BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE New Delhi)

Yelahanka, Bengaluru 560064

Bachelor of Engineering

Department of Mechanical Engineering

III Semester Scheme and Syllabus
2022 Scheme
Effective from the AY 2024-25

2023 BATCH

Approved in the BoS meeting held on 12.07.2024

Vision and Mission of the Department

Vision

To develop technically competent Mechanical Engineering professionals for the benefit of the society

Mission

Impart quality education in Mechanical Engineering and allied areas by state- of- the- art- infrastructure and dedicated faculty. Provide conducive environment for both students and faculty to pursue higher education & research and to work ethically for the benefit of society.

Program Educational Objectives (PEOs)

1. Be successful professionals in the field of Mechanical Engineering and allied areas
2. Exhibit skills to work effectively and ethically in multiple domains of engineering as part of a team
3. Excel in higher studies, research and adapt in a world of constantly developing technology

Program Specific Outcomes (PSOs)

1. Design, Analyze and fabricate the mechanisms.
2. Analyze the fluid and thermal aspects of different mechanical systems and components.
3. Develop materials and components through different manufacturing methods with managerial skills.

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BMS Institute of Technology and Management
(An Autonomous Institution, Affiliated to VTU Belagavi)
Avalahalli, Doddaballapur Main Road, Bengaluru, Karnataka – 560064

Ref.: BMSIT&M/Exam/2023-24/ 104 **Date:** 21.09.2024

CONTINUOUS INTERNAL EVALUATION (CIE) AND SEMESTER END EXAMINATION (SEE) PATTERN

(Applicable to UG students admitted from the 2022 batch, effective from the Academic year 2024-25 onwards)

The UG students admitted from the 2022 batch onwards are hereby informed to note the following regarding Continuous Internal Evaluation and Semester End Examination pattern:

- The Weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Examination (SEE) is 50%.
- The Minimum passing mark for the CIE is 40% of the Maximum marks (i.e. 20 marks out of 50) and for the SEE minimum passing mark is 35% of the Maximum marks (i.e. 18 out of 50 marks).
- A student will be declared to have passed the course if they secure a minimum of 40% (i.e. 40 marks out of 100) in the combined total of the CIE and SEE.

The following tables summarize the CIE and SEE Patterns for the courses of various credits:

INTEGRATED PROFESSIONAL COMPETENCE COURSE (IPCC) COURSES **4 OR 3 CREDITS**						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE - Internal Assessment (IA) Tests	CIE – Test 1 (1.5 hr)	40	20	-	The sum of the two internal assessment tests will be **80 Marks** and the same shall be scaled down to **20 Marks**.
		CIE – Test 2 (1.5 hr)	40			
	CIE – CCA (Comprehensive Continuous Assessment)	CCA	10	10	-	Any one assessment method can be used from the list appended below.
	Total CIE Theory			**30**	**12**	
Practical Component	CIE - Practical		30	10	-	Each laboratory experiment is to be

					assessed for **30 Marks** using appropriate rubrics.
	CIE Practical Test	20	10	-	One test after all experiments to be conducted for **20 Marks**
	Total CIE Practical		**20**	**08**	
Total CIE Theory + Practical			**50**	**20**	
SEE		100	50	18	SEE exam is a theory exam, conducted for **100 Marks**, scored marks are scaled down to **50 Marks.**
CIE + SEE			**100**	**40**	
Note: The assessment of the laboratory component for the IPCC courses shall be restricted to CIE only.					

PROFESSIONAL CORE COURSES (PCC) / ENGINEERING SCIENCE COURSES (ESC) 03 OR 02 CREDITS						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	30	-	The sum of the two internal assessment tests will be **80 Marks** and the same will be scaled down to **30 Marks**.
		CIE – Test 2 (1.5 hr)	40			
	CIE - CCAs	CCA	20	20	-	Any Two assessment methods can be used from the list. If it is project-based, one CCA shall be given.
	Total CIE Theory			**50**	**20**	
SEE			100	50	18	SEE is a theory exam, conducted for **100 Marks**, scored marks are scaled down to **50 Marks.**
CIE + SEE				**100**	**40**	

NON-IPCC COURSES **01 CREDIT – MULTIPLE CHOICE QUESTION TYPE**						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation Component	CIE – IA Tests (MCQs)	CIE – Test 1 (1 hr)	40	40	-	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on a higher Bloom's level. The sum of the two internal assessment tests will be **80 Marks**, and the same will be scaled down to **40 Marks**.
		CIE – Test 2 (1 hr)	40			
	CIE - CCAs	CCA	10	10	-	Any One Assessment method can be used from the list provided below.
	Total CIE			**50**	**20**	
SEE (MCQ Type)				50	18	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on higher Bloom's level. MCQ-type question papers of 50 questions with each question of a **01 Mark**, the examination duration is 01 hour.
CIE + SEE				**100**	**40**	

PROFESSIONAL CORE COURSE LABORATORY (PCCL) /ABILITY ENHANCEMENT COURSE LABORATORY (AEC) **01 CREDIT**					
Evaluation Type	**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation	CIE - Practical	30	30		Each laboratory experiment is to be evaluated for **30 Marks** using appropriate rubrics.
	CIE - Practical Test	50	20		One test after all experiments is to be conducted for **50 Marks** and to be scaled down to **20 Marks**.
	Total CIE	-	**50**	**20**	
Semester End Examination		100	50	18	SEE to be conducted for **100 Marks**.
CIE+SEE		**100**		**40**	

NON-IPCC / ABILITY ENHANCEMENT COURSE (AEC) **01 CREDIT – DESCRIPTIVE TYPE**						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	30	-	The sum of the two internal assessment tests will be **80 Marks** and the same will be scaled down to **30 Marks**.
		CIE – Test 2 (1.5 hr)	40			
	CIE - CCAs	CCA	20	20	-	Any Two assessment methods can be used from the list. If it is project-based, one CCA shall be given.
	Total CIE Theory			**50**	**20**	

SEE	100	50	18	SEE is a theory exam, conducted for **100 Marks for 02 Hours duration**, scored marks are scaled down to **50 Marks.**
CIE + SEE		**100**	**40**	

COMPUTER AIDED ENGINEERING DRAWING (BCEDK103/BCEDK203)
3 CREDIT

Evaluation Type		Topics/ Modules	Computer Printout	Preparatory Sketch	Max Marks	Total Marks	Marks to be Scaled Down to	Min Marks to Pass
CIE	**Sketch Book and CAD Modelling**	Projection of Points	10	05	15	200	20	-
		Projection of Lines	10	10	20			
		Projection of Planes	20	15	35			
		Projection of Solids	40	20	60			
		Isometric Projections	20	15	35			
		Development of lateral surfaces	20	15	35			
	Test 1	Module 1 & 2	24	06	30	70	20	-
		Module 3	32	08	40			
	Test 2	Module 3	32	08	40	70		
		Module 4	24	06	30			
	CCA 1	Module 5	08	02	10	10	10	-
	CCA 2	Module 5	08	02	10			
CIE Total							**50**	**20**
SEE		Module 1 & 2	24	06	30	100	**50**	**18**
		Module 3	32	08	40			
		Module 4	24	06	30			
CIE + SEE							**100**	**40**

COMPUTER AIDED MODELLING FOR MANUFACTURING (BME305) **1 CREDIT**								
Evaluation Type		**Topics/ Modules**	**Computer Printout**	**Preparatory Calculations / Sketch**	**Max Marks**	**Total Marks**	**Marks to be Scaled Down to**	**Min Marks to Pass**
CIE	**Sketch Book and CAD Modelling**	Module 1	60	30	90	200	20	
		Module 2	40	20	60			
		Module 3	40	10	50			
	Test 1	Module 1	20	10	30	60	20	-
		Module 2	20	10	30			
	Test 2	Module 1	20	10	30	60		
		Module 3	20	10	30			
	CCA	Module 1	30	10	40	40	10	-
CIE Total							**50**	**20**
SEE		Module 1	30	10	40	100	**50**	**18**
		Module 2	20	10	30			
		Module 3	20	10	30			
CIE + SEE							**100**	**40**

Learning Activities for CCAs:

A faculty member may choose the following CCAs based on the needs of the course:

1. Course project
2. Literature review
3. MOOC
4. Case studies
5. Tool exploration
6. GATE-based aptitude test
7. Open book tests
8. Industry integrated learning
9. Analysis of Industry / Technical / Business reports
10. Programming assignments with higher Bloom level
11. Group discussions
12. Industrial / Social / Rural projects

CoE 21/09/2024

Dean - AA 21/09/24

21/9/2024

Principal

Copy To:

1. The Vice-Principal, Deans, HoDs, and Associate HoDs
2. All faculty members and students of 2022, 2023, and 2024 batch.
3. Examination Section

BMS Institute of Technology & Management

(Autonomous Institution Affiliated to VTU, Belagavi)

B. E. in Mechanical Engineering

Scheme of Teaching and Examinations – 2022 Scheme

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022-23 onwards)

III Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Credits Distribution				Examination				Contact Hours/week
					L	T	P	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (H)	
1	IPCC	BME301	Mechanics of Materials	TD: ME PSB: ME	2	1	1	4	50	50	100	3	6
2	IPCC	BME302	Manufacturing Process		3	0	1	4	50	50	100	3	5
3	PCC	BME303	Material Science and Engineering		3	0	0	3	50	50	100	3	3
4	PCC	BME304	Basic Thermodynamics		2	1	0	3	50	50	100	3	4
5	PCCL	BME305	Computer Aided Modelling for Manufacturing		0	0	1	1	50	50	100	3	2
6	ESC	BME306X	Engineering Science Course		3	0	0	3	50	50	100	3	3
7	UHV	BSCK307	Social Connect and Responsibility	Humanities	0	0	1	1	100	-	100	-	1
8	AEC	BME358X	Ability Enhancement Course / Skill Enhancement Course	Any Department	For Theory course 1	0	0	1	50	50	100	1	1
					For Practical course 0	0	1	1				2	2
9	MC	BNSK359	National Service Scheme (NSS)	NSS Coordinator	0	0	0	0	100	-	100	-	2
		BPEK359	Physical Education(Sports and Athletics)	PED									
		BYOK359	Yoga	Yoga Teacher									
		BNCK359	NCC	NCC Department									
		BMCK359	Music	Music Department									
TOTAL					**14**	**2**	**5**	**20**	**550**	**350**	**900**	**-**	**29**
Non-Credit Mandatory Course (NCMC) prescribed to lateral entry Diploma Students													
10	NCMC	BENGDIP1	English Communications Skill I	HSS	0	0	0	0	100	-	100	-	2

The Lateral entry diploma students admitted to III semester are required to complete the English Communications Skill I in the III semester and English Communications Skill II in the IV semester. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Engineering Science Courses (ESC)		Ability Enhancement Courses (AEC)	
Course Code	**Course Name**	**Course Code**	**Course Name**
BME306A	Electric Vehicle Technology	BME358A	Python Programming Lab [0-0-2]
BME306B	Smart Materials & Systems	BME358B	Fundamentals of Virtual Reality [0-2-0]
BME306C	Internet of Things (IoT)	BME358C	Spreadsheet for Engineers [0-0-2]
BME306D	Waste handling and Management	BME358D	Tools in Scientific Computing [0-0-2]

B.E MECHANICAL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - III

MECHANICS OF MATERIALS (2:2:0) 3

(Effective from the academic year 2022-2023)

Course Code	**BME301**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course Objectives:

- To provide the basic concepts and principles of strength of materials.
- To give an ability to calculate stresses and deformations of objects under external loadings.
- To give an ability to apply the knowledge of strength of materials on engineering applications and design problems.

