PAPER ID-411239

Subject Code: RME501

Roll No: | | | | | | | | | | | | | |

B.TECH
(SEM V) THEORY EXAMINATION 2021-22
MACHINE DESIGN-1

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. What is the preferred size and standardization?
b. Define Notch sensitivity?
c. Differentiate between caulking and fullering
d. State assumption taken during shaft design.
e. Differentiate between saddle key and sunk key
f. Differentiate Soderberg and Goodman Criteria.
g. What is stiffness of spring?

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. A Cylindrical shaft made of steel of yield strength 700 MPa is subjected to static Load consisting of bending moment 10 KN-m and a torsional moment 30 KN-m. Determine the diameter of the shaft using maximum shear stress theory, and assuming a factor of safety of 2. Take E=210 GPa and poission's ratio= 0.25.

b. Determine the diameter of circular rod made of ductile material with fatigue strength (Complete reversal) = 280 MPa and a tensile yield strength of 350 MPa. The member is subjected to a varying axial load from 700 KN to -300 KN. Assume K_t = 1.8 and F.O.S = 2.

c. A line shaft is driven by means of a motor placed vertically below it. The pulley on line shaft is 1.5 m in diameter and has belt tensions 5.4 KN and 1.8 KN on the right side and slack side of the belt respectively. Both the tension may be assumed to be vertical. If the pulley the overhang from the shaft. The distance of Centre line of the pulley from the Centre line of the bearing being 400, find the diameter of shaft, Assuming maximum allowable shear stress of 42 MPa.

d. A mechanism used in printing machinery consists of a tension spring assembled with a preload of 30 N. The wire diameter of spring is 2 mm with a spring index of 6. The spring has 18 active coils. The spring wire is hand drawn and oil tempered having following material properties:
Design shear stress = 680 MPa; Modulus of rigidity = 80 KN/mm^2
Determine (i) The initial torsional shear stress in the wire, (ii) Spring rate and (iii) The force to cause the body of the spring to its yield strength,

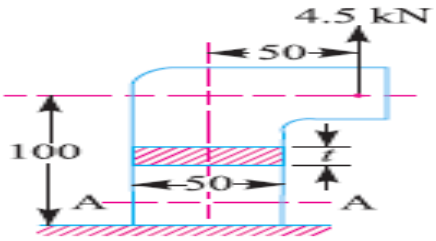
e. Explain Procedure the designing of Screw Jack.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Explain any five theories of failure, used for designing the machine part.

(b) A steel bracket is subjected to a load of 4.5 KN as shown in figure. Determine the required thickness of the section at A-A in order to limit the tensile stress to 70 MPa.



All dimensions in mm.

4. Attempt any *one* part of the following: 7 x 1 = 7

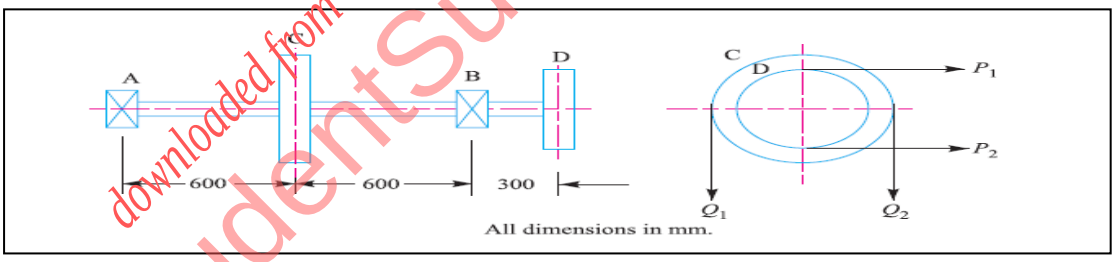
(a)A Leaf spring is subjected to Cyclic Stresses. The avg. Stress= 150 MPa; variable stress = 500 MPa; Ultimate stress= 630 MPa; Yield point Stress= 350 MPa and endurance limit =150 MPa, Estimate under what factor safety of spring by Goodman and Soderberg formula.

(b) Design the longitudinal Joint for a 1.25 m diameter steam boiler has to carry a steam pressure of 2.5 N/mm^2 The ultimate strength of boiler plate may be assumed as 420 MPa, crushing strength as 650 MPa and shear strength as 300 MPa. Take the joint efficiency as 80 %. Sketch the joint with all dimensions. Adopt suitable F.O. S

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) A shaft made of mild steel is required to transmit 100 KW at 300 r,p.m. The supported length of shaft is 3 meters. Assuming the safe value of stress. Determine the diameter of shaft.

(b) A horizontal shaft AD supported in bearing at A and B and carrying pulleys at C and D is to transmit 75 KW at 500 r.p.m from pulley D to off-take pulley C as shown in figure



All dimensions in mm.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) Prove that in a spring, using two concentric coil spring made of same material, having same length and compressed equally by an axial load, the loads shared by two springs are directly proportional to the square of the diameters of the wires of the two springs

(b) A railway wagon weighing 50 KN and moving with a speed of 8 Km per hour has to be stopped by four buffer spring in which the maximum compression allowed is 220 mm. Find the number of turns in each spring of mean diameter 150 mm. The diameter of spring wire is 25 mm. Take G = 84 KN/mm^2

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) A shaft 80 mm diameter transmits power at maximum shear stress of 63 MPa. Find the length of a 20 mm wide key required to mount a pulley on the shaft so that the stress in the key does not exceed 42 MPa

(b) Explain the procedure of designing of protective flange coupling.