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3E1206**3E1206****B.Tech. III-Sem. (Main/Back) Examination, January - 2025****Automobile Engg.****3AE2-01 Advance Engineering Mathematics-I****AN, AG, AE, CE, CR, EC, EI, ME, MH, PT****Time : 3 Hours****Maximum Marks : 70****Instructions to Candidates:**

Attempt all Ten questions from Part A, Five questions out of Seven questions from Part B and Three questions out of Five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

PART - A**(Answer should be given up to 25 words only)****All questions are compulsory.****(10×2=20)**

1. What is the value of $\Delta^n(e^x)$; if $h = 1$.
2. Write the trapezoidal rule.
3. Write the formula for Euler's modified method.
4. Find the first approximation to a real root of equation $x^3 - 3x^2 - 2 = 0$ by Regula falsi method between 3 to 4.
5. What are the existence conditions of Laplace transform?
6. Find $L^{-1}\left[\frac{1}{s^2}\right]$
7. Define Fourier sine and cosine transforms.

8. Find the Fourier transform of $f(t)=1, |t| < 1$.
9. Find the Z - transform of the sequence $u_n = \{2, -4, 6, -8\}$.
10. Find $Z^{-1}\left[\frac{z}{z-3}\right]$.

PART - B

(Analytical/Problem solving questions)

Attempt any Five questions.

(5×4=20)

1. Using Lagrange's interpolation formula, find the value of $y=f(x)$ at $x=9.5$ for the following:

x	7	8	9	10
$f(x)$	3	1	1	9

2. Compute the value of $\int_0^6 \frac{dx}{1+x^2}$ by Simpson's " $\frac{1}{3}$ " rule.
3. Using Euler's method, solve the differential equation $\frac{dy}{dx} = x + y$; with initial condition $y(0)=1$ for $x=1$, using $h = 0.2$
4. Find Laplace transform of $\sin \sqrt{t}$
5. Find $L^{-1}\left[\frac{4s+5}{(s+2)(s-1)^2}\right]$
6. Find the Fourier Sine and cosine transform of $f(x)$, where $f(x) = \begin{cases} 1, & 0 < x < a \\ 0, & x > a \end{cases}$
7. Using convolution theorem, evaluate $z^{-1}\left[\frac{z^2}{(z-1)(z-3)}\right]$

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PART - C

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any Three questions.

(3×10=30)

1. Use Stirling's formula to find y at $x = 12.2$ from the following data:

x :	10	11	12	13	14
y :	23967	28060	31788	35209	38368

2. Calculate $y(0.2)$ using Runge - Kutta fourth order method to solve

$$\frac{dy}{dx} = x + y^2, y(0) = 1, h = 0.2$$

3. Use Laplace transform to solve $(D^2 + 25)y = 10 \cos 5x$, given that $y(0) = 2, y'(0) = 4$.

4. Find the complex fourier transform of $e^{-|x|}$

5. Use Z transform to solve the difference equation. $U_{n+2} + 4U_{n+1} + 3U_n = 3^n$, given that $u_0 = 0, u_1 = 1$.
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3E1200**3E1200****B.Tech. III-Sem. (Main/Back) Examination, January - 2025****Artificial Intelligence & Data Science****Managerial Economics and Financial Accounting****Common to All Branches****Time : 3 Hours****Maximum Marks : 70****Instructions to Candidates:**

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used! calculated must be stated clearly. Use of following supporting material is permitted during examination. (Mentioned in form No.205)

PART - A

(Answer should be given up to 25 words only)

All questions are compulsory.

(10×2=20)

- 1 Define the term economics.
2. What do you mean by profit and loss statement.
3. Differentiate between monopoly and monopolistic competition.
4. What do you mean by opportunity cost.
5. What does financial accounting mean.
6. Why do economic problems arise.
7. What do you mean by marginal product of an input. How is it calculated.
8. What are the determinants of supply.

9. What does liabilities mean.
10. What does the circular flow model depicts.

PART - B

(Analytical/Problem solving questions)

Attempt any Five questions.

