QP Code: RJ23MTECH053 | Reg. No | | | | | | | | | | | AY 23

# GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (First Semester) Examinations, January– 2024

## MPEMD1034 – Fatigue, Creep & Fracture

(MD/MFT)

Time: 3 hrs | Maximum: 70 Marks

**(The figures in the right hand margin indicate marks.)**

**PART – A** **(2 x 10 = 20 Marks)**

| Q.1. Answer all questions | CO# | Blooms Level |
|---|---|---|
| a. Differentiate between Goodman and Soderberg curves. | CO1 | K2 |
| b. Distinguish between "stress concentration factor" and "stress intensity factor"? | CO1 | K2 |
| c. Define low cycle and high cycle fatigue? | CO4 | K1 |
| d. What do you mean by creep rate? | CO2 | K1 |
| e. Explain the phenomenon of creep in metals. | CO2 | K2 |
| f. How does a continuous system differ from a discrete system in the nature of its equation of motion? | CO3 | K2 |
| g. What are the disadvantages of using LEFM theory? | CO4 | K2 |
| h. What is Fretting Fatigue? | CO4 | K1 |
| i. State the basic characteristics of ductile fracture. | CO3 | K1 |
| j. What is meant by "change in compliance approach"? | CO3 | K1 |

**PART – B** **(10 x 5=50 Marks)**

Answer ***ANY FIVE*** questions

| | | Marks | CO# | Blooms Level |
|---|---|---|---|---|
| 2. a. | A hot rolled steel shaft is subjected to a torsional moment that varies from 330 N-m clockwise to 110 N-m counter clockwise and an applied bending moment at a critical section varies from 440 N-m to -220 N-m. The shaft is of uniform cross-section and no keyway is present at the critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MN/m2 and a yield strength of 410 MN/m2. Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and a surface finish factor of 0.62. | 6 | CO1 | K3 |
| b. | What are the different factors to be considered while designing machine parts to avoid fatigue failure? | 4 | CO1 | K2 |

| | | | | |
|---|---|---|---|---|
| 3.a. | A machine component is subjected to a flexural stress which fluctuates between +300MN/$m^2$ and -150 MN/$m^2$. Determine the value of minimum ultimate strength according to:<br>(i) Gerber relation (ii) Modified Goodman relation (iii) Soderberg relation | 10 | CO1 | K3 |
| 4. a. | Explain the mechanism of creep deformation. | 5 | CO2 | K1 |
| b. | Explain briefly Primary secondary and territory creep. | 5 | CO2 | K2 |
| 5.a. | Distinguish between LEFM and EPFM. | 5 | CO4 | K2 |
| b. | Describe the creep phenomenon for high temperature bolting design in pressure vessels. | 5 | CO4 | K2 |
| 6. a. | Explain Griffith theory of brittle fracture. | 5 | CO3 | K1 |
| b. | Derive the Griffith equation for fracture stress in a plain stress and plain strain condition. | 5 | CO3 | K3 |
| 7.a. | What advantages does a fracture mechanics approach over traditional approaches for a design? | 5 | CO3 | K2 |
| b. | What do you mean by linear elastic fracture mechanics? Derive an equation for stress intensity factor. | 5 | CO3 | K2 |
| 8. a. | Write down the creep stress time relations for simple tension considering different methods for short time and long time. | 10 | CO2 | K3 |

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