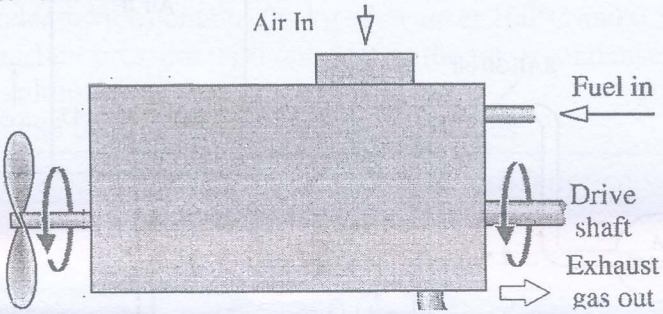
MEA-1110

ENGINEERING THERMODYNAMICS

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

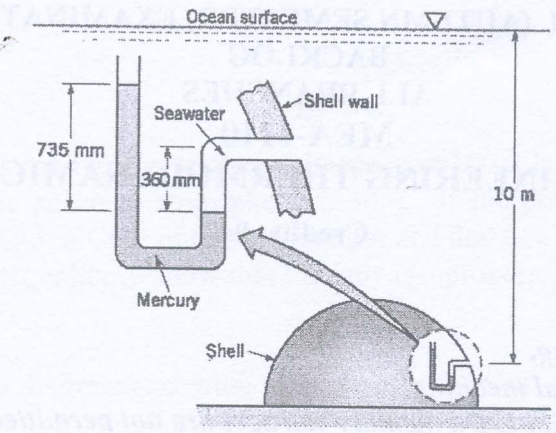
Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.
Programmable calculators (with extra memory storage) are not permitted.
Steam Tables are allowed.

Q.No.	Question	COs	M. M.
1a)	Figure below shows the combustion chamber of an engine. What type of system is it? Show a suitable system boundary to analyse this system giving justification for the same.	CO1	[03]



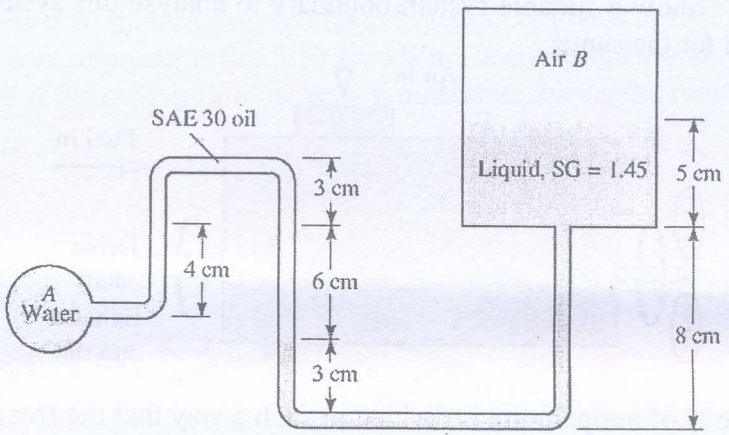
1b)	A new scale N of temperature is divided in such a way that the freezing point of ice is 100N and the boiling point is 400N. What is the temperature reading on this new scale when the temperature is 150C? At what temperature readings of both the scale would be same?	CO1	[05]
1c)	An air-filled, hemispherical 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 $\gamma_{Hg} = 133$ kN/m^3 and $\gamma_{seawater} = 10.1$ kN/m^3.	CO1	[07]

contd....2.



