ELECTIVES

17MD009MECHANICS OF COMPOSITE MATERIALS

COURSE CODE	COURSE TITLE	L	P	T	C
17MD009	MECHANICS OF COMPOSITE MATERIALS				

Course Description and objectives:

Composite materials are being increasingly used in engineering structures as load bearing elements. The main objective of this subject is to provide knowledge about stress distribution, calculation of stresses, stress transfer and failure theories associated with fiber reinforced composite laminates. The extent of the material science information required to reach this objective is also covered in the content.

Course Outcomes:

Upon successful completion of the course student should be able to:

Understand the basic elements in a composite

Understand the difference between various types of composites.

Suggest the suitable type of composite materials for given applications.

Acquire knowledge on failure theories used in composite analysis.

Understand the reasons for hygro-thermal stresses and ways to minimize these stresses.

Explain the damage progression in the laminate

Skills Acquired:

Estimation of the composite properties from the constituent element properties.

Acquire knowledge on laminates and the dependence of laminate properties on stacking sequence.

Laminate strength calculation. Estimation of the variation of the laminate elastic/strength characteristics with off-axis angles. Characterization of the lamina and laminate.

Activities: Calculation of the principle stresses from body coordinate stresses. Transformation of stresses from on-axis to off-axis or vice versa.

UNIT-I

Introduction, classifications of composites, particulate composites, fiber composites, sandwich structures, applications, geometric andphysical definitions, classification offibers, classification of matrices,typesandclassificationofFRPs,applications,productionmethods.

UNIT-II

Micromechanicsand macromechanics,stressstraindiagrams,fiber,matrix,composite. Micro mechanical estimationofelasticpropertiesoflamina,differentmodesoffailures,factorsinfluencing thestrengthandstiffness,experimental characterization ofcomposites.

UNIT-III

Hooks law for orthotropic materials, relations between engineering constants and elements of stiffnessandcompliance matrices, restrictionsonelasticconstants, stressstrainrelationsforlamina witharbitraryorientation,transformation ofengineeringconstants.

UNIT-IV

Strengthofanorthotropiclaminasubjectedto biaxialstressfield,theoriesoffailures,failureenvelop, importanceofsignofshearstresson strengthofcomposites,multidirectionallaminates,stress-strain relations,loaddeformation relations,differenttypesoflaminates, compliances, laminateengineering properties.

UNIT-V

Stressanalysisandsafetyfactorsforfirst-plyfailureoflaminates,computational procedureforstress andfailureanalysisofgeneralmultidirectional laminates, hygrothermal stressesmicromechanics of progressivefailure,stiffnessreduction,ultimatelaminatefailure,interlaminarstresses,edgeeffects.

TEXTBOOKS:

1. Isaac and M Daniel, "Engineering Mechanics of Composite Materials", 2nd Edition, Oxford UniversityPress,2006.

REFERENCEBOOKS:

1. B.D. AgarwalandL.J.Broutman,"AnalysisandperformanceoffibreComposites",3rd Edition, Wiley-Inter-scienceNewYork,2006.
2. R.M.Jones,"MechanicsofCompositeMaterials", 2ndEdition,TaylorandFrancisPublications, 1999.