

Code: 15A03602

B.Tech III Year II Semester (R15) Supplementary Examinations December/January 2018/19

DESIGN OF MACHINE MEMBERS – II

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

PART – A

(Compulsory Question)

1 Answer the following: (10 X 02 = 20 Marks)

- (a) State any four assumptions made in deriving the expression for stress due to bending at the extreme fibers of a curved beam.
- (b) Mention the advantages of chain drives over belt drives.
- (c) What do you understand by spring and mention some industrial applications?
- (d) Differentiate between differential screw and compound screw.
- (e) Explain wedge film and squeeze film journal bearings.
- (f) What are the commonly used materials for sliding contact bearings?
- (g) What are the various forces acting on a spur gear?
- (h) Explain the following terms used in helical gears: (i) Normal pitch. (ii) Normal module.
- (i) State the function of the following for an IC engine piston: (i) Ribs. (ii) Piston pin.
- (j) Explain the various stresses induced in the connecting rod.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

- 2 (a) Define curved beam. What is the difference with respect to straight beam?
- (b) A central horizontal section of a hook is symmetrical trapezium 60 mm deep, the inner width being 60 mm and the outer width being 30 mm. Estimate the extreme intensities of stresses when the hook carries a load of 20 kN, the load line passes at 40 mm from the inside edge of the section and the centre of curvature lies in the load line.

OR

- 3 Design a belt drive pulley for transmitting 10 kW at 180 rpm. The velocity of the belt is not to exceed 10 m/s and the maximum tension is not to exceed 15 N/mm width. The tension on the slack is one half of that on the tight side. Determine: (i) Width of the pulley. (ii) Diameter of the pulley.

UNIT – II

- 4 A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 N/mm² and modulus of rigidity 84 kN/mm², find the axial load which the spring can carry and the deflection per active turn: (i) Neglecting the effect of curvature. (ii) Considering the effect of curvature.

OR

- 5 A double threaded power screw, used for lifting the load, has a nominal diameter of 30 mm and pitch of 5 mm. The coefficient of friction at the screw threads is 0.16, neglecting the collar friction, calculate: (i) Efficiency of the screw with square threads. (ii) Efficiency with ACME threads.

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UNIT – III

- 6 Specify suitable materials for ball bearing components and give reasons for their selection. Select a ball bearing for a drilling machine spindle rotating about 2000 rpm. It is subjected to an axial load of 1.5 kN and a radial load of 3 kN. It has to work for 50 hours per week for two years. Take diameter of the spindle as 45 mm. Also calculate the actual life of the selected bearing.

OR

- 7 Design a journal bearing for centrifugal pump from the following data:
Load on the journal = 20 kN
Speed of the journal = 900 rpm
Type of oil SAE 10 for which absolute viscosity at 55°C = 17 centipoises
Ambient temperature of oil = 15.5°C
Maximum bearing pressure for the pump = 1.5 N/mm²
Calculate also the mass of the lubricating oil required for artificial cooling to rise in temperature of the oil limited to 10°C. Heat dissipation coefficient = 12.2 kN/m²/°C

UNIT – IV

- 8 Design a pair of spur gears to transmit 20 kW from a shaft rotating at 1000 rpm to a parallel shaft, which rotates at 310 rpm. Assume number of teeth on pinion 31 and 20° full depth tooth form. The material for the pinion is C-45 steel untreated and for gear cast steel 0.2% C untreated.

OR

- 9 A pair of helical gears consists of 24 teeth pinion meshing with 72 teeth gear. Normal pressure angle is 20° and helix angle is 24°. The pinion rotates at 720 rpm. Normal module of the gear is 5 mm and face width is 50 mm. Both the pinion and gear are made of steel with $\sigma_{ut} = 600 \text{ MPa}$. Gears are heat treated to a surface hardness of 360 BHN. What power can be transmitted by gears if service factor is 1.4 and factor of safety is 2? Assume that velocity factor accounts for the dynamic load.

UNIT – V

- 10 Design piston head and piston barrel for aluminium alloy piston with two compression rings and one oil ring for a petrol engine of following particulars:
Cylinder diameter = 0.1 m
Peak gas pressure = 3.2 MPa
Mean effective pressure = 0.8 MPa
Average side thrust = 2400 N
Skirt bearing pressure = 0.22 MPa
Bending stress in piston crown = 36 MPa
Crown temperature difference = 70°C
Heat dissipated through crown = 157 kJ/m²s
Allowable radial pressure = 0.04 MPa
Bending stress in rings = 90 MPa
Heat conductivity = 160 W/m/°C.

OR

- 11 An automobile diesel engine has a cylinder bore of 125 mm and a connecting rod of 300 mm length. The maximum pressure acting on the piston is 7 MN/m². Design: (i) The size of the piston. (ii) The suitable I-section for the middle of the connecting rod. Mention the materials of which each of the above parts is made.
