Hall Ticket No | | | | | | | | | | | Question Paper Code: AMEB42

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
(Dundigal-500043, Hyderabad)

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2022
Regulation: R18

ADVANCED MACHINE DESIGN

Time: 3 Hours **(ME)** **Max Marks: 70**

Answer FIVE Questions choosing ONE question from each module
(NOTE: Provision is given to answer TWO questions from any ONE module)
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) What is bearing? Explain its function. List out various types of lubricants used in sliding contact bearings. **[7M]**

   (b) A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of $1.4 N/mm^2$. The speed of the journal is 900 rpm and the ratio of journal diameter to the diametrical clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75^0C may be taken as $0.011 kg/m-s$. The room temperature is $35^0 C$. Find,

   i). The amount of artificial cooling required

   ii) The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is $10^0 C$. Take specific heat of the oil as 1850 J / kg / $^0 C$. **[7M]**

2. (a) Write about life of bearing and derive the expression for dynamic load rating for rolling contact bearings under variable loads. **[7M]**

   (b) Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 rpm for an average life of 5 years at 10 hours per day. Assume uniform and steady load. **[7M]**

MODULE – II

3. (a) State the function of the following for an internal combustion engine piston:

   i) Ribs ii) Piston rings iii) Piston skirt iv) Piston pin **[7M]**

   (b) Design a side or overhung crankshaft for a 250 mm × 300 mm gas engine. The weight of the flywheel is 30 kN and the explosion pressure is 2.1 N/mm^2. The gas pressure at the maximum torque is 0.9 N/mm^2, when the crank angle is 35^0 from IDC. The connecting rod is 4.5 times the crank radius. **[7M]**

4. (a) Explain the various stresses induced in the connecting rod. Why I section of connecting rod is used. **[7M]**

   (b) The conical valve of an IC engine is 60 mm in diameter and is subjected to a maximum gas pressure of 4 N/mm^2. The safe stress in bending for the valve material is 46 MPa. The valve is made of steel for which k = 0.42. The angle at which the valve disc seat is tapered is 30^0. The bracket plate is 25 mm thick. All rivets are to be of the same size. Load on the bracket, P = 50 kN; rivet spacing, C = 100 mm; load arm, e = 400 mm. Permissible shear stress is 65 MPa and crushing stress is 120 MPa. Determine: i) Thickness of the valve head ii) Stem diameter

   iii) Maximum lift of the valve iv) Determine the size of the rivets to be used for the joint. **[7M]**

MODULE – III

5. (a) Derive an expression for ratio of tensions for flat belt drive. **[7M]**

   (b) A belt 100 mm wide and 10 mm thick is transmitting power at 1000 metres/min. The net driving tension is 1.8 times the tension on the slack side. If the safe permissible stress on the belt section in 1.6 MPa, calculate the maximum power, that can be transmitted at this speed. Assume density of the leather as 1000 kg/m^3. Calculate the absolute maximum power that can be transmitted by this belt and the speed at which this can be transmitted. **[7M]**

6. (a) Mention the different steps to be followed in designing of wire rope. **[7M]**

   (b) A rope drive transmits 600 kW from a pulley of effective diameter 4 m, which runs at a speed of 90 rpm The angle of lap is 160^0 the angle of groove 45^0 the coefficient of friction 0.28; the mass of rope 1.5 kg / m and the allowable tension in each rope 2400 N. Find the number of ropes required. **[7M]**

MODULE – IV

7. (a) Derive an expression of Lewis equation used for beam strength of gears. **[7M]**

   (b) A helical cast steel gear with 30^0 helix angle has to transmit 35 kW at 1500 rpm. If the gear has 24 teeth, determine the necessary module, pitch diameter and face width for 20^0 full depth teeth. The static stress for cast steel may be taken as 56 MPa. The width of face may be taken as 3 times the normal pitch. What would be the end thrust on the gear? The tooth factor for 20^0 full depth involute gear may be taken as 0.154 -0.912/TE where TE represents the equivalent number of teeth. **[7M]**.

8. (a) Explain the terminology associated with bevel gear with neat sketch. **[7M]**

   (b) A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4 : 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20^0 full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. **[7M]**

MODULE – V

9. (a) Explain different types of screw threads used for power screws with neat sketches. **[7M]**

   (b) An electric motor driven power screw moves a nut in a horizontal plane against a force of 75 kN at a speed of 300 mm/min. The screw has a single square thread of 6 mm pitch on a major diameter of 40 mm. The coefficient of friction at screw threads is 0.1. Estimate power of the motor. **[7M]**

10. (a) Derive the relation for torque required to raise load by square threaded screws. **[7M]**

    (b) A differential screw jack is to be made as shown in Figure 1. The outside screw diameter is 50 mm. The screw threads are of square form single start and the coefficient of thread friction is 0.15. Determine efficiency of the screw jack. **[7M]**

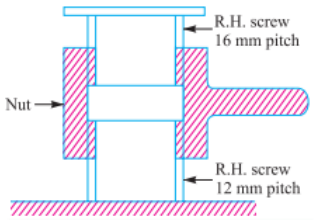

Figure 1