Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

II SEMESTER M.TECH (CAAD/MET) END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: MECHANICS OF COMPOSITE MATERIAL, MME 5266

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL the** questions.
- Missing data may be suitably assumed.

1A. Derive the expression for modulus of rigidity and poisons ratio of a lamina, in global co-ordinate system as a function of fiber orientation and engineering properties in fiber co-ordinate system. **(6)**

1B. What are the advantages of composite materials over Metals? **(4)**

2A. Determine the elements in the stiffness and compliance matrix for a lamina containing 60% volume of T-300 carbon fibers in an epoxy matrix. Consider fiber orientation angle of 45^0. The properties are as follows: for fiber E_f = 220 GPa and ν_f = 0.2 and for the matrix, E_m = 3.6 GPa and ν_m = 0.35. **(6)**

2B. Explain the process of filament winding. **(4)**

3A. A 500 mm long, 25 mm wide and 2 mm thick composite plate contains 55% by volume of unidirectional continuous HMS carbon fibers in an epoxy matrix parallel to its length.

- Calculate the change in length and width of the plate if it is subjected to an axial tensile force of 75 kN in the length direction.
- Calculate the change in length and width of the plate if it subjected to an axial tensile force of 75 kN in the width direction.

Assume that the modulus, and Poisson's ratio of the epoxy matrix are 3.2 GPa, and 0.3. Also the modulus, and Poisson's ratio of the HMS carbon fibers are 180 GPa, and 0.2. **(6)**

3B. List the basic assumptions of classical lamination theory **(4)**

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4A. A Kevlar 49–epoxy composite has the following material properties: E_1=76 GPa, E_2=5 G.5 Pa, ν_{12}=0.34 & G_{12}=2.1 GPa., S_{Lt}=1400MPa; S_{Lc}=234 MPa; S_{Tt}=12 MPa; S_{Tc}=53 MPa & S_{LTs}=34MPa, A unidirectional lamina of this material is subjected to uniaxial tensile loading in the x direction. Determine the failure stress of the laminate using Azzi-Tsai Hill failure theory, if the lamina is orientated at 30^0 **(6)**

4B. Using relevant standard, explain how the tension test is conducted on a unidirectional laminate. **(4)**

5A. Determine [A], [B] and [D] matrices for [45^0/60^0/-60^0/-45^0] laminate. The thickness of every layer is 3mm. Use the following material properties: E_1=138 GPa, E_2=10 GPa, ν_{12}=0.21 & G_{12}=6.5 GPa for computation. **(10)**