ARMY INSTITUTE OF TECHNOLOGY, PUNE

Autonomous Institute

Affiliated to

Savitribai Phule Pune University,
Maharashtra, India

DEPARTMENT OF MECHANICAL ENGINEERING

National Education Policy (NEP)-2020 Compliant Curriculum

First Year B. Tech. in Mechanical Engineering (2025 Pattern)

(With effect from Academic Year 2025-26)

VISION OF THE INSTITUTE

To become a "Globally Recognised" technical institute providing world class education and research facilities to the wards of Defence personnel.

MISSION OF THE INSTITUTE

(a) Provide the right environment, to the wards of Defence personnel, for development of physical, intellectual, emotional and spiritual quotients, with a view to produce total quality engineers.

(b) Create an ecosystem which can foster the culture of research, innovation, creative thinking and higher studies.

(c) Develop an education system which creates entrepreneurs and technology leaders who are committed towards sustainable development of society and nation building.

CORE VALUES OF THE INSTITUTE

Excellence, Honesty, Integrity, Team Work, Continuous Learning and Innovation.

VISION OF THE DEPARTMENT

Emerge as a globally recognized provider of Mechanical Engineering education and solutions.

MISSION OF THE DEPARTMENT

M1. Provide an environment for developing intellectual, emotional, physical and spiritual quotients that are essential to produce total quality engineers.

M2. Establish a platform that fosters a culture of creativity, research, innovation and life-long learning.

M3. Become a center of excellence that creates technology leaders and entrepreneurs committed towards sustainable development of society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1. Provide sound foundation of mechanical engineering fundamentals to formulate, analyze and solve engineering problems.

PEO2. Enable students to lead and work as part of teams engaged in multi-disciplinary research and projects.

PEO3. Instill integrity, ethics and life skills in students to take on diverse roles.

PREFACE

The National Education Policy (NEP) 2020 has shown pathway to make India a global knowledge superpower. Army Institute of Technology (AIT) with its new Vision has already started working in that direction. As an important milestone, it has been conferred academic autonomy by UGC and SPPU and has prepared first ever curriculum under autonomy.

The Department of Mechanical Engineering at AIT Pune is committed to the effective and fruitful implementation of NEP 2020 in its true spirits emphasizing holistic and multidisciplinary education as per the directives of

Maharashtra government. It emphasizes a multidisciplinary approach, aiming to develop critical thinking and creativity, thereby contributing to the holistic development of individuals.

We are delighted to present the first-year engineering syllabus -2025 pattern, which has been meticulously designed in alignment with the NEP 2020 with effect from academic year 2025-26. This curriculum aims to provide students with a holistic approach to engineering education ensuring a strong foundation in Mathematics and Science courses. This curriculum also includes components of vocational and skill enhancement courses, Indian Knowledge System and Co-curricular courses to shape well-rounded engineers who can adapt to global demands. Also, this document provides information on the credit system, course contents, and examination and evaluation scheme along with guidelines to make best use of the curriculum designed.

The syllabus encourages experiential learning, where theoretical concepts are supported by practical laboratory sessions. It also promotes research and innovation, encouraging students to engage in projects from the early stages of their academic journey. I wish to thank all the Board of Studies members who contributed in designing this curriculum.

We believe that this syllabus, crafted with the essence of the NEP 2020, will equip our students with the necessary skills and knowledge to excel in their future endeavors. We look forward to embarking on this exciting academic journey with our students.

KNOWLEDGE AND ATTITUDE PROFILE (WK)

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAM OUTCOMES

PO1	**Engineering knowledge**	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	**Problem analysis**	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	**Design/Development of Solutions**	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).
PO4	**Conduct Investigations of Complex Problems**	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	**Engineering Tool Usage**	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	**The Engineer and The World**	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	**Ethics**	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	**Individual and Collaborative Team work**	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	**Communication**	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning.
PO10	**Project Management and Finance**	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	**Life-Long Learning**	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)
PSO1	**Program Specific Skill**	Ability to identify, formulate and solve real world engineering problems in three core streams of Mechanical Engineering namely, Design engineering, Thermal-fluids engineering and Manufacturing engineering
PSO2	**Program Specific Skill**	Ability to design, develop and test a cost effective and efficient system(s) for engineering application from concept to manufacture
PSO3	**Program Specific Skill**	Utilize industry-oriented software tools using Virtual and Robust engineering methods to design, optimize and develop product
PSO4	**Program Specific Skill**	Provide a platform to generate interest in futuristic areas such as Electrical Vehicles, Systems Engineering, Artificial Intelligence and Machine Learning, Energy Management, Additive Manufacturing and Automation

ABBREVIATIONS

ABC : Academic Bank of Credit

AEC : Ability Enhancement Course

AI : Artificial Intelligence

AIT : Army Institute of Technology

AWES : Army Welfare Education Society

BSC : Basic Science Course

CBCS : Choice Based Credit System

CCC : Co-Curricular Courses

CCE : Comprehensive Continuous Evaluation

CEP : Common Engineering Project

CO : Course Outcome

CP : Credit Points

ELC : Experiential Learning Courses

ESC : Engineering Science Course

FP : Field Project

GoM : Government of Maharashtra

HEI : Higher Education Institutions

INT : Internship

IKS : Indian Knowledge System

IQAC : Internal Quality Assurance Cell

MDM : Multidisciplinary Minor

MOOC : Massive Open Online Courses

MPUA : Maharashtra Public Universities Act, 2016

MSDE : Ministry of Skill Development and Entrepreneurship

MSFDA : Maharashtra State Faculty Development Academy

NAAC : National Assessment and Accreditation Council

NEP : National Education Policy

NSDC : National Skill Development Corporation

NSQF : National Skills Qualification Framework

NSS : National Service Scheme

NTA : National Testing Agency

OE : Open Elective

OJT : On Job Training

PCC : Program Core Course

PEC : Programme Elective Course

PO : Program Outcomes

PR : Practical

PRN : Permanent Registration Number

PRJ : Project

PSO : Program Specific Outcome

RM : Research Methodology

SPPU : Savitribai Phule Pune University

SSCs : Sector Skill Councils

TH : Theory

TU : Tutorials

VEC : Value Education Course

VSE : Vocational and Skill Enhancement Course

VC : Vice Chancellor

NEP 2020 Compliant Curriculum Structure

FIRST YEAR BTECH (MECHANICAL ENGINEERING)

