Seat No: - _____

Ganpat University
B. Tech. Sem. IV Mechanical Engineering
CBCS Regular Examination April - June 2015
2ME402 Fundamentals of Machine Design & Drafting

[Time: 3 Hour] [Total marks: 70]

Instructions:

(1) Attempt all questions.
(2) Figure to the **right** indicate full marks.
(3) Assume suitable data if necessary.
(4) Only scientific calculator is allowed.
(5) Draw neat sketch wherever essential.

SECTION-I

Que.1

(A) Write advantages and application of cotter and knuckle joint. [03]

(B) It is required to design a cotter joint to connect two steel rods of equal diameter. Each rod is subjected to an axial tensile force of 50 kN. Design the joint and specify its main dimensions. [09]

For Spigot, Socket and rod: Permissible values of tensile stress is 67 N/mm^2, Shear stress is 34 N/mm^2 and Crushing stress is 134 N/mm^2. Factor of safety is 2.

For Cotter: Permissible values of tensile stress is 100 N/mm^2, Shear stress is 50 N/mm^2.

OR

Que.1

(A) Why cotter is provided with taper? What is magnitude of taper on cotter? [03]

(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. [09]

Que.2

(A) How the shaft is designed when it is subjected to bending moment only? [03]

(B) A steel solid shaft transmitting 15 kW at 200rpm is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5mm module is located 100 mm to the left of right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5mm module is located 150 mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear, determine the diameter of shaft. [09]

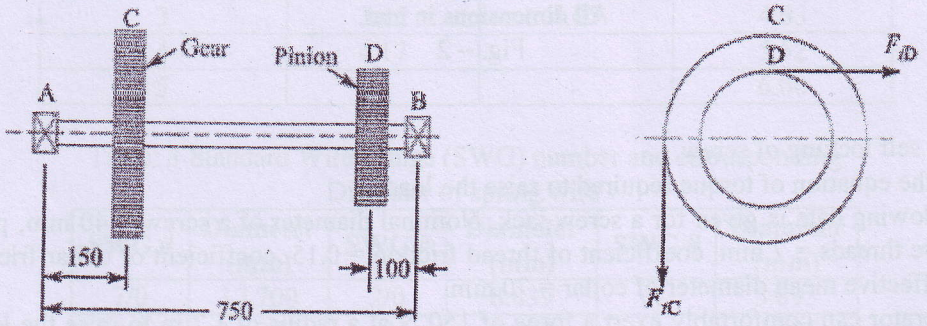


Fig. – 1

OR

Que.2

(A) Square key is stronger against crushing than rectangular key. Justify the statement. [03]

(B) Write short note on Muff coupling. [03]

(C) Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following [06]

permissible stresses may be used:

Shear stress for bolt and key material = 40 MPa
Crushing stress for bolt and key = 80 MPa
Shear stress for cast iron = 8 MPa

Take shaft diameter = 35 mm, outer diameter of hub = 70 mm, length of hub = 52.5 mm.

Que.3

(A) Draw and explain Stress strain diagram for Ductile material. [03]

(B) Explain phases of machine design. [04]

(C) What is preferred series? Write advantages of it. Also derive R10 series. [04]

SECTION – II

Que.4

(A) Define following terms of the spring. [03]
(i) Active and inactive coils, (ii) Spring index, (iii) Stiffness of spring.

(B) Classify springs according to their shapes. Draw neat sketches indicating in each case whether stresses are induced by bending or by tension. [04]

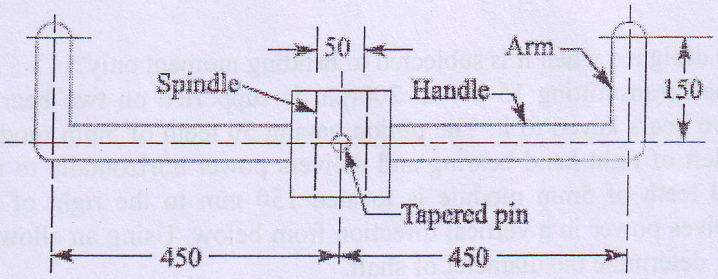
(C) Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm^2. [05]

