CBCS SCHEME

USN | | | | | | | | | | |

18MT52

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Design and Analysis of Machine Elements

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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Module-1

1 a. Define machine design and explain classification of machine design. **(07 Marks)**

b. Explain factors to be considered while designing machine. **(07 Marks)**

c. Define factor of safety and explain codes and standards. **(06 Marks)**

OR

2 a. Define stress concentration and explain methods of reducing stress concentration. **(06 Marks)**

b. A bar of rectangular section is subjected to an axial pull of 500kN as shown in Fig.Q2(b). Calculate its thickness if the allowable tensile stress in the bar is 200MPa.

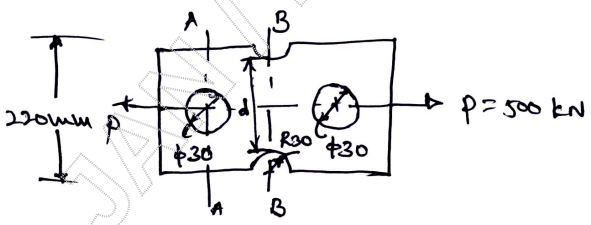

Fig.Q2(b) **(08 Marks)**

c. Explain maximum normal stress theory and maximum shear stress theory. **(06 Marks)**

Module-2

3 a. Sketch and explain S.N. Diagrams. **(06 Marks)**

b. Define endurance limit and explain effect of factors on endurance limit. **(07 Marks)**

c. A piston rod is subjected to a maximum reversed axial load of 110kN. It is made of steel having an ultimate stress of 900N/mm^2 and the surface is machined. The average endurance limit is 50% of the ultimate strength. Take the size correction coefficient as 0.85 and factor of safety = 1.75. Determine the diameter of the rod. (e_L = 0.7 and e_{Sr} = 0.78). **(07 Marks)**

OR

4 a. Sketch and explain cumulative fatigue damages. **(06 Marks)**

b. Explain Goodman and Soderberg relationship. **(07 Marks)**

c. A steel rod of ultimate strength 600N/mm^2 and yield strength 400N/mm^2 is subjected to a cyclic torque ranging from 350N-m to – 100N.m. Calculate the diameter of the rod. Torsional yield stress = 70% σ_y. Average endurance limit = 50%. Shear stress concentration factor = 1.3. Factor of safety = 1.8. **(07 Marks)**

Module-3

5 a. Explain with neat sketch different types of power screws. **(06 Marks)**

b. Derive an expression for torque required to lift the load on square threaded screw. **(06 Marks)**

c. Write complete design procedure of power screw. **(08 Marks)**

OR

6 a. Derive an expression for stress in helical springs of circular wire. **(06 Marks)**

b. Design a spring used in a recoil system so as to absorb 120Nm of energy with a maximum force of 3000N. Assume spring index 8 and factor of safety is 2. [Assume $\tau_y = 0.55$GPA and G = 79GPa]. **(12 Marks)**

c. Define self locking. **(02 Marks)**

Module-4

7 a. Derive an expression for beam strength of spur gear teeth. **(07 Marks)**

b. Explain dynamic tooth load. **(06 Marks)**

c. Write design procedure for wear. **(07 Marks)**

OR

8 a. Derive an expression for beam strength of helical gears. **(08 Marks)**

b. Design a pair of helical gears to transmit a power of 20KW from a shaft running at 1500rpm to a parallel shaft to be run at 450rpm. Suggest suitable surface hardness for the gear pair. **(12 Marks)**

Module-5

9 a. Define FEM? Explain advantages, limitations and applications of FEM. **(06 Marks)**

b. Explain basic steps involved in FEM. **(06 Marks)**

c. A stepped bar is subjected to loading as shown in Fig.Q9(c). Take it as a bar element. Determine :

i) Nodal displacement

ii) Stresses in each element

iii) Reaction at the fixed support. Take E = 2×10^5N/mm^2.

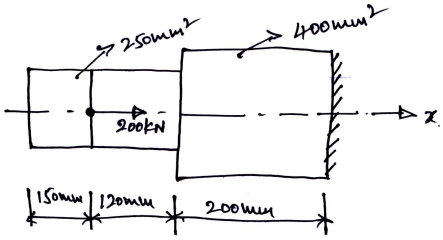

Fig.Q9(c) **(08 Marks)**

OR

10 a. Explain with neat sketch different types of elements. **(06 Marks)**

b. Explain node numbering scheme. **(06 Marks)**

c. For the continuum as shown in Fig.Q10(c). Determine the nodal displacement, reactions at the supports. Take E = 200GPa.

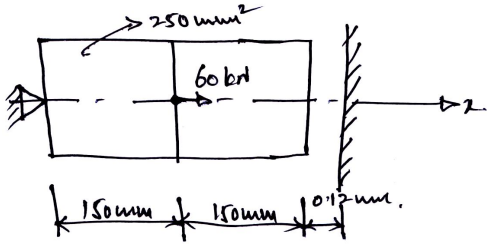

Fig.Q10(c) **(08 Marks)**

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