OR

1c') In the figure below the pressure at point A is 160 kPa. What is the air pressure in closed chamber B, in Pa? (specific gravity of SAE 30 is 0.88). **CO1** **[07]**



2a) A piston–cylinder device contains 0.15 kg of air initially at 2 MPa and 350°C. The air is first expanded isothermally to 500 kPa, then compressed polytropically with a polytropic exponent of 1.2 to the initial pressure, and finally compressed at the constant pressure to the initial state. Determine the boundary work for each process and the net work of the cycle. (The properties of air are R = 0.287 kJ/kg.K , k = 1.4) **CO2** **[06]**

2b) Apply SFEE to a throttling device. **CO2** **[02]**

2b) Air at a temperature of 15°C passes through a heat exchanger at velocity of 30 m/s, where temperature is raised to 800°C. It then enters a turbine with same velocity of 30 m/s and expands until temperature falls to 650°C. On leaving the turbine the air is taken at velocity of 60 m/s to a nozzle where it expands until the temperature has fallen to 500°C, If the air flow rate is 2 kg/s, calculate (a) rate of heat transfer to air in the heat exchanger, (b) power output from **CO2** **[07]**

Contd.... 3.

turbine assuming no heat loss and (c) velocity at exit from the nozzle. Assuming no heat loss.

OR

2b') A piston cylinder device contains 50 kg of water at 150 kPa and 25°C. The cross sectional area of the piston is 0.1 m^2. Heat is now transferred to the water, causing part of it to evaporate and expand. When the volume reaches 0.2 m^3, the piston reaches a linear spring whose spring constant is 100 kN/m. more heat is transferred to the water until the piston rises 20 cm more. Determine (a) the final pressure and temperature and (b) the work done during this process. Also, shown the process on a P-V diagram. **CO2** **[07]**

3a) Four litre rigid tank contains 2 kg of saturated liquid vapour mixture of water at 50°C. The water is now heated slowly until it exists in a single phase. Show that whether water will be in the liquid phase or vapour phase, at the final state. **CO3** **[04]**

OR

3a') A piston–cylinder device contains 0.6 kg of steam at 200°C and 0.5MPa. Steam is cooled at constant pressure until one-half of the mass condenses. Determine the change in volume of the steam. **CO3** **[04]**

3b) Complete the table below for water using steam tables. **CO3** **[03]**

T, °C	*P*, kPa	*h*, kJ/kg	*x*	Phase description
	200		0.7	
140		1800		
	950		0.0	

OR

3b') Find the enthalpy, entropy, and volume of steam at 1.4 MPa, 380°C. **CO3** **[03]**

3c) Steam (1Mpa, 250 °C) flowing at the rate of 1kg/s expands through a well-insulated nozzle to 10 kPa. Neglecting the velocity of the steam at the inlet of the nozzle. The steam exiting the nozzle is discharged to a condenser wherefrom it exits as saturated water. The condenser is a counter-flow heat exchanger cooled by cooling water whose inlet and exit temperatures are 25 °C and 35 °C. Show the expansion process within the nozzle on a T-s plot and determine the following: **CO3** **[08]**

(a) velocity of the steam at the nozzle exit
(b) exit area of the nozzle
(c) mass flow rate of the cooling water

4a) Explain the relevance of second law of thermodynamics based on limitations of first law. **CO4** **[04]**

contd....4.

OR

4a')	A refrigerator is used to maintain certain space at 10°C. It pumps 18000 kJ/hr of heat from the space to atmosphere at 30 °C. If the power input is 2 kW, determine the ratio of COP of this refrigerator and that of a Carnot refrigerator.	**CO4**	**[04]**
4b)	Use Clausius Inequality to show that Entropy is a property.	**CO4**	**[04]**

OR

4b')	Draw p-v & T-s diagrams showing processes for the Otto cycle.	**CO4**	**[04]**
4c)	A household refrigerator is maintained at a temperature of 2°C. Every time the door is opened, warm material is placed inside, introducing an average of 450 kJ, but making only a small change in the temperature of the refrigerator. The door is opened 20 times a day, and the refrigerator operates at 15% of the ideal COP. The cost of power is Rs. 5.50 per kWh. Calculate the monthly bill of the refrigerator if the average atmospheric temperature during the month is 30°C.	**CO4**	**[07]**

