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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B.Tech II Year I Semester Examinations, May/June-2013

Elements of Mechanical Engineering

(Petroleum Engineering)

Time: 3 hours

Max. Marks: 75

**Answer any five questions
All questions carry equal marks**

- 1.a) Calculate the force required to punch a hole of 10 mm diameter through a mild steel plate 4 mm thick. The maximum shear strength of mild steel is 250 MPa. Also find the compressive stress in the punch.
- b) The head of a cylinder is held by 8 studs of 6 mm diameter each. The diameter of the cylinder is 200mm. If internal pressure in the cylinder is 1.5 MPa, calculate the tensile in each stud. [8+7]
2. A beam 10 m long and simply supported at each end has a uniformly distributed load of 1000 N/m extending from the left end upto the centre of the beam. There is also an anti-clock wise couple of 15 kN-m at a distance of 2.5 m from the right end. Develop the equations for shear force and bending moments. Draw the shear force and bending moment diagram. [15]
- 3.a) What assumptions are taken in the analysis of thin cylinders?
- b) A thin cylinder of 200 mm inside diameter is 4 mm thick. The ends of the cylinder are closed by rigid plates and then it is filled with water under pressure. If an external axial pull of 75 kN is applied to the ends, the water pressure falls by 0.12 MPa. Find the value of the Poisson's ratio. $K= 2100$ MPa and $E= 150$ GPa. [3+12]
- 4.a) Explain the function of an air preheater in a boiler.
- b) Give the construction and working of Locomotive boiler. List the merits and demerits of Locomotive boiler. [6+9]
- 5.a) Derive the equation for maximum discharge for multi stage compression of reciprocating air compressor with perfect inter cooler.
- b) A two stage air compressor with perfect inter cooling takes in air at 1 bar and 300K. The law of compression in both the stages is $PV^{1.3} = \text{constant}$. The compressed air is delivered at 9 bar. Calculate for unit mass flow rate of air, the minimum work done and the heat rejected in the inter cooler. Compare the values if compression is carried out with the single stage air compressor [6+9]
- 6.a) What are the advantages and limitations of S.I. Engine over C.I. Engine?
- b) A four cylinder engine running at 1200 rpm gave 18.6 kW brake power. The average torque when one cylinder was cut out was 105 N-m. Determine the indicated thermal efficiency if the calorific value of the fuel is 42000 kJ/kg and the engine used 0.34 kg of petrol per brake power hour [7+8]

7. Two parallel shafts 5m apart are connected by open flat belt drive. The diameter of the bigger pulley is 1.5m and that of the smaller pulley 0.75m. The initial tension in the belt is 2.5 kN. The mass of the belt is 1.25 kg/m length and coefficient of friction is 0.25. Taking centrifugal tension into account, find the power transmitted, when the smaller pulley rotates at 450rpm. [15]
8. An epicyclic gear consists of a pinion, a wheel of 40 teeth and an annulus with 84 internal teeth concentric with the wheel. The pinion gears with the wheel and the annulus. The arm that carries the axis of the pinion rotates at 100 rpm. If the annulus is fixed, find the speed of the wheel, if wheel is fixed, find the speed of an annulus. [15]

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