Preamble: Introduction, significance and scope of mechanics of materials in industries.

Module – 1

Simple stress and strain: Definition/derivation of normal stress, shear stress, and normal strain and shear strain, Hook's law, Stress-strain diagram for brittle and ductile materials, Poisson's ratio & volumetric strain, Deformation in bars having uniform, stepped and linearly varying (circular and rectangular) cross sections, Principle of superposition, Composite sections, Generalized Hook's law, Elastic constants, relationship between elastic constants and Poisson's ratio, thermal stresses, numerical problems. **(8 hours)**

Module-2

Bi-axial Stress system: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, graphical method - Mohr's circle for plane stress.

Thick and Thin cylinders: Stresses in thin cylinders, Changes in dimensions of cylinder (diameter, length, and volume) Lame's equation for thick cylinders subjected to internal and external pressures, numerical problems. **(8 hours)**

Module-3

Bending moment and Shear forces in beams: Definition of beam – Types of beams Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, couple and combination of these loads, numerical problems.

(8 hours)

Module-4

Theory of simple bending – Assumptions – Derivation of bending equation, Neutral axis, Determination of bending stresses – section modulus of rectangular and circular sections (Solid and Hollow) and symmetrical I– sections, Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular and symmetrical I sections.

Deflection of Beams: Introduction**,** differential equation for deflection (no derivation), equations for deflections, slope and moments, double integration method for cantilever and simply supported beams for point loads, UDL and couple, Macaulay's method.

(8 hours)

Module-5

Torsion of circular shafts: Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts, numerical problems.

Theory of columns – Euler's theory for axially loaded long columns, Euler's formula for critical load for different end conditions, effective length, Rankine's formula, numerical problems.

(8 hours)

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

CO1: Apply the knowledge to understand the behavior of bars, beams shafts and columns under various load conditions.

CO2: Solve for stresses and deformations in bars, cylinders, shafts, and columns subjected different loads.

CO3: Analyse stresses on inclined plane under plane stress condition using analytical and graphical methods.

CO4: Construct shear force and bending moment diagram for different types of beams subjected to different types of transverse loads.

CO5: Analyze stress distribution and deflection in beams for different cross sections.

CO6: Make use of different material testing equipment's to measure various mechanical properties of the materials.

TEXTBOOKS:

1. Mechanics of Materials, S.I. Units, Ferdinand Beer & Russell Johnstan, 7th Ed, TATA McGrawHill-2014

2. J M Gere, B J Goodno, "Mechanics of Materials", 8th Edition, Cengage Publications, 2013.

REFERENCES:

1. Mechanics of Materials, K.V.Rao, G.C.Raju, Subhash Stores, First Edition, 2007

2. Strength of Materials by R.K. Bansal, Laxmi Publications 2010.

3. R. Subramanian, "Strength of Materials", 3rd Edition, Oxford Publications, 2016.

4. Punmia B C, Ashok Kumar Jain and Arun Kumar Jain, "Mechanics of Materials", 5th Edition, Laxmi Publications, 2016.

5. S S Bhavikatti, "Strength of Materials", 4th Edition, Vikas Publishing House Pvt. Ltd., 2013.

6. S. Ramamrutham, R. Narayanan, "Strength of Materials", 20th Edition, Dhanpat Rai Publishing Company, 2020.

Web links and Video Lectures (e-Resources):

1. Statics and Strength of Materials, Shehata, 2nd edition, 1994. (http://www.astm.org/DIGITAL_LIBRARY/JOURNALS/TESTEVAL/PAGES/JTE12637J. htm)

2. http://www.astm.org/DIGITAL_LIBRARY/JOURNALS/TESTEVAL/PAGE S/JTE12637J.htm

3. 3. http://www.freeengineeringbooks.com/Civil/Strength-of-MaterialBooks.php

DEPARTMENT OF MECHANICAL ENGINEERING

Choice Based Credit System (CBCS)

MANUFACTURIG PROCESS (3:0:1) 4

(Effective from the academic year 2022-23)

Course Code	**BME302**	Semester	**III**
Teaching Hours/Week (L:T:P)	3:0:2	CIE Marks	50
Total Number of Contact Hours	40 + 8 Lab Slots	SEE Marks	50
Examination Nature (SEE)	Theory	Exam Hours	03

Course Objectives:

This course will enable students to:

1. With knowledge and skill on major manufacturing techniques including casting, bulk deformation, sheet metal work and welding.
2. Create parts and components by applying casting and welding operations.
3. Distinguish between different manufacturing process and select appropriate process for given application.
4. Carryout analysis on force developed and power required under bulk deformation processes.

Preamble to Manufacturing: Definition and Classification of Manufacturing Processes. Such as Casting, Bulk deformation, Joining etc.,

Module – 1

Sand Casting: Casting process, Open mould and closed mould, Sand Casting mould, Mould making process, Methods of packing sand in the mould, Quality of sand mould. Classification of sand mould.

Patterns and Cores – Application, types and materials used and methods of making patterns and cores. Buoyant force tending to lift the core – Numerical Calculations

Metals for Casting: Ferrous alloys and non-ferrous alloys. Heating of metal, Pouring Temperature, Solidification and shrinkage, Riser design using Chvorinov's Rule – Numerical Problems.

(9 Hours)

Self- Study: Study on common defects in Castings.

Module – 2

Permanent Mould Casting: Economic disadvantage of sand mould casting, Advantages of permanent mould casting, Steps involved in permanent mould casting, Low pressure casting and Vacuum Permanent mould casting. Die casting methods: Cold chamber and Hot Chamber

Centrifugal casting: Process and Machinery, True Centrifugal Casting, Semi Centrifugal casting, Rotational speed of Horizontal Centrifugal Casting, Centrifugal force required to cast. Numerical Problems.

Furnaces used casting: Classification of furnaces, Crucible Furnace, Construction and working of Cupola furnace, Electric Arc Furnace. Induction Furnace,

(7 Hours)

Self- Study: Studies on plastic Injection Moulding Process

Module – 3

Advanced Fusion Welding: Features of a Fusion-Welded Joint, Laser Beam Welding (LBW), Electron Beam Welding (EBM), Resistance Spot welding (RSW) processes.

Heat Balance in Fusion Welding: Heat transfer phenomenon, Power density, energy balance in Fusion welding, Volume rate of metal welded, Speed of welding – Numerical Problems.

Weld Quality and inspection: Residual Stresses and Distortion, Welding Defects, Weldability, Inspection of welding – Visual method, Magnetic particle method and Ultrasonic methods.

(8 hours)

Self- Study: Studies on Solid State Welding Processes

Module – 4

Metal Forming Process: Classification, Cold working, Warm working and Hot working, Temperature, Strain rate and Coefficient of friction. Material behaviour in metal forming, Average Flow Stress

Rolling: Flat Rolling Process, Various configurations of rolling mills, Draft in rolling, reduction ratio, forward slip, Effect of sticking on coefficient of rolling friction, true strain and Maximum Draft, contact length, Rolling force, Torque and Power required for rolling - Numerical problems.

Forging: Types of forging operation, Open Die forging, Forging Force, Load-Stroke Curve, Forging Press and Die, Upsetting and Heading - Numerical problems

(8 hours)

Self- Study: Studies on rolling deformation processes.

Module – 5

Extrusion: Type of extrusion, hot vs cold extrusion, extrusion die, hydrostatic extrusion, extrusion defects. Extrusion ratio, reduction ratio, true strain and average flow stress, Ram force in extrusion, Power required in extrusion operation - Numerical problems

Drawing Process: Drawing dies, area reduction, draft, true strain, draw stress, drawing force. - Numerical problems

Sheetmetal Working: Shearing, bending, drawing, other Sheetmetal operations using metal tool and flexible tool. Dies – simple, compound, combination and progression. Sheetmetal Press machines. Maximum drawing force and holding force. Numerical problems.

(8 hours)

Self- Study: Processing of metal parts using Powder Metallurgy

PRACTICAL COMPONENT OF IPCC

Experiments

1. Prepare sand specimens and conduct the compression and Shear tests.
2. Determine the size distribution and American Foundry Society (AFS) fineness number for the foundry sand by using standard ASTM sieves
3. Preparation of green sand moulds
4. Prepare casting parts of non-ferrous metal using permanent mould gravity casting
5. Apply the MIG Welding skills to prepare parts
6. Apply the TIG Welding skills to prepare parts
7. Apply the Laser Welding skills to prepare parts of non-ferrous material
8. Practically determine the correlation between weld sheet thickness, electrode force and power density for a resistance spot welding

Demonstration Experiments

1. Foundry Practice: Use of foundry tools and other equipment for Preparation of moulding sand mixture. Preparation of green sand moulds kept ready for pouring in the following cases:
    a. Using two moulding boxes (hand cut moulds).
    b. Using patterns (Single piece pattern and Split pattern)
2. Demonstration of forging model using Power Hammer
3. Demonstration of material flow and solidification simulation using Auto-Cast software

Course Outcomes:

The students will be able to:

CO1. Apply the knowledge of primary and secondary manufacturing techniques to provide the solutions for complex engineering products.

CO2. Analyze welding, casting, and forming parameters to opt for an appropriate manufacturing technique

CO3. Develop a solution for complex manufacturing problems related to Casting, Welding and Metal forming processes.

CO4. Prepare the parts or models for various applications by selecting appropriate manufacturing processes.

Suggested Learning Resources:

Textbooks:

1. Mikell P. Groover, “Fundamentals of Modern Manufacturing: Materials, Processes, and Systems”, John Wiley & Sons, 7th Edition, 2019.

