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Question Paper Code: AME015



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech VI Semester End Examinations (Regular) - May, 2019

Regulation: IARE – R16

MACHINE DESIGN

Time: 3 Hours

(ME)

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

- (a) List out the important characteristics of a good bearing material. [7M]

(b) A full journal bearing 90 mm diameter and 150 mm long has a radial load of 2 MPa per unit projected area. Shaft speed is 500 rpm. The bearing is operating with SAE 20 oil at 50⁰ C. The specific gravity of oil at the operating temperature is 0.985. Calculate the following. [7M]

 - Heat loss due to friction
 - Mass of the lubricating oil required
- (a) Explain the following terms : (i) Static load carrying capacity (ii) Dynamic load carrying capacity. [7M]

(b) A single row deep groove ball bearing No.6202 is subjected to an axial thrust of 1000 N and a radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition. [7M]

UNIT – II

- (a) Write short notes on functions of piston and piston parts. [7M]

(b) Design a cast iron piston for a single acting four stroke engine for the following data: Cylinder bore = 100 mm ,Stroke = 125 mm, Maximum gas pressure = 5 N/mm², Indicated mean effective pressure = 0.75 N/mm² , Mechanical efficiency = 80%, Fuel consumption = 0.15 kg per brake power per hour ; Higher calorific value of fuel = 42 × 10³ kJ/kg ,Speed is 2000 r.p.m. Any other data required for the design may be assumed. [7M]
- (a) List out various forces acting on the connecting rod. [7M]

(b) Determine the dimensions of cross section of the connecting rod for a diesel engine with the following data, cylinder bore = 100 mm, length of connecting rod = 350 mm, maximum gas pressure = 4 MPa, factor of safety = 6. Any other data required for the design may be assumed. [7M]

UNIT – III

5. (a) Derive the expression for the length of an open belt drive. [7M]
(b) Two pulleys, one 450 mm diameter and the other 200 mm diameter, on parallel shafts 1.95 m apart are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25? [7M]
6. (a) Explain the advantages and disadvantages of chain drives. [7M]
(b) It is required to design a chain drive to connect a 5 kW, 1400 rpm electric motor to a drilling machine. The speed reduction is 3:1. The centre distance should be approximately 500 mm. (i) Select a proper roller chain for the drive (ii) Determine the number of chain links and (iii) Specify the correct center distance between the axis of the sprockets. [7M]

UNIT – IV

7. (a) Explain the procedure for the design of Spur gear. Write expressions for static limiting wear load, dynamic load for gear tooth of spur gear explain various terms used. [7M]
(b) Design a pair of spur gears with 20° full depth involute teeth based on Lewis equation. The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 10 Kw, 1440 rpm motor. The starting torque of the motor is 150% of the rated torque. The speed reduction is 4 :1. The pinion as well as the gear are made of plain carbon steel 40C8 ($\sigma_{ut} = 600 \text{ N/mm}^2$). The factor of safety may be taken as 1.5. Compute the dimensions of the gears. Design a pair of spur gears with 20° full depth involute teeth based on Lewis equation. The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 10 Kw, 1440 rpm motor. The starting torque of the motor is 150% of the rated torque. The speed reduction is 4 :1. The pinion as well as the gear are made of plain carbon steel 40C8 ($\sigma_{UT} = 600 \text{ N/mm}^2$). The factor of safety may be taken as 1.5. Compute the dimensions of the gears. [7M]
8. (a) What are the various forces acting on helical gears? Explain axial pitch lead angle pressure angle and pitch diameter of helical with the help of a sketch. [7M]
(b) Design a worm gear drive to transmit 18 kW from a worm rotating at 1440 rpm to a worm wheel to rotate at 40 rpm. Check the heating capacity of gears and determine the efficiency. [7M]

UNIT – V

9. (a) Explain the various types of stresses induced in the power screws. [7M]
(b) A double threaded power screw, ISO metric trapezoidal threads is used to raise a load of 300 kN. The nominal diameter is 100 mm and the pitch is 12 mm. The coefficient of friction at screw threads is 0.15. Neglecting collar friction, Calculate (i) Torque required to raise the load (ii) Torque required to lower the load. [7M]
10. (a) Why are square threads preferable to V-threads for power transmission? [7M]
(b) A vertical two start square threaded screw of 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of the lever which is 400 mm long in order to lift and lower the load. When coefficient of friction for the vertical screw and nut is 0.15 and that for the collar bearing is 0.20. [7M]