USN ☐☐☐☐☐☐☐☐☐☐ **10AE52**

Fifth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Introduction to Composite Materials

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting*
atleast TWO questions from each part.

PART – A

1. a. Define a composite material. What are the advantages of composite materials over monolithic materials? **(06 Marks)**
   b. Discuss the types of matrices and reinforcements used in composite materials. **(10 Marks)**
   c. Distinguish between thermoplastics and thermoset polymers. **(04 Marks)**

2. a. Explain hand layup technique, with neat sketches. **(10 Marks)**
   b. Explain the production procedure for vaccum bag moulding technique, with neat sketches. **(10 Marks)**

3. a. With a neat sketch, explain filament winding processes. **(10 Marks)**
   b. Discuss the applications of composites with respect to i) recreational and sports goods ii) marine. **(10 Marks)**

4. a. Explain with neat sketches high pressure water jet cutting system and laser jet cutting system. **(12 Marks)**
   b. What are the principal modes of failure of :
      i) Adhesive bonded joints
      ii) Bolted joints. **(08 Marks)**

PART – B

5. a. Derive an expression for ultimate transverse strength for an unidirectional lamina using mechanics of material approach. State the assumption made in the approach. **(10 Marks)**
   b. Explain :
      i) Maximum stress failure theory
      ii) Maximum strain failure theory. **(10 Marks)**

6. a. Derive an expression for elastic modulus of a composite under ISO – strain and ISO – stress condition, in terms of elastic moduli and volume fraction of matrix and fiber phases. **(14 Marks)**
   b. Find the longitudinal and transverse elastic modulus of a unidirectional glass-epoxy lamina with 70% fibre volume fraction. Take the values of young's modulus of the fiber $E_f = 85$ GPa and Young's modulus of the matrix $E_y = 3.4$ GPa. **(06 Marks)**

7   A laminate is made up by stacking 0° and 45° plies as shown below :

h_4	45^0	3mm
h_3		
mid phase h_2	0^0	3mm
	0^0	3mm
h_1		
h_0	45^0	3mm
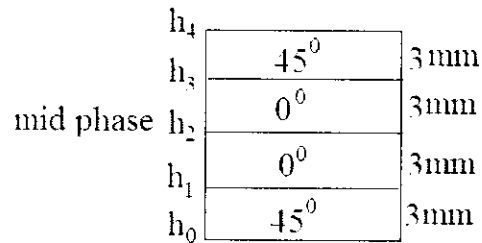
The $[Q_{ij}]_{0°}$ and $[Q_{ij}]_{45°}$ matrices are :

$$[Q_{ij}]_{0°} = \begin{bmatrix} 140 & 5 & 0 \\ & 5 & 0 \\ & & 5 \end{bmatrix} GPa$$

$$[Q_{ij}]_{45°} = \begin{bmatrix} 50 & 35 & 30 \\ & 50 & 30 \\ & & 35 \end{bmatrix} GPa$$

Compute the [A], [B] and [D] matrices for this laminate.   **(20 Marks)**

8 a. Explain the powder metallurgy technique of producing metal matrix composites. **(12 Marks)**
    b. What matrix material and reinforcement material are used in fabricating MMCs? Explain.
        (08 Marks)

* * * * *