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Total Number of Pages: 02

M.Tech.
MDPE101

1st Semester Back Examination 2017-18

FATIGUE, CREEP AND FRACTURE

BRANCH: MECH. SYSTEM DESIGN

Time: 3 Hours

Max Marks: 70

Q.CODE: B1077

Answer Question No.1 which is compulsory and any FIVE from the rest.

The figures in the right hand margin indicate marks.

- Q1** Answer the following questions: *Short answer type* (2 x 10)
- a) What are the basic modes of fracture? Explain
 - b) What is the surface energy of the material?
 - c) What is the Miner's rule?
 - d) What is the SIF? What are the parameters affect the SIF?
 - e) Describe the methods to improve fatigue strength of the materials.
 - f) What are the controlling factors in fatigue? Explain.
 - g) What are the stages in fracture failure? Explain.
 - h) What is the equation for the creep torsional shear stress? Explain
 - i) What is J integral in fracture mechanics?
 - j) What is fracture toughness
- Q2** a) Determine the critical crack length using Griffith's theory. (5)
b) Explain the Erwin's theory. (5)
- Q3** a) Differentiate ductile & brittle fracture (5)
b) Explain the stable and unstable crack growth (5)
- Q4** a) Explain the Sigmoidal curve and state the Paris-Erdogan law (5)
b) An edge crack is detected on a large plate, is of length of 3.1 mm under a constant amplitude cyclic load having $\sigma_{\max}=300$ MPa and $\sigma_{\min}=172$ MPa. If the plate material's $K_{IC}=165$ MPa \sqrt{m} . Determine (a) Propagation of life up to failure (b) propagation of life up to crack length 25 mm. (5)
(Take $m=3.0$, $C=6.8 \times 10^{-12}$)
- Q5** a) A steel cantilever is 200 mm long. It is subjected to an axial load which varies from 150 N (compression) to 450 N (tension) and also a transverse load at its free end which varies from 80 N up to 120 N down. The cantilever is of circular cross-section. It is of diameter 2d for the first 50 mm and of diameter d for the remaining length. Determine its diameter taking a factor of safety of 2. (5)
Assume the following values:
Yield stress = 330 MPa
Endurance limit in reversed loading = 300 MPa
Correction factors = 0.7 in reversed axial loading = 1.0 in reversed bending
Stress concentration factor = 1.44 for bending, = 1.64 for axial loading
Size effect factor = 0.85, Surface effect factor = 0.90, Notch sensitivity index = 0.90.
- b) What is stress concentration? How it can be reduced? (5)

