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C-112

B.Tech. Mechanical Engineering III Semester Examinations (Jun 2026)

Mechanics of Solids-I (BT-ME-203A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1		Marks
(a)	Define Poisson's ratio. State its significance.	2
(b)	Differentiate between shear force and bending moment.	2
(c)	What is meant by polar modulus of a shaft?	2
(d)	Define equivalent length of a column and state its significance in column buckling analysis.	2
(e)	State the assumptions of Euler's column theory.	2
(f)	Define neutral axis and neutral layer in bending of beams.	2

UNIT-I

Q.2(a)	A bar of mild steel has an overall length of 2100 mm. The diameter of 700 mm length is 56 mm. The diameter of the remaining 1400 mm is 35 mm. Calculate the extension of the bar due to tensile load of 55 KN. Take $E = 200GN/m^2$	6
Q.2(b)	Define shear stress, shear strain and Modulus of rigidity.	6
Q.3	Explain Mohr's Circle of Stress in detail and describe the procedure for determining principal stresses, principal planes and maximum shear stress in a two-dimensional stress system using Mohr's circle.	12

UNIT-II

Q.4	Draw shear force and bending moment diagrams for an overhanging beam subjected to uniformly distributed loading and point loads.	12
Q.5(a)	Classify beams based on their support conditions and explain the different types of beams with neat sketches.	6
Q.5(b)	Derive an expression for shear stress in a beam of rectangular section.	6

UNIT-III

Q.6	A hollow shaft transmits 250 kW at 120 rpm. The external diameter is 300 mm and internal diameter is 200 mm. Determine: 1. Maximum shear stress, 2. Angle of twist in a length of 4 m. Take G=$8 \times 10^4\ N/mm^2$	12
Q.7(a)	Discuss the concept of combined bending and torsion. Derive the expression for equivalent torque used in shaft design.	6
Q.7(b)	Derive the torsion equation for a circular shaft and state the assumptions made in the theory of pure torsion.	6

UNIT-IV

Q.8(a)	Discuss Rankine Gordon's empirical formula and explain its applicability in column analysis.	**6**
Q.8(b)	Differentiate between short columns and long columns on the basis of failure criteria and behavior under loading.	**6**
Q.9(a)	Define buckling of columns and explain the significance of slenderness ratio in column design.	**6**
Q.9(b)	Explain the Moment Area Method for determining slope and deflection in beams.	**6**

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C-113

B.Tech. Mechanical Engineering - III Semester Examinations (June 2026)

Thermodynamics (BT-ME-205A)

Time- 3hrs
Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1		Marks
(a)	What is microscopic approach in thermodynamics?	2
(b)	What is perpetual motion machine of first kind [PMM1]?	2
(c)	Prove that the difference in specific heat capacities equal to $C_p - C_v = R$.	2
(d)	Illustrate reversible and irreversible process.	2
(e)	Prove that for an isolated system, there is no change in internal energy.	2
(f)	Define heat reservoir, source and Sink.	2

UNIT-I

Q.2(a)	Define the term State and Process.	5
Q.2(b)	Prove that for an isolated system, there is no change in internal energy.	7
Q.3	1.5 Kg of air gas at a pressure of 8 bar and 20°C occupies the volume of 0.15 m^3. It expands adiabatically to a pressure of 0.9 bar and volume 0.73 m^3. Determine 1. Values of two specific heats c_p and c_v 2. Specific internal energy 3. The work done during the process.	12

UNIT-II

Q.4(a)	Explain the First law of Thermodynamics and Justify that for non-flow process.	7
Q.4(b)	A gas has 1000 Joules of heat energy added to it as it does 700 Joules of work on its environment. What is the change in the internal energy of the gas?	5
Q.5	Two reversible engines A and B are arranged in series. Engine 'A' rejects heat directly to engine 'B'. Engine 'A' receives 200 kJ at temperature of 421°C from the hot source while engine 'B' is in communication with a cold sink at a temperature of 5°C. If the work output of 'A' is twice that of 'B'. Find 1. Intermediate temperature between A and B; 2. Efficiency of each engine and 3. Heat rejected to the sink.	12

