

## Academic Course Description

**BHARATH UNIVERSITY**  
 Faculty of Engineering and Technology  
 Department of Mechanical Engineering  
 BME007- COMPOSITE MATERIALS AND TECHNOLOGY  
 Sixth Semester, 2015-16 (Even Semester)

### Course (catalog) description

To understand the fundamentals of composite material strength and its mechanical behavior Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.

**Compulsory/Elective course:** Elective for Mechanical students

**Credit& contact hours** : 3 & 45

**Course Coordinator** : Mr.Sharavanan

**Instructor(s) :**  
 C.M.MEENAKSHI,  
 MR.SHARAVANAN

Name of the instructor	Class handling	Office location	Office phone	Email (domain: @bharathuniv.ac.in)	Consultation
C.M.MEENAKSHI,	Third year MECH	Sk 002		Meenakshi.mech@bharathuniv.ac.in	9.00 to 9.50 am
MR.SHARAVANAN	Third year MECH	Sk 003		sharavanan.mech@bharathuniv.ac.in	1.30 to 2.20 pm

### Relationship to other courses

Pre-requisites : machine design –I, Metallurgy

Assumed knowledge : Knowledge on material science and metallurgy

Following courses : Nil

## Syllabus Contents

<b>UNIT I INTRODUCTION</b>	<b>9</b>
Conventional materials–Limitations–Definition of composite materials–Difference between conventional and composite materials-Types of Characteristics (Dispersions, particulates, fibre)-Application.	
<b>UNIT II MATERIALS</b>	<b>9</b>
Fibres-Materials-fibre reinforced plastics-Thermoset polymers-Coupling agents, fillers and additives-Metal matrix and ceramic composites-Particulate reinforced composite	
<b>UNIT III MANUFACTURING</b>	<b>9</b>
Fundamentals-bag moulding-compression moulding- pultrusion-filament winding-other manufacturing process-MMC's Casting (Solid and liquids state processing)-quality inspection and non destructive testing	
<b>UNIT IV MECHANICS AND PERFORMANCE</b>	<b>9</b>
Introduction to micro-mechanics-Unidirectional laminates-interlinear stresses-static mechanical properties-fatigue properties-impact properties-environmental effects-fracture mechanics and toughening mechanisms, damage prediction, failure modes.	
<b>UNIT V DESIGN OF COMPOSITES</b>	<b>9</b>
Failure predictions-design considerations-joint design-codes-design examples. Optimization of laminated composites-Application of FEM for design and analysis of laminated composites.	

### TEXTBOOKS:

1. Krishnan Chawla ,Composite Materials Science and Engineering, Springer publications,2012.
2. Daniel gay, Composite Materials, CRC Press, 3<sup>rd</sup> edition.

### REFERENCES:

1. Ronald Gibson, Principles of Composite Material Mechanics, Tata McGraw Hill, 1994.
2. Michael Hyer, Stress Analysis of Fiber- reinforced composite Materials, Tata McGraw Hill, 1998.
- 3.<http://www.springer.com/in/book/9780387743646>
- 4.[https://books.google.co.in/books/about/Composite\\_Materials.html?id=5Q6oUTF00RgC](https://books.google.co.in/books/about/Composite_Materials.html?id=5Q6oUTF00RgC)

**Computer usage:** NIL

### Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

**Broad area :** | Engineering

### Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	FEB 2nd WEEK	Session 1 to 14	2 Periods
2	Cycle Test-2	MARCH 2 <sup>nd</sup> week	Session 15 to 28	2 Periods
3	Model Test	APRIL 3rd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

### Mapping of Instructional Objectives with Program Outcome

	Correlates to program outcome		
	H	M	L
To understand the functions and design principles of Jigs, fixtures and press tools To gain proficiency in the development of required views of the final design.			
Will understand basic introduction of composite material	a	h	k
Will understand the fundamentals of fibres and polymers	a,l	h	k
Understanding the manufacturing process .	c.d.e.f.g	h	k
Thermo-mechanical behavior and study of residual stresses in Laminates during processing. Implementation of Classical Laminate Theory (CLT)	G,l	e	k
Study about design of composites	l	e	
Understand application of FEM	g,l	f,h	