(5×4=20)

1. Explain the inductive and deductive methods of economic analysis.
2. Discuss the concept of kinked demand curve under oligopoly.
3. Write short notes on ratio analysis.
4. Explain the concept of demand and elasticity of demand.
5. Discuss the concept of least cost combination of inputs.
6. Discuss various concepts of National Income.
7. Explain the methods of demand forecasting.

PART - C

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any Three questions.

(3×10=30)

1. Critically examine the methods of evaluating capital budgeting proposals.
 2. Discuss the price and output determination under perfect competition.
 3. Using suitable diagram, explain the law of variable proportions.
 4. Explain with the help of curves, relationship between various cost concepts.
 5. What do you mean by balance sheet. Discuss.
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3E1207**3E1207****B.Tech. III-Sem. (Main/Back) Examination, January- 2025****Automobile Engg.****3AE3-04 Engineering Mechanics****AE, ME****Time : 3 Hours****Maximum Marks : 70****Instructions to Candidates:**

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

PART - A

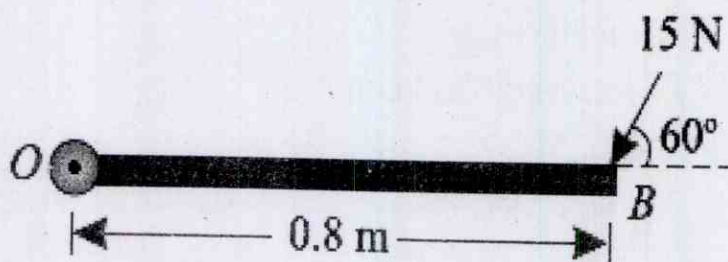
(Answer should be given up to 25 words only)

All questions are compulsory.

(10×2=20)

- 1 Differentiate centroid and center of gravity.
2. Two forces of 100 N and 150 N are acting simultaneously at a point. What is the resultant of these two forces, if the angle between them is 45° ?
3. State the Lami's theorem with diagram.
4. State the D'Alembert's principle.
5. Define principles of transmissibility
6. State parallel axis theorem?
7. State the principle of impulse-momentum?
8. State the Law of machine?

9. A force of 15 N is applied at an angle of 60° to the edge of a door 0.8 m wide as shown in Fig. Find the moment of the force about the hinge (O).



10. Write the principle of virtual work.

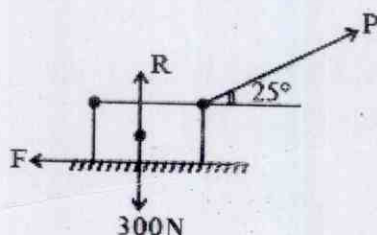
PART - B

(Analytical/Problem solving questions)

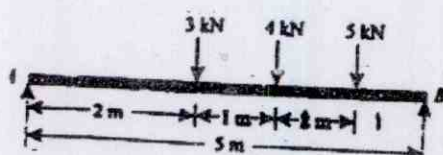
Attempt any Five questions.

(5×4=20)

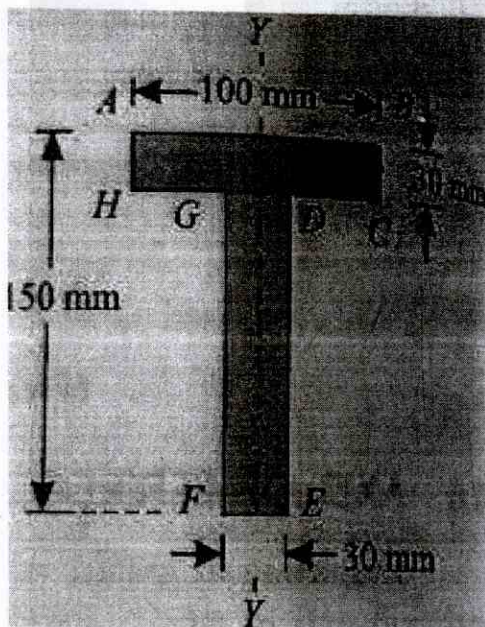
1. A body of weight 300 N is lying on a rough horizontal plane having a coefficient of friction as 0.3. Find the magnitude of the force (P), which can move the body, while acting at an angle of 25° with the horizontal.



