CBCS SCHEME

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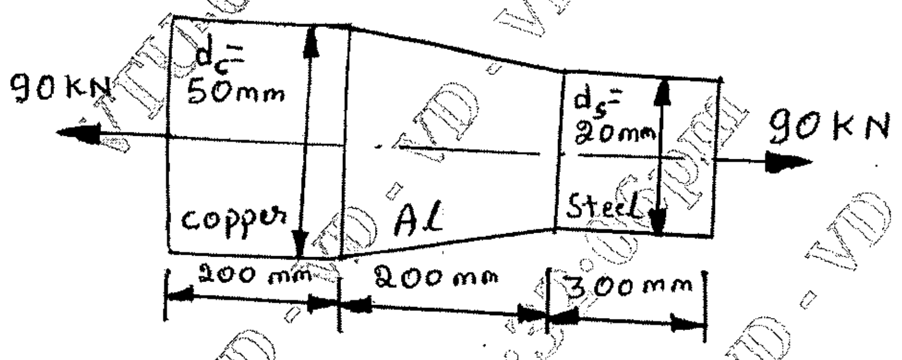
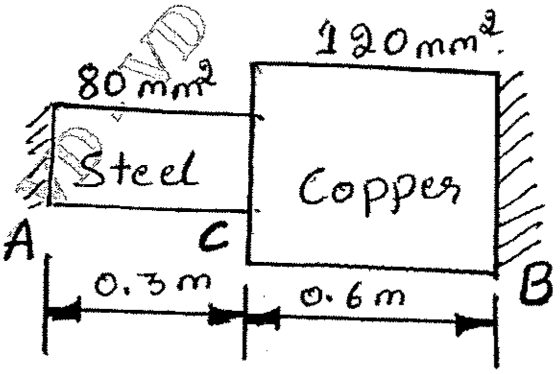
BME301

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define the following : i) Ductility ii) Brittleness iii) Toughness iv) Resilience.	4	L1	CO1
	b.	Derive an expression for the extension of a member subjected to a tensile load P.	6	L2	CO1
	c.	Find the elongation in bar loaded as shown in Fig.Q1(c) take modulus of elasticity for steel E_s = 200 GPa, for copper E_C = 100 GPa and for aluminum E_A = 70 GPa.  Fig.Q1(c)	10	L3	CO1
		OR			
Q.2	a.	Define the following : i) Steady load ii) Impact load iii) Sudden load iv) Shock load.	4	L1	CO2
	b.	A stepped bar shown in Fig.Q2(b) is fixed at its two ends rigidly. The bar is free from stresses when its temperature is 30°C. When the temperature of the bar is increased to 90°C determine : i. Stresses induced in steel and copper portions ii. Displacement in the junction at point C. Take : E_C = 100 GPa, $\alpha_C = 1.8 \times 10^{-5}$ /°C E_S = 200 GPa, $\alpha_S = 1.2 \times 10^{-5}$ /°C  Fig.Q2(b)	16	L3	CO1

Module – 2

Q.3	a.	Define principle planes and principal stresses.	4	L1	CO2
	b.	The state of stress at a point in a strained material is as shown in Fig.Q3(b). Determine : i. Principle stresses and their planes ii. Maximum shear stress and planes of maximum shear stress iii. Normal stress and tangential stress on plane XY Solve by Mohr's circle method.	16	L3	CO2

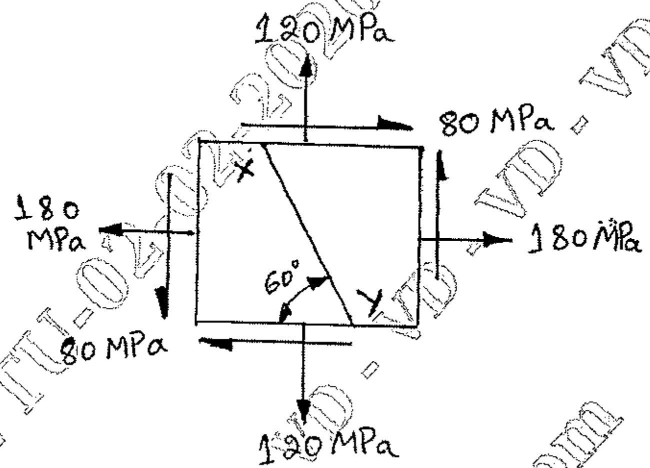


Fig.Q3(b)

