morning.

D - 15/05/2014.

Seat No: - _____

Ganpat University

B. Tech. Sem. IV Mechanical Engineering

Regular Examination May/June - 2014

2ME402 Fundamentals of Machine Design & Drafting

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

Instructions:

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

SECTION-I

Que. 1

(A) What is stress concentration? Also write causes and remedies of it. [4]
(B) Enlist and explain factors affecting selection of material. [4]
(C) What is Preferred series? Find out nos. of R20 Basic series from 1 to 10. [4]

OR

Que. 1

(A) List out various theories of failure and explain any one in brief. [4]
(B) Derive an expression for the maximum load in a bolt when a bracket with circular base is bolted to a wall by means of four bolts. [4]
(C) Two plates of 7 mm thick are connected by triple riveted lap joint of zig-zag pattern. Calculate the diameter rivet pitch and distance between rows of rivets for the joints. Also state the mode of failure of the joint. Take value of C = 3.47. The safe working stresses are as follows; [4]

Tensile stress in plates = 90 MPa
Shearing stress in rivets = 60 MPa
Crushing stress in rivets = 120 MPa

Que. 2

(A) What is torsional and lateral rigidity of shaft? State application where rigidity is design criterion. [3]
(B) The layout shown in fig.-1 is driven by pulley D from an electric motor. Another belt drive from pulley C is running a compressor. The belt tensions for pulley C are 1500 N and 600 N, while the ratio of belt tensions for pulley D is 3.5. Find the shaft diameter. Allowable shear stress is 85 MPa. Take K_m = 1.75 and K_t = 1.25. If the solid shaft is to be replaced by a hollow shaft with outside diameter of 30 mm, find the inside diameter. [9]

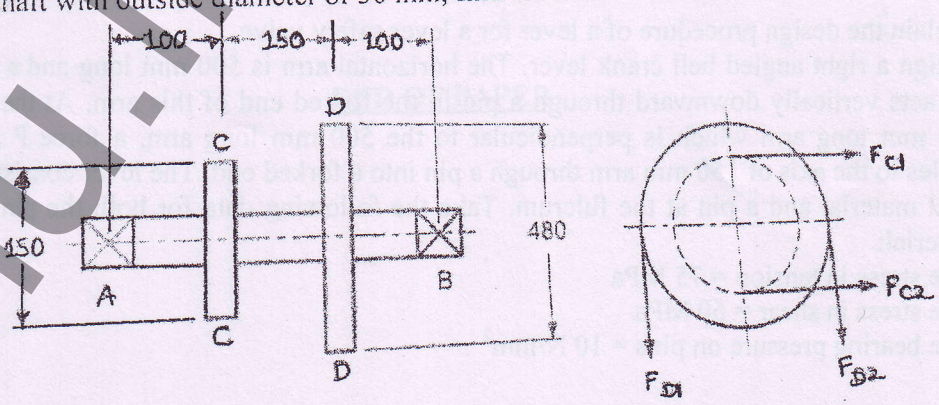

Fig.-1

OR

Que. 2

(A) What is coupling? What are the requirements of good coupling? [3]

(B) Design a protective type of cast iron flange coupling along with a square key for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. The number of bolts connecting the halves are four. Assume that the same material is used for shaft and key and the crushing stress is twice the value of its shear stress. The maximum torque is 25% more than the full load torque. The shear stress for cast iron is 14 MPa. Take width of key = Dia. of shaft/4. [9]

Que. 3

(A) Why cotter is provided with taper? Why taper is provided only on one side? What is magnitude of taper on cotter? [2]

(B) It is required to design a 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. Take permissible tensile stress = 80 N/mm^2, permissible shear stress = 40 N/mm^2 and permissible crushing stress = 80 N/mm^2. [9]

SECTION – II

Que. 4

(A) Define stress concentration and explain the methods to reduce stress concentration. [4]

(B) Explain importance of standardization in machine design. [4]

(C) What is stress? Enlist different types of stresses and explain bending stress in detail. [4]

OR

Que.4

(A) "Euler's formula holds good only for long columns." Justify the statement. [4]

(B) What is the difference between caulking and fullering? Explain with the help of neat sketches. [4]

(C) The maximum load on a petrol engine push rod 300 mm long is 1400 N. It is hollow having 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. [4]

Que. 5

(A) Derive the equation of stiffness of helical spring. [4]

(B) What is shot peening of spring? [3]

(C) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm^2. Also calculate the maximum shear stress induced. [4]

OR

Que. 5

(A) Explain the design procedure of a lever for a lever safety valve. [4]

(B) Design a right angled bell crank lever. The horizontal arm is 500 mm long and a load of 4.5 kN acts vertically downward through a pin in the forked end of this arm. At the end of the 150 mm long arm which is perpendicular to the 500 mm long arm, a force P act at right angles to the axis of 150 mm arm through a pin into a forked end. The lever consists of forged steel material and a pin at the fulcrum. Take the following data for both the pins and lever material: [7]

Safe stress in tension = 75 MPa

Safe stress in shear = 60 MPa

Safe bearing pressure on pins = 10 N/mm^2

Que. 6

(A) Show that the efficiency of self-locking screws is less than 50 percent. [3]

(B) Derive the equation of torque required to raise the load by square thread. [3]

(C) The lead screw of a lathe has Acme threads of 60 mm outside diameter and 8 mm pitch. It supplies drive to a tool carriage which needs an axial force of 2000 N. A collar bearing with inner and outer radius as 30 mm and 60 mm respectively is provided. The coefficient of friction for the screw thread is 0.12 and for the collar it is 0.10. Find the torque required to drive the screw and the efficiency of the screw. [6]

Table : 1 Size of rivet diameters for rivet hole diameters

Basic size of rivet (mm)	14	16	18	20	22	24	27	30	33	36	39	42
Rivet hole diameter (mm)	15	17	19	21	23	25	28.5	31.5	34.5	37.5	41	44

Table:2 Design dimensions of screw threads, bolts and nuts

Designation	Pitch mm	Major or nominal dia. Nut and bolt (d = D) mm	Effective or pitch diameter Nut and Bolt (d_p) mm	Minor or core diameter (dc) mm		Depth of thread (bolt) mm	Stress area mm^2
				Bolt	Nut		
M 10	1.5	10.000	9.026	8.160	8.876	0.920	58.3
M 12	1.75	12.000	10.863	9.858	10.106	1.074	84.0
M 14	2	14.000	12.701	11.546	11.835	1.227	115
M 16	2	16.000	14.701	13.546	13.835	1.227	157
M 18	2.5	18.000	16.376	14.933	15.294	1.534	192
M 20	2.5	20.000	18.376	16.933	17.294	1.534	245
M 22	2.5	22.000	20.376	18.933	19.294	1.534	303
M 24	3	24.000	22.051	20.320	20.752	1.840	353
M 27	3	27.000	25.051	23.320	23.753	1.840	459
M 30	3.5	30.000	27.727	25.706	26.211	2.147	561
M 33	3.5	33.000	30.727	28.706	29.211	2.147	694
M 36	4	36.000	33.402	31.093	31.670	2.454	817

END OF PAPER