

Total No. of Questions : 8]

SEAT No. :

P4480

[4860] -106

[Total No. of Pages :2

M.E. (Mechanical -Design Engineering)
b-ENGINEERING FRACTURE MECHANICS
(2008 Course) (Semester - II) (Elective - III) (502211-B)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *Questions Nos. 4 and 8 are compulsory. Answer any two questions from each sections*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary; Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, slide rule and non-programmable electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

SECTION - I

Q1) Differentiate between failure and fracture of a machine component. Also explain failure modes at macroscopic level. **[16]**

Q2) Explain with neat sketch the plastic zone shape and plastic constraint factor. **[16]**

Q3) A wide sheet of aluminium alloy has a central crack 30 mm long. If the fracture stress for the sheet is 300 MPa and yield stress of the material is 400 MPa. Calculate the fracture toughness of the material using plastic zone correction. **[16]**

Q4) A long pressure vessel was designed and manufactured to withstand a maximum internal pressure of 29.5 MPa. The vessel inner diameter is 1.3 m with a wall thickness of 65 mm. The material has a yield strength of 700 MPa ultrasonic inspection discovered a longitudinal surface flaw at inner diameter. The flaw has a length of 100 mm and a depth of 20mm. Determine the minimum required fracture toughness so that the vessel can operate at the design internal pressure. Estimate the critical crack depth if the plane-strain fracture toughness is 100 MPa \sqrt{m} **[18]**

P.T.O.

SECTION - II

- Q5)** Explain with neat sketch time varying multiaxial loading and load spectra. [16]
- Q6)** The staircase method for fatigue limit testing was conducted on thin walled tubular specimens subjected to axial sinusoidal loading with $R = -1$ and $R = 0$. The two fatigue limits are found as $\sigma_{E, R=-1} = 700$ MPa and $\sigma_{E, R=0} = 560$ MPa. Determine mean stress sensitivity factor α_{oct} and sines stress. [16]
- Q7)** A support bracket is welded to a backing plate. A fluctuating force in the coupling rod causes a stress variation of ± 50 MPa at the weld. Calculate maximum size of defect which could be tolerated in the weld. $\Delta K_{\text{TH}} = 1.65$ MPa \sqrt{m} . [16]
- Q8)** Explain leak before break criteria in fracture mechanics. [18]