OR

Q.4	a.	Obtain expression for hoop and longitudinal stresses for a thin cylinder stating clearly the assumptions made.	8	L2	CO2
	b.	A thick walled cylindrical pressure vessel has inner radius of 150 mm and outer radius of 185 mm. Draw a sketch showing the radius pressure and hoop stress distribution in the section of the cylinder wall, when an internal pressure of 10 MPa is applied.	12	L3	CO2

Module – 3

Q.5	a.	Define the following : i) SFD ii) BMD.	4	L1	CO3
	b.	Draw the SFD and BMD for the simply supported beam as shown in Fig.Q5(b).	16	L3	CO3

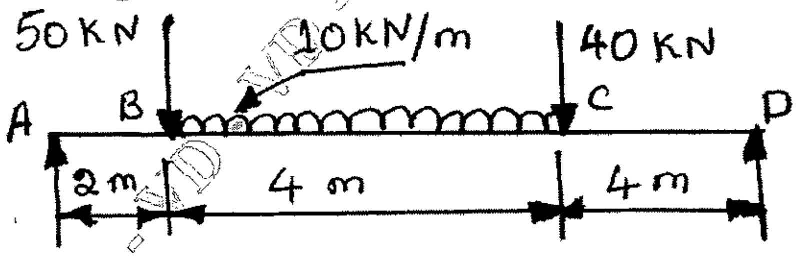
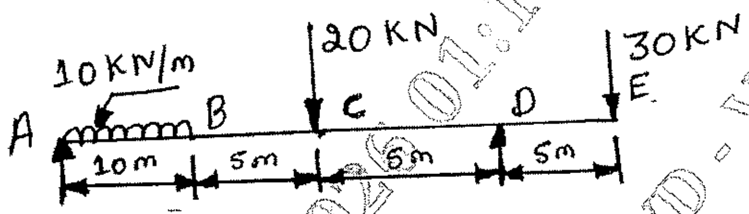


Fig.Q5(b)

		OR			
Q.6	**a.**	Draw the SFD and BMD of cantilever of length L carrying UDL = W/meter.	**6**	**L2**	**CO3**
	b.	Draw the SFD and BMD for the overhanging beam shown in Fig.Q6(b).  Fig.Q6(b)	**14**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Derive an expression for the bending and radius of curvature for a straight beam subjected to pure bending.	**10**	**L2**	**CO4**
	b.	A beam having T section with its flanges of (180 mm × 10 mm) and web of (220 mm × 10 mm) is subjected to sagging bending moment 15 KN –m. Determine the maximum tensile stress and maximum compressive stresses, and their locations in the section . Draw a sketch showing bending stress distribution.	**10**	**L3**	**CO4**
		OR			
Q.8		An I – section beam 350 mm × 200 mm has a web thickness of 12.5 mm and a flange thickness of 25 mm. It carries a sharing force of 200 KN at a section. Sketch the shear stress discretion across the section.	**20**	**L4**	**CO4**
		Module – 5			
Q.9	**a.**	Derive torsion equation with usual notation. State the assumption in the theory of pure torsion.	**10**	**L2**	**CO5**
	b.	A hollow circular steel shaft has to transmit 60 KW at 210 rpm such that the maximum shear stress does not exceed 60 MPa. If the ratio of internal to external diameter is equal to 0.75 and the value of rigidity modulus is 84 GPa, find the dimensions of the shaft and angle of twist in length of 3 m.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	Derive an expression for the critical load in a column subjected to compressive load, when both end is fixed.	**10**	**L2**	**CO5**
	b.	A 2.5 meter long column with hollow circular section is hinged at both ends. External diameter is 140 mm and thickness of wall is 20 mm. Taking E = 80 GPa. $\alpha = \frac{1}{1600}$ and σ_C = 550 MPA, Compare the buckling loads obtained using : i. Euler's formula ii.Rankine's formula Also find the length of column for which both formulae given same load.	**10**	**L3**	**CO5**

