Roll No: ----------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

Mid Semester Examination, December - 2017

Program Name:	**B. Tech. (Fire and Safety)**	**Semester: V**
Course Name :	**Principle of Engineering Design**	**Max. Marks: 100**
Course Code :	**FSEG-341**	**Duration: 3 Hrs.**
No. of page/s:		

SECTION: A – **(4 * 5 = 20 Marks)**

1. Write short notes on:
   a. Eccentric loading of spring
   b. Creep of belt

2. Derive the equation for longitudinal stress on thin cylindrical shell with proper assumptions

$$t = \frac{pd}{4\sigma_t \eta_c}$$

3. Discuss failures in riveted joint due to tearing and crushing.

4. Design a tube of internal diameter 0.1 m subjected to an internal pressure 5/8 of the value of maximum permissible circumferential stress. Also find the increase in diameter when internal pressure is 90 MPa. Given, E = 205000 N/mm^2, Poisson's Ratio = 0.29. Neglect longitudinal strain.

SECTION: B – **(4 * 10 = 40 Marks)**

5. A closely coiled helical spring is made of 10 mm diameter steel wire, the coil considering of 10 complete turns with a mean diameter of 120 mm. the spring carries an axial pull of 200 N. Determine the shear stress induced in the spring neglecting the effect of stress due to curvature. Determine also the deflection in spring, its stiffness and strain energy stored by it, if the modulus of rigidity of the material is 80 kN/mm^2.

6. An engine running at 2.5 rps drives a line shaft by means of a belt. The engine pulley is 0.75 m diameter and the pulley on the line shaft is 0.45 m. A 0.9 m diameter pulley on the line shaft drives a 0.15 m diameter pulley keyed to a dynamo shaft. Find the speed of dynamo shaft. When,
   - ✓ There is 0 % slip
   - ✓ There is a slip of 2% at each drive

7. Determine the length of the weld run for a plate of size 0.12 m wide and 15 mm thick to be welded to another plate by means of
   a. A single transverse weld, and
   b. Double parallel fillet welds when the joint is subjected to variable loads.
   Where, tensile stress = 70 MPa, shear stress = 56 MPa, Factor of safety for transverse weld = 1.5 and Factor of safety for parallel fillet weld = 2.7.

8. Derive the equation:

$$\tau' = \frac{1}{4} f' L (d_o - d_i)$$

Where, τ' = Total frictional torque acting on clutch plate (for uniform wear condition), f' = Co-efficient of friction, L = Axial force, d_o and d_i = outer and inner diameter of friction plate

SECTION: C – (ANY TWO) **(2 * 20 = 40 Marks)**

9. A safety valve of 60 mm diameter is to blow off at a pressure of 1.2 N/mm^2. It is held on its seat by a close coiled helical spring. The maximum lift of the valve is 10 mm. Design a suitable compression spring of spring index 5 and providing an initial compression of 35 mm. The maximum shear stress in the material of the wire is limited to 500 MPa. The modulus of rigidity for the spring material is 80 kN/mm^2. Calculate:
   a. Diameter of spring wire
   b. Mean col diameter
   c. Number of active turns, and
   d. Pitch of coil

10. A multiple disc clutch is to transmit 5500 W at 15 rps. The inner radius of contact surface is 5 cm and outer radius of contact surface is 8 cm. The clutch operates in oil with an expected co-efficient of friction 0.13. The average allowable pressure is 0.4 N/mm^2. Find:
    a. Total number of discs
    b. The actual axial force required
    c. The actual average pressure
    d. The actual maximum pressure

11. A steam boiler is to be designed for a working pressure of 2.5 N/mm^2 with its inside diameter 1.6 m. Give the design calculations for the longitudinal and circumferential joints for the following working stresses for steel plates and rivets.
    Stress in tension = 75 MPa, shear stress = 60 MPa, Crushing stress = 125 MPa.
    Assume, the longitudinal joint is triple riveted with two unequal cover strap (value of C = 6) and the circumferential joint is double riveted lap with zigzag riveting.

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