Code No: 5215AQ **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech II Semester Examinations, February - 2017
MECHANICAL BEHAVIOUR OF ENGINEERING MATERIALS
(Machine Design)

Time: 3hrs **Max.Marks:75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

5 × 5 Marks = 25

1.a) Enumerate the differences between edge and screw dislocations. [5]
b) Explain why compressive residual stresses improve fatigue life. [5]
c) From the following data, sketch a cycle stress curve: σ_{mean} = 200MPa and T = 0.33. [5]
d) What is the difference between creep and relaxation? [5]
e) Sketch typical curves for two different initial stresses and mark on it the different parameters. [5]

PART - B

5 × 10 Marks = 50

2.a) What assumption is used in all these hypotheses with respect to tension and compression.
b) Why is nominal stress considered adequate for most analysis of metal machine parts? [5+5]

OR

3.a) Explain with equations the definitions of nominal (Lagrangean) and natural (Logarithmic/true) strains as used for metals.
b) Briefly explain the ductile fracture and the Mc clintock's analytical treatment of ductile fracture. [5+5]

4. A true stress-strain relation is fitted to $S = k\,\varepsilon_N{}^n$. Assuming constancy of volume and given at ultimate load point $\varepsilon_{NU} = n$, show that the Theoretical Ultimate Load, $P_u = A_o \left(\frac{n}{e}\right)^n$ [10]

OR

5. Determine k and n, given the following two points P_1= 60000 N, and dL_1= 2 mm; P_2= 80000 N and dL_2=6 mm. The gauge length and the diameter of the specimen are 50 mm and 12 mm respectively. Compute theoretical ultimate load P_u and toughness. Relationship given $P_u = A_o \left(\frac{n}{e}\right)^n$, $S = k\,\varepsilon_N{}^n$. [10]

6.a) Describe the fracture toughness testing.
b) Derive the relation for the strain energy release rate G, in terms of different energies involved and the crack area. [5+5]

OR

7. Discuss in detail about J integral concept and write expression for J integral for the compact-test specimen. [10]

8.a) Explain the construction of S-N curves for ferrous and non-ferrous metals.
b) A steel bar is subjected to an axial load that varies from 400 KN tension to 200 KN compression. The mechanical properties of steel are $\sigma_u = 1100$ N/mm^2, $\sigma_o = 1000$ N/mm^2 and $\sigma_c = 500$ N/mm^2. Determine the bar diameter for infinite life based on a safety factor of 2.5. Use Goodman's theory. [5+5]

OR

9.a) With the help of neat sketches explain the three modes of crack deformation.
b) Discuss about stress concentration factors. [5+5]

10. Explain the creep curve and sketch the creep curve with the three of creep. What is Andrade's Analysis? [10]

OR

11. What do you mean by Larson-Miller parameter? Determine also the stress required for failure in 10^5 hours at temperatures of 650 ^{0}C and 870 ^{0}C. [10]

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