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BME302

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

Manufacturing Process

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	**a.**	Explain various pattern allowances and their importance.	**10**	**L2**	**CO1**
	b.	Sketch and explain Jolt type moulding machine.	**06**	**L1**	**CO1**
	c.	Define the following terms with reference to the moulding sand: (i) Permeability (ii) Green Strength (iii) Dry Strength (iv) Hot Strength	**04**	**L1**	**CO1**
		OR			
Q.2	**a.**	Sketch and explain Shell moulding process.	**10**	**L2**	**CO1**
	b.	Give the functions of a riser in a casting. Also, differentiate between open and blind risers.	**06**	**L1**	**CO1**
	c.	Explain the terms 'Core' and 'Chaplet'.	**04**	**L1**	**CO1**
		Module – 2			
Q.3	**a.**	With a neat sketch explain the constructional features of a Cupola.	**10**	**L2**	**CO2**
	b.	Sketch and explain resistance furnace.	**10**	**L2**	**CO2**
		OR			
Q.4	**a.**	With a neat labelled diagram explain continuous casting process.	**10**	**L2**	**CO2**
	b.	Explain with neat sketches following casting defects: (i) Hot tears (ii) Cold shut and Misrun	**10**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Explain the following yield criteria : (i) Tresca Criterion (ii) Von Mises Criterion	**10**	**L2**	**CO3**
	b.	Sketch and explain wire drawing. Also list the characteristics of cold working process.	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	With a neat sketch explain explosive forming process.	**10**	**L2**	**CO3**
	b.	With a neat sketch explain die-punch assembly used in sheet metal work. Also explain blanking and punching operations.	**10**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Sketch and explain the types of oxy-acetylene welding flames.	**10**	**L2**	**CO4**
	b.	Explain briefly the principle of gas welding. Also list its advantages, disadvantages and applications.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	Sketch and explain submerged arc welding process.	**10**	**L2**	**CO4**
	b.	With a neat sketch explain Tungsten Inert Gas welding process. Mention its advantages and disadvantages.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	With a neat sketch explain various zones in welded structure.	**10**	**L2**	**CO5**
	b.	With neat sketches explain welding defects.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Write short notes on : (i) Soldering (ii) Brazing	**10**	**L2**	**CO5**
	b.	Explain the following resistance welding processes: (i) Butt Welding (ii) Seam welding	**10**	**L2**	**CO5**

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BME303

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Material Science and Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define the following terms : (i) Unit Cell (ii) Space Lattice (iii) Crystal Structure (iv) Coordination Number	08	L1	CO1
	b.	Define APF. Calculate the APF for simple cube and HCP crystal structures.	12	L3	CO1
		OR			
Q.2	a.	Classify the Crystal imperfection. With neat sketch explain point defects.	10	L1	CO1
	b.	Explain these concepts of materials : (i) Slip (ii) Twining (iii) Ionic and Metallic Bonding	10	L2	CO1
		Module – 2			
Q.3	a.	Define Diffusion. List the factors affecting diffusion. Explain diffusion laws for both steady and non-steady state.	10	L1	CO2
	b.	Explain eutectic phase diagram where 2 metals completely soluble in liquid state and insoluble in solid state. Draw neat phase diagram and label all phases.	10	L2	CO2
		OR			
Q.4	a.	Explain Gibb's phase rule.	05	L1	CO2
	b.	A binary alloy system contains two solid phases α and β. The composition of α and β are A = 5% B and A = 95% B respectively. Calculate (i) A = 40% B alloy (ii) A = 70% B alloy composition by Lever rule.	06	L3	CO2
	c.	Draw a neat sketch of Iron-Carbon diagram and label all the phases. Quote three important critical temperature lines.	09	L2	CO2
		Module – 3			
Q.5	a.	Define Heat Treatment. Describe with a neat sketch TTT diagram.	10	L1	CO3
	b.	Explain with neat diagram, Austempering and Martempering process for steel.	10	L2	CO3
		OR			
Q.6	a.	Describe with neat sketch, flame hardening process.	08	L2	CO3
	b.	Explain these heat treatment techniques: (i) Age hardening (ii) Grain Growth in steel specimen (iii) Recrystallization technique	12	L1	CO3