References:

1. Serope Kalpakjian and Steven R. Schmid, “Manufacturing Engineering and Technology”, Pearson Education, 8th Ed, 2023

2. P. N. Rao, “Manufacturing Technology - Foundry, Farming and Welding - Volume1” , McGraw Hill Education; 5th Ed, 2018
3. Ghosh, A. and Mallik, A. K., “Manufacturing Science”, East-West Press, 2nd ed, 2017
P L Jain, “Principles of foundry technology”, Tata McGraw Hill, 4th ed, 2017

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/112/107/112107145/#
- https://archive.nptel.ac.in/courses/113/106/113106087/
- https://amadaweldtech.com/wp-content/uploads/2018/12/Resistance-Welding-Fundamentals.pdf
- https://amadaweldtech.com/wp-content/uploads/2019/12/Laser-Welding-Fundamentals.pdf

B.E MECHANICAL ENGINEERING

Choice Based Credit System(CBCS)

MATERIAL SCIENCE AND ENGINEERING (3:0:0)3

(Effective from the Academic Year 2022-23)

Course Code	**BME303**	Semester	**III**
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Number of Lecture Hours	40	SEE Marks	50
Examination nature (SEE)	Theory	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Gain knowledge of crystal structure, defects in solids.
2. Impart knowledge of construction of phase diagrams, phase transformation and diffusion.
3. Understand iron carbon diagram and TTT diagrams.
4. Identify the heat treatment to modify the properties.
5. Illustrate the surface coating and powder metallurgy techniques.
6. To describe various types of metals and composite materials and application.

Preamble: Historical Perspective, Engineering materials, materials of the future, modern materials needs, important properties and applications of engineering materials.

MODULE-1

Crystal Structure: Crystal Lattice, Unit Cell**,** Coordination number, atomic Packing Factor of all the Cubic structures and Hexa Close Packed structure**.** Numerical problems on APF Imperfections in Solids: Types of imperfections, Point defects: vacancies, interstitials, substitutional impurities, line defects, 2-D and 3D-defects.

Diffusion: Diffusion Mechanisms: Vacancy Diffusion and Interstitial Diffusion, Fick's laws of diffusion, Factors affecting diffusion.

Hands-on: Specimen preparation for micro structural examinations and study the microstructure of a sample metals.

(08 Hours)

Self-study: Studies on applications of diffusion process.

MODULE-2

Nucleation and growth: Introduction to homogeneous and heterogeneous nucleation, critical radius for nucleation.

Alloy System: Solidification, mechanism of solidification in pure metals and alloys Classifications of solids solutions, Substitutional solid solution, interstitial solid solution, Hume-Rothery Rules

Phase diagrams: Construction of Binary phase diagram. Isomorphous systems, Invariant Binary Reactions: Eutectic reaction, Eutectoid reaction and Peritectic reaction, Lever Rule, Numarical problems on Lever Rule.

Iron – Iron carbide equilibrium diagram: Description of equilibrium phases, invariant reactions,

Effect of common alloying elements in steel. **(08 Hours)**

Self -study: Study on mechanical behavior of Iron-carbon alloys.

Hands-on: Magnetic Particle Test (MPT), Dye Penetration Testing (DPT) and Ultrasonic Flaw Detection (UT) to study the defects in the metallic materials

MODULE-3

TTT diagram: TTT diagram for eutectoid steels and CCT curves.

Heat treatment: Classification and objectives of heat treatment processes. Annealing, normalizing, hardening, tempering, Hardenability and Jominy End Quench Test, Case hardening: carburizing, cyaniding, nitriding. Surface hardening: Flame and Induction hardening. Recovery- Recrystallization-Grain Growth. Strengthening mechanisms: Strain hardening, Precipitation
hardening (Solid-Solution Strengthening), Grain refinement. Recent advances in heat treat technology.

Hands-on: Study the hardening heat treatment processes for steel.

(08 Hours)

Self -study: Study on case hardening processes.

MODULE-4

Surface coating technologies: Introduction, coating materials, types of coating: Electro-plating, Chemical Vapor Deposition(CVD), Physical Vapor Deposition(PVD).

Powder metallurgy: Powder Production Techniques: Different Mechanical methods: Abrasion methods, Ball Milling and Chemical reduction method, Particle Size and Shape Distribution,

Selection and Economic considerations: Selection of materials: Service, fabrication and economic requirements. Performance of materials in service, residual life assessment, Economic considerations: Component.

(08 Hours)

Self -study: Studies on powder metallurgy applications for different industries.

MODULE-5

Engineering Materials and Their Properties: Classification, Ferrous materials: Macrostructure Properties, Compositions and uses of Grey cast iron and steel. Non-Ferrous materials: Microstructure, properties, compositions and uses of copper, brass, bronze.

Composite Materials: Definition, classification of composite materials**.**

Polymer Matrix Composites (PMC): Matrix and reinforcement materials used in PMC**.** Classification of production process of PMC. Production of polymer matrix composites: filament winding, hand lay-up, Pultrusion.

Metal Matrix Composites (MMC): Matrix and reinforcement materials used in MMC, Production of MMcs: stir casting and squeeze casting,

Ceramic Matrix Composites (MMC): Matrix and reinforced materials used in CMC. Production of CMC's by powder metallurgy, process. Applications of composite materials.

Hands-on: Demonstration of various materials and their properties. **(08 Hours)**

Self-study: Case studies on applications of Composite material

Course outcomes:

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

CO1: Summarize the defects and diffusion in crystalline materials.

CO2: Analyze the phase diagrams and Iron carbon equilibrium diagram.

CO3: Explain various heat treatment processes for metals and alloys.

CO4: Describe the coating and powder metallurgy techniques.

CO5: Identify the metals, composite materials, their properties.

Suggested Learning Resources:

Textbooks:

1. William. D. Callister., "Material science and Engineering an Introduction", 10th Edition, Wiley, 2018.

2. Shackleford., M. K. Muralidhara, "Introduction to Materials Science for Engineers", 8th Edition, Pearson Publication, 2017.

References:

1. Smith., "Foundations of Materials Science and Engineering", 6th Edition, McGraw-Hill Education, 2019.

2. Raghavan. V., "Materials Science and Engineering: A First Course", 6th Edition, Prentice Hall India Learning Private Limited, 2015.

3. L. H. Van Vlack., "Elements of Materials Science and Engineering", 6th Edition, Pearson India, 2014.

Web links and Video Lectures (e-Resources):

1.Bhattacharya, B., Materials Selection and Design, NPTEL Course Material, Department of Mechanical Engineering, Indian Institute of Technology Kanpur, http://nptel.ac.in/courses/112104122/

2. Dr. Rajesh Prasad, Introduction to Materials Science and Engineering, NPTEL Course Material, Department of Materials. https://archive.nptel.ac.in/noc/courses/noc18/SEM1/noc18-me01

B.E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)

Basic Thermodynamics (2:1:0) 3
(Effective from the academic year 2022-23)

Course Code	**BME304**	Semester	**III**
Teaching Hours/Week (L:T:P)	2:2:0	CIE Marks	50
Total Number of Lecture Hours	40	SEE Marks	50
Examination nature (SEE)	**Theory**	Exam Hours	03

Course objectives:

This course will enable students to:

1. Learn about thermodynamic system and its equilibrium.
2. Understand various forms of energy - heat transfer and work.
3. Study the basic laws of thermodynamics including, zeroth law, first law and second law.
4. Understand the principle of entropy, pure substance, ideal gases and real gases.

Preamble: Significance and scope of thermodynamics, concepts of thermodynamics in economic growth, emerging trends in thermodynamics.

Module –1

Fundamentals of Thermodynamics: Macroscopic and microscopic view point, thermodynamic systems, thermodynamic properties, processes and cycles, homogeneous and heterogeneous system, thermodynamic equilibrium, quasi-static process, zeroth law of thermodynamics, temperature, scales, International practical temperature scale, numericals.

Work and Heat: Work transfer, P-dV work, other types of work transfer, net work done by a system, heat transfer – A path function, specific heat and latent heat, comparison of work and heat transfer, numericals.

(09 Hours)

Self Study Component: Study on Various temperature measuring devices.

Module – 2

First Law of Thermodynamics: Statement, Joules experiment to illustrate first law for a closed system undergoing a cycle, extension of first law to non-cyclic processes, internal energy is property of the system, Perpetual Motion Machine of 1st kind – PMM1, numerical.

First Law applied to flow processes: Control volume, steady state and steady flow**, S**teady Flow Energy Equation (SFEE), applications of SFEE related to turbines, compressors, nozzles, throttling device and heat exchangers, numerical.

(08 Hours)

Self-Study Component: Study on different forms of stored energy.

Module – 3

Second Law of Thermodynamics: Cyclic heat engine, energy reservoirs, Kelvin – Planck statement and Clausius statement of second law of thermodynamics, refrigerator and heat pump, equivalence of Kelvin-Planck and Clausius statements of second law of thermodynamics, PerpetualMotion Machine of 2nd kind – PMM2, reversibility and irreversibility, causes of irreversibility, Carnot cycle, reversed heat engine, Carnot's theorem, absolute thermodynamics temperature scale,efficiency of the reversible heat engine, numerical.

(08 Hours)

Self-Study Component: Studies on thermal energy devices at homes, hostels and college premises.

Module – 4

Entropy: Introduction, Clausius theorem for reversible cycle, property of entropy, entropy principle, inequality of Clausius, entropy change in an irreversible process, numerical.

Pure Substances: Two property rule, triple point, critical point, phase equilibrium diagrams: P-V, P-T, and T-S diagrams, enthalpy of change of phase (latent heat), steam tables and its use, dryness fraction, separating calorimeter, throttling calorimeter, combined separating and throttling calorimeter, numerical.

(08 Hours)

Self Study Component: Studies on physical significance of entropy and its implications in mechanical engineering field.

Module – 5

Ideal gases: Difference between Ideal and real gases. Ideal gas mixtures, Daltons law of partial pressures, Amagat's law of additive volumes, evaluation of properties of perfect and ideal gases, Air-Water mixtures and related properties, Numerical.

Real gases – Introduction , Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart, Numerical.

(07 Hours)

Self-Study Component: Studies on applications of ideal gases in engineering

Course outcomes:

The students will be able to:

CO1: Summarize the fundamental concepts of thermodynamics, various energy interaction systems and pure substance.

CO2: Apply the principles of thermodynamics for various energy interaction systems

CO3: Examine first law of thermodynamics to closed and open systems to determine the quantity of energy transfer.

CO4: Identify the feasibility of cyclic and non-cyclic processes related to second law of thermodynamics and entropy.

CO5: Compare the applicability of ideal and real gases.

Suggested Learning Resources:

Textbooks:

1. P.K. Nag, "Basic and Applied Thermodynamics", 6th Edition, Tata McGraw Hill, 2015.
2. R.K. Rajput, "Engineering Thermodynamics", 11th Edition, Laxmi Publications, 2020.

