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**University Examinations 2016/2017**

THIRD YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING.

**EMT 3304: SOLID AND STRUCTURAL MECHANICS II**

**DATE: DECEMBER, 2016 TIME: 2 HOURS**

**INSTRUCTIONS: -** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30 MARKS)**

1. Define the following terms
2. Cantilever (1 mark)
3. Strain energy (1 mark)
4. Resilience (1 mark)
5. Proof resilience (1 mark)
6. Modulus of resilience (1 mark)
7. Slenderness ratio (1 mark)
8. (i) Describe the difference between a column and a strut (2 marks)

(ii) A steel plate of width 120 mm and of thickness 20mm is bent into a circular arc of radius 10m. Determine the maximum stress induced and the bending moment which will produce the maximum stress (5 marks)

Take .

1. (i) Explain the meaning of a spring and describe the two main types of helical springs (6 marks)

(ii) A closely coiled helical spring is to carry a load of 500N. Its mean coil diameter is to be 10 times that of the wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring is to be 80N/mm2 (5 marks)

1. A cantilever of length 3m is carrying a point load of 25kN at the file end. If the moment of inertia of the beam=108mm4 and value of , find
2. Slope of the cantilever at the fuce-end. (3 marks)
3. Deflection at the fuce end (3 marks)

**QUESTION TWO (20 MARKS)**

1. Using sketches, describe the following types of loads
2. Point load (2 marks)
3. Uniformly distributed load (2 marks)
4. Eccentric load (2 marks)
5. A simply supported beam AB of length L carries a point load W at the centre as shown below. At a section X, located a distance x metres from the left pivot, A, determine;
6. Slope equation (5 marks)
7. Deflection equation at any point (2 marks)
8. Maximum deflection for the beam (2 marks)

1. A beam 3m long, simply supported at its ends, is carrying a point load W at the centre. If the slope at the ends of the beam should not exceed 2, find the deflection at the centre of the beam (5 marks)

**QUESTION THREE (20 MARKS)**

1. Define the thick cyclinder (1 mark)
2. Find the thickness of metal necessary for a cylinder shell of internal diameter 160mm to withstand an internal pressure of 8N/mm2. The maximum hoop stress in the section is not to exceed 35N/mm2. (8 marks)
3. A steel cylinder of 300mm external diameter is to be shrunk to another steel cylinder of 150mm internal diameter. After shrinking the diameter at the junction is 125mm and radial pressure at the common function is 28N/mm2. Find the original difference in radii at the junction. Take. (6 marks)
4. A thick spherical shell of 200mm internal diameter is subjected to an internal fluid pressure of 7N/mm2. If the permissible tensile stress in shell material is 8N/mm2, find the thickness of the shell. (5 marks)

**QUESTION FOUR (20 MARKS)**

1. Define a composite beam (1 mark)
2. A timber beam 100mm wide and 200 mm deep is to be reinforced by bolting on two steel flitches each 150mm by 12.5mm in section. Calculate the moment of resistance and the maximum stress in the steel in the following cases;
3. Flitches attached symmetrically at the top and bottom (10 marks)
4. Flitches attaches symmetrically at the sides (9 marks)

Allowable stress in timber is 6N/mm2.

Take young’s modulus for steel,  while young’s modulus for timber, 

**QUESTION FIVE (20 MARKS)**

1. Explain the difference between a neutral layer and a neutral axis (2 marks)
2. State four assumptions made in the theory of bending (4 marks)
3. A beam is simply supported and carries a uniformly distributed load of 40 kN/m run over the whole span. The section of the beam is rectangular having depth as 500mm. If the maximum stress in the material of the beam is 120N/mm2 and moment of inertia of the section is 7x108mm4, find the span of the beam (6 marks)
4. An I-section shown below is simply supported over a span of 12m. If the maximum permissible bending stress is 80N/mm, what concentrated load can be carried at a distance of 4m from one support? (8 marks)