Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech**

PME8J001

8th Semester Regular Examination 2018-19

FATIGUE CREEP & FRACTURE

BRANCH : MECH

Max Marks : 100

Time : 3 Hours

Q.CODE : F018

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right-hand margin indicate marks.

Part- I

Q1 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Define the terms “safe” life and “fail safe”.

b) Give the example of stress reversals.

c) Write down the different stages of fatigue failure.

d) What do you mean by endurance limit? What are the factors that affect the endurance limit?

e) State the different factors which affect the surface of fatigue specimen.

f) How Gerber curve is different from Soderberg line?

g) What is J integral?

h) Why secondary creep is usually referred to as steady state creep?

i) State the different mechanism of creep deformation.

j) Write down the parameters responsible for crack propagation.

Part- II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Explain the different techniques of fail-safe design.

b) Analyze the effect of compressive cyclic stress on fatigue.

c) Explain briefly the effect of stress concentration factor in fatigue failure.

d) Design and develop a cantilever type fatigue testing machine with a physical model.

e) Differentiate between low cycle fatigue and high cycle fatigue.

f) Differentiate between ductile and brittle fracture.

g) Explain about the cumulative fatigue damage.

h) What is J integral? Explain J integral approach.

i) What do you mean by linear elastic fracture mechanics? Derive an expression for stress intensity factor and state of stress at the end of the crack.

j) Derive the relationship between strain energy release rate and stress intensity factor.

k) Write a short note on Baily’s Power Law.

l) What is meant by creep relaxation? With neat sketch, explain briefly about primary creep, secondary creep and tertiary creep.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Describe briefly Gerber, Goodman and Soderbergh's criteria with neat sketch. **(6)**

b) Determine the value of minimum ultimate strength according to Goodman's relation and yield strength according to Soderberg's relation for a component which is subjected to a flexural stress, fluctuates between +225 MN/m^2 and -100 MN/m^2. Yield strength =0.55 ultimate strength, endurance strength= 0.5 ultimate strength and factor of safety=2 **(10)**

Q4 Explain briefly how the fatigue strength can be improved by chemical/metallurgy processes and mechanical work. **(16)**

Q5 **a)** Discuss about Plastic zone size and its evaluation **(6)**

b) A steel plate with a through thickness crack of length 2a = 20 mm is subjected to a stress of 400 MPa normal to the crack. If the yield strength of the steel is 1500 MPa, what is the plastic zone size and the stress intensity factor for the crack. Assume that the plate is infinitely wide. **(10)**

Q6 **a)** Explain Griffith theory of Brittle Fracture. **(6)**

b) Using Griffith Equation determine the critical crack length for steel for the following: **(10)**

$\sigma_{critical} = 1150MPa$

Y= surface energy per unit area= 1.5 J/m^2

E= 200 GPa

What would be the critical crack length according to Griffith-Orwan equation?

Take p=plastic work required to extend the crack wall = 1200 J/m^2