Course Code:BMEA103C	Course Title: Elements of Mechanical Engineering	Credits : (3 : 0 : 0)
Hours/Week (L:T:P) : 03		CIE Marks : 50
Total Hours of Pedagogy (Theory + Lab): 40		SEE Marks : 50
Course Type: Theory		

Brief description of Subject:

1. Provides an overview of the role of Mechanical Engineering across various industries like energy, manufacturing, automotive, aerospace, and marine sectors. It highlights emerging trends and technologies shaping these fields. The topic also covers the basics of steam formation, types of steam, heat transfer, and the applications of steam through simple numerical problems. Additionally, it introduces different energy sources and the working principles of various power plants such as hydel, thermal, nuclear, solar, tidal, and wind.
2. Students will learn the working principles of machine tools, including the lathe, drilling machine, and milling machine, and explore various machining operations such as turning, drilling, boring, reaming, and milling. The module emphasizes practical applications without requiring detailed sketches but focusing on understanding operations. It also introduces advanced manufacturing systems, including CNC technology, its components, advantages, and applications, along with an introduction to 3D printing.
3. Provides knowledge on the basic components and working principles of internal combustion (IC) engines, with a focus on 4-stroke petrol and diesel engines, their applications, and performance calculations through simple numerical problems. Additionally, it introduces refrigeration and air conditioning principles, including the working of VCR refrigeration systems and room air conditioners, along with the properties of refrigerants and their applications.
4. Students will learn about various mechanical power transmission systems, including different types of gears (spur, helical, bevel, worm, rack and pinion) and belt drives (flat and V-belt). Topics like velocity ratio, compound gear trains, and belt tension calculations will be covered. The module also discusses joining processes such as soldering, brazing, and welding, with an overview of different welding techniques like arc welding, TIG, MIG, and gas welding.
5. Introduces students to the latest trends in electric and hybrid vehicle technologies, including their components, working principles, and the advantages and disadvantages of EVs and hybrid systems. It also provides an introduction to mechatronics and robotics, covering open-loop and closed-loop systems, robot anatomy, and the applications of robots in material handling, processing, assembly, and inspection

Course Objectives:

1. Introduce students to the concepts of energy sources, steam formation and role of mechanical engineering in industry and society
2. Discuss the basic knowledge on automobile, IC engine, electric and hybrid vehicle and understand the principle working of refrigeration and air conditioning.
3. Discuss the fundamental of machining and understand the different types and principle working of conventional machine tool, CNC and metal joining process.
4. Provide students with opportunities to solve problems on velocity ratio of gear trains and belt drives, also to have the knowledge of different gear drives, belt drive and applications of robotics.

Module-1	8 Hrs.

Introduction to Mechanical Engineering (Overview only):
Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Steam Formation and Application:
Modes of heat transfer, Steam formation, Types of steam, Steam properties and applications of steam (simple numerical problems).

Energy Sources and Power Plants:
Basic working principles of Hydel power plant, Thermal power plant, nuclear power plant, Solarpower plant, Tidal power plant and Wind power plant.

Module-2	8 Hrs.

Machine Tool Operations:
Lathe: Principle of working of a center lathe, lathe operations: Turning, facing, knurling, threadcutting, taper turning by swiveling the compound rest,
Drilling Machine: Working of simple drilling machine, drilling operations: drilling, boring, reaming,tapping, counter sinking, counter boring,
Milling Machine: Working and types of milling machine, milling operations: plane milling, endmilling and slot milling.
(No sketches of machine tools, sketches to be used only for explaining the operations).
Introduction to Advanced Manufacturing Systems: Introduction, components of CNC, advantagesand applications of CNC, 3D printing.

Module-3	8 Hrs.

Introduction to IC Engines: Components and working principles, 4-Stroke Petrol and Diesel engines,Application of IC Engines, performance of IC engines (Simple numerical).
Introduction to Refrigeration and Air Conditioning: Principle of refrigeration, Refrigerants and their desirable properties. Working principle of VCR refrigeration system, working principle of room air conditioner & Applications of air Conditioners.

Module-4	8 Hrs.

