

Exam.Code:0941
Sub. Code: 7052

1078
B.E. (Mechanical Engineering)
Fifth Semester
MEC-501: Design of Machines Elements – I

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part. Use of design data book is not allowed.

x-x-x

- I. Write briefly: (2x5)
- State the basic factors which are considered in selecting the material for a machine element.
 - Explain the different modes of failure of the pin in knuckle joint.
 - State one advantage and one disadvantage of a multiple start screw.
 - Why do levers have tapered arms.
 - What are the different stresses developed in the rim of the flywheel.

PART A

- II. (a) What is meant by endurance limit of a material. How do the size and surface condition of a component and type of load affect such strength. (3)
- (b) Determine the diameter of a circular rod made of ductile material with a endurance limit of 280 MPa and a tensile yield strength of 350 MPa. The member is subjected to a varying axial load from 700 kN to -300 kN. Assume $K_t = 1.3$ and $F.S. = 2$. (7)
- III. (a) A tie-bar in a bridge consists of flat 350 mm wide and 20 mm thick plate. It is connected to a gusset plate of the same thickness by a double cover butt joint. Design an economical joint if the permissible stresses are: $\sigma_t = 90\text{MPa}$, $\tau = 60\text{MPa}$, $\sigma_c = 120\text{MPa}$. (6)
- (b) Explain the procedure for designing an axially loaded unsymmetrical welded section. (4)
- IV. Design a shaft and flange for a Diesel engine in which protected type of flange coupling is to be adopted for power transmission. The following data is available for design : Power of engine = 75 kW; speed of engine = 200 r.p.m.; maximum permissible stress in shaft = 40MPa; maximum torque = 1.25 × mean torque; For bolt: Yield strength in tension=380MPa, factor of safety=3, no. of bolts=4 (10)

PART B

- V. Design a right angled bell crank lever having one arm 500 mm and the other 150 mm long. The load of 5 kN is to be raised acting on a pin at the end of 500 mm arm and the effort is applied at the end of 150 mm arm. The lever consists of a steel forgings, turning on a point at the fulcrum. The permissible stresses for the pin and lever are 84 MPa in tension and compression and 70 MPa in shear. The bearing pressure on the pin is not to exceed 10 N/mm². (10)

- VI. Design and draw an oval flanged pipe joint for a pipe having 50 mm bore. It is subjected to an internal fluid pressure of 7 N/mm^2 . The maximum tensile stress in the pipe material is not to exceed 20 MPa and in the bolts 60 MPa. (10)
- VII. A punching press is required to punch 30 holes per minute of 20mm diameter in a steel plate 13mm thick. The actual punching takes place at $1/6^{\text{th}}$ of angular rotation of crankshaft. The shear strength of the plate is 310MPa. The driving motor is geared to counter shaft upon which flywheel is mounted. The counter shaft in turn is geared to crankshaft of the press. The crank shaft is powered by the counter shaft through a reduction gear having ratio 1:10. Design the flywheel rim if the space limitations restrict the flywheel diameter to 0.92m and the flywheel speed is reduced by maximum of 10% of mean speed. (10)

x-x-x