GANPAT UNIVERSITY

B.TECH SEM. IV - MECHATRONICS ENGINEERING
REGULAR EXAMINATION April - June 2015
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 Answer the following questions.

(A) What is the function of a spring? Discuss the materials and practical applications for the various types of springs. [05]

(B) 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 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/mm^2. Assume the cross-section of the lever as rectangular and pin length as 1.25 times the pin diameter and depth (b) as three times the thickness (t). [07]
Calculate: 1. The diameter, length and shear stress of fulcrum pin;
2. The dimensions of the boss of the lever at the fulcrum; and
3. Design of lever

OR

Que:1 Answer the following questions.

(A) State the application of hand and foot levers. Discuss the procedure for designing a hand or foot lever. [05]

(B) Design a compression helical spring to carry a load of 500 N with a deflection of 25 mm. The spring index may be taken as 8. If the permissible shear stress is 350 Mpa and modulus of rigidity is 84 kN/mm^2. Take Wahl's stress factor. [07]

Que:2 Answer the following questions.

(A) Derive the equation for torque required to raise the load by square threaded screw. [03]

(B) What do you understand by overhauling and self-locking of screw? [03]

(C) A vertical two start square threaded screw of a 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing of 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of a lever which is 400 mm long in order to lift and lower the load. The coefficient of friction for the vertical screw and nut is 0.15 and that for collar bearing is 0.20. [05]

OR

Que:2 Answer the following questions.

(A) Explain different types of riveted joints. [03]

(B) Define the following terms related to riveted joints. [03]
1. Pitch 2. Margin 3. Diagonal 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. Take two rivets per pitch length; the value of C is 2.62. [05]
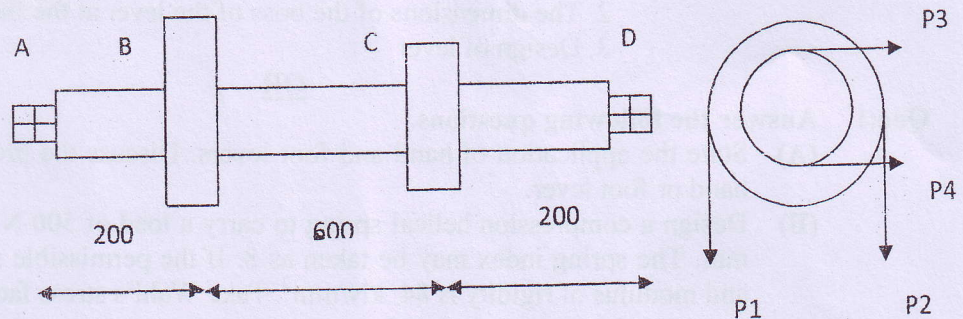
Que:3   **Answer the following questions.**

    (A)   What is factor of safety? Write the steps for the selection of factor of safety.

    (B)   State the assumptions used in Euler's column theory.

    (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/mm^2. 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/mm^2 and factor of safety as 8. The length of rod may be assumed as 3 meters. Piston rod is considered to have both ends fixed.

SECTION – II

Que:4   **Answer the following questions.**

    (A)   What are the basic functions of the key? What is splined shaft?   **[02]**

    (B)   The layout of transmission shaft carrying two pulleys B and C and Supported **[10]** bearings A and D is shown in fig below pulley B having 500 mm diameter and C having 250 mm diameter power is supplied to vertical belt pulley B that is transmitted to horizontal pulley C. The maximum tension in belt on pulley B is 2.5 kN. The angle of wrap for the both pulley is 180° and coefficient of friction is 0.24. The shaft is made of plain carbon steel (S_{yt}= 400 N/mm^2) and factor of safety is 3. Determine the shaft diameter on strength basis.

OR

Que:4   **Answer the following questions.**

    (A)   What are the applications of a cotter joint?   **[02]**

    (B)   A transmission shaft is supported between two bearings that are 750 rpm. Power is **[10]** supplied to the shaft through a coupling that is located to left of left-hand bearing. Power is transmitted from the shaft by means of a belt pulley, 450 mm diameter which is located at a distance of 200 mm to the right of left –hand bearing. The weight of the pulley is 300 N and the ratio of belt tension of tight and slack sides is 2:1. The belt tensions act in vertically downward direction. The shaft is made of steel FeE 300(S_{yt}=300 N/mm^2) and factor of safety is 3. Determine the shaft diameter if it transmits 12.5 KW power at 300 rpm from the coupling to the pulley (S_{ys}=0.5S_{yt}).

Que:5 It is required to design a Cotter joint to connect two circular rods subjected to an [11] 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 dimensions of its components. Take 30C8 (S_{yt}=400N/mm^2) and FOS is 5. Assume ($S_{yc}=S_{yt}$) and ($S_{ys}=0.5S_{yt}$).

OR

Que:5 With the free body diagram give expression of each and every part's failure of [11] Knuckle joint.

Que:6 Attempt any three. [12]
(A) Explain general considerations in designing a machine component.
(B) Explain stress-strain diagram for ductile material with neat sketch.
(C) Why with same amount weight and equal torque transmit capacity hollow shaft is more strengthen then solid shaft? Prove it.
(D) Why standards are use in Machine Design? What do you mean by standard 55cr3?

END OF PAPER