		Module – 4			
Q.7	**a.**	Explain thermal spray coating with neat diagram. Discuss the advantages of the coating methods.	**10**	**L1**	**CO4**
	b.	With a flow chart, explain in detail the steps of powder metallurgy process.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	With a neat sketch explain atomization and roll crushing methods of powder production.	**10**	**L2**	**CO4**
	b.	Discuss the advantages , disadvantages and applications of powder metallurgy.	**10**	**L1**	**CO4**
		Module – 5			
Q.9	**a.**	Define Composite Materials. Describe the classification, advantages and applications of composite materials.	**10**	**L1**	**CO5**
	b.	With neat sketch explain wet lay up and filament winding process.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Classify Engineering Materials. Discuss types, composition and applications of cast iron.	**10**	**L2**	**CO5**
	b.	Describe factors affecting material selection chart.	**10**	**L1**	**CO5**

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BME303

Third Semester B.E./B.Tech. Degree Examination, June/July 2025

Material Science and Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M: Marks, L: Bloom's level, C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain classification of materials. Compare crystalline solids and non crystalline solids.	10	L2	CO1
	b.	Define (i) Crystal lattice (ii) Unit cell (iii) Planar atomic density (iv) Coordination number (v) Atomic packing factor.	10	L1	CO1
		OR			
Q.2	a.	Derive atomic packing factor for simple cubic structure.	10	L2	CO1
	b.	Explain edge and screw dislocations.	10	L2	CO1
		Module – 2			
Q.3	a.	State and explain HumeRothery rules.	10	L1	CO2
	b.	Explain Fick's laws of diffusion.	10	L2	CO2
		OR			
Q.4	a.	Explain iron-carbon diagram with a sketch.	10	L2	CO2
	b.	Two metals A and B are used to form an alloy containing 75% A and 25% B. A melts at 650°c and B at 450°c. The solid solubility of metal A is B and of B is A are negligible. The metal pair forms an eutectic at 40% A and 60% B which solidifies at 300°c. Assume liquids and solidus lines are straight draw phase diagram for the alloy series.	10	L3	CO2
		Module – 3			
Q.5	a.	Explain (i) Annealing (ii) Normalizing (iii) Hardening (iv) Tempering (v) Nitriding.	10	L1	CO3
	b.	Explain with sketch Joming End Quench test.	10	L2	CO3
		OR			
Q.6	a.	Explain with a neat sketch flame hardening.	10	L2	CO3
	b.	Explain with a graph T-T-T diagram.	10	L2	CO3
		Module – 4			
Q.7	a.	With a neat sketch explain physical vapours deposition.	10	L2	CO4
	b.	Write advantages and disadvantages of surface coating.	10	L2	CO4
		OR			
Q.8	a.	Explain different powder production techniques in mechanical methods.	10	L2	CO4
	b.	Explain the functions of lubricants and binders in powder metallurgy.	10	L2	CO4
		Module – 5			
Q.9	a.	State properties, composition and uses of low, medium and high carbon steels.	10	L2	CO5
	b.	Explain with sketch hand-layup process.	10	L2	CO5
		OR			
Q.10	a.	Briefly explain the selection criteria for selection of materials.	10	L2	CO5
	b.	With a sketch explain filament winding process.	10	L2	CO5

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BME304

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Basic Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Use of Thermodynamics data hand book is permitted.

