

GANPAT UNIVERSITY
B.TECH SEM. IV - MECHATRONICS ENGINEERING
REGULAR EXAMINATION MAY/JUNE - 2012
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) Enlist different types of cotter joints & explain design procedure of any one. [06]
- (B) A shaft supported at the ends in ball bearings carries a straight tooth spur gear at its mid span and is to transmit 7.5 kW at 300 r.p.m. The pitch circle diameter of the gear is 150 mm. The distances between the centre line of bearings and gear are 100 mm each. If the shaft is made of steel and the allowable shear stress is 45 MPa, determine the diameter of the shaft. Show in a sketch how the gear will be mounted on the shaft; also indicate the ends where the bearings will be mounted? The pressure angle of the gear may be taken as 20°. [06]

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

- (A) Define equivalent twisting moment and equivalent bending moment. State when these two terms are used in design of shaft. [06]
- (B) 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) Show that square key is equally strong in shearing and crushing. [04]
- (B) Discuss the function of a coupling? [02]
- (C) Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa. Take Width of key as 18 mm and Thickness of key as 18 mm. [05]

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

- (A) Explain different types of riveted joints. [04]
- (B) Define the following terms related to riveted joints. [02]
 1. Pitch 2. Margin 3. Diagonal pitch 4. Back pitch
- (C) Find the efficiency of the double riveted lap joints with zig-zag riveting is to be designed for 13 mm thick plates. Assume 80 MPa, 60 MPa and 120 MPa in tension, Shear and crushing respectively. Also calculate pitch of rivets. [05]

Que:-3 Attempt All.

- (A) Explain stress-strain diagram for brittle material with sketch. [12]
- (B) List the name of different failure theories and explain any one.
- (C) Explain construction of Leaf spring

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. [05]
- (B) A lever loaded safety valve is 70 mm in diameter and is to be designed for a boiler to blow-off at pressure of 1 N/mm² gauge. Design a suitable mild steel lever of rectangular cross-section using the following permissible stresses : [07]
Tensile stress = 70 MPa; Shear stress = 50 MPa; Bearing pressure intensity = 25 N/mm².
The pin is also made of mild steel. The distance from the fulcrum to the weight of the lever is 880 mm and the distance between the fulcrum and pin connecting the valve spindle links to the lever is 80 mm.

OR

Que:-4 Attempt All.

- (A) State the application of hand and foot levers. Discuss the procedure for designing a hand or foot lever. [05]
- (B) 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/mm², find the axial load which the spring can carry and the deflection per active turn. [07]

Que:-5 Attempt All.

- (A) State the assumptions used in Euler's column theory. [03]
- (B) Define 'slenderness ratio'. How it is used to define long and short columns? [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) What do you understand by overhauling and self locking of screw? [03]
- (B) Derive the expression for the efficiency of square threaded screw. [03]
- (C) Calculate the diameter of a piston rod for a cylinder of 1.5 m diameter in which the greatest difference of steam pressure on the two sides of the piston may be assumed to be 0.2 N/mm². The rod is made of mild steel and is secured to the piston by a tapered rod and nut and to the crosshead by a cotter. Assume modulus of elasticity as 200 kN/mm² and factor of safety as 8. The length of rod may be assumed as 3 metres. [05]

Que:-6 Attempt All.

- (A) Define stress concentration and explain the methods to reduce stress concentration. [12]
- (B) Differentiate between elasticity and plasticity.
- (C) Explain basic procedure for machine design.

END OF PAPER