OR

Que.4

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

(B) A handle for turning the spindle of a large valve is shown in **Fig. 2**. The length of the handle from the centre of the spindle is 450 mm. The handle is attached to the spindle by means of a round tapered pin. If an effort of 400 N is applied at the end of the handle, find: 1. mean diameter of the tapered pin, and 2. diameter of the handle. The allowable stresses for the handle and pin are 100 MPa in tension and 55 MPa in shear. [07]



All dimensions in mm.

Fig. – 2

Que.5

(A) Explain self locking of screw. [03]

(B) Derive the equation of torque required to raise the load. [04]

(C) The following data is given for a screw jack. Nominal diameter of a screw = 40 mm, pitch of square threads = 7 mm, coefficient of thread friction = 0.15, coefficient of collar friction = 0.1, effective mean diameter of collar = 70 mm. [05]
The operator can comfortably exert a force of 150 N at a radius of 1.2 m to raise the load. Assuming a single start thread, calculate: (i) the maximum load that can be lifted and (ii) efficiency of screw.

OR

Que.5

(A) Define the following terms related to bolted joint: [03]
(a) Major diameter,(b) Pitch,(c) Lead.

(B) What is fullering? Explain with the help of neat sketch. [03]

(C) Design a double riveted butt joint with two cover plates for the longitudinal seam of boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2. Assume joints efficiency as 75%. Allowable tensile stress in the plate 90 MPa, Compressive stress 140 MPa and shear stress in the rivet 56 MPa. [06]

Que.6

(A) State the assumptions used in Euler's column theory. [04]

(B) Define 'slenderness ratio'. How is it used to define long and short columns? What is equivalent length of a column? [04]

(C) A bracket as shown in **fig.-3**, supports a load off 30 kN. Determine the size of bolts, if the max. allowable stress in bolt is 60 MPa. The distances are L_1 = 80 mm, L_2 = 250mm, L_3 = 500 mm. [03]

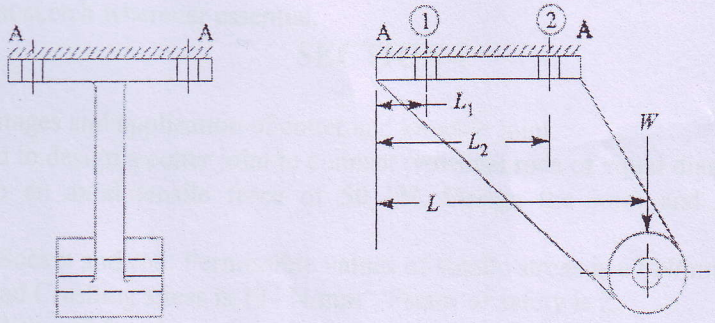


Fig. – 3

Table: 1 Size of rivet diameters for rivet hole diameters as per IS:1928-1961

Basic size of rivet (mm)	12	14	16	18	20	22	24	27	30
Rivet hole diameter (min) mm	13	15	17	19	21	23	25	28.5	31.5

Table: 2 Values of constant C.

Number of rivets per pitch length	**Lap joint**	**Butt joint (Single strap)**	**Butt joint (Double strap)**
1	1.31	1.53	1.75
2	2.62	3.06	3.50
3	3.47	4.05	4.63
4	4.17	-	5.52
5	-	-	6.00

Table: 3 Standard Wire Gauge (SWG) number and corresponding Diameter of spring wire

SWG #	**Diameter (mm)**	**SWG #**	**Diameter (mm)**	**SWG #**	**Diameter (mm)**
7/0	12.700	2/0	8.839	4	5.893
6/0	11.786	0	8.230	5	5.385
5/0	10.973	1	7.620	6	4.877
4/0	10.160	2	7.010	7	4.470
3/0	9.449	3	6.401	8	4.064

END OF PAPER