References:

1. A. Venkatesh, 2008, "Basic Engineering Thermodynamics", 1st Edition, Universities Press, 2008.
2. Yunus A. Cenegal., Michael A. Boles, "Thermodynamics- An Engineering Approach",7th Edition, Tata McGraw Hill publications, 2001.
3. James B Jones, G.A. Hawkins, "Engineering Thermodynamics – An introductory textbook", 2nd Edition, John Wiley Sons, 2010.

Y.V.C.Rao, "An Introduction to Thermodynamics", 2nd edition, Universities Press, 2004.

B.E. MECHANICAL ENGINEERING

Choice Based Credit System (CBCS)

Electric Vehicle Technology (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	BME306A	Semester	III
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Number of Contact Hours	40	SEE Marks	50
Examination Nature (SEE)	Theory	Exam Hours	03

Course objectives:

This course will enable students to:

1.Acquire basic understanding about electric vehicles and its architecture.

2.Study the power management systems and understand various energy storage systems.

3.Obtain the knowledge of various motor and control system for electric vehicles and its characteristics.

4.Impart various domains related to power grid interconnections of electric vehicle.

5.Develop a skill for components, motor, control, and charging system selection considering environmental concern.

Teaching-Learning Process

1.These are some of the strategies for this course attainment various course outcomes and to accelerate current trends towards electric vehicles towards sustainability.

2.Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.

3.Arrange visits to show the live working models other than laboratory topics.

4.Adopt collaborative (Group Learning) Learning in the class.

5.Adopt Problem Based Learning (PBL), which foster students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.

6.Chalk and Talk method for Problem Solving.

Preamble: Importance of sustainable vehicle in today's scenario, adaptability and scalability of electric technology.

Module – 1

Environmental Impact of Vehicles : History, Developments towards the End of the Twentieth Century and the Early Twenty-First Century, Electric Vehicles and the Environment, Energy Saving and Overall Reduction of Carbon Emissions, Reducing Local Pollution, Reducing Dependence on Oil, Usage Patterns for Electric Road Vehicles.

Electric Vehicle Architecture: Types of Electric Vehicles – EV Architecture, Battery Electric Vehicles, The IC Engine/Electric Hybrid Vehicle and architectures, Fuel cell EVs, EVs using Supply Lines, EVs with Flywheels and Supercapacitors, Solar-Powered Vehicles, Linear Motor Vehicles.

(8 Hours)

Module – 2

Energy Storage for EVs: Battery Parameters, Cell and Battery Voltages, Charge Capacity, Energy Stored, Specific Energy, Energy Density, Specific Power, Amp-Hour Efficiency, Energy Efficiency, Self-discharge Rates, Battery Geometry, Battery Temperature, Heating and Cooling Needs, Battery Life and Number of Deep Cycles, Battery Management Systems (BMS),

Fuel cells for EVs: Types, Characteristics, Fuel Cell Technologies, hybridization of various energy storage devices. Selection of the energy storage technology.

Hands on Training: Demo on Electrical vehicle systems and component. **(8 Hours)**

Module – 3

DC and AC Machines & Drives: Various types of motors, selection and size of motors, **Permanent magnet** motor drives and characteristics, **Brushed & Brushless** DC motor drive and characteristics, **Switched reluctance motors** and characteristics, **IPM motor drives** and characteristics, mechanical and electrical connections of motors.

Regenerative Breaking: Maximum Braking Force, Slip in braking, Vehicle Maximum Deceleration during braking, Braking energy on front and rear axle, Parallel Hybrid Braking, Fully controllable hybrid braking

(8 Hours)

Module – 4

Design Considerations of EV components: Design parameters of batteries and ultra-capacitors, aerodynamic considerations, calculation of the rolling resistance and the grade resistance, calculation of the acceleration force, total tractive effort, torque required on the drive wheel, transmission efficiency, consideration of vehicle mass. **(8 Hours)**

Module – 5

Electric Vehicles charging architecture: Electricity Supply, Normal Existing Domestic and Industrial Electricity Supply, Infrastructure Needed for Charging Electric Vehicles, Electricity Supply Rails, Inductive Power Transfer for Moving Vehicles, Battery Swapping.

Smart charging: Grid to vehicle and vehicle to grid, smart metering and ancillary services, introduction to battery charging stations and its installation and commissioning, preliminary discussion on estimation on station capacity and associated technical issues, different connectors.

(8 Hours)

Course outcomes: The students will be able to:

CO1. Apply the knowledge of electric vehicles to distinguish their architecture.

CO2. Identify the power management systems for electric vehicles using various energy storage systems.

CO3. Select the appropriate motor and control system for electric vehicles.

Compare various domains related to electric vehicle components, systems, and power grid interconnections.

Textbooks:

1.Iqbal Hussain, “Electric and Hybrid Vehicles Design Fundamentals”, 1st Edition, CRC Press, 2003.
2.James Larminie, John Lowry “Electric Vehicle Technology Explained”, 1st Edition, John Wiley and Sons, 2003.

References:

1.Chris Mi, M. Abul Masrur, David Wenzhong Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, Wiley publication ,2011.
Allen Fuhs, “Hybrid Vehicles and the future of personal transportation”, CRC Press, 2009.

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)

Computer Aided Modeling for Manufacturing (0:0:1) 1
(Effective from the academic year 2022-23)

Course Code	**BME305**	Semester	**III**
Teaching Hours/Week (L:T:P)	0:0:3	CIE Marks	50
Total Number of hours	36	SEE Marks	50
Examination Nature (SEE)	Practical	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To improve the visualization skills and understand the conventions used in engineering drawing.
2. To impart fundamental knowledge of drawing of different machine parts.
3. To enable the students with concepts of dimensioning and standards related to drawings.
4. To enable the students to draw the assembly of various machine components.
5. To enable the students on limits, tolerance and fits and indicate them on machine drawings.

Preamble:

Discuss the benefits of using CAD software in the process of design and modeling, visualization and virtual feeling and its influence on increased reliability, accuracy and efficiency in the engineering design.

Module-1

Basics of sketching and modeling: Review of 2D Sketching, Parametric Solid Modeling, Assembly creation and product rendering. Create a basic sketch - Profile Tools, Curve Tools, Editing Tools, Operation Tools, Constraints, construction geometries and adding dimensions. Part- Solid from sketches, Solid from surfaces, modify Tools, Operation Tools.

Exploring design tools for production:

Lofted Feature, Combine, Split, Indent, Flex, 3D Sweep, Reference Geometry Commands and Multi thickness Shell - Create holes - Use a coil and threads feature - Mirrors and patterns - Surface creation for complex geometry - Use surfaces to split bodies and faces - Practice exercise.Convert to 3D objects and convert the 3D objects to production drawing consisting of front view/sectional front view, top view, side view and isometric view

1. Open Ended Spanner
2. Cranking Handle
3. Bearing bracket
4. Shift Fork
5. Shaft Support
6. Shaft Bracket

Assembly Drawings

Use McMaster-Carr parts in a design - Explode a 3D model for a drawing, create a drawing sheetand views, add geometry and dimensions to a drawing, add GD & T text, BOM, tables and symbols, exploded view, edit a title block, export to different file formats.

1. Screw jack (Bottle type)
2. Knuckle Joint
3. Plummer block
4. Machine vice

(12 Hours)

Module-2

Sheet metal working:

Applying Sheet Metal modeling features like Flange, Edge Flange, Hem, Miter Flange, Sketch Bend,Corners, Jog, Sheet Metal Gussets, Vent and Forming Tool create following sheet metal parts modeling:

1. L-Angle Bracket
2. Cup Bracket
3. Wall Mount Bracket
4. U-Clamp Bracket

(12 Hours)

Module-3

Surface Modeling:

Applying Sheet Metal modeling features Extruded Surface, Revolved Surface, Sweep Surface, Lofted Surface, Planar Surface, Filled Surface, Offset Surface, Face Fillet, Extend Surface, Trim Surface, Knit Surface, Thicken, Cut with Surface and various commands for curves create following sheet metal parts modeling:

1. Water Bottle
2. Juice Jug
3. Electrical Socket Casing (Cut Section)
4. Electric Distributor Cap (Cut Section)

(12 Hours)

Course Outcomes:

The student will be able to:

CO1. Develop orthographic projections of pictorial views in manual drawing and generate 3D modelling for various machine parts.

CO2. Construct the drawings of threads and fasteners using different standards.

CO3. Model and assemble the machine parts using 3D modelling software by applying appropriate limits and tolerances.

CO4. Develop 3D model and manufacturing drawing for simple mechanisms /machines/systems/products for the given application by working in group and communicate effectively with appropriate media.

TEXT BOOKS:

1. K R Gopala Krishna, “Machine Drawing”, Subhash Publications, 2005
2. Sandeep Dogra, Solidworks Sheet Metal Design 2021, 1st Edition, CADArtifex, Mumbai India.
3.Sham Tickoo and CADCIM Technologies. SOLIDWORKS 2020 for Designers, 18th Edition, CADCIM Series SOLIDWORKS 2020

REFERENCES:

1. K L Narayan, “Machine Drawing”, New Age International Publishers, 2006.
2. N D Bhatt, “Engineering Drawing”, Charotar Publishing House, 2011

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)

SMART MATERIALS AND SYSTEMS (3:0:0) 3
(Common to all Branches) (Effective from the academic year 2022-23)

Course Code	**BME306B**	Semester	**III**
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Number of Contact Hours	40	SEE Marks	50
Examination nature (SEE)	**Theory**	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Study various types of smart materials used in engineering application.
2. Understand the coupling properties and underlying physical phenomena of different active materials.
3. Propose improvement on the design, analysis, manufacturing and application issues involved in integrating smart materials and devices under various engineering structures and products.
4. Demonstrate knowledge and understanding of the physical principles underlying the behavior of Shape Memory Alloy and piezoelectric materials.

Preamble: Relevance of material science in day today activities, Importance of materials in industrial, defense and research application and its economic implications.

Module – 1

Smart Materials and Structures: Introduction to Smart Materials, need of smart materials, typesof smart materials, difference between smart materials and structure, components of smart materials, properties of smart materials, Application areas of smart systems.

(08 Hours)

Self-study: Smart clothes and Smart Shoes.

Module – 2

Shape Memory Alloys: Shape memory materials; Shape memory alloys (SMAs), Classification - Transformation - Ni-Ti Alloys, Shape memory effect, Martensitic transformation, One way and two-way SME, binary and ternary alloy systems, Functional properties of SMAs, Shape memory ceramics - Shape memory polymers – Applications.

