PVP 22

Code: 22MEMD2T5A

I M.Tech - II Semester – Regular Examinations - JULY - 2023

FRACTURE MECHANICS
(MACHINE DESIGN)

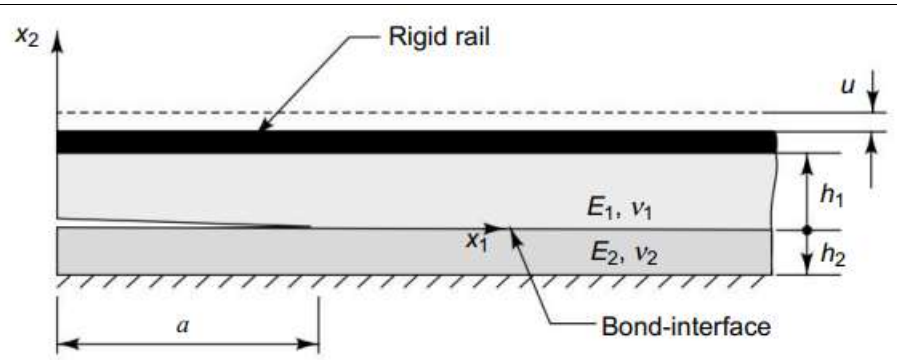
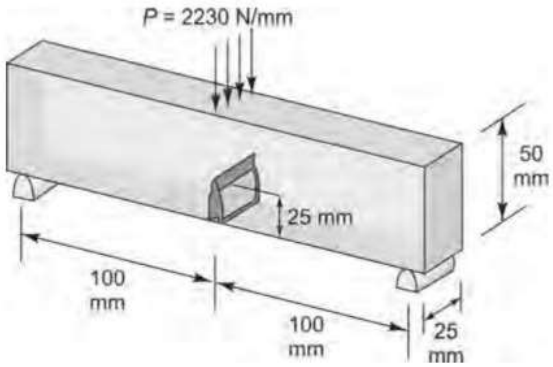
Duration: 3 hours Max. Marks: 60

Note: 1. This paper contains 4 questions from 4 units of Syllabus. Each unit carries 15 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	Discuss the different modes of fracture failure with neat sketch and their significance in design of structures.	L3	CO1	10 M
	b)	Discuss the energy release rate of DCB specimen.	L3	CO1	5 M
OR					
2	a)	A large plate of 36 mm thickness with an edge crack of a = 32 mm length is pulled very slowly under displacement control loading. At the displacement of 7.2 mm, when the recorded load is 2750 N, the crack starts growing. At a = 41.7 mm, the crack is arrested and the load decreases to 1560 N. Determine the critical energy release rate.	L4	CO1	10 M
	b)	Discuss the phenomenon of stable and unstable crack growth.	L3	CO1	5 M

		UNIT-II			
3	a)	Discuss the phenomenon of Linear Elastic Fracture Mechanics (LEFM) in brittle materials.	L3	CO1 CO2	7 M
	b)	Discuss the variation of critical SIF with plate thickness.	L3	CO1 CO2	8 M
		OR			
4	a)	In a large plate, a crack of length 2a is inclined with an angle α with x_1 -axis. The plate is loaded in x_2 direction with $\sigma_{22} = \sigma$. (i) Find the stress intensity factors. (ii) For σ = 80 MPa, 2a = 20 mm and $\alpha = 30°$, determine K_I and K_{II}.	L3	CO1 CO2	8 M
	b)	Relate Energy release rate and stress intensity factor.	L3	CO1 CO2	7 M
		UNIT-III			
5		Consider two infinitely long strips of thickness h_1 and h_2 with material properties as shown in Fig. These strips are bonded together with an edge-crack of length a. The strips are wide enough to assume plane strain conditions. The lower face of the bottom strip is bonded to a rigid surface, while the top surface of the upper strip is bonded to a rigid rail. Determine the J-Integral, if the rail is pulled up by distance u. (Note: At the interface $\sigma^{(1)}{}_{22} = \sigma^{(2)}{}_{22,}$ but also $\varepsilon^{(1)}{}_{22} \neq \varepsilon^{(2)}{}_{22.}$)	L4	CO1 CO3	15 M

				
	OR			
6	Consider a three-point bend specimen with a centre load as shown in Fig.  The material properties for the Ramberg-Osgood relation are: $\sigma_{ys} = \sigma_0 = 700$ MPa, $\varepsilon_0 = \sigma_0/E$, E = 207 GPa, a = 8.2 mm, n = 6 (a) Determine K_I (b) Estimate the plastic zone size (c) Determine GI based on the LEFM (d) Determine Jp using the engineering approach.	L4	CO1 CO3	15 M
	UNIT-IV			
7	Explain any three test specimens for determination of the critical stress intensity factor (K_{Ic}).	L3	CO1 CO4	15 M
	OR			
8	Discuss any three indirect methods to determine fracture parameters with a neat sketch.	L3	CO1 CO4	15 M