2. A simply supported beam AB of span 5 m is loaded as shown in Fig. Find the reactions at A and B.



3. Find the centre of gravity of a $100 \text{ mm} \times 150 \text{ mm} \times 30 \text{ mm}$ T-section.



4. In a certain weight lifting machine, a weight of 1 kN is lifted by an effort of 25N. While the weight moves up by 100mm, the point of application of effort moves by 8 m. Find mechanical advantage, velocity ratio and efficiency of the machine.
5. Derive the expression for time of flight of a projectile on a horizontal plane?
6. A ball of mass 1 kg moving with a velocity of 2 m/s impinges directly on a ball of mass 2 kg at rest. The first ball, after impinging, comes to rest. Find the velocity of the second ball after the impact and the coefficient of restitution.
7. A circular wheel of mass 50 kg and radius 200 mm is rotating at 300 r.p.m. Find its kinetic energy.

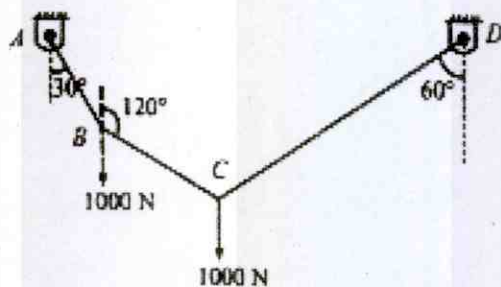
PART - C

(Descriptive/Analytical/Problem Solving/Design questions)

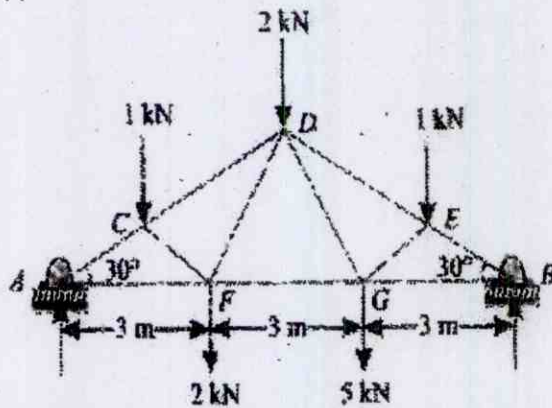
Attempt any Three questions.

(3×10=30)

1. Derive the equation for the length of a cross-belt drive?
2. A string ABCD, attached to fixed points A and D has two equal weights of 1000 N attached to it at B and C. The weights rest with the portions AB and CD inclined at angles as shown in Fig. Find the tensions in the portions AB, BC and CD of the string, if the inclination of the portion BC with the vertical is 120° .



3. Derive the expression for moment of inertia of a rectangular section?
4. A body of mass 0.5 kg tied to string is whirled in a vertical circle making 2 rev/s. If radius of the circle is 1.2m, then find tensions in the string when the body is at top of the circle, and (ii) at the bottom of the circle.
5. A truss of 9 m span is loaded as shown in Fig. Find the reactions at the two supports.



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3E1208**3E1208****B.Tech. III-Sem. (Main Back) Examination, January - 2025****Automobile Engg.****3AE4-05 Engineering Thermodynamics****AE, ME****Time : 3 Hours****Maximum Marks : 70****Instructions to Candidates:**

Attempt all Ten questions from Part A, Five questions out of Seven questions from Part B and Three questions out of Five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

PART - A**(Answer should be given up to 25 words only)****All questions are compulsory.****(10×2=20)**

1. Differentiate between the intensive and extensive Properties with example.
2. What do you understand by path function and point function?
3. Explain Clausius statement of second law of thermodynamics.
4. What is perpetual motion machine of first kind?
5. What do you understand by triple point?
6. Write the various Maxwell's Equations.
7. What do you understand by entropy principle.
8. Mention the merits and demerits of Ericsson cycle.
9. What is the effect of regeneration on the cycle efficiency.
10. State Gibbs Dalton law.

PART - B

(Analytical/Problem solving questions)

Attempt any Five questions.

