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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Sixth Semester, B.E. - Mechanical Engineering

Semester End Examination; June - 2017

Design of Machine Elements - II

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii)Use of Design Data Hand book is permitted. iii) Missing data may be suitably assumed.

UNIT - I

1 a. A cylinder relief valve of diameter 60 mm is working at a pressure of 1.5 N/mm^2 and lifts 6 mm for 5% increase in pressure. Design the valve spring by computing important parameters of the spring. The allowable shear stress is 500 N/mm^2 and G = 0.85x10^5 N/mm^2 for spring material. Assume spring index of 8. 10

b. A compression spring is subjected to a load which varies from 400 N to 1000 N. The other parameters are :
(i) C = 6, (ii) FOS = 1.25, (iii) Shear stress = 770 MPa,
(iv) Compression at maximum load = 30 mm,
(v) G = 80 kN/mm^2. Determine, size of wire mean coil dia, Number of coils and free length. 10

2 a. A leaf spring system is subjected to a total load of 140 kN. The other parameters of the spring are as follows:
(i) Number of springs supporting the load = 4 (ii) Number of leaves = 10
(iii) Span of the spring =1000 mm (iv) Deflection allowed = 80 mm
(v) Allowable stress in the spring material = 600 MPa.
Take value of E = 200 kN/mm^2 and design the leaf spring. 10

b. Design the leaf spring for the rear axle of a tractor trolley. The load on the rear axle of the trolley is 8 kN. The span is 1000 mm and the width of the clamp is 100 mm. Totally 10 leaves are used out of which two are main leaves and the remaining are graduated leaves. Assume σ_{all} = 300 MPa. 10

UNIT - II

3 a. Explain thin and thick cylinders. Also give examples for thin and thick cylinder 4

b. A 500 mm diameter thin cylindrical pressure vessel is subjected to an internal pressure of 2 N/mm^2. The thickness of the pressure vessel is 20 mm. Find hoop stress longitudinal stress and maximum shear stress. 6

Contd….2

c. Derive an expression for calculating thickness of shell of a thin cylinder subjected to internal pressure. Also give the η, if the circumferential joint of the spherical shell. 10

4 a. Derive Lame's equation to find the thickness of pressure vessel. 10

b. A high pressure cylinder consists of steel tube with inner and outer diameter of 20 mm and 40 mm respectively. It is jacketed by an outer steel tube with an outer diameter of 60 mm. Take tubes are assembled by shrinkage process in such a way that maximum principal stress is limited to 100 N/mm^2. Calculate the shrinkage pressure and original dimensions of the tube (Take E = 207 kN/mm^2). 10

UNIT - III

5. Design a pair of spur gear with 20º full depth involute teeth based on Lewis equation. 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 gear is made of plain carbon steel (σ_{ut} = 600 N/mm^2). The factor of safety can be taken as 1.5. Compute the dimensions of the gear and suggest suitable hardness for the gear. 20

6. The shafts at right angles are connected by pair of 20º full depth involute teeth bevel gear. The velocity ratio between the shafts is 3:1. The gear is made of steel having an allowable static stress as 70 MPa and pinion is made steel with allowable static stress of 100 MPa. The pinion transmits 37.5 kW at 750 rpm. Design the gear completely. 20

UNIT - IV

7 a. Give the different types of friction clutches. Also state the design considerations for friction clutches. 6

b. Design a cone clutch to transmitt 15 kW at 960 rpm. The outercone is of cast iron and forms the part of IC Engine flywheel. The overall dimensions restrict the mean diameter of cone to 275 mm. The semicone angle is 15º. The inner cone is positioned by means of centrally placed helical spring. 14

8 a. Give the complete classification of brakes. Also state the importance of PV value while despring a brake. 8

b. A band and block brake has a brake drum of 1 m dia and is fitted with 24 blocks each having a contact angle of 10º. The radial thickness of each block, measured from the centre line of band to the rim of the wheel is 70 mm. The band is designed to sustain a maximum force of 2000 N. The lever is arranged as shown in figure below with l = 800 mm, a =100 mm and b = 80 mm. Calculate the force p required to be applied at the end of the lever, if μ = 0.4. Calculate the power loss due to friction, if drum rotates at 240 rpm. 12

Contd….3

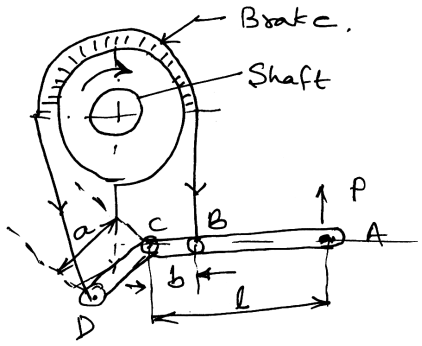

Fig. Q. 8b.

UNIT - V

9 a. Explain the following terms in journal bearing :
i) Bearing modulus
ii) Sommerfield number
iii) Main film thickness. 8

b. Design a journal bearing to support a load of 4500 N at 600 rpm. The bearing lever is made of bronze backed bebbit and the Journal hardened steel. Oil rings are used to lubricate the bearings. Take ambient temperature as 21ºC and oil temperature in bearing as 80ºC. 12

10 a. Explain how the following factors influence the life of a rolling element bearing :
(i) Reliability (ii) Load
(iii) Temperature (iv) Speed. 8

b. Two spindle of wood working machine runs at 1000 rpm. It is mounted on two single row ball bearings, one of which is to carry a radial load of 3250 N and thrust load of 2900 N. The machine runs 8 hrs per day. Assuming the life of 5 years and spindle diameter = 40 mm, select suitable bearing. 12

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