UNIT-III

Q.6(a)	Explain principle of increase of entropy.	6
Q.6(b)	Compare reversible and irreversible entropy changes.	6
Q.7	Calculate the decrease in available energy when 25 kg of water at 95°C mix with 35 kg of water at 35°C, the pressure being taken as constant and the temperature of the surroundings being 15°C (C_p of water = 4.2kJ/kgK).	12

UNIT-IV

Q.8(a) What are triple point and critical point? Explain their significance in a pure substance. **7**

Q.8(b) A rigid vessel contains 2 kg of water at a pressure of 200 kPa and temperature of 120°C. Determine: **5**

1. The phase of water
2. The total volume of the vessel

Given data from steam tables at 200 kPa:

- Saturation temperature, T_{sat}=120.2°C
- Specific volume of saturated liquid, v_f=0.001061 m^3/kg
- Specific volume of saturated vapor, v_g=0.8857 m^3/kg

Q.9 Derive the following relations: **12**

1. $\left(\frac{\delta T}{\delta p}\right)_s = \frac{Tv\beta}{c_p}$
2. $\left(\frac{\delta T}{\delta v}\right)_s = -\frac{T\beta}{c_v K}$

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C-115

B.Tech. CE/ME/TE/IT/ECE III/IV Semester Examinations (June 2026)

Indian Knowledge System: Concepts in Engineering (ASH-HUM-210A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1		Marks
(a)	Name the four Vedas of Indian Knowledge Tradition.	2
(b)	What are Vedangas? Mention any two Vedangas.	2
(c)	Define Traditional Knowledge (TK).	2
(d)	What is the importance of Zero in mathematics?	2
(e)	Write any two features of Sindhu Valley Civilization town planning	2
(f)	State one scientific significance of Iron Pillar of Delhi.	2

UNIT-I

Q.2(a)	Explain the structure and significance of Vedas, Smriti, Puranas and Upanishads in Indian Knowledge System.	6
Q.2(b)	Compare Indian Knowledge System with Western Knowledge System on the basis of objectives, approach and values.	6
Q.3 (a)	Discuss the six orthodox schools of Indian Philosophy.	6
Q.3(b)	Explain the contribution of Nalanda and Takshashashila universities in the development of ancient education system.	6

UNIT-II

Q.4	Discuss the need and significance of protection of Traditional Knowledge. Explain the role of Government in safeguarding indigenous knowledge systems.	12
Q.5(a)	Explain the concept of Patents in relation to Traditional Knowledge with suitable examples.	6
Q.5(b)	Suggest suitable strategies for increasing protection of Traditional Knowledge in India.	6

UNIT-III

Q.6	Explain the scientific contributions of ancient India with reference to gravity, Sage Agastya's battery model and velocity of light.	12
Q.7(a)	Explain Bhāratīya Kāla-gaṇanā and Indian Calendar System.	6
Q.7(b)	Discuss India's contribution to mathematics with reference to decimal system, zero, infinity and Sulba-sutras.	6

UNIT-IV

Q.8	Discuss the engineering excellence of Pre-Harappan and Sindhu Valley Civilization with suitable examples.	12
Q.9(a)	Explain the achievements of ancient Indian metallurgy with special reference to Iron Pillar of Delhi.	6
Q.9(b)	Write short notes on Marine Technology and Bet-Dwārkā.	6

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D-111

B.Tech. Civil/Mechanical Engineering IV Semester Examinations (June 2026)

Mathematics III (ASH-MAT-202A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1		Marks
(a)	Define Bisection Method. Write its formula and one advantage of the method.	3
(b)	State Simpson's 3/8Rule and write its formula for numerical integration.	3
(c)	State Euler's formula for determining the Fourier coefficients of a function $f(x)$defined in the interval $c < x < c + 2\pi$.	3
(d)	Form the partial differential equation by eliminating the arbitrary constants from $z = ax + by + ab$.	3

UNIT-I

Q.2(a) Find the root of the equation $\mathbf{x-e^x=0}$, using bisection method up to three decimal places. **6**