(5×4=20)

1. Drive the general expression for the maximum work of an open system which exchanges heat only with the surroundings.
2. Explain the First Law of Thermodynamics in detail.
3. A vessel of volume 0.04m^3 contains a mixture of saturated water and saturated steam at a temperature of 250°C . The mass of liquid present is 9kg. Find the mass, the specific volume, the enthalpy and the internal energy.
4. A reversible adiabatic process begins at pressure 10bar and temperature of 300°C and ends with pressure 1 bar. Find the specific volume and the work done per kg of air.
5. Derive the first and second TDS equation.
6. Draw p-v and T-s diagram of otto cycle and derive the expression for air standard efficiency of it.
7. Explain the Rankine Cycle with neat sketch.

PART - C

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any Three questions.

(3×10=30)

1. What is a steady flow process? Derive the steady flow energy equation for a single stream entering and a single stream leaving a control volume. Also explain its various terms in it.

2. A mass of air is initially at 260°C and 700kPa , and occupies 0.028m^3 . The air is then expanded at constant pressure to 0.084m^3 . A polytropic process with $n=1.50$ is then carried out, followed by a constant temperature process which completes a cycle. All processes are reversible.
 - a) Sketch the cycle on p-v and T-s plane.
 - b) Find the heat received and heat rejected in the cycle, and
 - c) Find the efficiency of cycle.
 3. Derive the expression for the difference in heat capacities, C_p and C_v . What does the expression signify?
 4. Show that the efficiency of Brayton cycle depends on the pressure ratio. Also discuss the effect of regeneration on Brayton cycle.
 5. A steam power plant operates on Rankine cycle with superheated steam entering the turbine at 4 Mpa and 300°C . The steam is condensed in a condenser at 20kPa . Determine the thermal efficiency of the cycle assuming ideal conditions.
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3E1209**3E1209****B.Tech. III-Sem. (Main/Back) Examination, January- 2025****Automobile Engineering****3AE4-06 Materials Science and Engineering****AE, ME****Time : 3 Hours****Maximum Marks : 70****Instructions to Candidates:**

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

PART - A**(Answer should be given up to 25 words only)****All questions are compulsory.****(10×2=20)**

- 1 Explain crystal imperfections.
2. Define elastic and Plastic modes of deformation.
3. Define Crystal growth.
4. Define eutectoid and peritectoid
5. Explain flame and induction hardening.
6. Explain equilibrium system in Material science.
7. Define strain hardening
8. Define critical cooling rate.

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9. Explain polymer.
10. Explain surface and volume defects.

PART - B

(Analytical/Problem solving questions)

Attempt any Five questions.

(5×4=20)

1. Define Bauschinger's effect and its process.
2. Explain formation of Austenite from pearlite.
3. Define critical cooling rate.
4. Explain Jominey end quench test.
5. Explain properties and applications of PE, PP, PS, PVC, PMMA , PET.

PART - C

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any Three questions.

(3×10=30)

1. Explain Frank Reed Source of dislocation.
 2. Define Iron carbon equilibrium diagram.
 3. Define HSLA steel.
 4. Define Hume-Rothery rule.
 5. Explain isothermal transformation diagram.
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3E1210**3E1210****B.Tech. III-Sem. (Main/Back) Examination, January- 2025****Automobile Engg.****3AE4-07 Mechanics of Solids****AE,ME****Time : 3 Hours****Maximum Marks : 70****Instructions to Candidates:**

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used! calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

PART - A

(Answer should be given up to 25 words only)

All questions are compulsory.

(10×2=20)

- 1 Draw stress-strain curve for both Ductile and Brittle material.
2. Explain the following mechanical properties:
 - a) Hardness
 - b) Ductility
 - c) Fatigue
 - d) Creep
3. Define Poisson's ratio.
4. Define section modulus.
5. Explain the term torsional rigidity.

6. Explain the term torsion and give general equation of torsion.
7. What is the buckling of columns?
8. Explain uniformly distributed load and uniformly varying load.
9. Differentiate between continuous and overhanging beam.
10. Explain thermal stresses and strain.

PART - B

(Analytical/Problem solving questions)

Attempt any Five questions.

