III B. Tech I Semester Supplementary Examinations, June/July-2022
DESIGN OF MACHINE MEMBERS-II
(Mechanical Engineering)

Time: 3 hours   Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
Design data book is permitted for examination
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UNIT-I

1. a) What is meant by bearing characteristic number? [2M]
   b) Design a journal bearing for a centrifugal pump from the following data: Load on the journal = 20000N; Speed of the journal = 900 r.p.m.; Type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg / m-s; Ambient temperature of oil = 15.5°C ; Maximum bearing pressure for the pump = 1.5 N / mm^2. Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232 W/m^2/°C. [13M]

(OR)

2. a) Explain the design procedure of ball bearings. [7M]
   b) Specify a suitable deep groove ball bearing for a radial load of 2.5 kN, and a thrust load of 1.5 kN. The operating speed is 3000 r.p.m. Assume steady load, and life of 15000 hours at 95% reliability. Recommend the bearing with the maximum possible bore size. [8M]

UNIT-II

3. a) Explain the stresses developed in the connecting rod. What do you mean by whipping stress? [7M]
   b) Design an overhung crankshaft with two main bearings for an I.C engine with the following data: Cylinder bore=250 mm, Stroke length=300 mm, Flywheel weight=25 kN, Maximum pressure=2.5 N/mm^2, Maximum torque at crank rotation 300, the pressure at that instant = 1.7 N / mm^2. [8M]

(OR)

4. a) The cylinder of a four-stroke diesel engine has the following specifications: Brake power = 3 kW, Speed = 800 rpm, Indicated mean effective pressure = 0.3 MPa, Mechanical efficiency = 80%. Determine the bore and length of the cylinder liner. [7M]
   b) The following data is given for the piston of a four-stroke diesel engine: Cylinder bore = 100 mm Material of piston rings = Grey cast iron Allowable tensile stress = 90 N/mm^2 Allowable radial pressure on cylinder wall = 0.035 MPa Thickness of piston head = 16 mm Number of piston rings = 4 Calculate: [8M]
   (i) radial width of piston rings;
   (ii) axial thickness of piston rings;
   (iii) gap between the free ends of the piston ring before assembly;
   (iv) gap between the free ends of the piston ring after assembly;
   (v) width of top land;   (vi) width of ring grooves;
   (vii)thickness of piston barrel; and (viii) thickness of barrel at open end.

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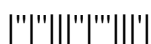
UNIT-III

5. a) A flat belt running on a pulley of diameter 1.2 m transmits 9.5 kW at 240 rpm μ = 0.3, diameter of smaller pulley = 225 mm and centre distance = 1.5 m. Find the necessary width of the belt if the pull should not exceed 20 N/mm. Neglect centrifugal tension. [8M]

   b) Sketch the cross-section of a V-belt and label its important parts. [7M]

(OR)

6. a) Why square threads are preferred over V-threads for power transmission? [5M]

   b) The lead screw of a lathe has 50 × 8 threads. The screw must exert and axial pressure of 2500 N in order to drive the tool carriage. The thrust is carried on a collar 110 mm outside diameter and 55 mm inside diameter and the screw rotates at 30 rpm. Determine: (i) The power required to drive the screw and (ii) The efficiency of the lead screw. Assume a coefficient of friction of 0.15 for the screw and 0.12 for the collar. [10M]

UNIT-IV

7. a) Discuss the design procedure of spur gears. [6M]

   b) A pair of spur gears with 20° pressure angle, consists of a 25 teeth pinion meshing with a 60 teeth gear. The module is 5 mm, while the face width is 45 mm. The pinion rotates at 500 rpm. The gears are made of steel and heat treated to a surface hardness of 220 BHN. Assume that dynamic load is accounted by means of the velocity factor. The service factor and the factor of safety are 1.75 and 2 respectively. Calculate (i) wear strength of gears; (ii) the static load that the gears can transmit without pitting; and (iii) rated power that can be transmitted by gears. [9M]

(OR)

8. Two parallel shafts are connected by a pair of steel helical gears. The power transmitted is 15 kW at 4000 rpm of the pinion. The safe static strength for the material is 100 MPa. Gear ratio is 4:1 Stub teeth with 200 pressure angle in diameter plane have helix angle of 450. Also calculate the necessary BHN with the standard point of wear. Check the design for dynamic load and suggest modification if necessary. Use 30 teeth on the pinion. [15M]

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UNIT-V

9. a) A bracket, made of steel FeE 200 (S_{yt} = 200 N/mm^2) and subjected to a   [12M] force of 5 kN acting at an angle of 30° to the vertical, is shown in Fig.1. The factor of safety is 4. Determine the dimensions of the cross-section of the bracket.
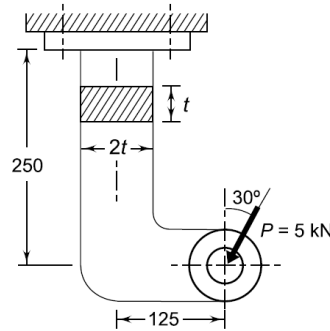

Fig.1

  b) Give practical applications of wire rope.   [3M]

(OR)

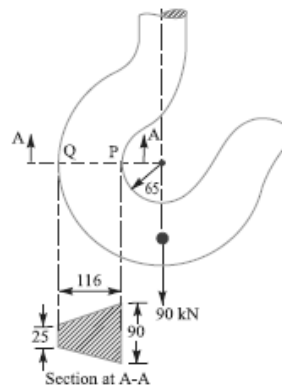10.   A crane hook has a trapezoidal section at A-A as shown in Fig.2. Find   [15M] the maximum stress at points P and Q.

Fig.2

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