Mechanical Power Transmission:
Gear Drives: Types - spur, helical, bevel, worm and rack and pinion, velocity ratio, simple andcompound gear trains (simple numerical problems)
Belt Drives: Introduction, Types of belt drives (Flat and V-Belt Drive), length of the belt and tensionsratio (simple numerical problems)
Joining Processes: Soldering, Brazing and Welding, Definitions, classification of welding process, Arc welding, Gas welding, (types of flames), TIG welding, MIG welding and Fusion welding.

Module-5	8 Hrs.

Insight into future mobility technology: Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of Electric Vehicles (EVs) and Hybrid vehicles.
Introduction to Mechatronics and Robotics: open-loop and closed-loop mechatronic systems. Joints & links, Robot anatomy, Applications of Robots in material handling, processing and assembly and inspection.

Practical Module

Suggested Learning resources

1. Elements of Mechanical Engineering, K R Gopala Krishna, Subhash Publications, 2008
2. Elements of Workshop Technology (Vol. 1 and 2), Hazra Choudhry and Nirzar Roy, Media Promotersand Publishers Pvt. Ltd., 2010.
3. Manufacturing Technology- Foundry, Forming and Welding, P .N. Rao Tata McGraw Hill 3rd Ed.,2003.
4. Robotics, Appu Kuttan KK K. International Pvt Ltd, volume 1
5. An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis. .

Course Outcomes:

CO1: Identify the types of energy sources, parts and operations of machine tools (Particularly lathe, drilling machine, milling machine) and working principle of joining process (Gas welding, arc welding, soldering and brazing) and refrigeration systems.

CO2: Calculate the energy of steam and performance parameters (power and efficiency) of IC Engine.

CO3: Apply the concept of electric vehicle, hybrid vehicle and robotic to industrial and society applications.

CO4: Determine velocity ratio of gear drives and power transmitted through power transmission system.

CO and PO Mapping Matrix

Course Outcomes	Programme Outcomes												Programme specific outcomes			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	1	1							1			1	1			
CO2	1	1							1			1	1			
CO3	2	1					1					1	1			
CO4	1	1										1	1			

Assessment Details (both CIE and SEE)

The weight age 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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures 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.

SEE for IPCC

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. 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.

3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Question Paper Pattern for theory SEE
Answer any 5 full questions choosing at least one from each unit for 100 Marks.

Course Title:	**Computer Aided Engineering Drawing (Common to All)**		
Course Code	**BMEB103C/203C**	CIE Marks	50
Teaching Hour/Week (L:T:P:S)	2:0:2:0	SEE Marks	50
Total Hours of Teaching - Learning	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives:

CLO1: To understand the basic principles and conventions of engineering drawing
CLO2: To use drawing as a communication mode
CLO3: To generate pictorial views using CAD software
CLO4: To understand the development of surfaces
CLO5: To visualize engineering components

Teaching-Learning (General Instructions):

- Students should be made aware of powerful engineering communication tool –Drawing.
- Simple Case studies can be suitably selected by the teacher for hands on practice to induce the feel of fruitfulness of learning.
- Appropriate Models, Power Point presentation, Charts, Videos, shall be used to enhance visualization before hands on practice.
- For application problems use very generally available actual objects. (Example: For rectangular prism / object; matchbox, carton boxes, book, etc can be used. Similarly for other shapes)
- Use any CAD software for generating orthographic and pictorial views.
- Make use of sketch book with graph sheets for manual / preparatory sketching

Module-1

Introduction: ***for CIE only***

Significance of Engineering drawing, BIS Conventions of Engineering Drawing, Free hand sketching of engineering drawing, Scales. Introduction to Computer Aided Drafting software, Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet and curves.

Orthographic Projections of Points, Lines and Planes:

Introduction to Orthographic projections: Orthographic projections of points in 1st and 3rd quadrants.

Orthographic projections of lines (Placed in First quadrant only).

Orthographic projections of planes viz triangle, square, rectangle, pentagon, hexagon, and circular laminae (Placed in First quadrant only using change of position method).

