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**BME-018**

**B. TECH. VIEP-MECHANICAL  
ENGINEERING (Computer Integrated  
Manufacturing)/B. Tech. (Aerospace  
Engineering) (BTAE/BTMEVI)**

**Term-End Examination**

**June, 2019**

**BME-018 : ENGINEERING MATERIALS**

*Time : 3 Hours*

*Maximum Marks : 70*

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*Note : Answer any five of the following question.*

*Use of scientific calculator is allowed.*

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1. (a) From creep test on 713 C alloy, the constant  $C$  in Larson-Miller parameter is determined as 85.75. In rupture test a specimen of this material fails under 500 hrs at 34 MPa and 1373 K. While another specimen at stress level 136 MPa at temperature of 1308 K fails after 3 hrs. Calculate stress to cause failure after 30,000 hrs at 1173 K.

8

(A-36) P. T. O.

- (b) Distinguish between true stress and engineering strain. Also distinguish between true strain and engineering strain. 6
2. (a) Draw iron-carbon phase diagram. Explain the following phases : 6  
Pearlite, ferrite, cementite, austenite and ledeburite.
- (b) Draw the microstructure of the following materials and also explain their important fractures of the following : 8
- (i) Grey cast iron
  - (ii) White cast iron
  - (iii) Malleable cast iron
  - (iv) Ductile cast iron
3. (a) Discuss the effect of the following alloying elements in steel : Tungsten, Nickel Chromium and Cobalt. 8
- (b) What are brasses and bronzes ? What is hydrogen embrittlement of copper and how can it be avoided ? 6

4. (a) A composite of glass fiber and epoxy has all fibers laid along the length and is required to carry a stress of 12 MPa. The limiting stress carried by fiber and epoxy are respectively,  $\sigma_f = 2400$  MPa,  $\sigma_m = 80$  MPa. The volume ratio and moduli of elasticity are as given below : 8

$$V_f = 0.7, V_m = 0.3, E_f = 72 \text{ MPa}, E_m = 3 \text{ MPa}$$

Calculate maximum stress the composite can carry in the direction of fibers and the modulus of elasticity.

- (b) What is an adhesive ? Distinguish between structural and non-structural adhesives. 6
5. (a) A large thin plate carrying a crack of 70 mm at its centre is subjected to fluctuating stress cycle perpendicular to crack,  $\sigma_{\max} = 70$  MPa and  $\sigma_{\min} = 30$  MPa. The fracture toughness of material of plate is  $1500 \text{ MPa} \sqrt{\text{mm}}$ . Calculate the critical half crack length. 8

- (b) Explain the phenomenon of ductility transition and why the temperature of this transition is higher for notched specimen? 6
6. (a) Explain diffusion and electroplating techniques for providing surface protection to wear. 7
- (b) Define viscosity and briefly explain viscosity index. 7
7. (a) For preparing to design structure against fracture describe step by step what experiment you would perform. 6
- (b) Write short notes on any *two* of the following terms : 4 each
- (i) Composite
  - (ii) Alloy
  - (iii) Tribology
  - (iv) Wear