SEMESTER I

(WEF AY 2025-26)

Level 4.5																
Course Code	Course Type	Course Name	Teaching Scheme (Hrs./week)				Examination Scheme and Marks						Credits			
			Lecture	Practical	Tutorial	Total	CIE	ESE	Term work	Practical	Oral	Total	Theory	Practical	Tutorial	Total
BCC25111A0A	BSC	Engineering Mathematics-I	3	-	-	3	50	50	-	-	-	100	3	-	-	3
BME25112A0A	BSC	Applied Science for Mechanical Engineering -I	3	-	-	3	50	50	-	-	-	100	3	-	-	3
BME25113A0A	ESC	Basic Mechanical Engineering	3	-	-	3	50	50	-	-	-	100	3	-	-	3
BEC25114A0A	ESC	Basic Electrical & Electronics Engineering	3	-	-	3	50	50	-	-	-	100	3	-	-	3
BCC25111A0C	BSC	Engineering Mathematics-I Tutorial	-	-	1	1	-	-	25	-	-	25	-	-	1	1
BME25112A0B	BSC	Applied Science for Mechanical Engineering -I Lab	-	2	-	2	-	-	25	-	-	25	-	1	-	1
BME25113A0B	ESC	Basic Mechanical Engineering Lab	-	2	-	2	-	-	25	-	-	25	-	1	-	1
BEC25114A0B	ESC	Basic Electrical & Electronics Engineering Lab	-	2	-	2	-	-	25	-	-	25	-	1	-	1
BCC25115A0X	VSEC & FP	Design Thinking & Ideation	1	2	-	2	50	-	25	-	-	75	1	1	-	2
BCC25116A0X	IKS	Indian Knowledge System	2	-	-	2	50	-	-	-	-	50	2	-	-	2
BCC25117A0X	VEC	Communication Skills & Human Values	1	-	1	2	50	-	25	-	-	75	1	1	-	2
BCC25118A0X	AC	Environmental Science	1	-	-	1	-	-	-	-	-	-	-	-	-	-
Total			**17**	**08**	**02**	**26**	**350**	**200**	**150**	**-**	**-**	**700**	**16**	**05**	**01**	**22**

NEP 2020 Compliant Curriculum Structure

FIRST YEAR BTECH (MECHANICAL ENGINEERING)

SEMESTER II

(WEF AY 2025-26)

Level 4.5																
Course Code	Course Type	Course Name	Teaching Scheme (Hrs./week)				Examination Schemeand Marks						Credits			
			Lecture	Practical	Tutorial	Total	CIE	ESE	Term work	Practical	Oral	Total	Theory	Practical	Tutorial	Total
BME25121A0A	BSC	Engineering Mathematics-II	3	-	-	3	50	50	-	-	-	100	3	-	-	3
BME25122A0A	BSC	Applied Science for Mechanical Engineering -II	3	-	-	3	50	50	-	-	-	100	3	-	-	3
BME25123A0A	ESC	Programming For Problem Solving Techniques	3	-	-	3	50	50	-	-	-	100	3	-	-	3
BME25124A0A	ESC	Engineering Drawing & Graphics	3	-	-	3	50	50	-	-	-	100	3	-	-	3
BME25121A0C	BSC	Engineering Mathematics-II Tutorial	-	-	1	1	-	-	25	-	-	25	-	-	1	1
BME25122A0B	BSC	Applied Science for Mechanical Engineering -II Lab	-	2	-	2	-	-	25	-	-	25	-	1	-	1
BME25123A0B	ESC	Programming For Problem Solving Techniques Lab	-	2	-	2	-	-	25	-	-	25	-	1	-	1
BME25124A0B	ESC	Engineering Drawing & Graphics Lab	-	2	-	2	-	-	25	-	-	25	-	1	-	1
BCC25125A0X	VSEC & PRJ	Design Thinking, Innovation & Prototyping	1	2	-	3	50	-	25	-	-	75	1	1	-	2
BCC25126A0X	HSSM	Entrepreneurship Skills and Professional Ethics	2	-	1	3	50	-	50	-	-	100	2	-	1	3
BCC25127A0X	CC	Life Skills & Liberal Learning	-	2	-	2	-	-	25	-	-	25	-	1	-	1
BCC25128A0X	AC	The Constitution of India	1	-	-	1	-	-	-	-	-	-	-	-	-	-
Total			**16**	**10**	**02**	**28**	**300**	**200**	**200**	**-**	**-**	**700**	**15**	**05**	**02**	**22**

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National Education Policy (NEP) Compliant Curriculum

Semester - I

First Year B. Tech. in Mechanical Engineering (2025 Pattern)

www.aitpune.com

Course Code: BCC25111A0A Course Name: Engineering Mathematics-I		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 03 Hrs/Week	**03**	**CIE (Theory): 50 Marks ESE (Theory): 50 Marks**

Prerequisite Courses, if any: 1. Elementary Mathematics 2. Elementary Calculus

Companion Course, if any:

Course Objectives: This course aims at enabling students,

- To understand and familiarize with concepts of linear algebra
- To understand and apply series expansion of functions
- To understand and apply basics of differential equations
- To understand and apply basics of vector differentiation
- To understand basics of vector integration and apply to solve engineering problems

Course Outcomes: On completion of the course, learner will be able to -

CO1: Understand and apply the concept of rank to find Eigen values and Eigen vectors

CO2: Determine the representation of a function in an infinite series using successive differentiation, Taylor's and McLaurin's theorems

CO3: Apply the effective mathematical tools for solving ordinary differential equations

CO4: Apply vector differentiations to **analyze** the vector fields

CO5: Apply vector integration and **analyze** the vector fields

Course Contents:

