

FACULTY OF ENGINEERING
B.E. 3/4 (M/P / AE) I – Semester (Main) Examination, Dec. 2014 / Jan. 2015

Subject: Design of Machine Elements

Time: 3 Hours

Max.Marks: 75

Note: Answer all questions from Part A. Answer any five questions from Part B.
PART – A (25 Marks)

- 1 Mention the various types of design considerations of machine elements.
- 2 Define the terms (i) Ductility (ii) Malleability and (iii) Hardness
- 3 Define the terms (i) Notch Sensitivity and (ii) Stress concentration factor.
- 4 Mention the factors affecting the fatigue strength.
- 5 Classify various types of keys and mention their applications.
- 6 Mention the applications of Muff and Flexible Couplings.
- 7 Distinguish between rope drive and chain drive.
- 8 Enumerate the role of locking devices for nuts.
- 9 What is meant by a power screw?
- 10 Classify different types of welded joints and mention their applications.

PART – B (50 Marks)

- 11 a) With a neat flowchart explain the general procedure in machine design. 6
b) According to Indian Standard Specifications, explain the meaning of the following designations used for steels: 4
i) Fe E 290 ii) 40C8
- 12 A simply supported beam has a concentrated load at the centre which fluctuates from a value of P to 4P. The span of the beam is 500 mm and its cross-section is circular with a diameter of 60 mm. Taking for the beam material an ultimate stress of 70 MPa, a yield stress of 500 MPa, endurance limit of 330 MPa for reverse bending, and a factor of safety of 1.3, calculate the maximum value of P. Take a size factor of 0.85 and surface finish factor of 0.9. 10
- 13 It is required to design a square key for fixing a gear on a shaft of 25 mm diameter. 15 kW power at 720 rpm is transmitted from the shaft to the gear. The key is made of steel ($f_y=460 \text{ N/mm}^2$) and the factor of safety is 3. The yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimensions of the key. 10
- 14 Design a knuckle joint to withstand a load of 100 kN. All the parts of the joint are made of the same material with $\sigma_{ut} = \sigma_{uc} = 480 \text{ Pa}$ and $\tau_u = 360 \text{ MPa}$. Use factor of safety of 6 on ultimate strength.

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- 15 A load of 12 kN is raised by a screw, with single start square threads of 50 mm mean diameter and 12 mm pitch. The screw is operated by a hand wheel, the boss of which is threaded to act as a nut. The load is resisted by a thrust collar, which supports wheel boss, and has a mean radius of 30 mm. The coefficient of friction is 0.15 for the screw, and 0.18 for the collar. If the tangential force applied by each hand on the wheel is 120N, determine the diameter of hand wheel required. 10
- 16 Design and draw a protective type of C.I. flange coupling for a steel shaft transmitting 15 kW at 200 rpm and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for C.I. is 14 MPa. 10
- 17 Write short notes on the following: 10
- a) Preferred Numbers
 - b) Soderberg Criteria
 - c) Bolts of Uniform Strength
 - d) Compound Screw.