(08 Hours)

Self- Study: NiTiNOL shape Memory

Module – 3

Smart polymers and Piezoelectric Smart Materials: Thermally responsive polymers, Electroactive polymers microgels, Synthesis, Properties and Applications, Protein-based smart polymers, pH-responsive and photo responsive polymers, Self-assembly, Drug delivery using smartpolymers.

(08 hours)

Self- Study: Introduction to MEMS, advantages and disadvantages of MEMS.

Module – 4

Chemically Activated Materials - Chemical Gels - Self healing materials Optically Activated Materials - Optically activated polymers - Azobenzene - Liquid Crystal, Smart materials for space applications: Elastic memory composites, Smart corrosion protection coatings, Sensors, Actuators, Transducers**.**

(08hours)

Self- Study: Study on Accelerometers, gyroscopes used in cell phones.

Module – 5

Electrically Activated Materials: Piezoelectricity, Piezo resistivity, Ferroelectricity,Piezoelectric materials- piezoelectric effect, Piezoceramics, Piezopolymers, Piezoelectricmaterials as sensors, Actuators and bimorphs**.**

(08 hours)

Self- Study: Study on Nanocarbon tube-based sensors.

Course Outcomes:

The students will be able to:

CO1: Describe the physical phenomenon, properties, and characteristics of various smartmaterials.

CO2: Identify and analyze various smart materials and components for their properties based onthe applications.

CO3: Summarize the latest developments in the field of smart materials and system.

CO4: Discuss on environmental and sustainable concerns with respect to smart material.

Textbooks:

1. A.V.Srinivasan, Smart Structures –Analysis and Design, Cambridge University Press, NewYork, 2001.
2. M.V.Gandhi and B.S.Thompson, Smart Materials and Structures, Chapmen & Hall, London,1992.

References:

1. P. Gauenzi, Smart Structures: Physical Behaviour, Mathematical Modelling and Applications, Wiley, 2009.
2. G. Gautschi, Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors,Materials and Amplifiers, Springer, Berlin, New York, 2002.
3. B. D. Agarwal and L. J. Broutman, Analysis and Performance of Fiber Composites, JohnWiley & Sons, 2015.
4. T. W. Duerig, K. N. Melton, D. Stockel,C,Mayman, Engineering aspects of Shape memory Alloys, Butterworth, Heinemann, 1990.
5. Brian Culshaw, Smart Structures and Materials, Artech House, 2000.
6. Donald J. Leo, Engineering Analysis of Smart Material Systems, 2007.

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)

Internet of Things (IoT) (3:0:0) 3
(Effective from the academic year 2022-23)

Course Code	**BME306C**	Semester	**III**
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Number of Contact Hours	40	SEE Marks	50
Examination nature (SEE)	**Theory**	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Acquire the knowledge and skill about Internet of Things and their importance in Industry 4.0
2. Understand Operational Technology, Networking, Connecting Technologies and IoTarchitecture.
3. Gain the exposure on IoT sensing and actuating, associate IoT technologies like Cloud Computing and Fog Computing.
4. Experience through hands-on the networking protocols and physical computing devices used in IoT architecture.

Preamble: Current trends in industry and society, Industrial Revolution, Industry 4.0 and digital transformation.

Module – 1

Networking: Introduction, Network Types and Classification, Layered network models – OSI and TCP/IP

IoT: Introduction, Emergence of IoT, Elements of an IoT ecosystem, Evolution of IoT, Enabling IoTand the Complex Interdependence of Technologies, IoT Networking Components. Characteristics of IoT

(**07Hours)**

Self- Study: Study on application domains and network paradigms like M2M, CPS and WoT

Module – 2

IoT Sensing: Introduction, Sensors, Classification, functional block, Characteristics, SensorialDeviations, Sensing. Types, Sensing Considerations,

IoT Actuators: Actuator Types, Actuator Characteristics.

IoT Connectivity: Protocol Standardization for IoT – Efforts, SCADA and RFID Protocols –Issueswith IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4,

(08 Hours)

Self- Study: Study on IoT Connectivity Technologies Zigbee, LoRa, Bluetooth, WiFi, NFC etc.

Module – 3

Physical Computing Devices: Introduction to Edgenode, Edge computing note, Gateways, Server, Cloud Platform, Arduino UNO Board Layout, Fundamentals of Arduino Programming, RaspberryPi Board Hardware Layout, Operating Systems on RaspberryPi, Programming RaspberryPi with Python, BeagleBone and ESP 32.

IoT Processing: Data Format, Structured Data, Unstructured Data, Processing Topologies and importance.

Hands-on: Demonstration of various physical computing devices.

(09 hours)

Self- Study: Study on IoT device design and selection consideration

Module – 4

ASSOCIATED TECHNOLOGIES:

Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service.

Fog computing: Introduction, essential characteristics, Fog Nodes and deployment, Architecture,Fog Computing in IoT

Hands-on: Demonstration of various sensor and actuators.

(08 hours)

Self- Study: Study on selected applications of Fog Computing

Module – 5

IoT Analytics – Introduction to Machine learning (ML), Advantages of ML, Challenges in ML,Types of ML, List of ML Algorithms

IoT Case Studies: Components, Architecture Advantages and risk of (i) Agricultural IoT (ii) Vehicular IoT (iii) Healthcare IoT

(08 hours)

Self- Study: Study on evolution of new IoT paradigms.

Course Outcomes:

The students will be able to:

CO1. Assess the genesis and impact of IoT applications, architectures in real world scenario

CO2. Compare various application protocols required for implementation of IoT in Industry

CO3. Evaluate sensor technologies and physical computing devices for sensing real world Entities and deploy IoT systems in various applications

CO4. Develop solutions for real world problems by diverse methods of deploying smart objects/devices through IoT platform

Suggested Learning Resources:

Textbooks:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge UniversityPress 2021.

References:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014.

Web links and Video Lectures (e-Resources):

1. https://archive.nptel.ac.in/courses/106/105/106105166/

DEPARTMENT OF MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)

Waste handling Management (0:0:1) 1
(Common to all Branches)
(Effective from the academic year 2022-23)

Course Code	**BME306D**	Semester	**III**
Teaching Hours/Week (L: T:P: S)	3:0:0:0	CIE Marks	50
Total Hours of Pedagogy	40	SEE Marks	50
Credits	03	Total Marks	100
Examination type (SEE)	**Theory**	Exam Hours	03

Course objectives: To make students to understand about;

1. Waste generation & effects.
2. Solid waste management & challenges.
3. Hazordous waste management & challenges.
4. Innovative methods in practice to handle waste & its effects.
5. Laws governing the waste management.

Module-1

Introduction to waste management: Importance, methods of logistics, human components, technological components- waste handlingequipment and technology, steps in waste management logistics. Waste collection system and organization: Environmental aspects of waste collection, role of publicauthority and private sector in waste collection, organizing collection of residential waste, fee schemes, public awareness programs.

Module-2

Engineering Systems for Solid Waste Management: Characteristics of solid waste, types of solid waste, Processing and Treatment of Solid Waste; Mechanical Treatment Material Recovery Facility, Recycling and Recovery, Types of Material Recovery Facilities, Biological Treatment & Biological methods for waste processing; Composting & methods. Biomethanation, Biodeisel, Biohydrogen, Mechanical Biological Stabilization, ThermalTreatment Incineration, Residues and its utilisation, co-combustion, Pyrolysis, Gasification, Refuse Derived Fuel, solid recovered fuel.
Engineering Disposal of SW: Dumping of solid waste; sanitary land fills – site selection,.

Module-3

Hazardous Waste Management: Hazardous waste definition, sources, identification and classification, Characteristics, Industrial waste & Plastic Waste; sources, environmental effects, challenges in handling Biomedicalwaste; Introduction to biomedical wastes, sources, classification, collection, segregation, treatment and disposal, E- waste; characteristics, generation, collection, transport, recycling and disposal, Effects on the society and environment, Transportation andDisposal, recycling and reuse, Nuclear waste; Characteristics, Types, Power reactors, Refinery and fuel fabrication wastes, Health and environmental effects, Decommissioning of Nuclear power reactors Hazardous waste landfills, Site selections.

Module-4

Innovations in waste management: Global and Indian Context, recycling, reuse, energy production, land filling, remediation of hazardous waste contaminated sites. Revenue models, Developing Networks, Entrepreneurship activities, Best practices in India and Abroad- Case studies, Waste management and waste handlingentrepreneurs in India and other countries, Case studies of different municipalities waste handling techniques, domestic composting, medium & large scale composting,

Centralised composting.

Module-5

Waste Management Laws in India: The Environmental Protection Act, The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008, The Plastic Waste (Management and Handling) Rules, 2011, Bio-Medical Waste (Management and Handling) Rules, 1998, The E-Waste (Management and Handling) Rules, 2011, The Batteries (Management and Handling) Rules, 2001. Duties of constitutional bodies and Ministries.

Course outcome:

At the end of the course, the student will be able to:Co1.
Identify & segregate the waste.

Co2. Formulate the appropriate waste segregation, collection & disposal system Generate a report onwaste management challenges.

CO3. Select a remedial measure for environmental & living being protection.

CO4. Exercise the constitution laws as a citizen.

Suggested Learning Resources:

Textbooks:

1. Tchobanoglous G and Kreith F, Handbook of Solid Waste Management, McGraw-HillEducation, 2002, 2nd Edition
2. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors, John Wiley andSons,1998, 1st Edition.
3. Hitt, M.A, Hoskisson, R.E, Ireland, R.D, Strategic Management, (2016)., Cengage Learning, India.
4. John Pichtel, Waste Management Practices: Municipal, Hazardous and Industrial, CRCPress,2014, 2nd Edition

Reference books:

1. John Pichtel, Waste Management Practices: Municipal, Hazardous and Industrial, (2014)., 2ndEd., CRC Press, USA.
2. Letcher, T.M., Vallero, D.A. Waste: A Handbook for Management, (2011)., 1st Ed,AcademicPress, USA.
3. National Environment Policy, 2006, Ministry of Environment and Forests, Government ofIndia, Approved by the Union Cabinet on 18 May, 2006 2,
4. Innovation and Entrepreneurship, Peter Drucker, (2012)., Routledge Publishers, England UK

Web links and Video Lectures (e-Resources):
1. https://nptel.ac.in/content/storage2/courses/105106056/Introduction.pdf 2. https://nptel.ac.in/courses/105/103/105103205/ 3. http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php 4. https://nptel.ac.in/courses/105/103/105103205/ 5. https://nptel.ac.in/courses/120/108/120108005/

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)
(Common to all branches)

Social Connect and Responsibility
(Effective for 2022 Scheme)

Course Code	**BSCK307**	Semester	**III**
Teaching Hours/Week (L: T:P)	0:0:2	CIE Marks	**100**
Total Number of Contact Hours	26 Hours	SEE Marks	-
Credits	01 - Credit	Exam Hours	-

Course objectives: The course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Social Connect & Responsibility –All Modules Activity Based Learning

Module-1

Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a groupof BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.
(04Hours)

Module-2

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog anddocumentary on evolution and practice of various craft forms - – Objectives, Visit, case study, report, outcomes. **(05 Hours)**

Module-3

Organic farming and waste management: Usefulness of organic farming, wet waste managementin neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes. **(06 Hours)**

Module-4

Water conservation: Knowing the present practices in the surrounding villages and implementationin the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.
(06Hours)

Module-5

Food walk: City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes. **(05Hours)**

Course outcomes (Course Skill Set): At the end of the course, the student will be able to:CO1: Communicate and connect to the surrounding.