Module-2

Orthographic Projection of Solids:

Orthographic projection of right regular solids (**Solids Resting on HP only**): Prisms & Pyramids (triangle, square, rectangle, pentagon, hexagon), Cones, Cylinders with axis/base inclined to HP and profile views.

Module-3

Isometric Projections:

Isometric scale, Isometric projection of hexahedron (cube), right regular prisms, pyramids, cylinders, cones andspheres. Isometric projection of combination of two simple solids (Co-Axial only).

Module-4

Development of Lateral Surfaces of Solids:
Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones resting with base on HP only.

Module-5

Multidisciplinary Applications & Practice *(For CIE Only):*
Free hand Sketching; True free hand, Guided Free hand, Roads, Buildings, Utensils, Hand tools & Furniture's etc
Drawing Simple Mechanisms; Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart &Four-wheeler carts to dimensions etc

Course Outcomes
At the end of the course the student will be able to:

CO 1. Draw and communicate the objects with definite shape and dimensions
CO 2. Recognize and Draw the shape and size of objects through different views
CO 3. Develop the lateral surfaces of the object
CO 4. Create a Drawing views using CAD software.
CO 5. Identify the interdisciplinary engineering components or systems through its graphical representation.

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) and that for SEE minimum passing marks is 35% of the maximum marks (18 marks). 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 of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE)

- CIE shall be evaluated for max. marks of 100 and later the same shall be scaled-down to 50 marks as detailed below:
- CIE component should comprise of Continuous evaluation of drawing work of students as and when the Modules are covered based on below detailed weightage.

Module	**Max. Marks Weightage**	**Evaluation Weightage in marks**	
		Computer display and print out (a)	**Sketching (b)**
Module 1	15	10	05
Module 2	20	15	05
Module 3	20	20	00
Module 4	20	20	00
Module 5	25	15	10
Total	**100**	**80**	**20**
Consideration of Class work		**Total of [(a) + (b)] = 100 Scaled down to 30 Marks**	

- At least one **Test** covering all the modules is to be conducted for 100 marks and evaluation to be based SEE pattern, and the same is to be scaled down to **20 Mark**s.
- The final CIE = Class work marks + Test marks

Semester End Examination (SEE)

- SEE shall be conducted and evaluated for maximum marks 100. Marks obtained shall be accounted for SEE final marks, reducing it by50%
- Question paper shall be set jointly by both Internal and External Examiner and made available for each batch as per schedule. ***Questions are to be set preferably from Text Books***.
- **Related to Module-1**: One full question can be set either from "***points & lines***" or "***planes***".
- Evaluation shall be carried jointly by both the examiners.
- Scheme of Evaluation: *To be defined by the examiners jointly and the same shall be submitted to the university along with question paper*.

One full question shall be set from each of the Module from Modules 1, 2, 3 and 4 as per the below tabled weightage details. ***However, the student may be awarded full marks, if he/she completes solution on computer display without sketch.***

Module	**Max. Marks Weightage**	**Evaluation Weightage in marks**	
		Computer display and print out(a)	**Preparatory sketching (b)**
Module 1	20	15	05
Module 2	30	25	05
Module 3	25	20	05
Module 4	25	20	05
Total	**100**	**80**	**20**
Consideration of SEE Marks		**Total of (a) + (b) ÷ 2 = Final SEE marks**	

Suggested Learning Resources:

Text Books

- *S.N. Lal, & T Madhusudhan*:, Engineering Visulisation, 1st Edition, Cengage, Publication
- *Parthasarathy N. S., Vela Murali*, Engineering Drawing, Oxford University Press,2015.

Reference Books

- *Bhatt, N.D., Engineering Drawing: Plane and Solid Geometry*, 53rd edition, Charotar Publishing House Pvt. Limited, 2019.
- *K. R. Gopalakrishna, & Sudhir Gopalakrishna*: Textbook Of Computer Aided Engineering Drawing, 39thEdition, Subash Stores, Bangalore,2017

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**3**	**2**			**3**	**1**		**1**	**1**	**3**		**2**
CO2	**3**	**2**			**3**	**1**		**1**	**1**	**3**		**2**
CO3	**3**	**2**			**3**	**1**		**1**	**1**	**3**		**2**
CO4	**3**	**3**			**3**	**1**	**1**		**1**	**3**		**1**
CO5	**3**	**2**			**3**				**1**	**3**		**2**

