

GANPAT UNIVERSITY
B.TECH SEM. IV - MECHATRONICS ENGINEERING
CBCS REGULAR EXAMINATION MAY/JUNE-2013
2MC402 INDUSTRIAL DRAFTING, DESIGN & PACKAGES

Time: 3 Hours

Total Marks: 70

Instructions:

- 1). All questions are **compulsory**.
- 2). Figures to the **right** indicate full marks.
- 3). Answers to the two sections must be written in **separate** answer books.
- 4). Assume all necessary data.

SECTION - I**Que:-1 Attempt All.**

- (A) Describe the design procedure of a cotter foundation bolts. [04]
 (B) What are the applications of a knuckle joint? [02]
 (C) A steel spindle transmits 4 kW at 800 r.p.m. The angular deflection should not exceed 0.25° per metre of the spindle. If the modulus of rigidity for the material of the spindle is 84 GPa, find the diameter of the spindle and the shear stress induced in the spindle. [06]

OR**Que:-1 Attempt All.**

- (A) State and explain the various criteria on which shaft are designed? [04]
 (B) Under what circumstances are hollow shafts preferred over solid shafts? [02]
 (C) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. [06]

Que:-2 Attempt All.

- (A) Describe the design procedure of a protected type flanged coupling. [05]
 (B) Design a clamp coupling to transmit 30 kW at 100 r.p.m. The allowable shear stress for the shaft and key are 40 MPa and the number of bolts connecting the two halves are 6. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface can be taken as 0.3. Take width of key is 22 mm and thickness of key is 14 mm. [06]

OR**Que:-2 Attempt All.**

- (A) Explain various failures of rivetted joints. [05]
 (B) Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2 . Assume joint efficiency as 75%, allowable tensile stress in the plate 90 MPa, compressive stress 140 MPa & shear stress in the rivet 56 MPa. [06]

Que:-3 Attempt All.

- (A) Explain stress-strain diagram for ductile material with neat sketch. [12]
 (B) Classify the different types of load & explain each In brief.
 (C) The maximum load on a petrol engine push rod 300 mm long is 1400 N. It is hollow having the outer diameter 1.25 times the inner diameter. Spherical seated bearings are used for the push rod. The modulus of elasticity for the material of the push rod is 210 kN/mm^2 . Find a suitable size for the push rod, taking a factor of safety of 2.5.

SECTION - II

Que:-4 Attempt All.

- (A) What is the function of a spring? Discuss the materials and practical applications for the various types of springs. [04]
- (B) What is nipping in a leaf spring? Discuss its role. [02]
- (C) For operating the exhaust valve of a petrol engine, the maximum load required on the valve is 5000 N. The rocker arm oscillates around a pin whose centre line is 250 mm away from the valve axis. The two arms of the rocker are equal and make an included angle of 160° . The tensile and shear stress are 70 Mpa and the bearing pressure is 7 N/mm^2 . Assume the cross-section of the rocker arm as rectangular and fulcrum pin length as 1.25 times the pin diameter. [06]
- Calculate:
1. The diameter and the length of fulcrum pin;
 2. The shear stress in the fulcrum pin;
 3. The dimensions of the boss of the lever at the fulcrum;
 4. Bending stress in the fulcrum pin;
 5. Design of lever arm.

OR

Que:-4 Attempt All.

- (A) Write applications of different types of levers. [04]
- (B) Explain clearly the necessity of providing bosses on the lever at pin locations. [02]
- (C) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm^2 , find the axial load which the spring can carry and the deflection per active turn. [06]

Que:-5 Attempt All.

- (A) State the assumptions used in Euler's column theory. [03]
- (B) What is equivalent length of a column? Write the relations between equivalent length and actual length of a column for various end conditions. [03]
- (C) The lead screw of a lathe has Acme threads of 50 mm outside diameter and 8 mm pitch. The screw must exert an axial pressure of 2500 N in order to drive the tool carriage. The thrust is carried on a collar 110 mm outside diameter and 55 mm inside diameter and the lead screw rotates at 30 r.p.m. Determine (a) the power required to drive the screw; and (b) the efficiency of the lead screw. Assume coefficient of friction of 0.15 for the screw and 0.12 for the collar. [05]

OR

Que:-5 Attempt All.

- (A) Derive the equation for torque required to lower the load by square threaded screw. [03]
- (B) Derive the expression for the maximum efficiency of square threaded screw. [03]
- (C) A 45 mm diameter shaft is made of steel with yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with yield strength of 340 Mpa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2. [05]

Que:-6 Attempt All.

- (A) Define stress concentration and explain the methods to reduce stress concentration. [12]
- (B) What are the basic functions of the key? What is splined shaft?
- (C) Explain polygon, array, mirror and trim commands of AutoCAD.

END OF PAPER