Registration No: | | | | | | | | | | |

Total Number of Pages: 02 **M.TECH**
P2SUCC10

2nd Semester Regular Examination 2016-17
COMPOSITE STRUCTURES

BRANCH: GEOTECHNICAL ENGG, SOIL MECHANICS, SOIL MECHANICS & FOUNDATION ENGG, STRUCTURAL & FOUNDATION ENGG, STRUCTURAL ENGG, TRANSPORTATION ENGG,

Time: 3 Hours

Max Marks: 100

Q.CODE: Z959

Answer Question No.1 which is compulsory and any FOUR from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: ***Short answer type*** **(2 x 10)**

a) Distinguish the analysis between the conventional materials and the composite materials.
b) Distinguish between the properties, *homogeneity* and *heterogeneity*.
c) Classify types of materials based on number of independent elastic constants.
d) Distinguish between lamina and laminate.
e) What are the various types of stresses which are induced at any point in a composite laminate subjected to external loading?
f) As per rule of mixture, write the formula to calculate the longitudinal modulus of a composite lamina.
g) State various types of fibers and matrices used in the preparation of composite laminates.
h) What do you mean by transversely isotropic material?
i) Give an example of an angle-ply *balanced laminate*.
j) Write all the terms of the transformation matrix $[T]$ in matrix form.

Q2 **a)** For a specially orthotropic lamina, develop the stress strain relationship in the principal material direction in form of compliance matrix. **(10)**

b) For a FRP composite of unidirectional lamina with fibre orientation of 45 degree, calculate the compliance matrix , stiffness matrix and transformed reduced stiffness matrix if E_{11}= 135 GPa, E_{22} = 8.5 GPa, G_{12} = 7.2 GPa, and ν_{12} = 0.3. **(10)**

Q3 **a)** Develop the transformation matrix T wrt strain when transformed from principal material axis, 1-2 to the reference axis X-Y. **(10)**

b) For a unidirectional lamina, if the reduced stiffness matrix is given by **(10)**

$$\begin{bmatrix} 180.0 & 2.90 & 0 \\ 2.90 & 10.5 & 0 \\ 0 & 0 & 7.0 \end{bmatrix}$$

determine the four material properties of the lamina.

Q4 **a)** State the basic assumptions in the analysis of laminated composites. **(8)**

b) Derive the formula to calculate the stress resultants of a composite laminate as a function of layerwise stiffness matrix. **(12)**

Q5 **a)** Prove that, all the terms of the bending-extension coupling stiffness matrix are zero for a symmetric laminate. **(10)**

b) Compute the A matrix for a three layered laminate, [45/30/45] laminate if E_1 = 130 GPa, E_2 = 10 GPa, E_6 = 5 GPa, ν_{12} = 0.3 and thickness of each layer is 0.5 mm. **(10)**

Q6 Derive the Navier's solution for finding deflection at centre of a rectangular orthotropic laminate subjected to uniformly distributed loading with all edges simply supported. **(20)**

Q7 **Write short notes on the followings.** **(5x4)**

a) Applications of composites

b) Characteristics of *special orthotropic materials*.

c) Shear coupling coefficients

d) Transformed reduced stiffness matrix