6E7011

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B. Tech. VI-Sem. (Main/Back) Exam., April/May-2016
Mechanical Engineering
6ME1A Design of Machine Elements-II
Common with AE, ME, PI

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks (Main & Back): 26

Instructions to Candidates:-

*Attempt any **five questions,** selecting **one question** from **each unit.** All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. Design Data Book 2. NIL

UNIT-I

Q.1 (a) What is physical significance of notch sensitivity factor being one and zero. [4]

(b) What is fluctuating stress? Draw stress – time curve for fluctuating stress.[2+2=4]

(c) A bolted assembly is subjected to an external force, that varies from 0 to 10 KN. The combined stiffness of the parts, held together by the bolt, is three times the stiffness of the bolt. The bolt is initially so tightened that at 50% overload condition the parts held together by the bolt are just about to separate. The bolt is made of plain carbon steel 50 C4. The fatigue stress concentration factor is 2.2 and the expected reliability is 90%. The factor of safety is 2. Determine the size of the bolt with fine threads. [8]

OR

Q.1 (a) Explain modified Goodman diagram for bending stresses? [6]

(b) What is the difference between failure due to static load and fatigue failure? [2]

(c) A transmission shaft carries a pulley midway between the two bearings. The bending moment at the pulley varies from 200N – M to 600 N – M, as the tore zonal moment in the shaft varies from 70 N – M to 200 N – M. The frequencies of variation of bending and tore zonal moments are equal to the shaft speed. The shaft is made of steel FeE 400. The corrected endurance limit of the shaft is 200 N/mm^2. Determine the diameter of the shaft using a factor of safety of 2. [8]

UNIT-II

Q.2 Design a plain carbon steel crank shaft for a 0.40m by 0.60m single acting 4 stroke single cylinder engine to operate at 200 r. p. m. The mean effective pressure is 0.49 MPa, and the maximum combustion pressure is 2.625 Mpa. At maximum tensional moment, when the crank angle is 36°, the gas pressure. is 0.975 MPa. The ratio of the connecting rod length to the crank radius is 4.8. The flywheel is used as a pulley. The weight of the flywheel is 54.50 KN and the total belt pull is 6.75 KN. Assume suitable values for the missing data. [16]

OR

Q.2 (a) What are the desirable properties of a piston in I.C. engine? [4]

(b) Determine the thickness of a cost iron cylinder wall and the stresses for a 300mm petrol engine, with a maximum gas pressure of 3.5 N/mm^2 [6]

(c) A vertical 4 – stroke C.I. engine has the following specifications :-
Break Power = 4.5 kw, speed = 1200rpm.
Indicated mean effective pressure = 0.35 N/mm^2 & η_m = 0.80 Determine the dimensions of the cylinder. [6]

UNIT-III

Q.3 (a) It is required to design a helical torsion spring for a window shade. The spring is made of patented and cold – drawn steel wire of grade – 4. The yield strength of the material is 60% of the ultimate tensile strength and the factor of safety is 2. From space considerations, the mean coil diameter is kept as 18mm. The Maximum bending moment acting on the spring is 250 N – mm. Determine the wire diameter and the number of active coils.
Take E = 207×10^3 N/mm^2 & K (stiffness of spring) = 3 N – mm/rad. [8]

(b) A helical tension spring is used in the spring balance to measure the weights. One end of the spring is attached to the rigid support while the other end, which is free, carries the weights to be measured. The maximum weight attached to the spring balance is 1500 N and the length of the scale should be approximately 100 mm. The spring index can be taken as 6. The spring is made of oil – hardened and tempered steel wire with ultimate tensile strength of 1360 N/mm^2 and modules of rigidity of 81370 N/mm^2. The permissible shear stress in the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate : [8]

(i) Wire diameter

(ii) No. of active coils

(iii) Required spring rate: and

(iv) Actual spring rate.

OR

Q.3 Design an open flat belt drive to connect horizontal shaft at 4.5m centre distance velocity ratio of deriver / driven pulleys is 2.5. Speed of smaller pulley is 960 rpm. Nominal power transmission is 20kw under very light shock. [16]

UNIT-IV

Q.4 (a) A pair of worm and worm wheel is designated as 3/60/10/6. The worm is transmitting 5kw power at 1440 rpm to the worm wheel. The co - efficient of function is 0.1 and the normal pressure angle is 20. Determine the components of the gear tooth force acting on the worm and worm wheel. [10]

(b) Derive the expression for beam strength of a gear tooth. [6]

OR

Q.4 (a) Design a pair of equal diameter, 20° stud tooth helical gears to transmit 37.5 kw with moderate shock at 1200rpm. The two shafts are parallel and 0.45m a port. Each gear is to be of steel. Find the module and face width of the teeth. [10]

(b) A C. I. bevel gear has a module of 2.5mm and its pitch diameter is 0.60m. The angle is 30° and the teeth are 20° full depth. Determine the permissible endurance load. [6]

UNIT-V

Q.5 (a) A single deep – groove ball bearing is subjected to a radial force of 8KN and a thrust force of 3KN. The shaft rotates at 1200rpm. The expected life L_{10h} of the bearing is 20000hr. The minimum acceptable diameter of the shaft is 75mm. Select a suitable ball bearing for this application. [8]

(b) Explain the method of lubrication in detail. [8]

OR

Q.5 (a) A taper roller bearing has a dynamic has a dynamic load capacity of 26KN. The desired life for 90% of the bearings is 8000hr and the speed is 300rpm. Calculate the equivalent radial load that the bearing can carry. [4]

(b) Following data is given for a 360° hydrodynamic bearing : Radial load = 10KN, Journal speed = 1440 rpm, unit bearing pressure = 1000kpa, clearance ratio (r/c) = 800; viscosity of lubricant = 30mpas. Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing.

Calculate:- [6×2=12]

(i) Dimensions of bearing;

(ii) Co – efficient of friction;

(iii) Power lost in friction;ss

(iv) Total flow of oil;

(v) Side leakage; and

(vi) Temperature rise.
