Student Exam No: _____

GANPAT UNIVERSITY

B.TECH SEM. IV - MECHATRONICS ENGINEERING

REGULAR EXAMINATION MAY/JUNE-2014

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

(A) Define Machine Design and explain various phases of machine design. [04]
(B) Define: (i) Strength, (ii) Ductility, (iii) Hardness, (iv) Resilience [04]
(C) What is standardization? Find out R 5 Basic series from 1 to 10. [04]

OR

Que:-1

(A) Explain stress-strain diagram for ductile material with neat sketch. [04]
(B) Write the method of determining the size of the bolt when the bracket carries an eccentric load perpendicular to the axis of the bolt. [04]
(C) A lever loaded safety valve has diameter of 100 mm and the blow off pressure is 1.6 N/mm^2. The fulcrum of the lever is screwed into the cast iron body of the cover. Find the diameter of the threaded part of the fulcrum if the permissible tensile stress is limited to 50 MPa and the leverage ratio is 8. [04]

Que:-2

(A) Derive equation for design of shaft subjected to twisting moment only. [04]
(B) Find the diameter of a solid shaft to transmit 20 kW at 200 r.p.m. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be need in place of solid shaft, find the inside and outside diameter when ration of inside to outside diameters is 0.5. [04]
(C) A steel spindle transmits 4 kW at 800 rpm. The angular deflection should not exceed 0.25° per metre of the spindle. If the modulus of rigidity for the material of the spindle is 84 GPa, find the diameter of the spindle and the shear stress induced in the spindle. [04]

OR

Que:-2

(A) Define coupling and write at least three practical applications of it. Also differentiate coupling and clutch. [04]
(B) Design and draw a cast iron flange coupling for a mild steel shaft transmitting 90 kW at 250 r.p.m. the allowable stress in the shaft is 40 MPa and the angle of twist is not to exceed 1° in a length of 20 diameters. The allowable shear stress in coupling bolts is 30 MPa and for hub is 14 MPa. Shaft and Key are of same material. Take Modulus of rigidity as 84 kN/mm^2. Width of key = 25 mm and thickness of key = 14 mm. [08]

Que:-3

(A) Write advantages and application of cotter joint. [03]
(B) Design a knuckle joint to connect two mild steel rods under tensile load of 25 kN. The allowable stresses are 65 MPa in tension, 50 MPa in shear and 83 MPa in crushing. [08]

Que:-4

(A) Explain different types of stresses induced in helical springs of circular wire. [04]

(B) What do you understand by A.M. Wahl's factor? [02]

(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. Design the spring considering Wahl's factor. [06]

OR

Que:-4

(A) What is the difference between caulking and fullering? Explain with the help of neat sketches. [04]

(B) What do you understand by the single start and double start threads? [02]

(C) A double riveted double cover butt joint in plates 20 mm thick is made with 25 mm diameter rivets at 100 mm pitch. The permissible stresses are σ_t = 120 MPa; τ = 100 MPa; σ_c = 150 Mpa. Find the efficiency of joint, taking the strength of the rivet in double shear as twice than that of single shear. [06]

Que:-5

(A) Show that the efficiency of self-locking screws is less than 50%. [03]

(B) What is the difference between square thread and trapezoidal thread? [02]

(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. [06]

OR

Que:-5

(A) Explain the design procedure of a cranked lever. [05]

(B) A foot lever is 1 m from the centre of shaft to the point of application of 800 N load. Find: 1. Diameter of the shaft, 2. Dimensions of rectangular arm of the foot lever at 60 mm from the centre of shaft. Assuming width of the arm as 3 times thickness. The allowable tensile stress may be taken as 73 MPa and shear stress as 70 MPa. [06]

Que:-6

(A) Explain principal stresses and principal planes with neat sketch. [04]

(B) How the piston rod is designed? [04]

(C) The maximum load on a petrol engine push rod 300 mm long is 1400 N. It is hollow having the 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. [04]

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

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