BMEB105B	Introduction to Sustainable Engineering	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

The course addresses the urgent need for **sustainable development solutions** in the face of global challenges like climate change and resource depletion. As industries and societies increasingly focus on environmental responsibility, engineers are at the forefront of designing solutions that balance technological progress with ecological preservation and social equity. The courses emphasize the importance of sustainability in various engineering disciplines, highlighting frameworks like the **Sustainable Development Goals (SDFs)** and the **Paris Agreement**.

These frameworks underscore the crucial role engineers play in creating a sustainable future. The course equips students with the knowledge and skills to assess and design **sustainable engineering solutions**. It introduces **Life Cycle Assessment (LCA)**, a vital tool for evaluating the environmental impact of products and processes throughout their entire life cycle. It also covers **Environmental Life Cycle Costing (ELCC), Social Life Cycle Assessment (SLCA), and Life Cycle Sustainability Assessment (LCSA)**, providing a comprehensive approach to sustainability evaluation. The curriculum includes practical applications in various engineering fields, such as energy systems, building and construction, chemical production, and food and agriculture. By integrating **sustainability principles into engineering design processes**, the course promotes innovative solutions for a more sustainable future. Understanding **environmental economics** helps engineers make informed decisions that consider the **value of environmental goods and services**. By incorporating these concepts and tools, the course empowers engineers to become agents of change, driving sustainable practices and contributing to a more sustainable future.

BMEB105B	Introduction to Sustainable Engineering	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	08 Hrs.
Sustainable Development and Role of Engineers: Introduction, Why and What is Sustainable Development, THE SDGs, Paris Agreement and Role of Engineering, Sustainable Development and the Engineering Profession, Key attributes of the Graduate Engineering Sustainable Engineering Concepts: Key concepts – Factor 4 and Factor 10: Goals of sustainability, System Thinking, Life Cycle Thinking and Circular Economy	
UNIT–II	**08 Hrs.**
Sustainable Engineering and Concepts, Principles and Frame Work: Green Economy and Low Carbon Economy, Eco Efficiency, Triple bottom Line, Guiding principles of sustainable engineering, Frameworks for sustainable Engineering. Tools for sustainability Assessment: Environmental Management System, Environmental Auditing, Cleaner Production Assessment, Environmental Impact Assessment, Strategic Environmental	
UNIT–III	**08 Hrs.**
Fundamentals of Life Cycle Assessment: Why and What is LCA, LCA Goal and Scope, Life cycle inventory, Life Cycle Impact Assessment, Interpretation and presentation of Results, Iterative Nature of LCA, Methodological Choices, LCI Databases and LCA Softwares, Strength and Limitations of LCA.	
UNIT–IV	**08 Hrs.**
Environmental Life Cycle Costing, Social Life Cycle Assessment, and Life Cycle Sustainability Assessment: Introduction, Environmental Life Cycle Costing, Social Life Cycle Assessment, Life Cycle Sustainability, LCA Applications in Engineering: Environmental Product Declarations and Product Category Rules, Carbon and Water Foot Printing, Energy systems, Buildings and the Built Environment, Chemical and Chemical Production Food and Agriculture. **Introduction to Environmental Economics**: Introduction – What Is Environmental Economics?, Valuing the Environment, Market-based Incentives (or Economic Instruments) for Sustainability, Command-and-Control versus Economic Instruments, A Simple Model of Pollution Control	
UNIT-V	**08 Hrs.**
Integrating Sustainability in Engineering Design: Problems Solving in Engineering, conventional to Sustainable Engineering Design Process, Design for Life Guidelines and Strategies, Measuring Sustainability, Sustainable Design through sustainable procurement criteria, Case studies on sustainable Engineering Design Process – Sustainable Process Design, Sustainable Production Design Sustainable product design in Electronic Engineering,	
Reference Books *	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year) 1. Introduction to Sustainability for Engineers, Toolseeram Ramjeawon, CRC Press, 1stEdn., 2020 2. Sustainability Engineering: Concepts, Design and Case studies, Prentice Hall, 1stEdn, 2015 3. System Analysis for sustainable Engineering: Theory and applications, Ni bin Chang, McGraw Hill Publications, 1stEdn., 2010 4. Engineering for Sustainable development: Delivery a sustainable development goals, UNESCO,	