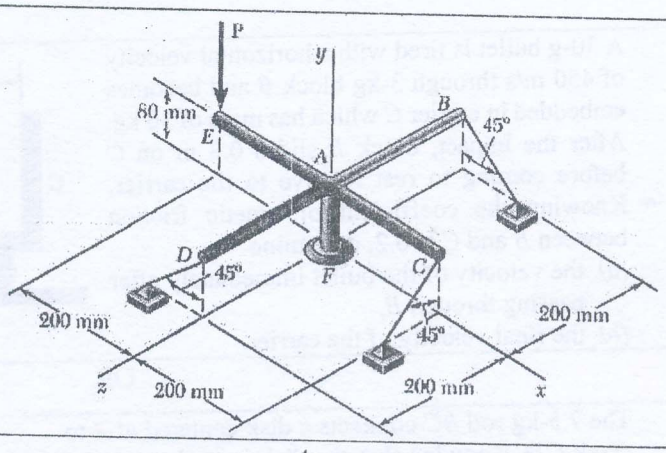
2023-24

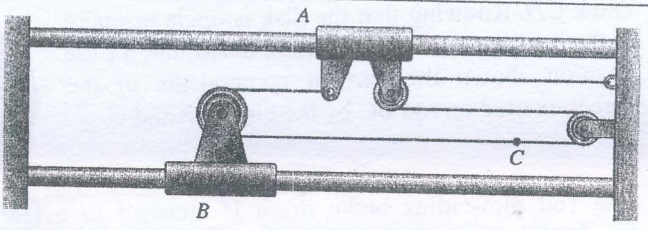
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ENGINEERING MECHANICS
MEA1120

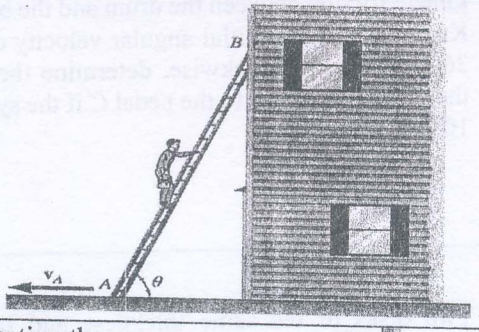
Maximum Marks: 60 **Credits: 03** **Duration: Two Hours**

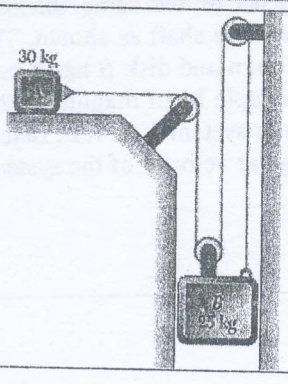
Answer all questions. Assume suitable data if missing.

Q.No.	Questions	CO	M.M.
1.	The assembly shown consists of an 80-mm rod *AF* that is welded to a cross consisting of four 200-mm arms. The assembly is supported by a ball-and-socket joint at *F* and by three short links, each of which forms an angle of 45^0 with the vertical. For the loading shown, determine (*a*) the tension in each link, (*b*) the reaction at *F*.	CO1	[15]
2a.	Collar A starts from rest and moves to the right with a constant acceleration. Knowing that after 8 seconds the relative velocity of collar B with respect to collar A is 610 mm/s, determine the accelerations of A and B.	CO2	[7]
2b.	A painter is halfway up a 10-m ladder when the bottom starts sliding out from under him. Knowing that point A has a velocity $v_A = 2$ m/s directed to the left when $\theta = 60°$, determine the angular velocity of the ladder.	CO2	[8]
3a.	The two blocks shown are originally at rest. Neglecting the masses of the pulleys and the effect of friction in the pulleys and between block *A* and the horizontal surface, determine (*a*) the acceleration of each block, (*b*) the tension in the cable.	CO3	[7]





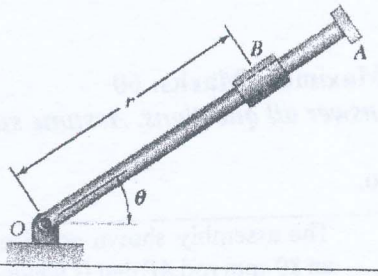




Contd...2.

