Reg. No										

AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (First Semester) Regular Examinations, February – 2025

24MMDPE11011 – Fatigue, Creep and Fracture

(Manufacturing Technology/ Machine Design)

Time: 3 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 ***ALL*** questions		CO #	Blooms Level
a.	In σ – N Curve show endurance strength for finite life and write down the expression to find out it.	CO1	K1
b.	Differentiate between Goodman and Soderberg curves?	CO2	K2
c.	Explain the phenomenon of creep in metals.	CO3	K2
d.	How does fracture stress and mode of fracture vary with specimen thickness?	CO4	K2
e.	Explain the miner's concept of cumulative fatigue damage.	CO5	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	Describe the different factors to be considered while designing machine parts to avoid fatigue failure.	5	CO1	K1
b.	Draw and describe different types of fatigue loading and stress reversal.	5	CO1	K2
	(OR)			
c.	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: i) Gerber relation ii) Modified Goodman relation iii) Soderberg relation	10	CO1	K2
3.a.	Draw and describe different types of fatigue loading and stress reversal.	5	CO2	K2
b.	Describe the methods of reducing stress concentration.	5	CO2	K2
	(OR)			
c.	Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 250 kN and a minimum value of 100 kN. The properties of the plate material are as follows: Endurance limit stress = 225 MPa, and Yield point stress = 300 MPa. The factor of safety based on yield point may be taken as 1.5.	10	CO2	K3
4.a.	Explain the mechanism of creep deformation.	5	CO3	K2
b.	Explain briefly Primary secondary and territory creep.	5	CO3	K2
	(OR)			
c.	Derive the expression showing the ratio of creep bending stress and elastic bending stress (creep stress ratio) considering creep in bending.	10	CO3	K3
5.a.	Describe the three modes of fracture with appropriate sketches	5	CO4	K2
b.	Derive an expression for the stress of crack propagation.	5	CO4	K2
	(OR)			

c.	Explain Griffith theory of brittle fracture.	5	CO4	K2
d.	Derive the Griffith equation for fracture stress in a plain stress and plain strain condition.	5	CO4	K3
6.a.	State and explain cumulative damage theory .	5	CO5	K2
b.	Discuss the various mechanical and metallurgical methods for improvement of fatigue strength in metal?	5	CO5	K2
	(OR)			
c.	A plate with a center crack of 20 mm is subjected to a tensile stress of 200 MPa. If the fracture toughness of the material is K_IC = 60 MPa$\sqrt{m}$, determine the critical crack length at which failure occurs.	5	CO6	K3
d.	Distinguish between LEFM AND EPFM	5	CO6	K2

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