Q.2(b) Find the real root of the equation $\mathbf{x^3-3x+1=0}$ using Newton-Raphson Method. **6**

OR

Q.3(a) **From the following data, find y at x=43, using Newton Forward Interpolation Formula.** **6**

x:	*40*	*50*	*60*	*70*	*80*	*90*
y:	*184*	*204*	*226*	*250*	*276*	*304*

Q.3(b) **Use Lagrange's formula to find f (6) from the following data.** **6**

x:	*2*	*5*	*7*	*10*	*12*
f(x):	*18*	*180*	*448*	*1210*	*2028*

UNIT-II

Q.4 **From the following table, find the values of $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x= 2, by Newton's forward difference formula for the following table.** **12**

x:	*1*	*2*	*3*	*4*	*5*
y:	*3*	*6*	*12*	*20*	*29*

OR

Q.5(a) **The following table gives the values of f(x) at equal intervals of x.** **6**

x:	*0*	*0.5*	*1.0*	*1.5*	*2.0*
f(x):	*0.399*	*0.352*	*0.242*	*0.129*	*0.054*

Evaluate $\int_0^2 f(x)dx$ using **Simpson's1/3 rule**.

Q.5(b) Apply Runge-Kutta method of fourth order to find an approximate value of y for x=0.1; **if** $\frac{dy}{dx} = x^2 + y^2$ given y=1, when x=0. **6**

UNIT-III

Q.6(a) Find Laplace Transform of $e^{3t} + 5t^4 - 2cost + 3sint$. **6**

Q.6(b) Solve the following equation by Laplace Transform Method **6**
(D^2-2D+2) x=0, where $D \equiv \frac{d}{dt}$ and x=1, Dx=1 at t=0.

OR

Q.7(a) Expand in a Fourier Series the function **f(x)= 2x** in the interval **$0<x<2\pi$.** **6**

Q.7(b) Obtain Fourier Series to represent e^{-x} in the interval **$0<x<2\pi$.** **6**

UNIT-IV

Q.8(a) Solve: **$2zx-px^2-2qxy+pq=0$** using Charpit's Method. **6**

Q.8(b) Solve: $(D^2 - 2DD' + D'^2)z = e^{(x+2y)}$ **6**

OR

Q.9 Solve completely the equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$, representing the vibrations of a string of length l, fixed at both ends. Given that **y (0, t) =0; y (l, t) =0;** **y(x,0) =f(x) and $\frac{\partial y(x,0)}{\partial t}$=0, 0<x<l.** **12**

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D-112

B.Tech. Mechanical Engineering IV Semester Examinations (Jun 2026)

Applied Thermodynamics (BT-ME-202A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory. Each Question carries 12 marks.

Q.1		Marks
(a)	What are boiler accessories?	2
(b)	What is superheater?	2
(c)	Define reheat factor.	2
(d)	Differentiate between fire tube and water tube boilers.	2
(e)	What is the function of condenser?	2
(f)	Explain in brief boiler efficiency.	2

UNIT-I

Q.2(a)	What are boilers? How are they classified?	5
Q.2(b)	Derive the condition for maximum discharge though chimney.	7
Q.3(a)	Explain regeneration cycle with the help of neat diagram. Derive the expression for efficiency.	5
Q.3(b)	A simple Rankine cycle works between pressures 28 bar and 0.06 bar, the initial condition of steam being dry saturated. Calculate the dryness fraction, cycle efficiency, work ratio and specific steam consumption.	7

UNIT-II

Q.4(a)	Final velocity of steam passing thorough a nozzle is found out to be 586 m/s. The pressure of steam at inlet is 15 bar and is dry and saturated. The exit pressure is 2 bar. Determine the dryness fraction of the steam when it leaves the nozzle.	6
Q,4(b)	How do you calculate the exit velocity of stem from an adiabatic nozzle?	6
Q.5(a)	How does air leakage affect the performance of a steam condenser?	4
Q.5(b)	In a surface condenser test, the vacuum gauge reading was 65 cm of Hg when the barometer read 75 cm of Hg. The temperature in the condenser was 50°C. if the quantity of air entering the condenser was reduced to 80 kg/he by suitable means. Find the resultant alteration in vacuum. If the condensate weighs 1000kg/hr calculate quantities of air and vapour which the pump has to deal with.	8

