

**Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)**



M.Tech. (First Semester – Regular/Supplementary) Examinations, January – 2026
24MMTPE11011 – Fatigue, Creep and Fracture

Time: 2 hrs

Maximum: 60 Marks

**Answer ALL questions
(The figures in the right hand margin indicate marks)**

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer <i>ALL</i> questions	CO #	Blooms Level
a. Explain the difference between low cycle fatigue and high cycle fatigue.	CO1	K2
b. What is notch sensitivity? How is it calculated?	CO2	K1
c. Define creep and explain factors affecting creep in metals.	CO3	K2
d. Differentiate between ductile and brittle fracture.	CO4	K2
e. State the assumptions of linear elastic fracture mechanics (LEFM).	CO6	K1

PART – B **(10 x 5 = 50 Marks)**

<u>Answer <i>ALL</i> the questions</u>	Marks	CO #	Blooms Level
2. a. With neat sketch explain Rotating mirror beam method.	5	CO1	K2
b. What information do you obtain from Soderberg diagram?	5	CO1	K1
(OR)			
c. In σ -N Curve show endurance strength for finite life and write down the expression to find out it.	5	CO1	K2
d. Explain safe life design with examples.	5	CO1	K2
3.a. Explain the effect of surface roughness on fatigue.	5	CO2	K2
b. What is meant by 'stress concentration'? How do you take it into consideration in a component subjected to dynamic loading?	5	CO2	K2
(OR)			
c. A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design.	10	CO2	K3
4.a. Write down the assumptions while considering creep in bending.	5	CO3	K1
b. Draw the Creep curve for viscous types of creep.	5	CO3	K2
(OR)			
c. Write down the creep stress–time relations for simple tension considering different methods for short time and long time.	5	CO3	K1
d. What is the reason of creep settlement? And if a constant load (w) is applied on a plate for long time, why does failure happen after long period?	5	CO3	K2
5.a. State the basic characteristics of ductile fracture.	5	CO4	K1
b. Mention two important causes for increasing tendency of brittle fracture of metals.	5	CO4	K2
(OR)			
c. How does a continuous system differ from a discrete system in the nature of its equation of motion?	5	CO4	K1

- | | | | | |
|------|---|---|-----|----|
| d. | What is super plasticity? And what are the requirements for a material to exhibit super plastic behaviour? | 5 | CO4 | K2 |
| 6.a. | Derive the expression for stress at crack propagation using Irwin's approach. | 5 | CO6 | K3 |
| b. | Explain stage I, II, and III of fatigue crack growth. | 5 | CO5 | K2 |
| (OR) | | | | |
| c. | A glass plate of modulus of elasticity 70 GPa and surface energy 0.27 J/m ² is subjected to tensile stress. Determine the maximum allowable flaw length. | 5 | CO6 | K3 |
| d. | Discuss the advantages of fracture mechanics approach over traditional design methods. | 5 | CO5 | K2 |

--- End of Paper ---