Unit I: Linear Algebra	**(08 Hrs)**
Rank, System of linear equations with applications, Linear dependence and independence of vectors, Linear transformations, Eigenvalues, Eigen vectors, Applications.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO4, PO5, PO11. PSO1, PSO2, PSO3**
Unit II: Calculus	**(08 Hrs)**
Successive Differentiation and Leibnitz theorem, Beta and Gamma functions, Differentiation under integral sign (DUIS), Taylor's series, McLaurin's series. Time Series Functions.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO4, PO5, PO11. PSO1, PSO2, PSO3**
Unit III: Differential Equations	**(09 Hrs)**
Ordinary Differential Equations: Linear Differential Equations, Exact differential equations, Differential equations reducible to Exact form. **Linear Differential Equations:** LDE of nth order with constant coefficients, Complementary Function, Particular Integral, General method, short methods, Method of variation of parameters, Cauchy's and Legendre's DE, Simultaneous and Symmetric simultaneous DE.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO4, PO5, PO11. PSO1, PSO2, PSO3**
Unit IV: Vector Differentiation	**(07 Hrs)**
Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO4, PO5, PO11. PSO1, PSO2, PSO3**
Unit V: Vector Integration	**(08 Hrs)**
Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stokes theorem. Applications to problems in Electro-magnetic fields.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO4, PO5, PO11. PSO1, PSO2, PSO3**

Learning Resources

Text Books:

1. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi

Reference Books:

1. Erwin Krey zig, "Advanced Engineering Mathematics", Wiley Eastern Ltd.
2. M. D. Greenberg, "Advanced Engineering Mathematics", Pearson Education
3. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Learning
4. George B. Thomas, "Thomas' Calculus", Addison-Wesley, Pearson

MOOC / NPTEL Courses/Other Resources:

1. https://youtu.be/9h_Q-R6sXbM?si=Nqz81D-JajSpAMvl
2. https://youtu.be/ksS_yOK1vtk?si=vNsF2s9nG9Ces_1O
3. https://youtu.be/NBcGLLU90fM?si=YfonBLq6fG2sopxJ
4. https://youtu.be/ksS_yOK1vtk?si=kW_YOORW8RIVRLto

Course Code: BCC25111A0C Course Name: Engineering Mathematics-I Tutorial		
Teaching Scheme:	**Credits**	**Examination Scheme:**
Tutorial: 01 Hrs./Week	**01**	**TermWork: 25 Marks**

Prerequisite Courses, if any: 1. Elementary Mathematics 2. Elementary Calculus

Companion Course, if any: Linear Algebra and Calculus

Course Objectives: This course aims at enabling students,

- To understand and familiarize with concepts of linear algebra
- To understand and apply series expansion of functions
- To understand and apply basics of differential equations
- To understand and apply basics of vector differentiation
- To understand basics of vector integration and apply to solve engineering problems

Course Outcomes: On completion of the course, learner will be able to -

CO1: Understand and apply the concept of rank to find Eigen values and Eigen vectors

CO2: Determine the representation of a function in an infinite series using successive differentiation, Taylor's and McLaurin's theorems

CO3: Apply the effective mathematical tools for solving ordinary differential equations

CO4: Apply vector differentiations to **analyze** the vector fields

CO5: Apply vector integration and **analyze** the vector fields

Guidelines for Student's Tutorials

- Will be given centrally

Guidelines for TW Assessment

For TW assessment - weightage given to

- Attendance
- Completion of Assignments (at least one assignment per unit)
- In time Submission

List of Assignments

Unit I - Linear Algebra

Obtain Eigen values and Eigen vectors using suitable software tools

Unit II - Calculus

Find series expansion of functions with the help of successive differentiation and Taylor's series using suitable software tools

Unit III- Differential Equations

Solve any one:

1. Solve problems of ordinary differential equations of first order and first degree.
2. Solve problems of linear differential equations

Unit IV- Vector Differentiation

Use various vector differentiation techniques to analyze/identify vector fields

Unit V- Vector Integration

Use various vector integration techniques to analyze/identify vector fields

MOOC / NPTEL Courses/Other Resources:

1. https://youtu.be/9h_Q-R6sXbM?si=Nqz81D-JajSpAMvl
2. https://youtu.be/ksS_yOK1vtk?si=vNsF2s9nG9Ces_1O
3. https://youtu.be/NBcGLLU90fM?si=YfonBLq6fG2sopxJ
4. https://youtu.be/ksS_yOK1vtk?si=kW_YOORW8RIVRLto

Course Code: BME25112A0A Course Name: Applied Science for Mechanical Engineering -I		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 03 Hrs./ Week	**03**	**CIE (Theory): 50 Marks** **ESE (Theory): 50 Marks**
Prerequisite Courses, if any:		
Companion Course, if any:		

Course Objectives:

- To impart the knowledge of fundamentals of physics and chemistry through hands-on experiments and extend it to relevant engineering applications.
- To gain a comprehensive understanding of Quantum Physics and Lasers, Ultrasonic and their applications.
- To gain the technology behind Nanotechnology, Nanomaterials and Polymers, their processing techniques and methods for enhancing the properties
- To gain a foundational understanding of the corrosion processes, including electrochemical reactions, NDT
- To understand of the working principles behind various types of energy sources

Course Outcomes: On completion of the course, the learner will be able to -

CO1: Explain optical phenomena of interference and polarization and develop an understanding of semiconductor physics and the working of semiconducting devices.

CO2: Understand the concepts of Quantum mechanics and develop an understanding of the working principle of Lasers and Ultrasonic for various engineering applications.

CO3: Understand Nanotechnology, Nanomaterials and Polymers, their processing techniques and methods for enhancing the properties.

CO4: Understand the mechanisms and types of corrosion, Corrosion Control & Prevention and NDT.

CO5: Understand the principles and workings of various energy sources.