UNIT-III

Q.6	Define governing. Describe the important methods used for the governing of steam turbines.	12
Q.7(a)	What is the necessity of compounding a steam turbine?	5

Q.7(b) Elaborate the various losses occurring in a steam turbine. 7

UNIT-IV

Q.8 A single stage single acting reciprocating compressor sucks air ar 1 bar and 30°C and delivers 0.6 kg of air per minute at 6 bar. The bore and stroke of the compressor are 10 cm and 15 cm respectively and clearance is 3% of stroke. Taking the index and compression and expansion as 1.3, 12

(i) The volumetric efficiency of the compressor
(ii) The power required if the mechanical efficiency is 85% and
(iii) Speed of the machine in rev/minute.

Q.9(a) Discuss the means for improving the efficiency and specific output of a gas turbine working on simple Brayton cycle. 6

Q.9(b) State the condition for optimum pressure ratio for minimum compressor requirement in two stage perfect intercooled compression. 6

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D 113

B.Tech. Mechanical Engineering IV Semester Examinations (Jun 2026)

Fluid Mechanics & Fluid Machines (BT-ME-204A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1		Marks
(a)	State Newton's law of viscosity.	2
(b)	Define density and specific gravity of the fluid.	2
(c)	What is a function of orifice meter?	2
(d)	Explain velocity potential in fluid flow.	2
(e)	Define unit discharge of turbine.	2
(f)	What do you understand about cavitation in the pump.	2

UNIT-I

Q.2(a) A 150 mm diameter shaft rotates at 1500 rpm in a 200 mm long journal bearing 150.5 mm internal diameter. The uniform annular space between the shaft and the bearing is filled with oil of dynamic viscosity 0.8 poise. Calculate power dissipated as heat. **8**

Q.2(b) State the continuity equation for incompressible flow. **4**

Q.3 Check whether the flow defined by the stream function $\psi = 2xy$ is irrotational. Determine the corresponding velocity potential. **12**

UNIT-II

Q.4 Assuming that the rate of discharge Q of a centrifugal pump is dependent upon the mass density ρ of fluid, pump speed N (rpm), the diameter of impeller D, the pressure p and the viscosity of fluid μ, show using the Buckingham's π-theorem that it can be represented by **12**

$$Q = (ND^3)\emptyset\left[\left(\frac{gH}{N^2D^2}\right),\left(\frac{\upsilon}{ND^2}\right)\right]$$

where H = head and υ = kinematic viscosity of the fluid

Q.5(a) A pipeline 0.225 m in diameter and 1580 m long has a slope of 1 in 200 for the first 790 m and 1 in 100 for the next 790 m. The pressure at the upper end of the pipeline is 107.91 kPa and at the lower end is 53.955 kPa. Taking f = 0.032 determine the discharge through the pipe. **8**

Q.5(b) Distinguish between laminar and turbulent flow in pipes. **4**

UNIT-III

Q.6	A Pelton wheel has to be designed for the following data: Power to be developed = 6000 kW Net head available = 300 m Speed = 550 r.p.m. Ratio of jet diameter to wheel diameter =1/10, and Overall efficiency = 85% Find the number of jets, diameter of the jet, diameter of the wheel, and the quantity of water required. Take coefficient of velocity= 0.98, Speed ratio= 0.46.	**12**
Q.7(a)	A jet of water 50 mm in diameter, moving with velocity of 15 m/s, impinges on a series of vanes moving with a velocity of 6 m/s. Find (a) Force exerted by the jet, (b) Work done by the jet, and (c) Efficiency of the jet.	**8**
Q.7(b)	Differentiate between Propeller and Kaplan turbine.	**4**

UNIT-IV

Q.8	Show from the first principles, that the work saved against friction in the delivery pipe of a single acting reciprocating pump, by fitting air vessel, is 84.8%.	**12**
Q.9(a)	Describe the different types of impeller of centrifugal pump. Give their advantages and disadvantages.	**8**
Q.9(b)	What is priming of the pump? Describe its necessity.	**4**

