Seat No. | | | | | | |

3098

मान - 003

Machine Design

P. Pages : 2

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Neat diagrams must be drawn wherever necessary.
5. Figures to the right indicate full marks.
6. Use of electronic pocket calculator is allowed.
7. Assume suitable data, if necessary.

SECTION - I

1. a) State and explain maximum shear stress theory of failure. Where do you use this theory ? **6**

   b) Explain the effect of residual stresses on load carrying capacity of component. **5**

   c) What is the value of maximum pressure when two cylindrical bodies of different radii are pressed together with force ? Show the distribution of contact stresses. **5**

2. a) Explain the Griffith's criterion. **6**

   b) State and explain the three stage of crack development observed during crack growth. **5**

   c) Calculate the stress concentration at the tip of an elliptical crack having major and minor radii a = 100 nm and b = 1 nm. **5**

3. a) Explain three stages of creep with the help of typical creep curve. **5**

   b) Explain modified Goodman diagram for fluctuating torsional shear stress. **5**

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c) A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm2. The corrected endurance limit stress for the machine component is 270 N/mm2. The ultimate tensile strength and yield strength of the material are 600 and 450 respectively.
Find the factor of safety using.
i) Gerber theory.
ii) Soderberg Line.
Also, find the factor of safety against static failure. 8

4. a) "As the complexity of a system increases, the reliability will decrease". Justify this statement in context of reliability engineering. 5

b) Explain following terms as related to reliability engineering. 6
i) Hazard
ii) Safety
iii) Risk
iv) Maintainability

c) An engineer approximates the reliability of a cutting assembly by 7

$$R(t)=\begin{cases}(1-t/t_o)^2, & 0\le t<t_o,\\ 0, & t\ge t_o\end{cases}$$

a) determine the failure rate.
b) Does the failure rate increase or decrease with time ?
c) Determine the MTTF.

5. a) State and explain the equations for upper and lower bound to the elastic modulus of a composite. 5

b) Discuss the effect of fiber orientation on strength of composites. 5

c) A metal composite is composed of metal M reinforced by parallel wires of metal W. The volume fraction W is 50%, and W has a yield stress of 200 MPa and a modulus of 210 GPa. Metal M has a yield stress 50 MPa and a modulus of 30 GPa. What is the maximum stress that the composite can carry without yielding ? 6

6. a) State and explain the guidelines for design for safety. 6

b) State and explain with suitable examples design guidelines for manufacture (DFM). 5

c) Discuss the various methods used in engineering design practice to improve reliability. 5

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