[EME-303]
B.Tech. Degree Examination
Mechanical Engineering
V SEMESTER
MACHINE DESIGN-I
(Effective from the admitted batch 2015–16)

Time: 3 Hours Max.Marks: 60

Instructions: Each Unit carries 12 marks.
Answer all units choosing one question from each unit.
All parts of the unit must be answered in one place only.
Figures in the right hand margin indicate marks allotted.

MODULE-I

1. a) Why there is necessity of preferred numbers in design?
   Briefly explain about them  
   b) Cylindrical shaft made of steel of yield strength 700 MPa is
   subjected to static loads consisting of bending moment
   10 K N – m and a torsional moment of 30 K N–m. Determine
   the diameters of the shaft using different theories of failure,
   and assuming a factor of safety of 2. Take E=210 GPa and
   Poisson's ratio=0.25

   OR

2. Consider the state of stress at a point of a bi-axially loaded member
   as shown in the figure1. Determine the principal stresses and
   calculate the factor of safety using.
   a) Maximum principal stress theory
   b) Maximum shear stress theory
   c) Maximum distortion energy theory
   Take the value of critical stress of the material as 300 N/mm²

   OR

   OR

   OR
3. a) What is S-N diagrams?  
   b) A rod is subjected to a variable axial load which varies from -300 to 900 N. If the endurance limit and the yield point of the material are 200 and 350 N/mm², respectively, determine the diameter of the rod, using a factor of safety of 3

4. a) What is stress concentration factor? Explain its significance  
    b) A hollow transmission shaft having inside diameter 0.6 times outside diameter is made of plain carbon steel 40C8 and the factor of safety is 3. A belt pulley 1000 mm in diameter is mounted on the shaft that over hangs the left hand bearing by 250 mm. The belts are vertical and transmit power to the machine shaft below the pulley. The tension on tight and slack sides of the belt are 3 KN and 1 KN respectively, while the weight of the pulley is 500 N. The angle of wrap of the belt on the pulley is 180°. Calculate the outside and inside diameters of the shaft
MODULE-III

5. a) What are the possible failures in riveted joints?  
   b) For supporting the travelling crane in a work shop, the brackets are fixed columns as shown in fig. 1 the maximum load that comes on bracket is 12KN acting vertically at a distance of 400 mm from the face of column. The vertical face of the bracket is secured to a column by four bolts, in the row at a distance of 50 mm from the lower edge of the bracket. Determine the size of the bolts if the permissible value of tensile stress for the bolt material is 84 Mpa. Also find the cross section of the arm of bracket which is rectangular.

OR

6. a) State the assumptions made in the design of welded joint  
   b) Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5m in diameter subjected to a steam pressure of 0.95 N/mm2. Assume joint efficiency as 75% allowable tensile stress in the plate 90 MPa; compressive stress 140 MPa; and shear stress in the rivet 56 MPa.

MODULE-IV

7. a) Draw a neat sketches of the following:  
   i) Sunk key  ii) Gib head key  iii) Woodruff key  
   b) Design a cotter joint to transmit a load of 2 KN. Take allowable stress values in tension and shear as 70 N/mm2 and 30 N/mm2, respectively.
8.   a) Why gibbs are used in cotter joint?
   b) A steel shaft 120mm in diameter and 1m long has a flywheel fitted at one end and rotates at 240rpm. When the shaft is suddenly stopped, determine the angle of twist and shear stress induced in shaft the mass of fly wheel is 100 kg and its radius of gyration is 350mm.
   take \( G=0.84 \times 10^5 \) Mpa

9.   a) Why a flexible coupling is called by that name? Explain with a sketch
   b) Design a Cl protective type flange coupling to transmit 15 KW at 900 rpm. The following permissible stresses may be used. Shear stress for shaft, bolt and key = 40 MPa. Crushing stress for bolt and key = 80 MPa, shear stress for C.I. = 8 MPa, Draw a neat sketch of the coupling

10.  a) Explain the coefficient of fluctuation of energy in fly wheel?
    b) Explain the coefficient of fluctuation of speed in fly wheel?

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