OR

3a'. 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 θ in radians. Determine the radial and transverse components of the force exerted on the collar when $t = 1$ s.

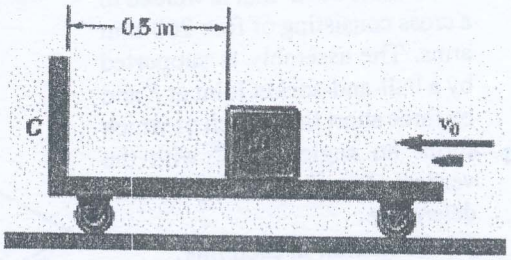


CO3 [7]

3b. A 30-g bullet is fired with a horizontal velocity of 450 m/s through 3-kg block B and becomes embedded in carrier C which has mass of 30 kg. After the impact, block B slides 0.3 m on C before coming to rest relative to the carrier. Knowing the coefficient of kinetic friction between B and C is 0.2, determine

(a) the velocity of the bullet immediately after passing through B,

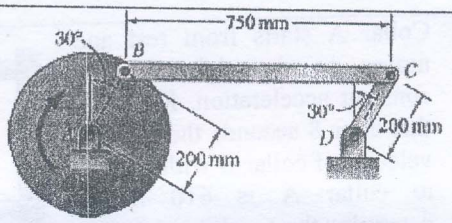
(b) the final velocity of the carrier.



CO3 [8]

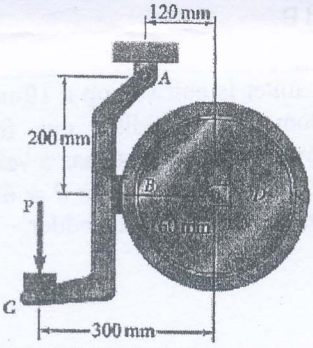
OR

3b'. The 7.5-kg rod BC connects a disk centered at A to crank CD. Knowing that the disk is made to rotate at the constant speed of 180 rpm, determine for the position shown the vertical components of the forces exerted on rod BC by the pins at B and C.



CO3 [8]

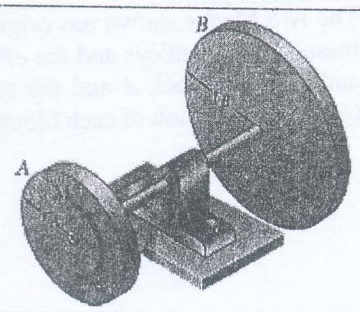
4. The 160 mm-radius brake drum is attached to a larger flywheel that is not shown. The total mass moment of inertia of the flywheel and drum is 20 kg-m^2 and the coefficient of kinetic friction between the drum and the brake shoe is 0.35. Knowing that the initial angular velocity of the flywheel is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



CO4 [15]

OR

4'. Two disks of the same thickness and same material are attached to a shaft as shown. The 4-kg disk A has a radius r_A=100 mm and disk B has a radius r_B=150 mm. Knowing that a couple **M** of magnitude 2.5 N-m is applied to disk A when the system is at rest, determine the time required for the angular velocity of the system to reach 960 rpm.



CO4 [15]

2023-24

B. TECH. (AUTUMN SEMESTER) EXAMINATION

ALL BRANCHES

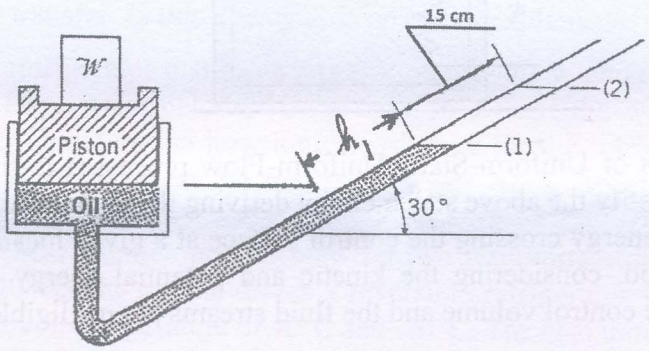
MEA1130

THERMAL SCIENCES

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

Note: *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)	A 15 cm-diameter piston is located within a cylinder which is connected to a 1 cm-diameter inclined tube manometer as show in figure below. The fluid in the cylinder and the manometer is oil (SG = 0.9). When a weight W is placed on the top of the cylinder the fluid level in the manometer tube rises from point (1) to (2). How heavy is the weight? Assume that the change in the position of the piston is negligible.	CO1	[06]