		Module – 1	M	L	C
Q.1	a.	State and explain the Zeroth Law of thermodynamics.	10	L1	CO1
	b.	The temperature 't' on a thermometric scale is defined interms of a property 'P' by the relation t = a lnp + b, where 'a' and 'b' are constants. The temperature of the ice point and steam point are assigned numbers as '0' and 100 respectively. Experiment gives values of 'P' of 1.86 and 6.81 at ice and steam point respectively. Evaluate the temperature corresponding to a reading of P = 2.5 on thermometer.	10	L2	CO1
		OR			
Q.2	a.	Draw the following process on P-V plane and write the expression for work in each case : i) Isothermal process ii) Polyntropic – process.	10	L1	CO1
	b.	Unit mass of a certain fluid is contained in a cylinder at an initial pressure of 20 bar. The fluid allowed to expand reversibly behind a piston according to the law $PV^2 = C$ until the volume is doubled. The fluid is then cooled reversibly at constant pressure until the piston regains its original position : heat is then supplied reversibly with the piston firmly locked in position until pressure rises to original value of 20 bar. Calculate network done by the fluid for an initial volume of 0.05 m^3. Show the process on PV diagram.	10	L2	CO1
		Module – 2			
Q.3	a.	With a neat diagram, explain the Joule's experiment. Also state the first law of thermodynamics.	10	L1	CO2
	b.	0.5 m^3 of air initially at a temperature of 210°C and a pressure of 40×10^4 N/m^2 are compressed according to the law $PV^{1.2} = C$ to a final volume of 0.05 m^3. Calculate : i) Mass ii) Final pressure iii) Work iv) Heat transfer v) Change in enthalpy Take : R = 0.287 KJ/kg °K ; √ = 1.4, Cp = 1.005 KJ/kg °K.	10	L2	CO2

		OR			
Q.4	**a.**	Derive the steady flow energy equation for a single stream of fluid entering and leaving the control volume.	**10**	**L2**	**CO2**
	b.	A turbine operates under steady flow conditions receiving steam at the following state : pressure is 1.2 MPa, temperature is 188°C. Enthalpy is 2785 KJ/kg, velocity is 34 m/s elevation is 3 m. The steam leaves the turbine at the following state : pressure is 200 MPa, Enthalpy is 2512 KJ/kg, velocity is 100 m/s and elevation is zero (0) meter. Heat is lost to the surroundings at a rate of 0.29 KJ/s. If the steam flow rate is 0.42 kg/s. determine the power–output from the turbine.	**10**	**L5**	**CO2**
		Module – 3			
Q.5	**a.**	Establish the equivalence of Kelvin-Planck and Clausius statement.	**10**	**L2**	**CO3**
	b.	In a heat engine the temperature of the source and sink are 700°C and 50°C respectively. The heat supplied is 83.3 KJ/s. Find the power developed by the engine.	**10**	**L5**	**CO3**
		OR			
Q.6	**a.**	State and explain Clausius in equality.	**10**	**L3**	**CO3**
	b.	2.5 kg of air at a pressure of 2 bar and 26°C forms a closed system, which undergoes a constant pressure process with a neat addition of 650 KJ, Calculate : i. Find temperature ii. Chang enthalpy iii. Change in internal energy iv. Work transfer v. Change in entropy Take : C_p = 1.005 KJ/kg°K, C_V = 0.714 KJ/kg°K.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the concept of available and unavailable energy.	**10**	**L3**	**CO4**
	b.	A fluid at 1 MPa and 250°C contained in a vessel having 0.28 m^3 volume is cooled until its pressure drops to 0.35 MPa. Determine the final temperature heat transferred and change in entropy of the fluid. Assume fluid to be air. Take : R = 0.287 KJ/kg°K, C_V = 0.7165 KJ/kg°K.	**10**	**L4**	**CO4**
		OR			
Q.8	**a.**	With neat sketch, explain the method of measurement of dryness fraction of steam using separating throttling colorimeter.	**10**	**L2**	**CO4**
	b.	Steam at 5 bar having a dryness fraction of 0.9 expands adiabatically and reversibly to a final pressure of 1 bar. Determine the final condition of steam.	**10**	**L5**	**CO4**

