[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
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June-16

B. Tech 6th Semester Examination

Design of Automobile Components-II (NS)

AU-323

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, select one question from each section A, B, C and D. Section E (question 9) is compulsory. Use of non-programmable calculator is permitted. Assume any suitable data if not given.

SECTION - A

1. (a) Explain with reference to a neat plot the importance of the bearing characteristic curve. (5)

   (b) A 100 mm long and 60 mm diameter journal bearing supports a load of 2500 N at 600 r.p.m. If the room temperature is 20°C, what should be the viscosity of oil to limit the bearing surface temperature to 60°C? The diametral clearance is 0.06 mm and the energy dissipation coefficient based on projected area of bearing is 210 $W/m^2/°C$. (15)

2. (a) How do you express the life of a bearing? What is an average or median life? (5)

   (b) The rolling contact ball bearing are to be selected to support the overhung countershaft. The shaft speed is 720 r.p.m. The bearings are to have 99% reliability corresponding to a life of 24000 hours. The bearing is subjected to an equivalent radial load of 1 kN. Consider

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life adjustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacturer's catalogue, specified at 90% reliability. (15)

SECTION - B

3. (a) Obtain an expression for the length of a belt in an open belt drive. (5)

   (b) A belt drive consists of two V-belts in parallel, on grooved pulleys of the same size. The angle of the groove is 30°. The cross-sectional area of each belt is 750 mm^2 and $\mu = 0.12$. The density of the belt material is 1.2 Mg/m^3 and the maximum safe stress in the material is 7 MPa. Calculate the power that can be transmitted between pulleys 300 mm diameter rotating at 1500 r.p.m. Find also the shaft speed in r.p.m. at which the power transmitted would be maximum. (15)

4. (a) Drive an expression for the length of the arc of contact in a pair of meshed spur gears. (5)

   (b) Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module = 6 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 90 r.p.m. Determine : 1. The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel, 2. The length of path and arc of contact, 3.The number of pairs of teeth in contact, and 4. The maximum velocity of sliding. (15)

SECTION - C

5. (a) Prove that in a spring, using two concentric coil springs made of same material, having same length and compressed equally by an axial load, the loads shared by the two springs are directly proportional to the square of the diameters of the wires of the two springs. (10)

(b) Find the maximum shear stress and deflection induced in a helical spring of the following specifications, if it has to absorb 1000 N-m of energy. Mean diameter of spring = 100 mm; Diameter of steel wire, used for making the spring = 20 mm; Number of coils = 30; Modulus of rigidity of steel = 85 kN/mm^2. (10)

6. (a) Establish a formula for the frictional torque transmitted by a cone clutch. (5)

(b) A multiple disc clutch, steel on bronze, is to transmit 4.5 kW at 750 r.p.m. The inner radius of the contact is 40 mm and outer radius of the contact is 70 mm. The clutch operates in oil with an expected coefficient of 0.1. The average allowable pressure is 0.35 N/mm^2. Find : 1. the total number of steel and bronze discs; 2. the actual axial force required; 3. the actual average pressure; and 4. the actual maximum pressure. (15)

SECTION - D

7. (a) Under what force, the big end bolts and caps are designed for a connecting rod? Discuss. (5)

(b) A four stroke diesel engine has the following specifications: Brake power = 5 kW; Speed = 1200 r.p.m.; Indicated mean effective pressure= 0.35 N/mm^2; Mechanical efficiency= 80%. Determine: 1. bore and length of the cylinder; 2. thickness of the cylinder head; and 3. size of studs for the cylinder head. (15)

8. Design a plain carbon steel centre crankshaft for a single acting four stroke single cylinder engine for the following data: Bore= 400 mm; Stroke= 600 mm ; Engine speed = 200 r.p.m.; Mean effective pressure = 0.5 N/mm^2; Maximum combustion pressure = 2.5 N/mm^2; Weight of flywheel used as a pulley =

50 kN; Total belt pull = 6.5 kN. When the crank has turned through 35° from the top dead centre, the pressure on the piston is 1 N/mm^2 and the torque on the crank is maximum. The ratio of the connecting rod length to the crank radius is 5. Assume any other data required for the design. (20)

SECTION - E

9. (i) How bearings are classified?

(ii) Why the rigidity of roller bearing is more than ball bearing?

(iii) What is an antifriction bearing?

(iv) What are the advantages of round belts?

(v) Why are gear drives superior to belt or chain drives?

(vi) What is backlash in gear teeth?

(vii) State the relationship between active, inactive and total number of coils in the helical compression spring.

(viii) What is shot peening of spring?

(ix) Distinguish between dry and wet operations of clutch.

(x) What is the function of piston skirt? (2×10=20)