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D 114

B.Tech. Mechanical Engineering IV Semester Examinations (Jun 2026)

Production Technology (BT-ME-206A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1		Marks
(a)	Define orthogonal and oblique cutting. Give one example of each.	2
(b)	State Taylor's tool life equation and define all terms used.	2
(c)	What is up milling and down milling? Mention one advantage of each.	2
(d)	Differentiate between a jig and a fixture.	2
(e)	State the principle of gear hobbing process.	2
(f)	List any two G-codes used in CNC part programming with their functions.	2

UNIT-I

Q.2(a)	With a neat diagram, explain the orthogonal cutting model. Derive the expressions for chip thickness ratio and shear angle.	7
Q.2(b)	A turning operation is performed at 60 m/min with tool life of 120 min. Find the tool life when cutting speed is increased to 90 m/min. Assume η=0.3	5
Q.3	Explain tool wear, tool life and factors affecting tool life. Derive Taylor's tool life equation.	12

UNIT-II

Q.4	Describe the grinding process in detail. Explain the marking system of a grinding wheel with an example. Discuss the factors affecting the selection of grinding wheel.	12
Q.5(a)	Differentiate between up milling and down milling with respect to chip formation, surface finish, and tool life.	6
Q.5(b)	Derive the expression for the minimum cost per piece in machining economics.	6

UNIT-III

Q.6	Explain methods of gear manufacturing and gear forming processes. Describe broaching of gears.	12
Q.7(a)	Describe the gear hobbing process with a neat diagram. Explain how helical gears can be produced using a hobbing machine.	7
Q.7(b)	Explain the concept of Single Minute Exchange of Die (SMED).	5

UNIT-IV

Q.8	Write a CNC part programme to turn a stepped shaft of 50 mm length having two diameters 40 mm and 30 mm from an initial diameter of 45 mm. Use appropriate G and M codes	12
Q.9	Explain the principle, working, and applications of Electro-Discharge Machining (EDM).	12

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D-115

B. Tech. Mechanical Engineering IV Semester Examinations (June 2026)
Materials Engineering (BT-ME-208A)

Time- 3 hrs
Max. Marks-60

Attempt 5 questions in all, selecting one question from each unit and Question 1 is compulsory. Each Question carries 12 marks.

Q.1		Marks
(a)	Explain about types of unit cell.	2
(b)	What is polymer and homo-polymer? Explain with example	2
(c)	What is degree of polymerization and co-polymer?	2
(d)	Explain about atomic packing fraction.	2
(e)	What are linear polymers? Give examples	2
(f)	What are branched polymers?	2
	UNIT-I	
Q.2(a)	Calculate atomic packing fraction of BCC crystal structure.	6
Q.2(b)	Differentiate between edge dislocation and screw dislocation.	6
Q.3(a)	Calculate atomic packing fraction of FCC crystal structure.	6
Q.3(b)	Write structure of polyethylene, polypropylene, PVC, polystyrene, polyacrylonitrile.	6
	UNIT-II	
Q.4(a)	What is Gibb's phase rule? Discuss its application in detail.	6
Q.4(b)	What is phase diagram? Discuss the main applications of phase diagram in detail.	6
Q.5(a)	Differentiate between normalizing and tempering.	6
Q.5(b)	Write difference between annealing process & hardening heat treatment process.	6
	UNIT-III	
Q.6(a)	Write difference between homo polymer and co polymer.	6
Q.6(b)	Discuss in details about alternate copolymer, random copolymer, block copolymer and graft copolymer.	6
Q.7(a)	What is polymer? Write difference between monomer & polymer with five examples	6
Q.7(b)	Discuss classification of polymer on the basis of monomer units.	6
	UNIT-IV	
Q.8(a)	Write difference between elasticity and plasticity. Write detailed notes on fatigue	6
Q.8(b)	What is metal? Discuss types, properties and uses of metals.	6
Q.9(a)	Differentiate between metal and non-metal.	6
Q.9(b)	What are ceramics, discuss its types, properties, and uses.	6