Module – 5					
Q.9	**a.**	State the i. Gibb's Dolton's law of partial pressure ii. Amagot's law.	**10**	**L2**	**CO5**
	b.	If a gas has C_p = 1.97 KJ/kg°K and C_V = 1.5 KJ/kg°K. Determine its molecular mass and characteristics gas constant.	**10**	**L4**	**CO5**
OR					
Q.10		Define the following : i) Ideal and real gas ii) State the Vander-Waal's equation iii) Compressibility factor iv) Law of corresponding states v) Beattie – Bridgeman equation.	**20**	**L3**	**CO5**

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BME306B

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

Smart Materials and Systems

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define a Smart structure and discuss the functions of its basic components with examples.	10	L1	CO1
	b.	Classify the Smart structure and state the functions of each structure.	10	L2	CO1
		OR			
Q.2	a.	List and explain the common smart materials and associated stimulus response.	8	L2	CO1
	b.	Discuss in detail the various application areas of smart structures.	6	L1	CO1
	c.	State important characteristics of smart structures.	6	L1	CO1
		Module – 2			
Q.3	a.	With suitable sketch, describe Piezo electric effect.	6	L1	CO1
	b.	Discuss the common applications of piezo electric materials.	6	L1	CO1
	c.	Describe the important properties and applications of piezo ceramic materials.	8	L2	CO2
		OR			
Q.4	a.	List the materials that exhibit piezo – resistive effect and state their applications.	6	L2	CO1
	b.	Write a note on the application of piezoelectric materials as Sensors and Actuators.	8	L1	CO1
	c.	Highlight the applications of following : i) Bimorphs ii) Nano carbon tubes	6	L1	CO1
		Module – 3			
Q.5	a.	Describe shape memory effect exhibited by Smart Materials with suitable sketches.	6	L2	CO1
	b.	State the functional properties of Shape Memory Alloys.	8	L2	CO1
	c.	Write a note on Phase transformation exhibited by Ni – Ti Alloys.	6	L2	CO1
		OR			

Q.6	a.	State the important properties of Shape Memory Polymers.	6	L1	CO1
	b.	Differentiate between One – way and Two – way Shape Memory Alloys with sketches.	8	L2	CO2
	c.	Discuss the applications of Shape Memory Ceramics.	6	L1	CO1
		Module – 4			
Q.7	a.	What are Smart Polymers? State their important characteristics.	6	L1	CO1
	b.	With the help of a Temperature Vs Concentration graph. Explain the significance of Lower Critical Solution Temp. (LCST) and Upper Critical Solution temp. (UCST).	8	L3	CO2
	c.	Discuss briefly the applications of Electro Active Polymer Microgels.	6	L1	CO2
		OR			
Q.8	a.	Write a note on the properties of Protein – based Smart Polymers.	6	L1	CO1
	b.	Discuss the applications of PH – responsive Smart Polymers.	8	L1	CO1
	c.	List the various Photo Responsive Polymers used in applications.	6	L1	CO2
		Module – 5			
Q.9	a.	State the important properties of applications of Polymer Gels.	10	L1	CO1
	b.	Write a note on : i) Self healing smart materials ii) Optically operated smart materials.	10	L1	CO1
		OR			
Q.10	a.	Discuss the space application of Chemically Activated Smart Materials.	10	L1	CO1
	b.	Elaborate the advantages of using Chemically Activated Smart Materials as i) Smart corrosion protection coatings ii) Sensors	10	L1	CO2

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