Course Contents	
Unit I: Wave optics and Semiconductor Physics	**(8 Hrs)**

Wave optics: Interference in a thin film of uniform thickness, conditions of maxima and minima for a reflected system; Conditions for maxima and minima for a wedge-shaped film (qualitative), fringe width, engineering applications, Types of polarization: Unpolarized, Polarized, PPL, CPL and EPL, Malu's law and related numerical problems; Double refraction: geometry of calcite crystal, Huygens' theory; Engineering applications of polarization

Semiconductor Physics: Energy Band Diagram, Fermi level, Fermi level diagram, Fermi-Dirac distribution function, Intrinsic and Extrinsic Semiconductors, Fermi Level in Intrinsic and Semiconductor, Variation of Fermi Level with Impurity Concentration and temperature, Drift and Diffusion Currents, Compound Semiconductors, Hall Effect, P-N Junction Diode, I-V Characteristics, Types of diodes and Solar Cell **(**Principle and Working, I-V characteristics), efficiency and fill factor, measures to improve the efficiency of solar cell, advantages and applications in environmental sustainability

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO11**

Unit II: Quantum Physics, Lasers and Ultrasonics	**(8 Hrs)**

Quantum Physics: Introduction to Quantum Mechanics, De Broglie Hypothesis, Properties of matter waves, Heisenberg Uncertainty Principle, Applications of Uncertainty Principle, Wave Function and Probability Interpretation, Schrödinger, Wave Equation (time-dependent and independent), the significance of Schrödinger Wave Equation, Wave function and Energy of a particle enclosed in a rigid box, Quantum mechanical tunneling, tunnel diode, Quantum computers

Laser Technology: Introduction, Interaction of Light with Matter, Light Amplification, Components of Laser, Laser Action, and Threshold condition for Lasing, Characteristics of lasers, Types of Lasers: Semiconducting laser, CO_2 Laser, Engineering Application.

Ultrasonics: Characteristics and properties of ultrasonic waves, magnetostriction effect, inverse piezoelectric effect; Engineering Application.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO6, PO11**

Unit III: Advanced Engineering Materials	(8 Hrs)
Introduction: Engineering Materials (Metallic materials, Polymers, Ceramics, and Composites) **Nanomaterials and Nanotechnology:** Introduction to Nanoscale, and its significance, Nanomaterials classification and their properties, Structure and applications of graphene, fullerene, carbon nanotubes, and quantum dots (semiconductor nanoparticles), Synthesis methods- colloidal method, Fabrication Techniques for Micro/nano Devices (Photolithography, Nanolithography, Physical Vapor Deposition, Electric Arc deposition, Chemical vapor deposition (CVD), Etching and doping process), Applications of nanotechnology **Polymers:** Introduction and classification based on thermal behavior, Specialty polymers: Introduction, properties, and applications. Conducting Polymer, Polymer nanocomposites, and Liquid Crystal Polymer. Applications of polymer in engineering.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO3, PO5, PO7, PSO2, PSO3**
Unit IV: Corrosion, Protection and NDT	**(8 Hrs)**
Corrosion: Corrosion; Anodic and cathodic reactions. Types of corrosion-differential metal, and differential aeration. Factors affecting corrosion (EMF, Temperature, pH, relative area of anode and cathode, and polarization). **Corrosion Control and Prevention**: Methods, Cathodic Protection (Sacrificial Anode and Impressed Current), metallic coatings and their types, surface preparation, methods to apply metallic coatings-hot dipping, electroplating. Corrosion Resistant / Anti-corrosive paints. **NDT:** Destructive testing, Non-destructive testing methods, Physics principles in Non-destructive Testing, Advantages of Non-destructive testing methods, Acoustic Emission Testing, Ultrasonic (thickness measurement and numerical, flaw detection), Radiography testing, infrared thermography	
Mapping of Course Outcomes with POs & PSOs	**PO2, PO4, PO6, PSO2**
Unit V: Energy Sources and Storage Devices	**(8 Hrs)**
Sustainable energy sources: Hydrogen as a fuel - advantages, production, and storage. Introduction, construction, working, and applications of methanol–oxygen fuel cell and polymer electrolyte membrane (PEM) fuel cell. **Energy Storage**: Introduction to batteries, Classification of batteries, Batteries, Construction, working and applications, solid-state batteries, Battery characteristics; construction, working, and applications of Lithium-ion batteries.	
Mapping of Course Outcomes with POs & PSOs	**PO2, PO3, PO6, PSO2**

Learning Resources

Text Books:

1. A Textbook of Engineering Physics, M. N. Avadhanulu, P. G. Kshirsagar & TVS Arun Murthy, S. Chand Publications.
2. Engineering Physics, R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications.
3. Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd.
4. Engineering Chemistry by O. G. Palanna, Tata Magraw Hill Education Pvt. Ltd.
5. Textbook of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria& Sons Publisher.

Reference Books:

1. Optics, Ajoy Ghatak, Tata Mc Graw Hill
2. Introduction to Solid State Physics, C. Kittel, Wiley and Sons.
3. Quantum Mechanics, A. K. Ghatak, S. Lokanathan, Laxmi Publications.
4. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni, Capital Publishing.
5. Physics for Scientists and Engineers with Modern Physics, Serway and Jewett, Cengage Publications.
6. Basic Concept of Analytical Chemistry, 2ed, S. M. Khopkar, New Age-International Publisher.
7. Instrumental Methods of Chemical Analysis, G. R. Chatwal& S. K. Anand, Himalaya Publishing House.
8. Spectroscopy of organic compounds, 2ed, P. S. Kalsi, New Age-International Ltd., Publisher.
9. Polymer Science, V. R. Gowarikar, N. V. Viswanathan, jayadev Sreedhar, Wiley Eastern Limited.
10. Fundamentals of Nanotechnology, G. L. Hornyak, J. J. Moone, H. F. Tihhale, J. Dutta, CRC press

e-Books:

1. Feynman Lecture series: https://www.feynmanlectures.caltech.edu/
2. Concepts of Modern Physics, Arthur Beiser: https://nitsri.ac.in/Department/PHYSICS/Beiser_Modern_Physics.pdf

MOOC / NPTEL Courses/Other Resources:

1. Lectures by Walter Lewin
   https://www.youtube.com/channel/UCiEHVhv0SBMpP75JbzJShqw
2. Quantum Mechanics Lecture Series by Prof. H. C. Verma
   https://www.youtube.com/playlist?list=PLWweJWdB_GuISnGkAafMpzzDBvTHg02At
3. Corrosion Protection Methods
   https://onlinecourses.nptel.ac.in/noc25_mm08/preview
4. Material and Energy Balances
   https://onlinecourses.nptel.ac.in/noc25_bt28/preview
5. Materials Science and Engineering
   https://onlinecourses.nptel.ac.in/noc25_mm19/preview
6. Cathodic Protection Engineering
   https://onlinecourses.nptel.ac.in/noc25_mm32/preview

Course Code : BME25112A0B Course Name : Applied Science for Mechanical Engineering -I Lab		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 02 Hrs./Week	**01**	**Term Work: 25 Marks**

Prerequisite Courses, if any:

Companion Course, if any:

Course Outcomes:

On completion of the course, learner will be able to–

CO1: correlate principles of Physics to everyday and complex engineering problems.

