

Course Title:	<b>Smart Materials and systems</b>		
Course Code:	<b>BETCK105A/205A</b>	CIE Marks	50
Course Type (Theory/Practical /Integrated )	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 Hours	Credits	03
<b>Course objectives</b> <ul style="list-style-type: none"> <li>To develop the students ability to learn emerging materials.</li> <li>To make students to learn prefabricated building components</li> <li>To understand the sensors deployed in smart buildings</li> <li>To learn building information modelling for building design</li> <li>To learn the concepts of 3-D printing</li> </ul>			
<b>Teaching-Learning Process</b> These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none"> <li>Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.</li> <li>Arrange visits to nearby sites to give brief information about the Civil Engineering structures.</li> <li>Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.</li> <li>Encourage collaborative (Group) Learning in the class.</li> <li>Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.</li> <li>Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.</li> <li>Topics will be introduced in multiple representations.</li> <li>Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.</li> <li>Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</li> <li>Individual teachers can device innovative pedagogy to improve teaching-learning.</li> </ol>			
<b>Module-1 (08)</b>			
<b>Emerging Materials</b> Honey comb structure (Carbon composites), Nano-materials, engineered polymers, emerging sustainable by products (Fly ash and GGBS) and construction chemicals			
<b>Module-2 (08)</b>			
<b>Prefabricated/ Manufactured building components</b> Definition, types of prefabricated/ manufactured building components and infrastructure, modular coordination, standardization, materials, systems, production, transportation and installation.			
<b>Module-3(08)</b>			
<b>Smart Materials</b> Definition, Principles of Piezo-electricity, materials (Polymers and Ceramics), sensors (Piezo-electric sensor, strain gauge, shear sensor, in-plane and out of plane sensor, accelerometer), smart composites			

<b>Module-4(08)</b>	
<b>BIM and IBMS</b>	
BIM: Definition, Necessity, advantages, BIM in building design, infrastructure design and construction IBMS – Definition, Necessity, advantages, Types of IBMS	
<b>Module-5 (08)</b>	
3-D Printing	
Importance, Historic development, advantages, common terminologies, classification, Process chain, 3 – D modelling, Data conversion and transmission, checking and preparation, Building, Post processing, Applications	
<b>Course outcome (Course Skill Set)</b>	
At the end of the course the student will be able to:	
CO1	Make use emerging materials for construction
CO2	Decide the proper prefabricated building component
CO3	Use smart materials and methods in building construction
CO4	Implement BIM in building design
CO5	Prepare 3-D modelling and manufacture building component

### Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

#### Continuous Internal Evaluation(CIE):

##### Three Tests each of 20 Marks;

- 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> tests shall be conducted after completion of the syllabus of 30-35%, 70-75%, and 90-100% of the course/s respectively.
- Assignments/Seminar/quiz/group discussion /field survey & report presentation/ course project/Skill development activities, suitably planned to attain the COs and POs for a total of 40 Marks.

If the nature of the courses requires assignments/Seminars/Quizzes/group discussion two evaluation components shall be conducted. If course project/field survey/skill development activities etc then the evaluation method shall be one.

Total CIE marks (out of 100 marks) shall be scaled down to 50 marks

#### Semester End Examination (SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

- The question paper shall be set for 100 marks. The medium of the question paper shall be English). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks.The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks.**
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

#### Suggested Learning Resources:

##### Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Donald R. Askeland and Pradeep P. Fulay, Essentials of Materials Science and Engineering, 2009, Cengage Learning.
- 2.
- 3.
- 4.
- 5.

<b>Web links and Video Lectures (e-Resources):</b>												
<ul style="list-style-type: none"> <li>• YouTube Videos.</li> <li>•</li> </ul>												
<b>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</b>												
<ul style="list-style-type: none"> <li>• Site visits to understand the prefabricated building components.</li> <li>• Visit to Smart material manufacturing facilities</li> <li>• Visit to 3-D printing facility</li> </ul>												
<b>COs and POs Mapping (Individual teacher has to fill up)</b>												
<b>COs</b>	<b>POs</b>											
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>
<b>C01</b>	2	3										
<b>C02</b>	2	3										
<b>C03</b>	2	3										
<b>C04</b>	2	3										
<b>C05</b>	2	3										
<b>Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped</b>												
<b>Note:</b> Depending on the assessment tool used, higher order POs can be identified by the concerned course instructor.												