

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III • EXAMINATION – WINTER • 2014****Subject Code: 2132004****Date: 01-01-2015****Subject Name: Principles of Material Science and Physical Metallurgy****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain the material selection process for gas turbine blades. **07**
 (b) 1. Ductile materials are tougher than brittle ones. Why? **03**
 2. Explain the Rockwell hardness test. **04**
- Q.2** (a) Explain the procedure to find out the indices for crystallographic directions and miller indices for crystallographic planes for cubic unit cell. Justify with proper example. **07**
 (b) Explain the bragg's law for x-ray diffraction. A sample of BCC iron was placed in an x-ray diffractometer using incoming x-ray with a wave length $\lambda=0.1541$ nm. Diffraction from the $\{110\}$ planes was obtained at $2\theta = 44.704^\circ$. Calculate a value for the lattice constant a of BCC iron. (Assume first-order diffraction with $n = 1$) **07**
- OR**
- (b) Explain Fatigue in detail. Mention various factors affecting it. **07**
- Q.3** (a) What is powder metallurgy? Describe various steps involved in powder metallurgy with each step controlling properties of final sintered component. **07**
 (b) What are the purposes of heat treatment? Explain the annealing process in detail. **07**
- OR**
- Q.3** (a) 1. What is micro examination of metal? Mention the various steps involved in these examination. **04**
 2. What is modulus of elasticity? Draw stress strain diagram for Mild Steel. **03**
 (b) Explain flame-hardening and Induction hardening process. **07**
- Q.4** (a) Enlist various carburizing techniques. Explain them in detail. **07**
 (b) Explain radiography technique in detail. Give at least two applications where this technique is used. **07**
- OR**
- Q.4** (a) Mention the CN for simple cubic, body centered cubic, face centered cubic and hexagonal closed pack unit cell system. Derive the APF for HCP unit cell system and justify the value obtained. **07**
 (b) List the most common methods for non-destructive testing. Explain LPT method in detail and by giving its working principal, application, advantages and limitations. **07**
- Q.5** (a) 1. Explain anisotropy and isotropy for single crystal material. **03**
 2. Mention various polycrystalline and non-crystalline materials. **04**
 (b) Justify the need of TTT diagram in context of material property and micro structure. **07**
- OR**
- Q.5** (a) Write the procedure for conducting Jominy Hardenability Test. Explain the need of this test. **07**
 (b) What is phase diagram? Explain Lever rule by giving suitable example. **07**
