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B. TECH.
(SEM V) THEORY EXAMINATION 2018-19
MACHINE DESIGN-1

Time: 3 Hours | *Total Marks: 100*

Note: Attempt all Sections. If require any missing data; then choose suitably. Machine Design data book is allowed.

SECTION A

1. Attempt *all* questions in brief. **2 x10 = 20**

a) What are the various phases of design process?

b) What are the factors affecting endurance strength?

c) What are the factors to be considered in the selection of materials for a machine element?

d) What do you understand by notch sensitivity?

e) Under what circumstances flexible couplings are used?

f) Write the numbers of active coils in terms of total number of coils for different end connections of compression springs.

g) Define the factor of safety.

h) A beam shown in figure 1 of uniform cross section is fixed at one end and carries an electric motor weighing 400 N at a distance of 300 mm from the fixed end. The maximum bending stress in the beam is 40 MPa. Find the width and depth of the beam if the depth is twice that of the width.

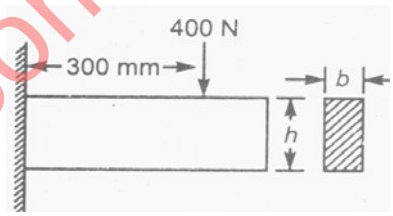

Fig : 1

i) Define the efficiency of riveted joint?

j) Write a short note on Modified Goodman Diagram.

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a. A cantilever beam made of cold drawn steel 20C8 (S_{ut} =540 N/mm^2) is subjected to a completely reversed load of 1000 N as shown in below figure.2. The corrected endurance limit for the material of the beam may be taken as 123.8 N/mm^2. Determine the diameter "d" of the beam for a life of 10000 cycles.

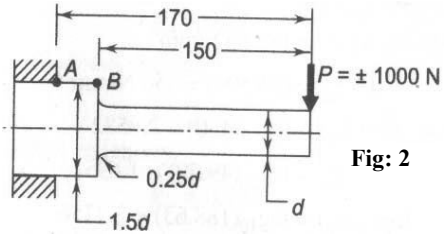

Fig: 2

b. It is required to design square key for fixing a gear to transmit a torque of 198943.68 N-mm. The key is made of plain carbon steel having the yield point in tension and in compression as 460 MPa and factor of safety 3. Determine the dimensions of the key.

c. Name the various components of the screw jack and their usual materials. A single start square threaded screw of mean diameter 24 mm and pitch of 5mm is tightening by screwing a nut whose mean diameter at bearing surface is 50 mm. If the coefficient of friction between the nut and screw is 0.1 and for the nut and bearing surface is 0.16. Find the force required at the end of a spanner 0.5-meter-long when the load on the screw is 10 kN.

d. Explain morphology of design in detail.

e. Design a spring for a balance to measure 0 to 1000N over a scale of length 80 mm. the spring is to be enclosed in a case of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 GPa. Also calculate maximum shear stress induced.

SECTION C

3. Attempt any *one* part of the following: 10 x 1=10

a. It is required to standardize load carrying capacities of dumpers in a manufacturing unit. The maximum and minimum capacities of such dumpers are 630 and 40 kN respectively. The company is interested in developing seven models in this range. Specify their load carrying capacities. Also explain preferred sizes and their significance.

b. Explain maximum shear stress theory in detail.

4. Attempt any *one* part of the following: 10 x 1=10]

a. A bracket supported by means of four rivets of the same size as shown in figure.3. Determine the diameter of the rivets if the maximum permissible shear stress for the material of the rivet is as 150 N/mm^2.

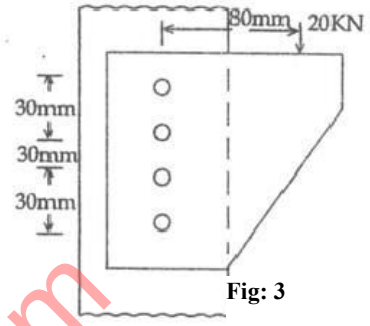

Fig: 3

b. **(i)** Explain the stress concentration effect and the various methods used to reduce this effect.

(ii) Draw and discuss briefly the S-N diagram.

5. Attempt any *one* part of the following: 10 x 1=10

a. A mild steel shaft transmits 20 kW at 200 rpm. It is subjected to a bending moment of 562.5 N-m. Determine the size of the shaft, if the allowable shear stress is 42 MPa, and the maximum tensile or compressive stress is not to exceed 58 MPa. What size of the shaft will be required if it is subjected to gradually applied load?

b. It is required to design a rigid type of flange coupling to connect two shafts. The input shaft transmits 37.4 kW power at 175 rpm to the output shaft through the coupling. The design torque is 1.5 times of the rated torque. Select suitable material for various parts of the coupling, design the coupling and specify the dimensions of its components.

6. Attempt any *one* part of the following: 10 x 1=10

a. Describe the various forms of the threads used for power screw, giving their merits and demerits. Discuss the procedure for the design of the screw having square threads.

b. A helical valve spring is to be designed for an operating load range of 90 N to 140 N. The 90 N load acts when the valve is closed and 140 N force acts when the valve is open. The deflection of the spring is limited to 8 mm. Take G=84 GPa.

7. Attempt any *one* part of the following: 10 x 1=10

a. A bolt is subjected to a tensile load of 25 kN and a shear load of 10 kN. Determine the diameter of the bolt according to

(i) Maximum principal stress theory
(ii) Maximum principal strain theory
(iii) Maximum shear stress theory.

Assume factor of safety as 2.5, yield point stress in simple tension = 300 N/mm^2, Poisson's ratio = 0.25.

b. Discuss precisely the weighted point method for selection of materials.