CO2: think out of box with the solid foundation of physics and chemistry to solve engineering problems.

Guidelines for Student's Lab Journal

1. Draw the diagram on the left side of the first page, in front of aim in pencil, on a blank page.
2. The observations will be written on blank age with a pencil, followed by the calculations on the same page.
3. The graph will face the observation table. Show the slope and any related calculations on the graph, in pencil.
4. Write the precautions.
5. The page on which the readings are taken in the laboratory will be signed by the teacher and attached to the file as rough readings.

Guidelines for Lab /TW Assessment

1. 15 marks for the lab/journal work, which includes 05 marks for timely submission/practical completion, 05 interests shown while, perform the practical and 05 marks for file writing, calculations etc.
2. 05 marks for theory attendance.
3. 05 marks for class seminars/viva.

Guidelines for Laboratory Conduction

1. Come with completed file in the laboratory.
2. Ensure the file is checked regularly.
3. Get the circuit verified before switching on the apparatus/circuit.
4. Do not enter the lab/work in the lab without instructor.

List of Laboratory Experiments

	Unit I (Any three)
1	Newton rings: to understand the interference and determine radius of curvature of a given plano-convex lens or determine wavelength of given monochromatic light.
2	To determine the band gap energy of a semiconductor sample
3	To plot I-V characteristics and determine fill factor and efficiency of a given solar cell.
4	To determine Hall coefficient and charge carrier density of a given semiconductor sample.
5	Tunnel diode characteristics
6	Laurent's Half-Shade Polarimeter for determination of unknown concentration
7	An experiment based on Law of Malus /Brewester law
	Unit II (Any two)
1	An experiment on Laser (determining the wavelength of laser or number of lines on a grating)
2	An experiment on Laser: To determine the divergence of a laser beam. To determine the diameter of a thin wire using a laser or to perform beam profile analysis of a laser beam
3	Velocity of ultrasonic waves
4	Determination of Plank's constant
	Unit III (Any two)
1	Synthesis of nanoparticles
2	Synthesis of Quantum dots nanoparticles (2-6 or 3-5 semiconductor).
3	Synthesis and Characterization of Conducting Polymer (polyaniline or polypyrrole).
4	Synthesis and characterization of Polystyrene polymer.
5	Synthesis and characterization of Phenol Formaldehyde polymer.
	Unit IV (Any two)
1	To determine the effectiveness of various protective coatings in preventing or reducing the corrosion
2	Corrosion Rate Measurement of Zinc Coatings Using Electrochemical Techniques
3	Electrochemical Corrosion Cell (Galvanic Corrosion)
4	An experiment on NDT (Dye Penetrant Test / Magnetic Particle Test)

Unit V (Any One)	
1	Exploring the Impact of Electrode Material on Battery Performance
2	Fabrication of Capacitors
3	Conductivity Measurements of Engineering Materials
4	Study of any electric vehicle

Useful Links/Resources:

1. https://vlab.amrita.edu/?sub=1&brch=282&sim=1512&cnt=1
2. https://virtuallabs.merlot.org/vl_physics.html
3. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html
4. https://virtuallabs.merlot.org/vl_chemistry.html
5. https://nptel.ac.in/courses/103107206
6. https://nptel.ac.in/courses/103107207

Course Code : BME25113A0A Course Name : Basic Mechanical Engineering		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 03 Hrs./ Week	**03**	**CIE (Theory): 50 Marks** **SEE (Theory): 50 Marks**

Prerequisites: Physics, Chemistry, Mathematics

Course Objectives:

- To know the principle, methods, possibilities and limitations of Thermal Engineering.
- To know the Thermal Engineering applications.
- To understand the importance of products, their Design considerations with respect to the applications.
- To be familiar with the characteristics of the different materials those are used in Manufacturing technologies and the machine tools used.
- To explore the potential of Automation and Robotics and its applications.

Course Outcomes: On completion of the course the learner will be able to;

CO1. Understand the fundamentals of thermodynamics and Heat transfer
CO2. Understand the applications of Thermal Engineering.
CO3. Understand the Design Engineering and its applications.
CO4. Understand the Production Engineering and its applications.
CO5. Understand the Automation and Robotics and its applications.

Course Contents

Unit 1:Thermal Engineering	**6 Hrs**

Thermodynamics: Laws of thermodynamics, Heat engine, Heat pump and Refrigerator
Heat Transfer: Modes of heat transfer with applications, Fourier's law, Newton's law of cooling, Stefan Boltzmann's law
Transportation: Two stroke and Four stroke engines (Petrol, Diesel and CNG engines), Electric and Hybrid Vehicles

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PO6, PO9, PSO1, PSO2**

Unit 2:Applications of Thermal Engineering	**8 Hrs**

Energy Sources: Thermal energy, Hydropower energy, Nuclear energy, Solar energy, Geothermal energy, Wind energy, Hydrogen energy, Biomass energy and Tidal energy. Grades of Energy
Energy Conversion Devices: Boiler, Pump, Compressor, Turbine, I.C. engines, Fans, Blowers, HVAC System, Household Refrigerator, Window Air Conditioner
Power Plants: Thermal, Hydroelectric, Nuclear, Solar, Geothermal, Wind, Hydrogen, Tidal, Biomass and Hybrid Power Plants.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PO6, PO9, PO10, PSO1, PSO2**