(5×4=20)

1. Find an expression for the total elongation of a bar due to its own weight when the bar is fixed at its upper end and hanging freely at the lower end.
2. A steel wire 2m. long and 3mm. in dia. Is extended by 0.75mm. when a weight w is suspended from the wire. If the same weight is suspended from a brass wire 2.5m long 2mm in dia, it is elongated by 4.64mm. Determine the modulus of elasticity of brass, if that of steel $2.0 \times 10^5 \text{ N/mm}^2$.
3. What are the assumptions made in the theory of simple bending?
4. Discuss in detail various Theories of failure.
5. Prove that neutral axis always passes through the Centroid of the cross-section.
6. Derive the expression for Euler's buckling load for a column. with one end fixed and the other hinged.
7. Discuss the effective length of columns with different end conditions.

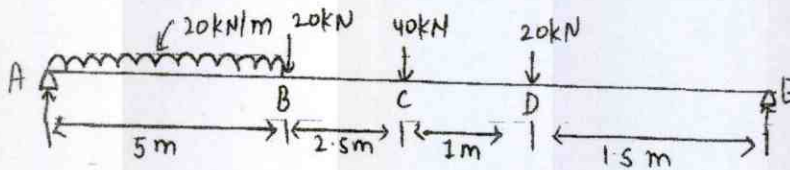
PART - C

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any Three questions.

(3×10=30)

1. Derive the relation between modulus of elasticity, modulus of rigidity, bulk modulus and Poisson's ratio.
2. A mild steel rod of 25 mm. dia. And 400mm. long is enclosed centrally inside a hollow copper tube of external dia 35mm and internal dia 30mm. The ends of the rod are brazed together and the composite bar is subjected to an axial pull of 50 kN. Calculate the stress developed in the rod and tube. Also find the extension of the rod. Take E for steel as 200 GN/m^2 , and that for copper as 150 GN/m^2 .
3. Draw the S.F.D and B.M.D for the simply supported beam shown below:



4. A Cantilever of length of 2m carries a UDL of 1.5 kN/m run over the whole length and point load of 2 kN at a distance of 0.5 m from the free end. Draw SFD and BMD.
5. A Simply supported beam of uniform section has a span L and carries two equal loads w load symmetrically placed at a distance $L/3$ on either side of mid-span. Find the deflection at the mid span. Using macaulay's method.

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3E1117	Roll No. _____	[Total No. of Pages : 2]
	3E1117	
	B.Tech. III-Sem. (Back) Examination, January - 2025	
	Automobile Engineering 3AE4-05 Engineering Thermodynamics AE, ME	

Time : 3 Hours**Maximum Marks : 120****Min. Passing Marks : 42****Instructions to Candidates:**

*Attempt all **Ten questions** from Part A, **Five questions** out of seven questions from Part B and **Four questions** out of five questions from Part C.*

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

PART - A**(Answer should be given up to 25 words only)****All questions are compulsory.****(10×2=20)**

1. Define extensive property.
2. Define Thermodynamic Equilibrium.
3. What is available energy?
4. Define dryness fraction.
5. Write Second law of thermodynamics.
6. State: Kelvin-Planck Statement.
7. Define irreversibility?
8. List the limitation of first law of thermodynamics?
9. Write Joule-Thomson coefficient.
10. What do you understand by Steady and Unsteady flow?

PART - B**(Analytical / Problem Solving Questions)****Attempt any Five questions.****(5×8=40)**

1. 90 kJ of heat is supplied to a system at a constant volume. The system rejects 95 kJ of heat at constant pressure and 18 kJ of work is done on it. The system is brought to original state by adiabatic process. Determine.
 - a) The adiabatic work
 - b) The values of internal energy at all states if initial value is 105 kJ

2. A closed insulated vessel contains 200 kg of water. A paddle wheel immersed in the water is driven at 400 rev/min with an average torque of 500 Nm. If the test run is made for 30 minutes. Determine rise in the temperature of water. Take specific heat of water 4.186 KJ/Kg K.
3. Explain regenerative cycle.
4. Describe Brayton cycle and Ericsson cycle with the help of a neat sketch.
5. Explain Dalton's law of partial pressures.
6. Describe the Equivalence of the Kelvin-Planck and Clausius statements.
7. A 30 kg iron block and a 40 kg copper block, both initially at 80°C. Thermal equilibrium is established after an while as a result of heat transfer between the blocks and the lake water. Determine the total entropy change for this process.