CO2: Create a responsible connection with society.

CO3: Involve in the community in general in which they work.

CO4: Notice the needs and problems of the community and involve them in problem –solving.

CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge infinding practical solutions to individual and community problems.

CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

ACTIVITIES: Jamming session, open mic, and poetry: Platform to connect to others. Share the storieswith others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing,one-act play, art-painting, and fine art.

PEDAGOGY: The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS: The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem

Duration: A total of 26 hours engagement per semester is required for the 3rd semester of the B.E./B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors have to design the evaluation system as per VTU guidelines of scheme & syllabus**.**

Guideline for Assessment Process: Continuous Internal Evaluation (CIE): After completion ofthe course, the student shall prepare with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connectInformation/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below

Excellent:	80 to 100
Good:	60 to 79

Satisfactory: 40 to 59 Unsatisfactory and fail: <39

Special Note: **NO Semester End Examination (SEE) – Completely Practical and activities-based evaluation**

Pedagogy – Guidelines: It may differ depending on local resources available for the study as wellas environment and climatic differences, location and time of execution.

Sl No	**Topic**	**Group size**	**Location**	**Activity execution**	**Reporting**	**Evaluation of the Topic**
1.	**Plantation and adoption ofa tree**	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc	Site selection /Proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
2.	**Heritage walk and crafts corner**	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/public associations/Government Schemes officers/ campus etc	Site selection /Proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
3.	**Organic farming and waste management**	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty

4.	**Water conservation & conservation techniques**	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers / campus etc	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
5.	**Food walk: Practices in society**	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluationas per the rubrics of scheme and syllabus by Faculty

Plan of Action (Execution of Activities)

Sl.NO	Practice Session Description
1	**Lecture session in field to start activities**
2	**Students Presentation on Ideas**
3	**Commencement of activity and its progress**
4	**Execution of Activity**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Case study-based Assessment, Individual performance**
9	**Sector/ Team wise study and its consolidation**
10	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work).
Field Visit, Plan, Discussion	10 Marks	

Commencement of activities and its progress	20 Marks	• The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Case study-based Assessment Individual performance with report	20 Marks	
Sector wise study & its consolidation 5*5 = 25	25 Marks	
Video based seminar for 10 minutes by each student at the end of semester with Report. **Activities 1 to 5, 5*5 = 25**	25 Marks	
Total marks for the course in eachsemester	**100 Marks**	
For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.		
Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.		

B.E MECHANICAL ENGINEERING
(**Choice Based Credit System (CBCS)**

PYTHON PROGRAMMING LAB (0:0:1) 1
(Effective from the academic year 2022-23)

Course Code	**BME358A**	Semester	**III**
Teaching Hours/Week (L: T:P)	0:0:2	CIE Marks	50
Total Number of Contact Hours	26	SEE Marks	50
Examination (SEE)	**Practical**	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To understand the problem-solving approaches.
2. To learn the basic programming constructs in Python.
3. To practice various computing strategies for Python-based solutions to real world problems.
4. To use Python data structures – lists, tuples, dictionaries.
5. To do input/output with files in Python.

Preamble: Introduction to python programming

PART A

1. Implementing programs using Functions.:
   a) Write a python program to find Factorial of a Number.
   b) Write a python program to find largest number in a list.
   c) Write a python program to find area of shape).
2. NESTED LISTS as a python:
   a) Write a program to read a 3 X 3 matrix and find the transpose of two 3 X 3 matrix.
   b) Write a program to read and addition, subtraction of two 3 X 3 matrices.
   c) Write a program to read and multiplication of two 3 X 3 matrices.
3. NumPy Library:
   a) Write a python program to find rank, determinant, and trace of an array.
   b) Write a python program to find eigen values of matrices.
   c) Write a python program to solve a linear matrix equation, or system of linear scalar equations.
4. Scientific problems using Conditionals and Iterative loops:
   a) Python Program using conditional functions
   b) Python Program using Iterative functions

PART B

5. Implementing programs using Strings:
   a) Python Program to Check if a String is Palindrome or Not.
   b) Python Program to Reverse the words.
   c) Python Program to count the characters.
   d) Python Program to replacing characters.
6. File Operation:
   a) Write a python program for file handling.
   b) Write a python program for read and write the data from different types of files.
7. Graphics:
   a) Write functions to draw triangle, rectangle, polygon, circle, and sphere.

b)Design a Python program using the Turtle graphics library to construct a turtle bar chartrepresenting the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed

8.Create a colour image using NumPy in Python.

Course Outcomes:

the student will be able to:

CO1: Develop algorithmic solutions to simple computational problems.

CO2: Develop simple Python programs using Conditionals and Iterative loops.

CO3: Develop and execute simple Python programs for string operations.

CO4: Develop and execute simple Python programs for file operations.

CO5: Develop compound data using Python data structures.

Suggested Learning Resources

Textbooks:

1. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
2. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press, 2021
3. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
4. Eric Matthes, "Python Crash Course, A Hands – on Project Based Introduction to Programming",2nd Edition, No Starch Press, 2019.
5. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)

INTRODUCTION TO VIRTUAL REALITY (0:0:1) 1
(Common to all Branches)
(Effective from the academic year 2022-23)

Course Code	**BME358B**	Semester	**III**
Teaching Hours/Week (L: T:P)	0-2-0	CIE Marks	50
Total Hours of Pedagogy	30	SEE Marks	50
Credits	01	Total Marks	100
Examination nature (SEE)	**Theory**	Exam Hours	01

Course objectives:

1. Describe how VR systems work and list the applications of VR.
2. Understand the design and implementation of the hardware that enables VR systems to be built.
3. Understand the system of human vision and its implication on perception and rendering.
4. Explain the concepts of motion and tracking in VR systems.
5. Describe the importance of interaction and audio in VR systems.

Module-1

Introduction to Virtual Reality : Defining Virtual Reality, History of VR, Human Physiology andPerception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface tothe Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Teaching- Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Module-2

Representing the Virtual World : Representation of the Virtual World, Visual Representation in VR, AuralRepresentation in VR and Haptic Representation in VR

Teaching- Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Module-3

The Geometry of Virtual Worlds &The Physiology of Human Vision: Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, ViewingTransformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.

Teaching- Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Module-4

Visual Perception & Rendering: Visual Perception - Perception of Depth, Perception of Motion, Perceptionof Color, Combining Sources of Information

Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions,Improving Latency and Frame Rates

Teaching- Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Module-5

Motion & Tracking: Motion in Real and Virtual Worlds- Velocities and Accelerations, The VestibularSystem, Physics in the Virtual World, Mismatched Motion and Vection

Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies

Teaching- Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Course outcome (Course Skill Set)

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

CO1: Describe how VR systems work and list the applications of VR.

CO2: Demonstrate the design and implementation of the hardware that enables VR systems to be built.

CO3: Understand the system of human vision and its implication on perception and rendering.

CO4: Explain the concepts of motion and tracking in VR systems.

CO5: Describe the importance of interaction and audio in VR systems.

Suggested Learning Resources:

Text Books

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman andAlan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002.

Reference Books:

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces,Theory and Practice", Addison Wesley, USA, 2005.
3. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India,2003.

1. http://lavalle.pl/vr/book.html
2. https://nptel.ac.in/courses/106/106/106106138/
3. https://www.coursera.org/learn/introduction-virtual-reality.

DEPARTMENT OF MECHANICALENGINEERING
Choice Based Credit System (CBCS)

SPREAD SHEET FOR ENGINEERS (0:0:1) 1
(Common to all Branches) (Effective from the academic year 2022-23

Course Code	**BME358C**	Semester	**III**
Teaching Hours/Week (L:T:P)	0:0:2	CIE Marks	50
Total Hours of Pedagogy	15 sessions	SEE Marks	50
Credits	01	Total Marks	100
Examination type (SEE)	**Practical**	Exam Hours	03

Course objectives:

1. To create different plots and charts
2. To compute different functions, conditional functions and make regression analysis
3. To carryout iterative solutions for roots, multiple roots, optimization and non-linear regressionanalysis
4. To carryout matrix operations
5. To Understand VBA and UDF
6. To understand VBA subroutines and Macros
7. To carryout numerical integration and solving differential equations using different methods

Sl.NO	Experiments
1	Charting: Create an XY scatter graph, XY chart with two Y-Axes, add error bars to yourplot,create a combination chart
2	Functions: Computing Sum, Average, Count, Max and Min, Computing Weighted Average, Trigonometric Functions, Exponential Functions, Using The CONVERT Function toConvert Unitsw
3	Conditional Functions: Logical Expressions, Boolean Functions, IF Function, Creating aQuadratic Equation Solver, Table VLOOKUP Function, AND, OR and XOR functions.
4	Regression Analysis: Trendline, Slope and Intercept, Interpolation and Forecast, The LINEST Function, Multilinear Regression, Polynomial Fit Functions, Residuals Plot,Slope and Tangent, Analysis ToolPack.
5	Iterative Solutions Using Excel: Using Goal Seek in Excel, Using The Solver To Find Roots,Finding Multiple Roots, Optimization Using The Solver, Minimization Analysis, NonLinearRegression Analysis.
6	Matrix Operations Using Excel: Adding Two Matrices, Multiplying a Matrix by a Scalar, Multiplying Two Matrices, Transposing a Matrix, Inverting a Matrix and SolvingSystem ofLinear Equations.
7	VBA User-Defined Functions (UDF): The Visual Basic Editor (VBE), The IF Structure,The Select Case Structure, The For Next Structure, The Do Loop Structure, Declaring Variables andData Types, An Array Function The Excel Object Model, For Each Next Structure.

