Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

V SEMESTER B.TECH (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: AIRCRAFT MATERIALS AND COMPOSITES [AAE 311]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.

1A. What is cold working of materials? What is its effect on mechanical properties of materials? **(02)**

1B. Define creep for materials. What are the parameters that can be find by conducting a creep test? **(02)**

1C. Derive the expression for determining the shear modulus of a unidirectional composite. **(06)**

2A. Explain the die casting process of producing Aluminum alloys. What are its advantages? **(03)**

2B. Determine the transverse modulus using strength of materials approach as well as Halpin-Tsai method. **(04)**
E_f=360 GPa, E_m= 65GPa, ν_m=0.3 and νf=0.35. Assume ξ= 2.

2C. The weight of the matrix is measured to be 30% of the weight of the composite. What is the fiber volume fraction? The specific gravities of glass and epoxy are 2.58 and 1.22 respectively. **(03)**

3A. Define the following with reference to composites (i) micro mechanics (ii) Transverse micro cracking (iii) whiskers (iv) chopped strand mats **(04)**

3B. Derive the stress-strain relations for a specially orthotropic lamina. **(04)**

3C. Differentiate between isotropic , orthotropic and anisotropic materials **(02)**

4A. Discuss the conventional fabrication procedure of glass fibers. **(04)**

4B. A lamina whose material axes is at 60^0 to reference axes is subjected to a stress of -5 MPa along the longitudinal, stress of 8 MPa along the transverse direction and a shear stress of -2 MPa. Find the stresses and strains in the longitudinal and transverse directions and then transform the strains in x and y direction. **(04)**

$$[T_1]=\begin{bmatrix} \cos^2\theta & \sin^2\theta & 2\sin\theta\cos\theta \\ \sin^2\theta & \cos^2\theta & -2\sin\theta\cos\theta \\ -\sin\theta\cos\theta & \sin\theta\cos\theta & \cos^2\theta-\sin^2\theta \end{bmatrix} \quad [T_2]=\begin{bmatrix} \cos^2\theta & \sin^2\theta & \sin\theta\cos\theta \\ \sin^2\theta & \cos^2\theta & -\sin\theta\cos\theta \\ -2\sin\theta\cos\theta & 2\sin\theta\cos\theta & \cos^2\theta-\sin^2\theta \end{bmatrix}$$

4C. Briefly explain maximum work theory **(02)**

5A. Explain the dry jet wet spinning method for the production of Kevlar fibers **(04)**

5B. Consider a 3 ply lamina whose top and bottom laminae are 2mm each in thickness and oriented at 45^0 to the laminate reference axis. The middle layer is 4mm thick with 0^0 fiber orientation. Obtain the A, B and D matrices for the lamina. **(05)**

$$\left[\overline{Q}2\right]=\begin{bmatrix} 20 & 0.7 & 0 \\ 0.7 & 2 & 0 \\ 0 & 0 & 0.7 \end{bmatrix}; \left[\overline{Q}_1\right]=\begin{bmatrix} 6.55 & 5.15 & 4.5 \\ 5.15 & 6.55 & 4.5 \\ 4.5 & 4.5 & 5.15 \end{bmatrix}=\left[\overline{Q}_3\right]$$

5C. What is a quasi-isotropic laminate? **(01)**

6A. Illustrate the filament winding technique for the production of polymer matrix composites **(04)**

6B. Briefly explain X-Radiography technique for detecting defects in composites. **(03)**

6C. Write about Laser Shearography nondestructive evaluation technique. **(03)**