JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, April - 2018
DESIGN OF MACHINE MEMBERS – II
(Common to AME, ME)

Time: 3 hours   Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B
consists of 5 Units. Answer any one full question from each unit. Each question carries
10 marks and may have a, b, c as sub questions.

Assume suitable data, if necessary. Design data book is permitted:
Illustrate your answers with NEAT sketches wherever necessary.

PART - A

(25 Marks)

1.a) Distinguish between rolling contact bearings and sliding contact bearings.   [2]
 b) Distinguish between the static load carrying capacity and dynamic load carrying
      capacity of ball bearings.   [3]
 c) Why are the connecting rods made of I – Section?   [2]
 d) What are the advantages and disadvantages of Aluminium piston over C.I. piston? [3]
 e) Why is the cross section of the pulley an elliptical arm?   [2]
 f) In chain drives, the sprocket has odd number of teeth and the chain has even number of
      links. Why?   [3]
 g) Define (i) Load concentration factor and (ii) Dynamic load factor with respect to spur
      gears.   [2]
 h) What are the four important factors that are required to specify a worm gear drive?
                                                                                                                   [3]
 i) What are the two methods to increase the efficiency of a square – threaded screw? [2]
 j) What is 'overhauling' of power screw? What is the condition for overhauling?   [3]

PART - B

(50 Marks)

2. A bearing for an axial flow compressor is to carry a radial load of 2500 N and thrust of
    1500 N. The service imposes light shock, and the bearing will be in use for 40 hours per
    week for 5 years. The speed of the shaft is 1000 rpm. Select a suitable ball bearing for
    the purpose, and give the required tolerances on the shaft and housing. Diameter of the
    shaft is 50 mm.   [10]

OR

3.a) What procedure would you follow while designing a journal bearing? Explain.
 b) Each bearing of an electrical motor sustains a radial load of 4 kN. Assuming (*l/d*)
      ratio of 1.1, determine the length of the bearing, if the permissible bearing pressure is
      limited to $1 \text{ N} / \text{mm}^2$.   [5+5]

4. Determine the dimensions of an I – Section connecting rod for a petrol engine from the following data : Diameter of the piston = 110 mm, Mass of the reciprocating parts = 2 kg, Length of the connecting rod from centre to centre = 325 mm, Stroke length = 150 mm, Speed = 1500 rpm with possible over speed of 2500 rpm, Compression ratio = 4 : 1, Maximum explosion pressure = 2.5 N / mm^2. [10]

OR

5.a) Explain the design of a centre crankshaft when the crank is at the TDC position, and subjected to maximum bending moment and no torsional moment.

b) Design a suitable connecting rod for a petrol engine for the following data: Diameter of the piston = 100 mm; Weight of reciprocating parts per cylinder = 20 N; Connecting rod length = 300 mm; Compression ratio = 7 : 1; Maximum explosion pressure = 3 N / mm^2; Stroke = 140 mm; Engine speed = 2000 rpm. [5+5]

6.a) Describe the basic procedure for selection of V – belts for power transmission.

b) Design a 120 cm diameter C.I. belt pulley transmitting 5 HP at 90 rpm. The tension in the belt is not to exceed 150 N per cm width of belt. The pulley has six elliptical arms. Tension on the tight side is double the tension on the slack side, and the centrifugal tension in the belt may be neglected. [5+5]

OR

7. A V – belt drive with the following data transmits power from a motor to compressor. Power transmitted = 100 kW; Speed of the electric motor = 750 rpm; Speed of the Compressor = 300 rpm; Diameter of compressor pulley = 800 mm; Centre distance between pulleys = 1.5 m; Maximum speed of the belt = 30 m/s; Mass density = 900 kg/m^3; Cross sectional area of belt = 350 km^2; Allowable stress in the belt = 2.2 N/mm^2; Groove angle of pulley = 38^0; Coefficient of friction = 0.28. Determine the number of belts required and the length of each belt. [10]

8.a) Write explanatory notes on gear teeth failures, illustrating your answer with a sketch.

b) A pair of bevel gears is required to transmit 25 HP at 600 rpm. The output shaft speed is 300 rpm, and is at right angles to the input shaft. Both gears are carried on overhanging shafts supported in the housing very close to the gears. The gear is of C.I. and the pinion is of steel. Design the gear wheel and prepare its dimensioned sketch. The static strength of C.I. is 55 N/ mm^2, and the pitch line velocity should not exceed 500 m per minute. [5+5]

OR

9. A helical cast steel gear with 30^0 helix angle has to transmit 40 HP at 1500 rpm. If the gear has 24 teeth, determine the necessary module, pitch diameter, and width for 20^0 full depth teeth. The static stress for cast steel may be taken as 55 N/mm^2. The width of the face may be taken as 3 p_n. What will be the end thrust on the gear? [10]

10.a) A single – threaded 25 – mm power screw is 25 mm in diameter with a pitch of 5 mm. A vertical load on the screw reaches a maximum of 5 kN. The coefficients of friction are 0.06 for the collar and 0.09 for the threads. The frictional diameter of the collar is 45 mm. Find the overall efficiency, and the torque to 'raise' and 'lower' the load.

b) Derive the expression for the torque required to raise the load by a power screw. [5+5]

OR

11. Design and draw a screw jack for lifting a maximum load of 50 kN without rotation. The jack is to be operated by a mean exerting force of 300 N, and the maximum lift is 25 cm. Choose suitable material and stresses. [10]

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