8	VBA Subroutines or Macros: Recording a Macro, Coding a Macro Finding Roots byBisection,Using Arrays, Adding a Control and Creating User Forms.
	Demonstration Experiments (For CIE)
9	Numerical Integration Using Excel: The Rectangle Rule, The Trapezoid Rule, TheSimpson'sRule, Creating a User-Defined Function Using the Simpson's Rule.
10	Differential Equations: Euler's Method, Modified Euler's Method, The Runge Kutta Method,Solving a Second Order Differential Equation

Course outcomes (Course Skill Set):

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

1. Create different plots and charts
2. Compute different functions, conditional functions and make regression analysis
3. Carryout iterative solutions for roots, multiple roots, optimization and non-linear regressionanalysis
4. Carryout matrix operations
5. Understand VBA and UDF, VBA subroutines and Macros
6. Carryout numerical integration and solving differential equations using different methods

Suggested Learning Resources:

Excel Resources - 600+ Self Study Guides, Articles & Tools (wallstreetmojo.com)

https://www.ictlounge.com/html/year_7/esafety_part7.htm

McFedries PaulMicrosoft Excel 2019 Formulas And Functions Microsoft Press, U.S, 2019 Edition

DEPARTMENT OF MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)

Tools in Scientific Computing (0:0:1) 1
(Effective from the academic year 2022-23)

Course Code	**BME358D**	Semester	**III**
Teaching Hours/Week (L:T:P)	0:0:2	CIE Marks	50
Total Hours of Pedagogy	15 Sessions	SEE Marks	50
Examination nature (SEE)	**Practical**	Exam Hours	03

Course objectives:

1. To learn the fundamentals of problem-solving using MATLAB/MATHCAD and go plot graphs usingOrigin software
2. To introduce programming for curve fitting and solving both linear and nonlinear equations.
3. To understand the concept of approximate methods and recognize their significance in computing.

Sl.NO	**Experiments**
1	Develop a program to find the eigenvalues and eigenvectors of a square matrix
2	Develop a user-friendly program for the Newton-Raphson method for solving simultaneousnonlinear equations
3	Develop a user-friendly program to find solution of simultaneous linear equations usingmatrix methods
4	Develop a program to find the equation that best fits for the given set of points using any ofthe curve fitting techniques
5	Develop a program to compute the area under the given curve described by the function usingnumerical techniques
6	Develop a user-friendly program for the thick or thin cylinders subjected to internaland external loads, determine the stresses developed within the cylinder and plot the variation ofstresses
7	Develop a program to find the principal stresses and their associated directions for agiven state of stress described by the components of stress in three dimensions (σxx, σyy, σzz, σxy,σxz, σyz),
8	Develop a user-friendly program for plotting the Mohr's circle for the given 2D stress stateand determine the principal stresses and directions of principle stress
	Demonstration Experiments (For CIE)
9	Develop a program to find the multiplication and inverse of a square matrix
10	Develop a program to find and plot the response of spring-mass-dashpot system subjected tohormonic excitation.
11	Develop a program to find the roots of a quadratic equation using numerical methods
12	Develop a program to find the solution of differential equation using approximate methods

Course outcomes (Course Skill Set):

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

1. Understand the fundamentals of programming in scientific computations.
2. Develop programming for curve fitting and solving both linear and nonlinear equations.
3. Apply the concept of approximate methods and recognize their significance in computing.
4. Apply MATLAB/MATHCAD/FORTRAN/PYTHON tools, etc., for solving engineering problems

Suggested Learning Resources:

1.Steven C.Chapra, Applied Numerical Methods with MATLAB for Engineers andScientists, Edition 3, McGraw-Hill, 2012

2.Steven C. Chapra, Raymond P. Canale, Numerical methods for engineers, 5th fifthedition,2006, McGraw-Hill Higher Education, Boston, 2006

3.Raj Kumar Bansal,MATLAB and Its Applications in Engineering et.al 2009, Pearson Education,

Department of Humanities and Social Sciences
Choice Based Credit System (CBCS)

National Service Scheme (NSS)
(Common to all branches)
(Effective for the 2022 scheme)

Course Code	**BNSK359**	Semester	III to IV
Teaching Hours/Week (L:T:P)	0:0:2	CIE Marks	100
Total Number of Contact Hours	26	SEE Marks	-
Examination pattern (CIE)	Theory + Practical	Exam Hours	-

Mandatory Course (Non-Credit)
(Completion of the course shall be mandatory for the award of degree)

Course Objectives: National Service Scheme (NSS) will enable the students to:

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Module – 1

Introduction to NSS

History and growth of NSS, Philosophy of NSS, Objectives of NSS, Meaning of NSS Logo, NSS Programs and activities, administrative structure of NSS, Planning of programs / activities, implementation of NSS programs / activities, National & State Awards for NSS College / Program Officer / Volunteers. **(04 Hours)**

Module – 2

Overview of NSS Programs

Objectives, special camping – Environment enrichment and conservation, Health, Family, Welfare and Nutrition program. Awareness for improvement of the status of women, Social Service program, production-oriented programs, Relief & Rehabilitation work during natural calamities, education and recreations, Selection of the problem to be addressed. (**04 Hours)**

Module – 3

NSS Activities - Group Contributions to Society / community (Activity based Learning)

Organic Farming, Indian agriculture (Past, Present, Future) Connectivity for marketing, Waste management– Public, Private and Govt. organization, 5 R's. Water conservation techniques – role of different stakeholders – implementation, preparing an actionable business proposal for enhancing the village income and approach for implementation. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.

(06 Hours)

Module – 4

NSS National Level Activities for Society / Community at large (Activity based Learning)

Developing Sustainable Water management system for rural areas and implementation approaches. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc

(**06 Hours)**

Module – 5

NSS Individual Activities for Local Voice (Activity based learning)

Govt. school Rejuvenation and helping them to achieve good infrastructure, Plantation and adoption of plants. Know your plants. Spreading public awareness under rural outreach programs, National integration and social harmony events. **(06 Hours)**

Course outcomes (Course Skill Set):

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

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools

Assessment Details

Weightage	**CIE – 100%**
Presentation -1 Selection of topic, PHASE-1	20 Marks
Commencement of activity and its progress – PHASE – 2	20 Marks
Case Study based Assessment – Individual performance	20 Marks
Sector wise study and its consolidation	20 Marks
Video based seminar for 10 minutes by each student at the end of the course with Report	20 Marks

Suggested Learning Resources:

Books:

1. NSS Course Manual**,** Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
Choice Based Credit System (CBCS)

Sports
(Common to all Branches)
(Effective for the 2022 scheme)

Course Code	**BPEK359**	Semester	**III to IV**
Teaching Hours/Week (L: T:P)	**0:0:2**	CIE Marks	**100**
Total Number of Contact Hours	**26**	SEE Marks	**--**
Examination pattern (CIE)	**Theory + Practical**	Exam Hours	**--**

Mandatory Course (Non-Credit)
(Completion of the course shall be mandatory for the award of degree)

Course Objectives: The course will enable students to

1. Develop a healthy life style.
2. Acquire Knowledge about various stages of sports and games.
3. Focus on modern technology in sports.

Module – 1

Introduction of the game: Aim of sports and games, Brief history of the game, Nature of the game, Terminology & Modern trends of the game, Fitness & Skill tests along with Game Performance.

(06 Hours)

Module – 2

Offensive and Defensive Techno Tactical Abilities: Fitness, Fundamentals & Techniques of the game with the implementation of Biomechanics, Tactics- Drills for the Techno Tactical abilities, Individual and Group, Miner games- to implement the Techniques, Tactics and Motor abilities.

(05 Hours)

Module – 3

Team tactics and Rules of the Game: Rules and Regulations of the Game: Game rules as well as sequence of officiating, Team tactics: Offensive and Defensive team strategies and scrimmages, Practice Matches: among the group, Analysis of Techno Tactical abilities: Correction and implementation of skills and Sports Injuries and rehabilitation: First aid, PRICE treatment,

(05 Hours)

Module – 4

Sports Training: Introduction of Sports Training, Principles of Sports performance, how to increase and sustain the sports performance, Training Load & Recovery- How to increase the training load (volume/Intensity) and means and methods for Recovery, Periodization: Shorts, Medium and Long term, Physiological changes: Changes in Lung capacity, heart beats etc…

(05 Hours)

Module – 5

Organization of Sports Event: Tournament system, Planning and preparation for the competition, Ground preparation and Equipment's, Organizing an event among the group.

(05 Hours)

The above 5 modules are common to all the sports events / games, we are offering the following games**:**
1. Baseball, 2. Kabaddi, 3. Table Tennis, and 4. Volleyball.

Course outcomes:

The students will be able to:

1 Understand the importance of sports and games, inculcate healthy habits of daily exercise & fitness, Self-hygiene, good food habits, Create awareness of Self-assessment of fitness.

2 Develops individual and group techno tactical abilities of the game.

3 Increases the team combination and plan the strategies to play against opponents.

4 Outline the concept of sports training and how to adopt technology to attain high level performance.

5 Summarize the basic principles of organising sports events and concept of technology implemented to organise competitions in an unbiased manner.

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation and video analysing.
- Practical classes in outdoor and indoor as per requirement.

CIE: 100 Marks

- CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.
- CIE 2 for 60 marks – A practical test conducted at the end of the semester in which the student has to give fitness and skill tests and his performance in game will be assessed.

Textbooks

1. Barbara Bushman, "ACSM's complete guide to Fitness & Health", 2011, Human Kinetics USA
2. **Pankaj Vinayak Pathak, "*Sports and Games - Rules and Regulation*", 2019, Khel Sahitya Kendra.**
3. Hardayal Singh, *"Sports Training, General Theory & Methods"*, 1984 "Netaji Subhas, National Institute of Sports".
4. Keith A. Brown, "International Handbook of Physical Education and Sports Science", 2018, (5 Volumes) Hardcover.

References

1. Tudor O Bompa,*" Periodization Training for Sports*", 1999, Human Kinetics, USA
2. Michael Boyle, "New Functional Training for Sports" 2016, Human Kinetics USA
3. Michael Kjaer, Michael Rogsgaard, Peter Magnusson, Lars Engebretsen & 3 more, "Text book of Sports Medicine: Basic Science and Clinical Aspects of Sports Injury and Physical Activity", 2002, Wiley Blackwell.
4. Scott L. Delp and Thomas K. Uchida, "Biomechanics of Movement: The Science of Sports, Robotics, and Rehabilitation", 2021, The MIT Press
5. MCARDLE W.D. "Exercise Physiology Nutrition Energy And Human Performance" 2015, LWW IE (50)

Department of Humanities and Social Sciences
Choice Based Credit System (CBCS)

Yoga
(Common to all Branches)
(Effective for the 2022 scheme)

Course Code	**BYOK359**	Semester	**III to IV**
Teaching Hours/Week (L:T:P)	**0:0:2**	CIE Marks	**100**
Total Number of Contact Hours	**26**	SEE Marks	**-**
Examination pattern (CIE)	**Theory + Practical**	Exam Hours	**-**

Course Objectives:

This course will enable students to:

6. Understand the importance of practicing yoga in day-to-day life.
7. Be aware of therapeutic and preventive value of Yoga.
8. Have a focussed, joyful and peaceful life.
9. Maintain physical, mental and spiritual fitness.
10. Develop self-confidence to take up initiatives in their lives.