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D-116

B.Tech. Mechanical Engineering IV Semester Examinations (Jun 2026)
Mechanics of Solids II (BT-ME-210A)

Time- 3hrs
Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1		Marks
(a)	What are the boundary conditions used to evaluate constants in Lame's equation for a thick cylinder experiencing external pressure?	2
(b)	Define 'Resilience' and write its expression for a member experiencing uniform pure shear stress.	2
(c)	State the fundamental criteria of failure according to the Maximum Principal Stress Theory.	2
(d)	Discuss how an open-coiled helical spring behaves differently from a close-coiled one when subjected to an axial twist.	2
(e)	How does the stress distribution in a curved beam differ from that of a straight beam subjected to pure bending?	2
(f)	What is a "shear centre," and why is its location critical when designing thin-walled open sections like channels, angles, and I-sections?	2

UNIT-I

Q.2(a)	A thin cylindrical shell of diameter d, length L, and wall thickness t is filled with fluid at an internal pressure p. Derive the mathematical expressions for the volumetric strain and longitudinal strain.	4
Q.2(b)	A thin seamless steel cylinder 1.2 m long, 200 mm internal diameter, and 6 mm wall thickness is filled completely with a liquid at atmospheric pressure. Find the additional volume of liquid that must be pumped into the vessel to raise the internal pressure to 5 N/mm^2. Take E = 210 GPa, Poissin's ratio = 0.3, and Bulk Modulus of liquid = 2.1 GPa.	8
Q.3	A thick steel cylinder with an inner diameter of 160 mm and an outer diameter of 240 mm is subjected to an internal pressure of 40 MPa. Plot the variation of hoop stress and radial stress across the cylinder thickness by computing values at intervals of 20 mm.	12

UNIT-II

Q.4(a)	Using Castigliano's theorem, derive an expression for the vertical deflection at the free end of a cantilever beam of length L and uniform flexural rigidity EI, carrying a point load W at its free end.	6
Q.4(b)	A bar of uniform cross-sectional area A and length L is subjected to a suddenly applied axial load P. Compare the maximum dynamic stress and maximum strain energy stored in this bar with those produced if the same load P were applied gradually.	6

Q.5(a)	Discuss the engineering applications of the Maximum Shear Stress Theory.	**6**
Q.5(b)	A bolt is subjected to an axial pull of 12 kN and a simultaneous transverse shear force of 6 kN. Determine the required diameter of the bolt based on the Maximum Principal Stress Theory using a factor of safety of 3. The yield strength of the bolt material in tension is 270 MPa.	**6**

UNIT-III

Q.6(a)	An open-coiled helical spring, having n turns of wire radius r and mean coil radius R, is subjected to an axial load W. The helix angle is α. Derive expressions for the axial elongation and angle of rotation produced at the free end.	**6**
Q.6(b)	A solid steel cylinder of radius 250 mm rotates about its longitudinal axis at a constant speed of 3000 rpm. Calculate the maximum tensile hoop stress and radial stress induced in the cylinder. Take density = 7850 kg/m^3 and Poisson's ratio = 0.3.	**6**
Q.7(a)	Derive expressions for the radial and hoop stresses developed in a thin, flat, rotating circular disc of uniform thickness with an outer radius R and a central hole of radius r, rotating at an angular velocity ω.	**6**
Q.7(b)	A leaf spring (semi-elliptical type) 1 meter long is made up of steel plates 60 mm wide and 6 mm thick. If the permissible bending stress is limited to 150 Mpa and the maximum central deflection must not exceed 25 mm, find the required number of plates and the central load it can safely carry. Take E = 200 Gpa.	**6**

UNIT-IV

Q.8	A curved bar of rectangular cross-section (40 mm wide and 60 mm deep) has a mean radius of curvature of 100 mm. If it is subjected to a bending moment of 2.5 kNm tending to increase its curvature, determine the maximum tensile and compressive stresses produced in the section.	**12**
Q.9(a)	Explain the concept of principal axes of inertia. Under what conditions does a beam experience unsymmetrical bending? Derive the expression for the orientation of the neutral axis.	**6**
Q.9(b)	A channel section has a total width of 100 mm, total depth of 150 mm, and uniform wall thickness of 10 mm for both flanges and web. Determine the exact position of its shear centre relative to the centerline of the web.	**6**