Unit 3:Design Engineering	**9 Hrs**

Machine elements: Power transmission elements (shafts, axles, keys, bush and ball bearings, Joint, universal joint, Springs and Dampers, Valves, Levers), Flywheel and Governors
Power Transmission Devices: Belts drives, Chain drive, Gears, Couplings, Clutch, Brakes, Applications of these devices
Mechanisms: Slider crank/ IC Engine mechanism, Four bar chain mechanism and its inversions, Geneva mechanism, Ratchet and Paul mechanism, Mobility/Transportation Mechanisms

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PO6, PO9, PSO1, PSO2**

Unit 4:Production Engineering	**9 Hrs**

Material Science: Materials used in Engineering and their applications, Metals (Ferrous and Non-Ferrous), Nonmetallic materials, Material selection criteria
Manufacturing Science: Introduction to Subtractive Manufacturing Processes and their Applications (Carpentry, Casting, Sheet metal work, Forging, Metal Forming, Metal Joining, Machining), Introduction to Additive Manufacturing Processes and their Applications.
Machine Tools: Working principle and types of operations of Lathe Machine, Milling Machine, Drilling Machine, Power saw, Grinding machine, NC and CNC machines, 3D Printers

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PO6, PO9, PO10, PSO1, PSO2, PSO4**

Unit 5: Automation and Robotics	**10 Hrs**

Automation: Reasons for Automation, Automation in Production systems, Automation Principles and Strategies, USA (Use, Simplify & Automate) Principle, Types of Automation, Classification by Function/Transfer Method

Automated Assembly Systems: Types and Configurations, Part Feeding Devices, Part Orientation Devices, Part Conveying Devices, Feed tracks, Escapements and Part placing mechanism, Parts Delivery at workstations, Single-station and Multi-station Assembly Machines

Robotics: Role of Robots in Automation, Definitions specified by Agencies, Classification and Applications, Laws of robotics, Specifications of robots, Robot Anatomy and configurations, Work Envelope/Volume, DoF associated with Robot Arm & Wrist, End-effectors/Grippers/Tooling, Robots in Manufacturing and Non-manufacturing Applications

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PO6, PO9, PO10, PSO1, PSO2, PSO4**

Books and other resources

Text Books:

1. Nag, P. K., "Engineering Thermodynamics," Tata McGraw-Hill Publisher Co. Ltd.
2. Chaudhari and Hajra, "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers, Mumbai
3. Agrawal,Basant and Agrawal, C. M., (2008), "Basics of Mechanical Engineering", John Wiley and Sons, USA
4. Rajput, R.K., (2007), "Basic Mechanical Engineering", Laxmi Publications Pvt. Ltd.
5. Pravin Kumar, (2018), " Basic Mechanical Engineering, 2nd Ed.", Pearson (India) Ltd.
6. Moran, M. J., Shapiro, H. N., Boettner, D. D., and Bailey, M. "Fundamentals of Engineering Thermodynamics", Wiley
7. Surinder Kumar, (2011), "Basic of Mechanical Engineering", Ane Books Pvt. Ltd. New Delhi
8. Saha, S. K., (2017), "Introduction to Robotics", 2nd Ed, McGraw Hill Education, New Delhi
9. Groover, M. P., (2024), "Automation, Production Systems, and Computer-integrated Manufacturing," 5th Ed, Pearson Education, New Delhi
10. Derby, S. J., (2004), "Design of Automatic Machinery," CRC Press

References Books:

1. Khan, B. H., "Non Conventional Energy Sources, Tata McGraw-Hill Publisher Co. Ltd.
2. Boyle, Godfrey, "Renewable Energy",2nd Ed., Oxford University Press
3. Khurmi, R.S. ,and Gupta, J. K.,"A Textbook of Thermal Engineering", S. Chand & Sons
4. Incropera, F. P. and Dewitt, D.P., (2007), "Fundamentals of Heat and Mass Transfer, 6th Ed., John Wiley and Sons, USA
5. Groover,Mikell P., (1996), "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", Prentice Hall, USA
6. Norton, Robert L., (2009), "Kinematics and Dynamics of Machinery", Tata McGrawHill
7. Cleghorn, W. L., (2005), "Mechanisms of Machines", Oxford University Press
8. Juvinal, R. C., (1994), "Fundamentals of Machine Component Design", John Wiley and Sons, USA
9. Ganeshan, V., (2018), "Internal Combustion Engines", McGraw Hill
10. Anderson, Curtis Darrel and Anderson,Judy, (2010), "Electric and Hybrid Cars: A History", 2nd Ed., McFarland
11. Deb, S. R., Deb, S., (2017), "Robotics Technology and Flexible Automation," McGraw Hill Education
12. Sandler, B. Z., (1999), "Robotics: Designing the Mechanisms for Automated Machinery," Academic Press/Prentice Hall
13. Niku, S. B., (2020), "Introduction to Robotics, Analysis, Control, Applications," Wiley
14. Siegwart, R., Nourbakhsh, I. R., Scaramuzza, D., (2011), "Introduction to Autonomous Mobile Robots," The MIT Press
15. Wilson, M., (2014), "Implementation of Robot Systems: An introduction to robotics, automation, and successful systems integration in manufacturing," Butterworth-Heinemann

Course Code: BME25113A0B Course Name – Basic Mechanical Engineering Lab		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical : 02 Hrs./ Week	**01**	**Term work: 25 Marks**

Prerequisite Courses, if any: Physics, Chemistry, Mathematics

Companion Course, if any:

Course Objectives:

- To know the principle, methods, possibilities and limitations of Thermal Engineering.
- To know the Thermal Engineering applications.
- To understand the importance of products, their Design considerations with respect to the applications.
- To be familiar with the characteristics of the different materials those are used in Manufacturing technologies and the machine tools used.
- To explore the potential of Automation and Robotics and its applications.

Course Outcomes: After learning the course, the students should be able to**:**

CO1. Understand the fundamentals of thermodynamics and Heat transfer

CO2. Understand the applications of Thermal Engineering.

CO3. Understand the Design Engineering and its applications.

CO4. Understand the Production Engineering and its applications.

CO5. Understand the Automation and Robotics and its applications.

Term Work

The student shall complete **any 10** of the following activity as a term work.