Module – 1

Introduction to Yoga: Introduction, classical and scientific aspects of yoga, Importance, Types, Healthy Lifestyle, Food Habits, Brief Rules, Sithalikarana Practical classes. **(04 Hours)**

Module – 2

Physical Health: Introduction, Pre-requisites, Asana-Standing, Sitting, Supine and Prone, Practical classes. **(06 Hours)**

Module – 3

Psychological Health: Introduction Thought Forms, Kriya (Kapalabhati), Preparation to Meditation, Practical classes. **(06 Hours)**

Module – 4

Therapeutic Yoga: Mudra Forms, Acupressure therapy, Relaxation techniques Practical classes. **(06 Hours)**

Module – 5

Spirituality & Universal Mantra: Introduction, Being Human, Universal Mantra, Universal LOVE, Benefits of practice of Spirituality in day-to-day life, practical classes. **(04 Hours)**

Course Outcomes:

Students will be able to:

1. Understand the requirement of practicing yoga in their day-to-day life.
2. Apply the yogic postures in therapy of psychosomatic diseases
3. Train themselves to have a focussed, joyful and peaceful life.
4. Demonstrate the fitness of Physical, Mental and Spiritual practices.
5. Develops self-confidence to take up initiatives in their lives.

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools

CIE: 100 Marks

- CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.
- CIE 2 for 60 marks – A practical test conducted at the end of the semester in which the student have to perform asanas.

Textbooks

1. George Feuerstein: The yoga Tradition (Its history, literature, philosophy and practice.)
2. Sri Ananda: The complete Book of yoga Harmony of Body and Mind. (Orient paper Backs: vision Books Pvt.Ltd., 1982.
3. B.K.S Iyenkar: Light on the Yoga sutras of patanjali (Haper Collins Publications India Pvt.,Ltd., New Delhi.)
4. Science of Divinity and Realization of Self – Vethathiri Publication, (6-11) WCSC, Erode

References

1. Principles and Practice of Yoga in Health Care, Publisher: Handspring Publishing Limited, ISBN: 9781909141209, 9781909141209
2. Basavaraddi I V: Yoga in School Health, MDNIY New Delhi, 2009
3. Dr. HR. Nagendra: Yoga Research and applications (Vivekanda Kendra Yoga Prakashana Bangalore)
4. Dr. Shirley Telles: Glimpses of Human Body (Vivekanda Kendra Yoga Prakashana Bangalore)

Web resources

Web links and Video Lectures (e-Resources): Refer links

1. https://youtu.be/KB-TYlgd1wE
2. https://youtu.be/aa-TG0Wg1Ls

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
Choice Based Credit System (CBCS)

Course: Music
(Common to all Branches)
(Effective for the 2022 Scheme)

Course Code	**BMUK359**	Semester	III to VI
Teaching Hours/Week (L: T:P)	0:0:2	CIE Marks	100
Total Number of Contact Hours	26	SEE Marks	-
Examination pattern (CIE)	Theory + Practical	Exam Hours	-

Mandatory Course (Non-Credit)
(Completion of the course shall be mandatory for the award of the Degree)

Course Objectives:

The course will enable the students to:

1. Identify the major traditions of Indian music, both through notations andaurally.
2. Analyze the compositions with respect to musical and lyrical content.
3. Demonstrate an ability to use music technology appropriately in a variety ofsettings.

Module – 1

Preamble: Contents of the curriculum intend to promote music as a language to developan analytical, creative, and intuitive understanding. For this the student must experiencemusic through study and direct participation in improvisation and composition.

Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela. **(03 Hours)**

Module – 2

Compositions: Introduction to the types of compositions in Carnatic Music - Geethe, JathiSwara, Swarajathi, Varna, Krithi, and Thillana, Notation system. **(03 Hours)**

Module – 3

Composers: Biography and contributions of Purandaradasa, Thyagaraja, Mysore Vasudevacharya. **(03 Hours)**

Module – 4

Music Instruments: Classification and construction of string instruments, wind instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments **(03 Hours)**

Module – 5

Abhyasa Gana: Singing the swara exercises (Sarale Varase Only), Notation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethein Malahari, and one Jathi Swara, One Nottu Swara OR One krithi in a Mela raga, a patriotic song **(14 Hours)**

Course Outcomes (COs):

The students will be able to:

CO1: Discuss the Indian system of music and relate it to other genres (CognitiveDomain)
CO2: Experience the emotions of the composer and develop empathy (AffectiveDomain)
CO3: Respond to queries on various patterns in a composition (Psycho-Motor Domain)

Teaching Practice:

- Classroom teaching
- ICT – PowerPoint Presentation
- Audio & Video Visualization Tools

CIE: 100 Marks

- **CIE 1** for 40 marks – A theory paper which is MCQ / Descriptive conductedduring the semester
- **CIE 2** for 60 marks – A practical test conducted at the end of the semester in which the student has to recite one Sarale Varase mentioned by the examiner inthree speeds. Sing / Play the Geethe in Malahari. Singing / Playing Jathi Swara /Krithi.

Textbooks

1. Vidushi Vasantha Madhavi, "Theory of Music", Prism Publication, 2007.
2. T Sachidevi and T Sharadha (Thirumalai Sisters), Karnataka Sangeetha Dharpana - Vol. 1 (English), Shreenivaasa Prakaashana, 2018.

References

1. Lakshminarayana Subramaniam, Viji Subramaniam, "Classical Music of India: APractical Guide", Tranquebar 2018.
2. R. Rangaramanuja Ayyangar, "History of South Indian (Carnatic) Music", Vipanci Charitable Trust; Third edition, 2019.
3. Ethel Rosenthal, "The Story of Indian Music and Its Instruments: A Study of thePresent and a Record of the Past", Pilgrims Publishing, 2007.
4. Carnatic Music, National Institute of Open Schooling, 2019.

Department of Humanities and Social Sciences
Choice Based Credit System (CBCS)
SEMESTER – III

English Communications Skill I
(Common to all Branches, for Lateral Entry Diploma students)
(Effective from the academic year 2024-2025)

Course Code	BENGDIP1	CIE Marks	100
Teaching Hours/Week (L: T:P)	0:0:2 - NCMC	SEE Marks	-
Total Number of Lecture Hours	26	Total Marks	100

Course objectives:

This course will enable students to

1. Familiarise with basic English Grammar and Communication Skills in general.
2. Identify the nuances of phonetics, intonation and enhance pronunciation skills
3. Enhance English vocabulary and language proficiency for better communication skills.
4. Learn about Techniques of Information Transfer through presentation

Module – 1: Fundamentals of Communication

Introduction, Communication-an overview, Definition of communication, Features of successful professional communication, Importance of communication, Purpose of professional communication, Rule of critical and creative thinking in effective communication, Role of emotions in communication, Role of Inter-Cultural Communication, Different forms of communication, Communication network in an organization, Barriers to communication, Some remedies.

Non-verbal communication: Introduction, Body language, Paralinguistic features, Proxemics/ Space distance, Haptics. **(4 Hours)**

Module – 2: Grammar Essentials and Phonetics

Grammar: Essentials and Applications

Introduction, Parts of Speech, Articles and Prepositions, Modals, Sentences and their types, Subject-verb, Concord, using tenses, Moods of Verbs, Active passive voice, Direct indirect speech, Clause and its types, Using non-Finites.

Basic of Phonetics: Introduction, Reasons for incorrect pronunciations, received pronunciation, Misconceptions about sounds, Transcriptions, Problems of Indian English, Syllables, Word stress, How to transcribe, Weak forms, Intonation and rhythm, Difference between British American and Indian spoken English**.** (**6 Hours)**

Module – 3: Reading and Listening Skills

Reading skills: Introduction, need for developing efficient reading skills, Benefits of effective reading, Speed of reading, four basic steps to effective reading, overcoming common obstacles, Types, Approaches to efficient reading, Tips for effective reading, employing different reading skills, Understanding the authors point of view, Identifying the central idea, inferring lexical and contextual meaning, employing discourse analysis, Worked out passages.

Listening skills: Introduction, Listening is an art, Listening vs hearing, Poor vs effective listening, Advantages of good listening, Process of listening, Types of listening. Intensive listening vs extensive listening, Barriers to effective listening, five steps of active listening techniques for effective listening, Listening and not taking. (**8 Hours)**

Module – 4: Paragraphs and Precis Writing

Introduction, precise, Summary, Abstract, Synopsis, Paraphrasing, Art of condensation, Some working principles, Seven step ladder to writing an effective precis, Writing precise for given passages, Structure of a paragraph, Construction of a paragraph, Features of a paragraph, Descriptive writing techniques, Augmentative paragraph, Analytical paragraph. **(4 hours)**

Module – 5: Professional Presentations and Writing

Professional Presentations: Introduction, combating stage fright, preparing PPT slides, Describing objects, Situations and people, Individual and group presentations, Delivering JAMs

Essays, Letters, Resumes: Introduction, Types of essays, Characteristic features of an essay, Stages in essay writing, Components comprising an essay, Essay writing-guiding principles, Business letters and resumes- Importance, Elements of structure, Layout. Business letters- Elements of style, Types of business letters, Resume preparation. **(4 Hours)**

Course Outcomes: The students will be able to:

1. Understand and apply basic English grammar for effective communication.
2. Identify the nuances of phonetics, intonation, and enhance pronunciation skills.
3. Understand and use all types of English vocabulary and language proficiency.
4. Enhance their knowledge about techniques of information transfer through presentations.

Textbooks

1. Meenakshi Raman and Sangeeta Sharma, Technical Communication Principles and Practice, Oxford Publications, 3rd Edition, 2015
2. Sanjay Kumar and Pushpa Lata, Communication Skills, Oxford University Press,
3. A Textbook of English Language Communication Skills, (ISBN-978-81-955465-2-7), Published by Infinite Learning Solutions, Bengaluru - 2022.

References

1. Gajendra Singh Chauhan, Technical Communication Cengage Learning India Pvt Limited, Latest Revised Edition, 2019
2. Michael Swan, Practical English Usage, Oxford University Press, 2016
3. N.P.Sudharshana and C.Savitha, English for Engineers, Cambridge University Press, 2018