PART - C

(Descriptive / Analytical / Problem Solving / Design Questions)

Attempt any Four questions.

(4×15=60)

1. In a Carnot cycle the maximum pressure and temperature are limited to 18 bar and 410°C. The volume ratio of isentropic compression is 6 and isothermal expansion is 1.5. Assume the volume of the air at the beginning of isothermal expansion as 0.18 m³. Show the cycle P-V and T-S diagram and determine
- The pressure and temperature at main points.
 - Thermal efficiency of the cycle.
2. Explain feed water heating co-generation cycle.
3. A quantity of air undergoes a thermodynamic cycle consisting of three processes. Process 1 - 2: Constant volume heating from $P_1 = 0.1$ MPa, $T_1 = 15^\circ$, $V_1 = 0.02$ m³ to $P_2 = 0.42$ MPa. Process 2 - 3: Constant pressure cooling. Process 3 - 1: Isothermal heating to the initial state. Employing the ideal gas model with $C_p = 1$ kJ/kgK, evaluate the change of entropy for each process. Sketch the cycle on p-v and T-s coordinates.
4. Explain Rankine cycle with help of neat sketch also describe effect of operating conditions on its efficiency.
5. Explain:
- Otto cycle.
 - Diesel cycle.

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3E1119**3E1119****B.Tech. III-Sem. (Back) Examination, January - 2025****PCC Automobile Engineering****3AE4-07 Mechanics of Solids****AE, ME****Time : 3 Hours****Maximum Marks : 160****Instructions to Candidates:**

Attempt all **Ten questions** from Part A, **Five questions** out of seven questions from Part B and **Four questions** out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

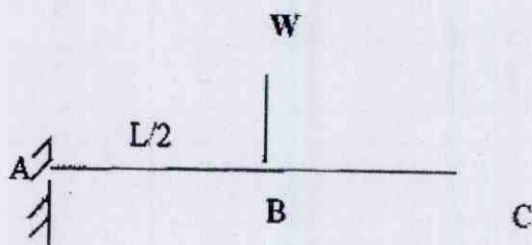
PART - A**(Answer should be given up to 25 words only)****All questions are compulsory.****(10×3=30)**

1. Define stress.
2. State Hooke's law.
3. State the relationship between Young's Modulus and Modulus of Rigidity.
4. Define strain energy.
5. Define elastic limit.
6. Define Bulk-modulus.
7. What is meant by transverse loading of beam?
8. What are the types of beams?
9. Define Torsion.
10. Define column.

PART - B**(Analytical / Problem Solving Questions)****Attempt any Five questions.****(5×10=50)**

1. Derive an expression for crippling load when one end of the column is fixed and the other end is free.
2. A pipe of 400 mm internal diameter and 100 mm thick contains a fluid at a pressure of 10 N/mm². Find maximum and minimum hoop stress across the section. Also sketch the stress distribution.

3. Explain Mohr's circle for stress and strain.
4. Determine the deflection of the beam given in figure. Use principle of virtual work.



5. Find the deflection at one third point from left end of the simply supported beam of span 6m subjected to uniformly distributed load of 20 kN/m by strain principle.
6. Derive a relation for strain energy due to torsion.
7. Derive the expression for strain energy due to bending.

PART - C

(Descriptive / Analytical / Problem Solving / Design Questions)

Attempt any Four questions.

(4×20=80)

1. Find the deflection at mid span of a simply supported beam carrying an uniformly distributed load of 2kN/m over the entire span using principle of virtual work. Take span = 5m, $EI = 20000 \text{ KN/m}^2$.
2. Derive the expression for buckling load of a long column fixed at one end and hinged at the other end.
3. A fixed beam AB of length 6m carries point loads of 160 kN and 120 kN at a distance of 2m and 4m from the left end A. Find the fixed end moments and the reactions at the supports. Draw B and SF diagrams.
4. Find the ratio of buckling strength of a solid column to that of a hollow column of the same material and having the same cross sectional area, the internal diameter of the hollow column is half of its external diameter. Both the columns are hinged and the same length.
5. Derive the Euler's buckling load for a column with both ends hinged.