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**Question Paper Code : 51642**

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fifth Semester

Mechanical Engineering

ME 2303/ME 53/10122 ME 504 — DESIGN OF MACHINE ELEMENTS/MACHINE DESIGN

(Regulation 2008/2010)

(Common to Fifth Semester, Automobile Engineering and Mechanical and Automation Engineering, Fourth Semester, Manufacturing Engineering, Industrial Engineering and Management and Industrial Engineering)

(Common to PTME 2303/PTME 3214 – Design of Machine Elements/Machine Design for B.E. (Part-Time)

Fourth Semester Mechanical Engineering – Regulation 2009)

Time : Three hours

Maximum : 100 marks

Note : Approved design data book is permitted to use in the examination.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

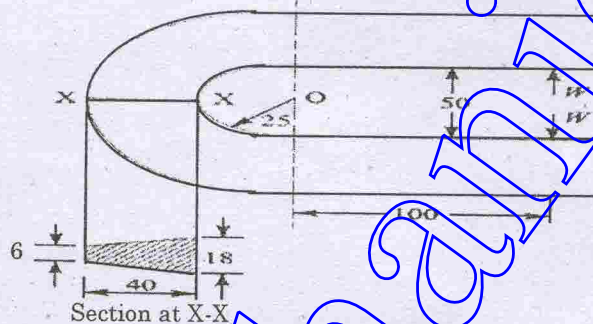
1. Differentiate between hardness and toughness of materials.
2. Define stress concentration and stress concentration factor.
3. What are the various stresses induced in the shafts?
4. Name any two of the rigid coupling.
5. Differentiate with a neat sketch the fillet welds subjected to parallel loading and transverse loading.
6. What are different types of cotter joints?
7. What is meant by semi elliptical leaf springs?
8. Define the term "fluctuation of energy".
9. Classify the types of bearings.
10. What is meant by journal bearing?

PART B — (5 × 16 = 80 marks)

11. (a) (i) What are the factors influencing machine design? Explain it. (10)
- (ii) Write short notes on the following : (6)
- (1) Interchangeability
  - (2) Tolerance
  - (3) Allowance.

Or

- (b) (i) The frame of a punch press is shown in fig. Find the stresses at the inner and outer surface at section X-X of the frame, if  $W = 5000$  N. (10)



All dimensions in mm

- (ii) What is factor of safety? List the factors to be considered while deciding the factor of safety. (6)

12. (a) A steel solid shaft transmitting 15 kW at 200 rpm is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5 mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5 mm module is located 150 mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear. Determine the diameter of the shaft. (16)

Or

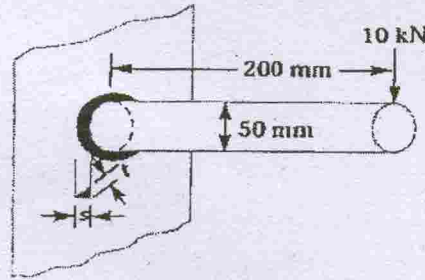
- (b) Determine the dimensions of flange coupling that connects a motor and a pump shaft. The power to be transmitted a 2 kW at a shaft speed of 960 rpm. Select suitable materials for the parts of the coupling and list the dimensions. (16)

13. (a) A cast iron cylinder head is fastened to a cylinder of 500 mm bore with 8 stud bolts. The maximum pressure inside the cylinder is 2 MPa. The stiffness of part is thrice the stiffness of the bolt. What should be the initial tightening load so that the point is leak proof at maximum pressure? Also choose a suitable bolt for the above application. (16)

Or



- (b) (i) What is an eccentric loaded welded joint? Discuss the procedure for designing such a joint. (6)
- (ii) A 50 mm diameter solid shaft is welded to a flat plate as shown in figure. If the size of the weld is 15 mm, find the maximum normal and shear stress in the weld. (10)



14. (a) A close-coiled helical compression spring has plain ends and is to fit over a 25 mm diameter rod. When a compressive force of 100 N is applied to the spring it compresses by 50 mm. If the spring has a preferred wire diameter of 4 mm, and the spring material has a maximum allowable shear stress of 180 MN/m<sup>2</sup> and a modulus of rigidity of 81 GN/m<sup>2</sup>, determine
- The mean coil diameter of the spring.
  - The diametrical clearance between the spring and the rod.
  - The number of coil in the spring
  - The solid length of the spring. (16)

Or

- (b) The areas of the turning moment diagram for one revolution of a multi cylinder engine with reference to the mean turning moment, below and above the line, are -32, +408, -267, +333, -310, +226, -374, +260 and -244 mm<sup>2</sup>.

The scale for abscissa and ordinate are : 1 mm = 2.4° and 1 mm = 650 N-m respectively. The mean speed is 300 r.p.m. with a percentage speed fluctuation of ± 1.5%. If the hoop stress in the material of the rim is not to exceed 5.6 MPa, determine the suitable diameter and cross section for the fly-wheel, assuming that the width is equal to 4 times the thickness. The density of material may be taken as 7200 kg/m<sup>3</sup>. Neglect the effect of the boss and arms. (16)

15. (a) Design a journal bearing for a centrifugal pump with the following data :  
 Diameter of the journal = 150 mm  
 Load on bearing = 40 kN  
 Speed of journal = 900 rpm. (16)

Or

- (b) Select a bearing for a 40 mm diameter shaft rotates at 400 rpm. Due to bevel gear mounted on the shaft, the bearing will have to withstand a 5000 N radial load and a 3000 N thrust load. The life of the bearing expected to be at least 1000 hrs. (16)