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6E7011

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B.Tech.VI Semester (Main) Examination, May-June 2015

Mechanical Engineering

6ME1A Design of Machine Elements-II

(Common for EE, EX)

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

**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 suitably be assumed and stated clearly.

Units of quantities used/calculated must be stated clearly.

**Unit - I**

1. a) What is stress concentration? What are its causes and what are the methods of reducing stress concentration? Discuss. (8)
- b) A machine component is subjected to two-dimensional stresses. The tensile stress in the X direction varies from 40 to 100 N/mm<sup>2</sup> while the tensile stress in the Y direction varies from 10 to 80 N/mm<sup>2</sup>. The frequency of variation of these stresses is equal. The corrected endurance limit of the component is 270 N/mm<sup>2</sup>. The ultimate tensile strength of the material of component is 660 N/mm<sup>2</sup>. Determine the factor of safety used by designer. (8)

**OR**

1. a) What is Goodman line? What is the difference between Gerber curve and Soderberg and Goodman lines? (8)
- b) A solid shaft is subjected to a bending moment of 3.46 KNm and torsional moment of 11.5 KNm. The shaft is made of C-45 steel, and factor of safety is 6. Determine the diameter of the shaft. (8)

**Unit - II**

2. a) Design a cast iron piston for a single acting four stroke engine for the following specifications:



Cylinder bore	= 100 mm
Stroke	= 120 mm
Maximum gas pressure	= 5 N/mm <sup>2</sup>
Brake mean effective for	= 0.65 N/mm <sup>2</sup>
Fuel consumption	= 0.227 kg/kw/hr
Speed	= 2200 rev/min
Assume suitable data.	

(16)

**OR**

2. Design a connecting rod for a single cylinder four stroke diesel engine with following specifications:

Power	= 7.5 kw
Mechanical eff	= 80%
Weight of reciprocating parts	= 20N
Length of connecting rod	= 0.30m
Speed	= 1500 r.p.m with a possible overspeed to 2500 r.p.m.

Assume suitable missing data.

(16)

**Unit - III**

3. a) It is required to design a helical compression spring subjected to a maximum force of 7.5 KN. The mean coil diameter should be 150mm. The spring rate is 75 N/mm. Spring is made of oil hardened and tempered steel wire with ultimate tensile strength of 1250 N/mm<sup>2</sup>. The permissible shear stress for the spring wire is 30% of the ultimate tensile strength ( $G=81370\text{N/mm}^2$ ) (10)

Calculate : i) Wire diameter and

ii) Number of active coils.

- b) What types of shear stresses are induced in the wire of helical spring? Sketch the distribution of shear stresses. (6)

**OR**

3. a) Find the diameter of cast iron bulleys and the thickness and width of a leather belt to transmit 128.7 kw power from a shaft that is directly connected to a steam engine running at 31.4 rad/sec, to a centrifugal pump with a speed ratio at 1:3.5. (8)



- b) Determine the size of a wire rope necessary for a mine hoist carrying a load at 69.50 kN to be lifted from a depth of 225 meters. A rope speed of 7.9 m/sec. is to be attained in 10 sec. (8)

Unit - IV

4. Determine the proper pitch, module, face, no. of teeth and outside diameters of a pair of  $20^\circ$  involute full depth spur gears to transmit 112.5 kw, from a pinion running at 750 r.p.m. to a gear running at 140 r.p.m., The service is intermittent with light shocks. (16)

OR

4. Design a bevel gear drive between two shafts whose axes are at right angles. Speed of pinion shaft is 240 r.p.m. and that of the gear shaft is 120 r.p.m. pinion is to have 21 teeth of involute profile with module of 20mm and a pressure angle of  $20^\circ$  and is to be of suitable material. Gear is of cast iron power at gear shaft = 75KW. (16)

Unit - V

5. a) A single row deep groove ball bearing No.6002 is subjected to an axial thrust of 1000 N and a radial load at 2200N. Find the expected life that 50% of the bearings will complete under this condition. (8)
- b) Distinguish between "Hydro-dynamic bearings" and "Hydro-static bearings." (8)

OR

5. A journal bearing is proposed for a centrifugal pump. The diameter of the journal is 0.15m and the load on it is 40kN and its speed is 900 r.p.m. complete the design calculations for the bearing. (16)