

**II B.Tech II Semester Supplementary Examinations,
November/December 2005
AEROSPACE MATERIALS
(Aeronautical Engineering)**

Time: 3 hours**Max Marks: 80**

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

1. (a) From fundamentals calculate the atomic packing factor for CPH crystal structure.
(b) Calculate the volume in cubic nanometers of the Beryllium crystal structure unit cell. Beryllium is CPH and the value of $a = 2.2856^0A$ and $c=0.358nm$.[8+8]
2. (a) What does impact test signify? Explain with necessary formulations, the procedure to be adopted in the impact test conducted on a pendubem type of impact testing machine.
(b) Discuss the different types of Notch bar impact test specimens with neat sketches and standard dimensions.[8+8]
3. (a) What do you mean semi-martensite. What is normal hardness of the above phase? Explain the significance of the above phase.
(b) Explain why low alloy steels rather than plain carbon steels, are commonly specified for components that are to be heat treated by quenching and tempering.[8+8]
4. (a) What is Hydrogen overpotential and what is it's effect upon the rate of corrosion?
(b) What is stray current corrosion? Explain under what conditions it occurs.[8+8]
5. (a) How Aluminium alloys are welded? What are the difficulties that have encountered in welding heat treatable aluminium alloys.
(b) Give the composition of any two high temperature resistance Aluminium alloys. What are their applications?[8+8]
6. (a) Give the classification of polymers? Explain the basis on which such a classification is made.
(b) What are amorphous plastics? Give examples of atleast four plastics. [10+6]
7. Where do we use Magnesium alloys in aircraft industry? Explain. [16]
8. (a) Name some of the super alloys which are used in aircraft industry? Give their nominal compositions.

- (b) Give the microstructure, composition of Nickel base and cobalt base heat resistant casting alloys. [8+8]

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2. (a) How is the buckling effect avoided in compression specimen. What are the probable errors in the compression test due to buckling.
(b) Following observations were recorded in a tensile test. Plot the stress strain curve and obtain.[6+10]
 - i. Modulus of Elasticity
 - ii. Proportional limit
 - iii. Modulus of resilience
 - iv. Yield stress at 0.2% offset and
 - v. what this material is likely to be

Stress (kgf/cm ²)	0	3060	2500	2600	2400
Strain mm/mm	0	0.0015	0.0017	0.0030	0.0050

3. (a) Compare Aluminum and Magnesium with regard to their corrosion resistance behavior.
(b) Explain why $(\alpha + \beta)$ Titanium alloys are superior in strength compared to alpha Titanium alloys & Beta Titanium alloys.[8+8]
4. (a) Explain the Beneficial effects of galvanic corrosion.
(b) Explain the principles involved for co-deposition of metals.
(c) What is the importance of over voltage on environment of corrosion rate.[6+6+4]
5. (a) What is a Y-alloy? Give its composition properties and industrial uses?
(b) What is the fabrication process that is adopted for semi-finished aluminium forms? Explain the process in detail.[6+10]
6. (a) Explain how glass fibers are manufactured?
(b) What are the characteristics and composition of e-glass fibers?[10+6]

7. Explain the following composites.
- (a) Metal matrix composites.
 - (b) Dispersion strengthened alloys. [8+8]
8. How are the nickel based super alloy structural components manufactured? Describe hot isostatic pressing of nickel based alloy powders. [16]

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1. (a) Define a crystalline solid. What are the three most common crystal structures. List five metals which have each of these crystal structures.
(b) Derive the relationship between the length of the side 'a' of the BCC unit cell and the radius 'r' of the atom.
(c) Tungsten is BCC and has an atomic radius of 0.141 nm. Calculate the lattice constant in Angstrom units.
(d) Calculate the effective number of atoms for FCC unit cell. [4+4+4+4]
2. (a) Why does yielding occur in ductile metals? Is the occurrence of yielding good or bad? How does it influence the behavior of Metal? Explain.
(b) Explain the difference between.
 - i. Continuous yielding and discontinuous yielding.
 - ii. Elastic deformation & anelastic deformation. [8+8]
3. (a) Hardened steel always requires tempering. Explain.
(b) Explain heat treatment, properties and applications of Ti-6Al-4V alloy? Explain the difficulties involved in vacuum heat treatment. [6+10]
4. Explain the effects of the following on corrosion rate.
 - (a) solution concentration
 - (b) Velocity.
 - (c) Temperature
 - (d) Galvanic coupling. [4+4+4+4]
5. (a) What are wrought Aluminium alloys? How is the temper of wrought alloys determined?
(b) Explain precipitation hardening in Aluminium-copper 4.3% alloy? [8+8]
6. (a) What are the elastomers? Explain.
(b) What are the various synthetic rubbers you know? Explain? Give industrial applications of these. [6+10]
7. (a) What are the various materials that are used in aircraft as structural materials? Classify them.

- (b) What type of Aluminum alloys are used in the fabrication of the following in aircrafts?
- i. Fuse-lag
 - ii. Wings
 - iii. Windows
 - iv. Nose-Comb. [8+8]
8. (a) Name some of the super alloys which are used in aircraft industry? Give their nominal compositions.
- (b) Give the microstructure, composition of Nickel base and cobalt base heat resistant casting alloys. [8+8]

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1. Differentiate between the following
 - (a) Climb up & climb down
 - (b) Cross slip & Jog
 - (c) Partial dislocations & mixed dislocations. [5+5+6]
2. (a) Explain the basic differences between engineering stress-strain & True stress-strain. Derive an Expression for the true stress and true strain in terms of engineering stress-strain.
(b) What is Necking. When it is observed. Explain the conditions for the formation of NECK in a tensile test. [10+6]
3. (a) Discuss in Brief the properties, and applications of Aluminium and Aluminium alloys.
(b) Between Al & Fe; Aluminium has better corrosion resistance than Iron. Explain with suitable answer. [8+8]
4. (a) Give examples of three changes in an environment that may be made to reduce its corrosive effect on articles in contact.
(b) Explain the following:
 - i. Caustic embrittlement
 - ii. Hydrogen embrittlement. [8+8]
5. (a) What are wrought Aluminium alloys? How is the temper of wrought alloys determined?
(b) Explain precipitation hardening in Aluminium-copper 4.3% alloy? [8+8]
6. (a) Explain how glass fibers are manufactured?
(b) What are the characteristics and composition of e-glass fibers? [10+6]
7. Where do we use Magnesium alloys in aircraft industry? Explain. [16]
8. What are the castable type of super alloys that are used in air space industry? Name a few components indicating their composition. [16]
