PVP 20

Code: 20ME3402

II B.Tech - II Semester – Regular / Supplementary Examinations
MAY - 2023

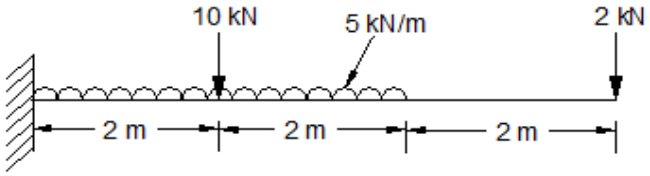
STRENGTH OF MATERIALS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	A 500 mm long and 16 mm diameter rod made of a homogenous and isotropic material is observed to increase in length by 300 μm, and to decrease in diameter by 2.4 μm when subjected to an axial load 12 kN. Find Young's modulus (E), Poisson's ratio (μ), Bulk modulus (K) and Modulus of rigidity (G) of the material.	L2	CO1	7 M
	b)	Define Hooke's law and Poison's ratio. Derive the expression for volumetric strain of rectangular bar subjected to axial loading.	L2	CO1	7 M
OR					
2		Calculate the length and diameter of a solid steel shaft which will transmit 90 kW at 160 rpm. The angle of twist must not exceed 1º over the entire	L3	CO2	14 M

		length and maximum shear stress is limited to 60 N/mm^2. Modulus of rigidity = 8 x 10^4 N/mm^2.			
		UNIT-II			
3		A simply supported beam AB of span 10 m carries an UDL of 5 kN/m over 3 m from left end and also over 4 m from right hand support. It also carries a point load of 25 kN and 65 kN at 3 m and 8 m respectively from left support. Draw SFD and BMD and also find the maximum bending moment.	L3	CO2	14 M
		OR			
4		Sketch the shear force and bending moment diagrams for the cantilever beam shown in the figure and mark the salient values. 	L3	CO2	14 M
		UNIT-III			
5	a)	Derive the equation for pure bending. $\left(\frac{M}{I}=\frac{f}{y}=\frac{E}{R}\right)$	L2	CO3	7 M
	b)	Calculate the maximum stress induced in a cast iron pipe of external diameter of 40 mm, internal diameter of 20 mm and of length 4 m when the pipe is supported at its	L3	CO3	7 M

		ends and carries a point load of 80 N at its centre.			
OR					
6	a)	A wooden beam 100 mm wide and 150 mm deep is simply supported over a span of 4 m. If shear force at a section of the beam is 4500 N, find the shear stress at a distance of 25 mm above the neutral axis.	L4	CO3	8 M
	b)	Show that for a rectangular section, the maximum shear stress is 1.5 times the average stress.	L2	CO3	6 M
UNIT-IV					
7		A beam of length 10 m is simply supported at its ends and carries two point loads of 100 kN and 60 kN at a distance of 2 m and 5 m respectively from the left support. Calculate the deflections under each load. Find also the maximum deflection. Take I = 1.8×10^8 mm^4 and E= 2.1×10^5 N/mm^2.	L4	CO3	14 M
OR					
8		A cylindrical vessel whose ends are closed by means of rigid flange plates made of 3 mm thick. The length and the internal diameter of the vessel are 50 cm and 25 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal pressure of 3 N/mm^2. Also calculate the increase in length, diameter and volume of the vessel.	L4	CO3	14 M

UNIT-V					
9	a)	Derive an expression or the major and minor principle stresses on an oblique plane, when the body subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress.	L2	CO4	7 M
	b)	A rectangular bar of cross sectional area 12000 mm^2 is subjected to an axial load of 360 N. Determine the normal and shear stresses on a section which is inclined at an angle of 30^o with the normal section of bar.	L4	CO4	7 M
OR					
10		Find an expression for crippling load for a long column when one end of the column is fixed and the other end is hinged.	L2	CO4	14 M