

**GANPAT UNIVERSITY**  
**B. TECH SEM-IV (ME/MC)**  
**CBCS REGULAR EXAMINATION- APRIL-JUNE 2016**  
**2ME401 Fundamentals Machine Design**

TIME: 3 HRS

TOTAL MARKS: 60

- Instructions:** (1) This Question paper has two sections. Attempt each section in separate answer book.  
 (2) Figures on right indicate marks.  
 (3) Be precise and to the point in answering the descriptive questions.

**SECTION: I**

**Q.1 Attempt the following questions.**

- (A) Why gibs are used in a cotter joint? Explain with the help of a neat sketch the use of single and double gib. (04)
- (B) It is required to design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50 kN. The rods are co-axial and a small amount of angular movement between their axes is permissible. Design the joint and specify the dimension of its components. The allowable stresses are 80 MPa in tension, 40 MPa in shear and 80 MPa in crushing. (06)

**OR**

**Q.1 Attempt the following questions.**

- (A) Explain the design procedure of Double Eye End for Knuckle Joint. (04)
- (B) Design and draw a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive stress = 50 MPa ; shear stress = 35 MPa and crushing stress = 90 MPa. (06)

**Q.2 Attempt the following questions.**

- (A) Explain Principal Stresses and Principal Planes with neat sketch. (04)
- (B) Define: Machine design, Design synthesis, Ergonomics, Industrial Design and Explain steps involved in design of a machine element. (06)

**OR**

**Q.2 Attempt the following questions.**

- (A) Explain stress-strain diagram for ductile material with neat sketch. (04)
- (B) A manufacture is interested in starting a business with five different models of tractors ranging from 7.5 to 75 kW capacities. Specify power capacities of the models. There is an expansion plan to further increase the number of models from five to nine to fulfill the requirement of farmers. Specify the power capacities of the additional models. (06)

**Q.3 Attempt Any TWO.**

- (A) Enlist the types of keys with neat sketch & Derive the equation for strength of a Sunk key. (10)
- (B) A solid circular shaft is subjected to a bending moment of 3000 N-m and a Torque of 10 000 Nm. The shaft is made of 45 C 8 steel having ultimate tensile stress of 700 MPa and a ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft.
- (C) Define coupling and write at least three practical application of it. Also differential Coupling and clutch.

## SECTION: II

**Q.4 Attempt the following questions.**

- (A) Derive equations of torque required to lowering the load against the thread friction for square thread. (04)
- (B) The cross bar of a planner weighing 12 kN is raised and lowered by means of two square threaded screws of 38 mm outside diameter and 7 mm pitch. The screw is made of steel and a bronze nut of 38 mm thick. A steel collar has 75 mm outside diameter and 38 mm inside diameter. The coefficient of friction at the threads is assumed as 0.11 and at the collar 0.13. Find the force required at a radius of 100 mm to raise and lower the load. (06)

OR

**Q.4 Attempt the following questions.**

- (A) Differentiate between differential screw and compound screw. (04)
- (B) A double start square threaded vertical power screw with a mean diameter of 120 mm and a pitch of 18 mm supports a load of 20 kN. The screw passes through the boss of a spur gear wheel which acts as a nut. The gear having 85 teeth meshes with pinion of 17 teeth. The mechanical efficiency of a gear pair is 95%. The axle thrust on the screw is taken by a collar bearing 250 mm outside diameter and 100 mm inside diameter. The coefficient of friction between screw and nut is 0.12 and that for collar bearing is 0.15. The allowable bearing pressure is 1.5 MPa. Find : (06)
- Torque to be supplied at the pinion shaft.
  - The height of the nut.

**Q.5 Attempt the following questions.**

- (A) Explain the design procedure of a lever for a lever safety valve. (04)
- (B) A double riveted double cover butt joint is made in 12 mm thick plates with 18 mm diameter rivets. Find the efficiency of the joint for a pitch of 80 mm, if permissible stresses are: tensile ( $\sigma$ ) = 115 MPa; shear ( $\tau$ ) = 80 MPa; and crushing ( $\sigma_c$ ) = 160 MPa. (06)

OR

**Q.5 Attempt the following questions.**

- (A) Explain the different types of riveted joints. (04)
- (B) Design a foot brake lever from the following data : (06)
- Length of lever from the centre of gravity of the spindle to the point of application of load = 1 metre, Maximum load on the foot plate = 800 N, Overhang from the nearest bearing = 100 mm, Permissible tensile and shear stress = 70 MPa .

**Q.6 Attempt Any TWO.**

- (A) What is equivalent length of a column? Write the relations between equivalent length and actual length of a column for various end conditions. (04)
- (B) Derive the equation for stresses & deflection in Helical spring of circular wire. (06)
- (C) A helical valve spring is to be designed for an operating load range of approximately 90 to 135 N. The deflection of the spring for the load range is 7.5 mm. Assume a spring index of 10. Permissible shear stress for the material of the spring = 480 MPa and its modulus of rigidity = 80 kN/mm<sup>2</sup>. Design the spring. (10)

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