International Centre for Engineering Education, France, 1stEdn., 2021

5. Introduction to Sustainable Engineering, Rag. R.L. and Ramesh Lakshmi Dinachandran, PHI Learning Pvt. Ltd., 2ndEdn, 2016

Course Outcomes

After completion of the course student will be able to

1. Analyze the principles of sustainable development, including the SDGs, key sustainable engineering concepts to evaluate the role and responsibilities of engineers in promoting sustainable practices.
2. Apply the frameworks of sustainable engineering, including green and low-carbon economies, eco-efficiency, and the triple bottom line, to evaluate and implement tools for sustainability assessment such as environmental management systems, and cleaner production. while recognizing their strengths and limitations.
3. Integrate LCA methodologies and life cycle sustainability concepts to assess the environmental, social, and economic impacts of engineering systems and products.
4. Assess and apply methods to measure sustainability in engineering design processes, incorporating strategies for sustainable product and process design through case study analysis.

Table: Revised Bloom Vincenti (RBV) Taxonomy Table

Cognitive Processes	Factual	Conceptual	Procedural	Meta-cognitive	Fundamental Design Principles	Criteria and Specifications	Practical Constraints	Design Instrumentalities
Remember								
Understand		AI1, AI2, AI3, AI4						
Apply		CO1, IA1, AI1, CO2, IA2, AI2	CO1, IA1, AI1, CO2, IA2, AI2, CO3, IA3, AI3, CO4, IA4, AI4	CO3, IA3, AI3, CO4, IA4, AI4				
Analyze								
Evaluate								
Create								

CO-Course Outcome AI-Assessment Items IA-Instructional Activities

Table: Mapping of COs with POs and PSOs

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	1					2	3								1	1
CO2	1		1		3		3						1		1	
CO3		2					2	1					1	1		
CO4			1	1			2					1	1			1

Table: Mapping of COs with Pos/PSOs, Cognitive Level, Knowledge Level and Classroom Sessions.

Course Outcomes (COs)	POs/	Cognitive	Knowledge	Class	Open-

	PSOs	Level	Level	Sessions (Hrs)	Ended Activities
CO1: Analyze the principles of sustainable development, including the SDGs, key sustainable engineering concepts to evaluate the role and responsibilities of engineers in promoting sustainable practices.	PO1, PO6, PO7, PSO3 PSO4	Remember, Understand Apply,	**Conceptual Procedural**	**10**	
CO2: Apply the frameworks of sustainable engineering, including green and low-carbon economies, eco-efficiency, and the triple bottom line, to evaluate and implement tools for sustainability assessment such as environmental management systems, and cleaner production. while recognizing their strengths and limitations.	PO1, PO3, PO5, PO7, PSO1 PSO2	Remember, Understand Apply,	**Conceptual Procedural**	09	
CO3: Integrate LCA methodologies and life cycle sustainability concepts to assess the environmental, social, and economic impacts of engineering systems and products.	PO2, PO7, PO8, PSO1 PSO2	Remember, Understand Apply,	**Procedural Meta-cognitive**	12	
CO4: Assess and apply methods to measure sustainability in engineering design processes, incorporating strategies for sustainable product and process design through case study analysis.	PO3, PO4, PO7, PO12, PSO1 PSO4	Remember, Understand Apply,	**Procedural Meta-cognitive**	09	
Total Hours of Instruction				**40**	

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

Course Code :BMEA105B Semester :01	**Course Title: Smart Materials and Systems**	**03 - Credits (3 : 0 : 0)**
Hours/Week (L:T:P) : 03		**CIE Marks : 50**
Total Hours of Pedagogy (Theory): 40		**SEE Marks :100**
Course Type: Theory		

Brief description of the course:

The course "Smart Materials and Systems" explores the principles and applications of materials that can respond dynamically to environmental changes. It covers topics such as piezoelectric materials, shape-memory alloys, and self-healing polymers. Carbon composites), Nano-materials, engineered polymers, emerging sustainable by products (Fly ash and GGBS) and construction chemicals. Prefabricated/ Manufactured building components Piezo-electricity, materials (Polymers and Ceramics), sensors (Piezo-electric sensor, strain gauge, shear sensor, in-plane and out of plane sensor, accelerometer), smart composites Students learn about the these materials and systems for applications in aerospace, robotics, and biomedical fields. The course emphasizes both theoretical concepts and implementations, encouraging innovation in developing responsive technologies. Smart materials and systems have a wide range of industrial applications, including Aerospace, Automotive, Civil Engineering Biomedical, Consumer Electronics, Robotics. These applications highlight the versatility of smart materials in enhancing performance, safety, and functionality across various industries.

MODULE – 1	**08 Hrs**

Emerging Materials :
Honey comb structure (Carbon composites), Nano-materials, engineered polymers, emerging sustainable by products (Fly ash and GGBS) and construction chemicals

MODULE – 2	**08 Hrs**

Prefabricated/ Manufactured building components :
Definition, types of prefabricated/ manufactured building components and infrastructure, modular coordination standardization, materials, systems, production, transportation and installation.

MODULE - 3	**08 Hrs**

Smart Materials :
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

MODULE 4	**08 Hrs**

BIM and IBMS
BIM: Definition, Necessity, advantages, BIM in building design, infrastructure design and construction IBMS – Definition, Necessity, advantages, Types of IBMS

MODULE 5 **08 Hrs**

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.

Practical Module --NO

Suggested Learning resources

1. D.J.Leo,Engineering Analysis of Smart Material Systems,Wiley 2007.
2. M.Addington,D.L.Schodek,Smart Materials and New Technologies in Architecture,Elsevier 2005.
3. DonaldR.AskelandandPradeepP.Fulay,EssentialsofMaterialsScienceandEngineering, 2009, Cengage Learning

Reference Books:

1. Gandi,M.V.andThompson,B.S.,"SmartMaterialsandStructures,"Chapman&Hall,UK, 1992,
2. Culshaw,B.,"SmartStructuresandMaterials,"ArtechHouse,Inc.,Norwood,USA, 1996.
3. DimitrisC.Lagoudas, ShapeMemoryAlloys: ModellingandEngineeringApplications, Springer, 2008.
4. T.Yoneyama&S.Mayazaki,Shapememoryalloysforbiomedicalapplications,CRCPress, 200

5.Weblinks and Video Lectures(e-Resources):

Smart materials intelligent system design NPTEL course

Course Outcomes: (Course Skill Set)

At the end of the course the student will be able to:

- CO1 Understand and apply the emerging materials for construction.
- CO2 Understand, analyze and decide the usage of proper prefabricated building component.
- CO3 Understand and apply smart materials and methods in building construction.
- CO4 Analyze and apply BIM in building design.
- CO5 Analyze ,prepare and apply 3-D modeling and manufacture building component.

CO and PO Mapping

Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

Course Outcomes (COs)	Programme Outcomes (Pos)/Programme Specific Outcomes (PSO)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	1	-	2	1	1	1	1	1	2	1	1	-
CO2	2	2	2	1	1	-	1	1	1	1	1	2	2	1	1	-
CO3	2	2	1	2	2	-	2	1	1	1	1	1	1	1	1	
CO4	2	2	2	1	1	-	1	1	1	1	1	2	2	1	1	-
	High -3, Medium – 2, Low - 1															

Question paper pattern for SEE:

1. Answer any FIVE FULL questions selecting at least ONE Full question from each unit

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures 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:

- For the Assignment component of the CIE, there are 10 marks and for the Internal Assessment Test component, there are 20 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-100% of the syllabus has been covered.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.

Course objectives

- To develop the students ability to learn emerging materials.
- To make students to learn prefabricated building components
- To understand and apply the sensors deployed in smart buildings
- To understand ,apply and learn building information modeling for building design
- To learn the concepts of 3-D printing**.**