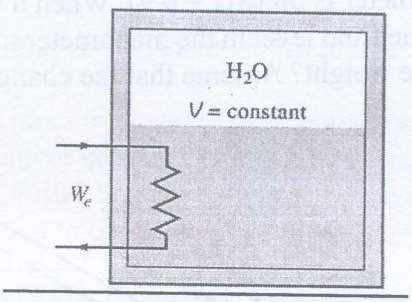
1b)	The relation between resistance R and temperature T for a thermistor closely follows: $$R = R_0 \exp\left[\beta\left(\frac{1}{T} - \frac{1}{T_0}\right)\right]$$ where R_0 is the resistance, in ohms (Ω), measured at temperature T_0 (K) and β is a material constant with units of K. For a particular thermistor $R_0 = 2.2\ \Omega$ at $T_0 = 310$ K. From a calibration test, it is found that $R = 0.31\ \Omega$ at $T = 422$ K. Determine the value of β for the thermistor.	CO1	[03]

Contd.....2.

1c) A piston–cylinder device contains 0.15 kg of air initially at 2 MPa and 350°C. The air is first expanded isothermally to 500 kPa, then compressed polytropically with a polytropic exponent of 1.2 to the initial pressure, and finally compressed at the constant pressure to the initial state. Determine the boundary work for each process and the net work of the cycle. (The properties of air are $R = 0.287$ kJ/kg.K , $k = 1.4$) **CO1** **[06]**

OR

1c') A well-insulated rigid tank contains 5 kg of a saturated liquid–vapor mixture of water at 100 kPa. Initially, three-quarters of the mass is in the liquid phase. An electric resistor placed in the tank is connected to a 110 volt source, and a current of 8 Amp. flows through the resistor when the switch is turned on. Determine how long it will take to vaporize all the liquid in the tank. (Refer figure below) **CO1** **[06]**



2a) "First law analysis of Uniform-State, Uniform-Flow processes is similar to closed system". Justify the above statement by deriving the expression of First law for mass and energy crossing the control surface at a given location over a finite time period, considering the kinetic and potential energy changes associated with the control volume and the fluid streams are negligible. **CO2** **[06]**

OR

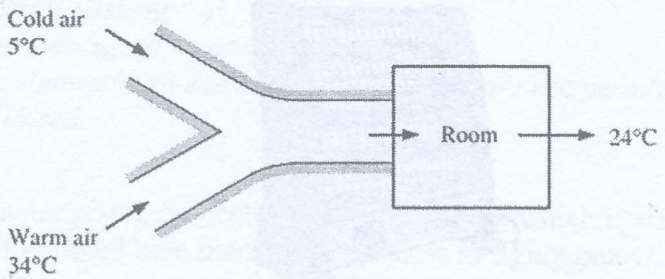
2a') Steam flows steadily through an adiabatic turbine. The inlet conditions of the steam are 10 MPa, 450°C, and 80 m/s, and the exit conditions are 10 kPa, 92 percent quality, and 50 m/s. The mass flow rate of the steam is 12 kg/s. Determine (a) the change in kinetic energy, (b) the power output, (c) the turbine inlet area. **CO2** **[06]**

2b) Complete the table below for water using steam tables. **CO2** **[03]**

T, °C	P, kPa	h, kJ/kg	x	Phase description
-----	200	-----	0.7	-----
140	-----	1800	-----	-----
-----	950	-----	0.0	-----

Contd ....3.

