



### End Term Examination (December 2019)

**School:** School of Engineering

**Program:** B-Tech-Mechanical

**Course:** Strength of Materials and Behavioural properties

**Course Code:** MEC201

**Semester:** III

**Max Marks:** 40

**Duration (mins):** 90

Note:1) Answers to the questions be written in answer sheet provided.

2) Figures to the right indicate full marks.

3) Neat diagrams must be drawn wherever necessary.

4) Assume suitable data, if necessary.

5) Q.1 & Q2 is compulsory, Solve Q3 or Q4; and Q5 or Q6.

Q1. Briefly explain the following:

- List the critical assumption made during the Euler's Column Theory.
- Explain the different end conditions for Crippling stress for Long Columns
- Equivalent spring stiffness when connected in series and parallel.
- The stresses to be considered for a thin shell subjected to pressure due to fluid head.

[10]

Q2. A Cantilever beam of length 30m carries a uniformly distributed load of 24 kN/m over the entire span. If moment of inertia of the beam is  $10^8 \text{mm}^4$ . Find the slope and deflection at the free end if the material is having  $E = 2.0 \times 10^5 \text{ N/m}^2$

[10]

Q3. A hollow propeller shaft having 16 cm external diameter and 8cm internal diameter transmits 600 hp at 80 rpm. The shaft is also subjected to a bending moment of 30kN-m. Find the principal stresses and their planes.

OR

[10]

Q4. A close coiled helical spring has a stiffness of 10kg/cm. Its length when fully compressed with adjacent coils touching each other is 40 cm. The modulus of rigidity of the material of spring is  $0.8 \times 10^6 \text{ kg/cm}^2$ .

Find the coil diameter if the wire diameter to mean coil diameter ratio is 1:10. If the gap between adjacent coils is 0.2cm, what maximum load can be applied before the spring is solid? What is the maximum shear stress in the spring?

Q5. A solid bar 4m long and 6 cm in diameter is used as a strut with both ends hinged. Determine the Crippling load [take  $E = 2.0 \times 10^5 \text{ N/mm}^2$ ], Also determine Crippling load when

- (i) one end of the strut is fixed and other end is free
- (ii) both the ends of strut are fixed
- (iii) one end is fixed and other is hinged.

OR

**[10]**

Q6. A cylindrical pipe of diameter 2.0m and thickness 2.0 cm is subjected to an internal fluid pressure of  $1.5 \text{ N/mm}^2$ . Determine:

- (i) longitudinal stress, and
- (ii) circumferential stress developed in the pipe material.

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