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# 2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

IV B.TECH II SEMESTER SUPPLEMENTARY EXAMINATIONS
**FATIGUE AND FRACTURE MECHANICS**
(AERONAUTICAL ENGINEERING)

TIME: 3 HOURS

JULY- 2005

MAX MARKS: 80

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**Answer any FIVE Questions**
**All Questions carry equal marks**

1. *(a) How the properties of materials and surface treatments improve the fatigue life of components?*
2. *(b) Explain how shot peering improves fatigue life.*

*2. (a) The fatigue limit of a 1045 steel is about 300 MN/m2 when the mean stress is zero. The tensile strength of this steel is 750 MN/m2. Estimate the safe stress amplitude for this material when the mean stress is 250 MN/m2.*

*(b) Discuss a typical fatigue testing procedure. Explain how the effect of mean stress can be studied.*

*3. (a) Explain the reasons for well defined fatigue limit in certain materials.*

*(b) The endurance limit of a steel member is 112 Mpa and the tensile strength is 385 MPa. What is the fatigue strength corresponding to a life of 70 x 103 cycles.*

*4. (a) Describe about stress fluctuations and cumulative damage in fatigue failure.*

*(b) How cumulative fatigue is expressed?*

*(c) Discuss woods theory of fatigue failure.*

*5. (a) Explain the mechanism of fatigue failure propagation.*

*(b) Discuss the interactions between parallel edge dislocations.*

*6. (a) A relatively large plate of glass is subjected to a tensile stress of 40MPa. If the specific surface energy and modulus of elasticity for this glass are 0.3 j/m2 and 69 Gpa, respectively, determine the maximum length of a surface flow that is possible with out fracture.*

*(b) What advantage does the fracture mechanics approach afford the engineer in designing components compared to more traditional approaches.*

*7. (a) Explain the differences in terms of work of brittle fracture between glass and a metal? Explain.*

*(b) A metallic plate of dimensions 2mm×50mm×200mm, with one internal flow (size = 1mm) is loaded in tension. If its fracture load is 2500 kg, calculate work of fracture (Gc); and critical stress intensity factor (Kc), Assume plane stress condition. The modulus of the material is 30 GPa. 8. Identify and explain several problems a designer must recognize when dealing with fatigue loading as compared with static loading.*