H: high correlation, M: medium correlation, L: low correlation

### Draft Lecture Schedule

Lecture No.	Topic (Unit No.)	No of hrs	Solving problems	Reference Books
1	Introduction to the subject	1	NO	R1.R2
2	<b>Unit –I</b> Conventional materials, Limitations–Definition of composite materials.	3	NO	R1.R2
3	Difference between conventional and composite materials-	1	NO	R1.R2
4	Types of Characteristics (Dispersions, particulates, fibre)-.	3	NO	R1.R2
5	Application,	1	NO	R1.R2
6	<b>Unit-II</b> Fibres-Materials-fibre reinforced plastics-	2	NO	R1.R2

7	Thermoset polymers-Coupling agents, fillers and additives-	2	NO	R1.R2
8	Metal matrix composites-	2	NO	R1.R2
9	Ceramic matrix composites	2	NO	R1.R2
10	Particulate reinforced composite	1	NO	R1.R2
11	<b>Unit-III</b> Fundamentals	1	NO	R1.R2
12	bag moulding, compression moulding-	2	NO	R1.R2
13	Pultrusion, filament winding- other manufacturing process.	2	NO	R1.R2
14	MMC's Casting (Solid and liquids state processing)-	2	NO	R1.R2
	quality inspection and non destructive testing	2	NO	R1.R2
15	<b>Unit-IV</b> Introduction to micro-mechanics- Unidirectional laminates-	2	NO	T1
16	interlinear stresses-static mechanical properties- fatigue properties- impact properties.	2	NO	T1
17	-environmental effects-	2	NO	T1
18	fracture mechanics and toughening mechanisms,	2	NO	T1
19	damage prediction, failure modes	1	NO	T1

20	<b>Unit-V</b>			T1
21	Failure predictions.	2	NO	T1
22	design considerations, joint design, codes design examples.	3	NO	T1
23	Optimization of laminated composites-	2	NO	T1
24	Application of FEM for design and analysis of laminated composites.	2	NO	T1

### Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.
- Slide presentations and video demos.

### Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment / Seminar / Online		
Test / Quiz	-	5%
Attendance	-	5%
Final exam	-	70%

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**Prepared by:**

*C.M.Meenakshi*

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### **ABET Outcomes expected of graduates of B.Tech / MECH / program by the time that they graduate:**

- The ability to apply knowledge of mathematics, science, and engineering fundamentals.
- The ability to identify, formulate and solve engineering problems.
- The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

- d) The ability to design and conduct experiments, as well as to analyze and interpret data
- e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- f) The ability to apply reasoning informed by the knowledge of contemporary issues.
- g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- h) The ability to understand professional and ethical responsibility and apply them in engineering practices.
- i) The ability to function on multidisciplinary teams.
- j) The ability to communicate effectively with the engineering community and with society at large.
- k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.
- l) The ability to recognize the need for, and an ability to engage in life-long learning.

### **Program Educational Objectives**

#### **PEO1: PREPARATION:**

Mechanical Engineering graduates are enthusiastic to provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the field of Mechanical Engineering.

#### **PEO2: CORE COMPETENCE:**

Mechanical Engineering graduates have competence to enhance the skills and experience in defining problems in the field of Mechanical Engineering and Technology design and implement, analyzing the experimental evaluations, and finally making appropriate decisions.

#### **PEO3: PROFESSIONALISM:**

Mechanical Engineering graduates made competence to enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

#### **PEO4: PROFICIENCY:**

Mechanical Engineering graduates became skilled to afford training for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

#### **PEO5: ETHICS:**

Mechanical Engineering graduates are morally merged to apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

COURSE TEACHER	SIGNATURE
C.M.MEENAKSHI	
MR.SHARAVANAN	

**CO-ORDINATOR**

C.M.MEENAKSHI

**HOD / MECH**