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D-117

B.Tech. Mechanical Engineering IV Semester Examinations (June 2026)
Electric Vehicle Battery Management Systems (BT-ME-252 A)

Time- 3hrs
Max.Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1		Marks
(a)	Differentiate between active and passive Battery Thermal Management Systems.	2
(b)	State the advantages of using heat pipes in EV battery cooling systems.	2
(c)	What is the purpose of boundary conditions in BTMS simulations?	2
(d)	What is meant by thermodynamic analysis of BTMS?	2
(e)	List any two major components modeled in Battery Thermal Management Systems.	2
(f)	What is battery second use in electric vehicle technology?	2

UNIT-I

Q.2(a)	Compare air cooling, liquid cooling, and direct refrigerant cooling techniques used in Battery Thermal Management Systems.	6
Q.2(b)	Analyze the performance of heat pipe and thermo-electric module technologies for EV battery cooling applications.	6
Q.3	Evaluate the suitability of different types of Phase Change Materials (PCMs) for passive BTMS applications with respect to thermal properties, cost, and environmental impact.	12

UNIT-II

Q.4	Develop a simulation approach for Battery Thermal Management Systems by considering governing equations, constitutive laws, and material input parameters of Li-ion cells and cooling components.	12
Q.5(a)	Analyze the importance of numerical modeling in the simulation of Li-ion battery thermal behavior.	6
Q.5(b)	Examine the influence of model assumptions and boundary conditions in PCM-based BTMS simulations.	6

UNIT-III

Q.6	Critically examine the application of energy and exergy analyses in evaluating the thermodynamic performance of Battery Thermal Management Systems.	12
Q.7(a)	Analyze the effect of battery temperature distribution on the performance and safety of electric vehicles.	6
Q.7(b)	Evaluate the role of heat exchangers and compressors in improving BTMS efficiency.	6

UNIT-IV

Q.8	Evaluate future trends in Battery Thermal Management Systems with special emphasis on battery swapping, battery second use, magnetic cooling, and dual cooling jet technologies.	**12**
Q.9(a)	Examine the significance of exergo-economic analysis in reducing the operating cost of BTMS.	**6**
Q.9(b)	Analyze the environmental impacts associated with advanced battery cooling technologies.	**6**

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B.Tech. Mechanical Engineering IV Semester Examinations (Jun 2026)
Robotics Engineering (BT-ME-254A)

Time- 3hrs
Max.Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1		Marks
(a)	What is Degrees of Freedom (DOF) in a robot?	2
(b)	Classify sensors used in robots.	2
(c)	Define Robot Kinematics.	2
(d)	What is PID control in robotic systems?	2
(e)	Define Encoder and mention its types.	2
(f)	Explain Translation and Rotation transformations.	2

UNIT-I

Q.2	Classify robots on the basis of configuration and control system. Explain with neat sketch.	12
Q.3 (a)	Describe the basic components of a robotic system with suitable diagrams.	6
(b)	Explain different types of grippers with applications.	6

UNIT-II

Q.4	Explain the working principle and applications of the following robotic sensors: (i) Touch sensors (ii) Force sensors (iii) Light sensors	12
Q.5	Explain the following: (i) Electric Drives (ii) Hydraulic drives (iii) Pneumatic drive	12

UNIT-III

Q.6(a)	Explain the forward and inverse kinematics with suitable examples.	5
(b)	Discuss trajectory planning in robotic systems. Explain point-to-point and continuous path trajectory planning methods.	7
Q.7	What is the Jacobian matrix? Derive the Jacobian for a two-link robotic manipulator and explain its applications in robot motion control.	12

UNIT-IV

Q.8(a)	Discuss robot control architectures. Explain PID controller tuning methods and their applications in robotics	6
(b)	Describe the process of robot vision. Explain image acquisition, frame grabbing, and image pre-processing techniques in detail.	6
Q.9	Write notes on the following: (i) Masking technique (ii) Pre-processing methods (iii) Robots motion planning	12

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