2c) An air-conditioning system involves the mixing of cold air and warm outdoor air before the mixture is routed to the conditioned room in steady operation as shown in figure below. Cold air enters the mixing chamber at 5°C and 105 kPa at a rate of 1.25 m^3/s while warm air enters at 34°C and 105 kPa. The air leaves the room at 24°C. The ratio of the mass flow rates of the hot to cold air streams is 1.6. Determine (a) the mixture temperature at the inlet of the room and (b) the rate of heat gain of the room. (Take c_p of air as 1.005 kJ/kg.K) **CO2** **[06]**



3a) Mention whether the entropy of the working fluid of the ideal Carnot cycle during the heat addition process will **increase/decrease/remain constant.** Also, **mention** whether during heat rejection process it will **increase/decrease/remain constant.** **CO3** **[02]**

3b) A cold canned drink is left in a warmer room where its temperature rises as a result of heat transfer. Is this a reversible process? Explain. **CO3** **[03]**

3c) A household refrigerator that has a power input of 450 W and a COP of 2.5 is to cool five large watermelons, 10 kg each, to 8°C. If the watermelons are initially at 20°C, determine how long it will take for the refrigerator to cool them. The watermelons can be treated as water whose specific heat is 4.2 kJ/kg°C. **CO3** **[03]**

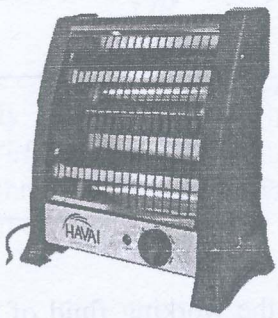
3b) A reversible heat engine operates between two reservoirs at temperatures of 600°C and 40°C. The engine drives a reversible refrigerator which operates between reservoir temperature of 40°C and -20°C. The heat transfer to the heat engine is 2000 kJ and the net work output of the combined engine refrigerator plant is 350kJ. Evaluate the heat transfer to the refrigerant and the net heat transfer to the reservoir at 40°C. **CO3** **[07]**

OR

3b') A household refrigerator is maintained at a temperature of 2°C. Every time the door is opened, warm material is placed inside, introducing an average of 450 kJ, but making only a small change in the temperature of the refrigerator. The door is opened 20 times a day, and the refrigerator operates at 15% of the ideal COP. The cost of power is Rs. 5.50 per kWh. Calculate the monthly bill of the refrigerator if the average atmospheric temperature during the month is 30°C. **CO3** **[07]**

Contd....4.

4a)	Explain Fourier's law of heat conduction? What is meant by thermal resistance?	**CO4**	**[02]**
4b)	Derive the expression for temperature profile of 1-D Steady State Heat Conduction through a plane wall having constant thermal conductivity 'k' with T_{s1} and T_{s2} as two wall temperatures ($T_{s1} > T_{s2}$).	**CO4**	**[02]**
4c)	A room is heated by an electric heater as shown below. Explain the phenomena of Heat Transfer by which the room is getting heated.	**CO4**	**[02]**



4d)	How Radiation Heat Transfer is different from the other modes of Heat Transfer?	**CO4**	**[02]**
4e)	A steel tube with a 5 cm inner diameter, 7.6 cm outer diameter, and k=15W/mK is covered with an insulative covering of thickness 2 cm, and k 0.2 W/mK. A hot gas at 330°C with h = 400 W/m^2K flows inside the tube. The outer surface of the insulation is exposed to cooler air at 30°C with h = 60 W/m^2K. Calculate the heat loss from the tube to the air for 10 m of the tube and the temperature of the outside surface of the insulation.	**CO4**	**[07]**

OR

4e')	A steel plate (k=45 W/m-K) 600mm x 900 mm x 25 mm is maintained at 310°C. Air at 15°C blows over the hot plate. If convection heat transfer coefficient is 22 W/m^2-K and emissivity of the steel plate as 0.2, calculate the (a) total heat transfer by the plate, (b) inside plate temperature. (Take $\sigma = 5.67 \times 10^{-8}$ $W/m^2.K^4$)	**CO4**	**[07]**