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**Question Paper Code: 51P03**

M.E. DEGREE EXAMINATION, APRIL 2019

First Semester

CAD/CAM

15PCD103- INTEGRATED MECHANICAL DESIGN

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1. (a) A machine component is subjected to a flexural stress which fluctuates between  $+300\text{MN/m}^2$  and  $-150\text{MN/m}^2$ . Evaluate the value of minimum ultimate strength according to
- (a) Gerber relation
- (b) Modified Goodman relation and Soderberg relation. Take yield strength = 0.55 Ultimate strength, Endurance strength = 0.5 Ultimate strength and factor of safety = 2.
- Or
- (b) Determine the thickness of a 120mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 1000N. The properties of the plate materials are as follows. Endurance limit stress is 225MPa and yield point stress is 300MPa. The factor of safety based on yield point may be taken as 1.5.
2. (a) A hollow shaft of 0.5m outside diameter and 0.3m inside diameter is used to drive a propeller of a marine vessel. The shaft is mounted on bearings 6m apart and it transmits 5600kW at 150 rpm. The maximum axial propeller thrust is 500kN and the shaft weighs 70kN. Predict the maximum shear stress developed in the shaft and the angular twist between the bearings.

Or

- (b) A hollow steel shaft is to transmit 20KW at 300 rpm. The loading is such that the maximum bending moment is 1000N-m, the maximum torsional moment is 500 N.m and axial compressive load is 15KN. The shaft is supported on rigid bearings 1.5m apart. The maximum permissible shear stress on the shaft is 40MPa. The inside diameter is 0.8 times the outside diameter. The load is cyclic in nature and applied with shocks. The values for the shock factors are  $K_t=1.5$  and  $K_m=1.6$ . CO2- App (20)

3. (a) A helical gears subjected to heavy shock load is to transmit 37.5kw at 1750rpm of the pinion. The speed reduction ratio is 4 and helix angle is  $15^\circ$ . The service is continue 8 hours per week for 3 years. select suitable material for pinion and wheel. CO3- App (20)

Or

- (b) Design a of helical gears to transmit 10 kw at 1000 rpm of the pinion. Reduction ratio of 5 is required. The gear is to work 8 hrs/day for 5 years. Design the drive. select suitable material for pinion and wheel. CO3- App (20)

4. (a) The block brake provides a braking torque of 360 N-m. The diameter of the brake drum is 300mm. The co-efficient of friction is 0.3. Calculate CO4- App (20)
- (a) The force (P) to be applied at the end of the lever for the clockwise and counterclockwise rotation of the brake drum.
- (b) The location of the pivot or fulcrum to make the brake self locking for the clockwise rotation of the brake drum.

Or

- (b) An automotive type internal-expanding double shoe brake as shown in fig. The face width of the friction lining is 40mm and the intensity of normal pressure is limited to 1 N/mm<sup>2</sup>. The coefficient of friction is 0.32. The angle  $\Theta_1$  is can be assumed to be zero. Calculate CO4- App (20)
- (i) the actuating force P, and
- (ii) the torque-absorbing capacity of the brake.

5. (a) Design a elevator as shown in fig. for a twenty storeyed building with a capacity of 10 passenger having a rated load of 2 tonne, and a rated speed of 1.6m/s, the height of travel is 60m, the roping factor as 3 and factor of safety assumed as 12. Calculate the important components dimensions (rope, shaft, bearing, counter weight, cabin and lifting power required) CO5- Ana (20)

Or

- (b) Explain the steps involved in designing a 12 speed gear box for a Gear hobbing Machine spindle rotating at a speed ranging from 200 rpm to 1250 rpm. Assume all are spur gears. Design the kinematic arrangement , gear, gear box and layout. CO5- Ana (20)
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