1. Study of Energy sources (Minimum one Conventional and one Nonconventional sources).
2. Study and demonstration of energy conversion devices.
3. Study and demonstration of Electric and Conventional IC engine vehicles, their specifications and systems
4. Study and demonstration of Power Plants.
5. Study and demonstration of Domestic appliances viz. refrigerator, air-conditioner, washing machine, cold storage.
6. Study and demonstration of power train/gear box system in the vehicle or machine tool.
7. Study and demonstration of Power Transmission Devices.
8. Study and demonstration of vehicle systems (automobile chassis, steering system, suspension system, braking system - Any Two).
9. Study and demonstration of additive manufacturing / rapid prototyping techniques and machines.
10. Study and demonstration of CNC machines.
11. Visit to any Manufacturing Industry.
12. Study and demonstration of basic Robot Configurations (Cartesian, Cylindrical, Spherical, Articulated, SCARA, Parallel Manipulator).
13. Study and demonstration of Robot End-effectors/Grippers/Tooling.
14. Visit to any Service Industry.

Course Code: BEC25114A0A Course Name – Basic Electrical & Electronics Engineering		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 03 Hrs./ Week	**03**	**CIE (Theory): 50 Marks** **SEE (Theory): 50 Marks**

Prerequisite Courses, if any: Electron theory, Ohms law, Magnetism, Number system, Semiconductor theory

Companion Course, if any: Science Subjects

Course Objectives:

- To provide working knowledge for the analysis of basic DC circuits.
- To build strong conceptual understanding of single phase and polyphase AC circuits with phasor diagram representation.
- To impart basic knowledge for conceptual understanding of DC and AC machines.
- To understand the construction and applications of diode and BJT
- To understand basics of combinational logic, Boolean algebra and flip -flops.

Course Outcomes: On completion of the course, learner will be able to -

CO1: Apply the knowledge of DC circuits to solve the complex networks and to define the various terms related to magnetic circuits.

CO2: Apply the knowledge of single phase and three phase circuits to determine unknown electrical quantities.

CO3: Demonstrate the constructional features and operational details of DC and AC machines.

CO4: Design simple analog circuits using these devices.

CO5: Build simple combinational and sequential logic circuits.

Course Contents

Unit I	Electric and Magnetic Circuit	(08 Hrs)

Electric Circuits: Classification of electrical networks, Source transformation, Simplification of networks using series and parallel combinations, Star delta transformation, Applications of Kirchhoff"s laws.

Magnetic Circuit: concept of Flux, flux density, reluctance, MMF, permeability and field strength, their units and relationships; comparison of electric and magnetic circuit.

Electromagnetism: Faradays law of electromagnetic induction, statically and dynamically induced EMF

Mapping of Course Outcomes with POs & PSOs	PO1, PO2, PO4, PO6

Unit II	Single and three phase AC circuits	(08 Hrs)

Single phase AC Circuits: AC Quantities, Single phase ac circuit analysis (R, L, C, R-L, R-C and R-L-C series) on the basis of impedance, admittance, voltage current and power waveform, concept of active, reactive, apparent power and power factor

Three phase AC Circuits: Introduction to 3 phase supply and its necessity, balance three phase system, relation between line and phase quantities (with phasor diagram), power in three phase circuits for star and Delta connection.

Mapping of Course Outcomes with POs & PSOs	PO3, PO5, PO6, PO10

Unit III	Electrical Machines	(08 Hrs)

DC Machines: Construction, working principle of D.C. Motor, types of D.C. motor (series and shunt), emf equation of D. C. generator (numerical), concept of Back emf in DC motor (Numerical), Industrial applications.

Transformer: Single phase transformers: Construction, operating principle, emf equation, voltage and current ratios. Losses, Efficiency and regulation, Auto-transformer, Sensors used for protection of machines.

Sensors for Electric Motors

Mapping of Course Outcomes with POs & PSOs	PO4, PO8, PO9, PO11

Unit IV	Analog electronics	(08 Hrs)

Diode: Ordinary Diode: Construction, symbol, working, characteristics. Application of diode: Half wave, full wave and bridge rectifiers.

Transistor: Construction, types, operation; transistor configuration (CE, CB and CC): characteristics, relationship between α and β, load line for a transistor, application of transistor as a switch and amplifier.

Mapping of Course Outcomes with POs & PSOs	PO1, PO5, PO6

Unit V	Digital electronics	(07 Hrs)
Logic Gates: Fundamental, derived and exclusive logic gates: symbol, operation, truth table, concept of universal gates **Combinational Logic Circuit**: Reduction of digital expressions by Boolean algebra, standard representation of logic functions (SOP and POS forms), and De Morgan‟s Theorem, half and full adder **Sequential Logic Circuit:** Flip – Flop (SR, JK & T): construction, working, truth table; types of Triggering.		
Mapping of Course Outcomes with POs & PSOs	PO4, PO8, PO9, PO11	

Learning Resources

Text Books:

1. “Theory and problems of Basic Electrical Engineering” by I. J. Nagrath and Kothari (PHI learning Pvt.Ltd), Eastern Economy Edition.
2. “Basic Electrical Engineering” by V. N. Mittal and Arvind Mittal, 2nd Edition. (McGrawHill),
3. “Modern Digital Electronics” by R.P. Jain, 4th Edition, Tata McGrawHill
4. Digital Communications, by John G. Proakis, Tata Mcgraw Hill Publications

Reference Books:

1. “A textbook of Electrical Technology Vol I “by B. L. Theraja and A. K. Theraja S. Chand & Co. Pvt. Ltd. New Delhi, 1st Edition.
2. Floyd, 'Electronic Devices and Circuits', pearson education, (7th edition),(2008)
3. AP Malvino & Donald Leach,'Digital Principles and Applications', McGraw Hill Education,(6 th edition), (2009)
4. Electrical Technology” by Edward Hughes, 10th Edition (Pearson).
5. Digital Fundamentals” by Thomas L Floyd, 10th Edition (Pearson).
6. Digital design” by M. Morris Mano, 3rd Edition (Pearson)
7. Op-Amps and Linear Integrated Circuits by Ramakant AGayakwad (Pearson)
8. Digital communication by Sanjay Sharma

MOOC / NPTEL Courses/Other Resources:

1. Fundamentals of Electrical Engineering
   https://nptel.ac.in/courses/108105112
2. Electrical Machine
   https://nptel.ac.in/courses/108105155
3. Digital Circuits
   https://nptel.ac.in/courses/117103064
4. Basic Electronics
   https://nptel.ac.in/courses/117103063

Course Code: BEC25114A0B Course Name : Basic Electrical & Electronics Engineering Lab		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 02 Hrs./ Week	**01**	**Term Work: 25 Marks**

Prerequisite Courses, if any: 12th standard Physics

Companion Course, if any: Science subjects of First year Engineering

Course Outcomes: On completion of the course, learner will be able to–
CO1: Demonstrate AC and DC circuits by performing different experiments.
CO2: Demonstrate AC and DC machines by performing different experiments

Guidelines for Student's Lab Journal

The students Lab Journal should contain following related to every experiment –
1. Title of the experiment
2. Objective
3. Apparatus with their detailed specifications
4. Brief theory related to the experiment
5. Connection diagram /circuit diagram
6. Observation table
7. Sample calculations for one/two reading
8. Result table
9. Graph and Conclusions

Guidelines for Lab /TW Assessment

1. Continuous assessment of laboratory work is to be done based on overall performance and Laboratory performance of student.
2. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each Laboratory assignment include- timely completion, performance, efficiency, punctuality, and neatness.

Guidelines for Laboratory Conduction

List of Laboratory Experiments

1.	Introduction of different electrical and electronics components and instruments.
2.	To perform electrical wiring to control lamps using one way and two-way switches.
3.	To measure steady state response of series RL and RC circuits on AC supply and observations of voltage and current waveforms.
4.	To derive resonance frequency and analyze resonance in series RLC circuit.
5.	To perform load test on single phase transformer to determine voltage regulation and efficiency.
6.	To verify the relation between phase and line quantities in three phase balanced star and delta connections of load.
7.	Speed control of DC motor.
8.	To determine output voltage and ripple voltage of half wave, full wave rectifier with center tap transformer and bridge rectifier with and without filter.
9.	To Plot input and output characteristics of CE Transistor configuration.
10.	Verify its truth table SR, JK & T flip flops
11.	Implementation of Half Adder & Full Adder using Logic Gate IC"s.
12	Introduction of different electrical and electronics components and instruments.

Useful Links/Resources:
1. https://www.vlab.co.in/broad-area-electrical-engineering
2. https://nptel.ac.in/courses/108105155

Course Code: BCC25115A0X Course Name – Design Thinking & Ideation		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 01 Hrs. / week	**01**	**CIE: 50 Marks**

Prerequisite Courses, if any: NIL

Companion Course, if any: NIL

Course Objectives:

- **Understand** the core principles of design thinking and its role in engineering.
- **Apply** knowledge of design thinking to analyze and solve complex problems.
- **Develop** creative and user-centered solutions to real-world challenges.
- **Demonstrate** effective communication and collaboration in multidisciplinary teams.
- **Evaluate** and analyze design concepts and prototypes.
- **Develop** a mindset for continuous innovation and improvement

Course Outcomes: On completion of the course, learner will be able to –

CO1: Apply empathy and observation to gain insights into user needs and behaviors.
CO2: Generate innovative ideas and solutions through brainstorming and ideation.
CO3: Carry out primary and secondary research for better insights.
CO4: Present and communicate design ideas effectively.
CO5: Collaborate with peers and industry professionals to address real-world design challenges.

Course Contents

Unit I: Introduction to Design Thinking (CO1&CO2)	**02 Hrs**

Introduction to Design Thinking, understanding what is design? Who is a design thinker? What is a design thinking process? Brain Storming, Decide the topic for Brain-Storming and generate keywords or ideas. 17 UN Sustainable Development Goals.

Mapping of Course Outcomes with POs & PSOs	**PO: 03, 06**

Unit II: Case Studies (CO1)	**03 Hrs**

Case studies to understand the design thinking process and field visit to validate: Refer Annexure I and II

Mapping of Course Outcomes with POs & PSOs	**PO: 02, 03, 06, 07, 09, 10**

Unit III: Idea Generation (CO1&CO4)	**03 Hrs**

Techniques for idea generation, innovation, brainstorming, key words, sorting, linkages. Mind mapping. Introduction to primary and secondary research methods.

Mapping of Course Outcomes with POs & PSOs	**PO: 01 to 09, 11**

Unit IV: Research Methodology (CO3&CO5)	**03 Hrs**

Sources of secondary research: 5W/1H tool, Publications, Events (Conference Papers, Workshops, Symposiums), Information gathered from the Internet, Web resources (Websites, Blogs, Web Magazines, Web Journals, etc.), Data Sets, Survey Results, Census Data, Records and Standards.

Sources of primary research: Talking to experts, questionnaires, Cue-cards, surveys, visits, interviews, focused group discussions etc, Application of primary and secondary research methodology.

Mapping of Course Outcomes with POs & PSOs	**PO: 02, 03, 04, 07, 08, 09, 11**

Unit V: Ideation (CO2&CO4)	**03 Hrs**

Brain storming for ideation, divergent thinking, SCAMPER, lateral thinking, idea sketching, generating innovative ideas.

Mapping of Course Outcomes with POs & PSOs	**PO: 02, 03, 04, 05, 06, 10**

Group Structure:

1. Working in faculty monitored groups. The students plan, manage and complete a task / project / activity which addresses the stated problem.
2. There should be a of team / group of 3 – 4 students.

Learning Resources

Reference Books:

1. Design Thinking: Understanding How Designers Think and Work by Nigel Cross
2. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by Tim Brown
3. Design Thinking for Visual Communication" by Ranjan Nayar and Jaidip Subedi
4. The Design of Everyday Things" by Don Norman• "Design Thinking: Creativity and Innovation" by S. Balaram
5. Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days" by Jake Knapp
6. Creative Confidence: Unleashing the Creative Potential Within Us All" by Tom Kelley and David Kelley (with a foreword by Ratan Tata)

MOOC / NPTEL Courses/Other Resources:

1. https://swayam-plus.swayam2.ac.in/courses
2. https://swayam.gov.in/explorer
3. https://nptel.ac.in/courses

Course Code: BCC25115A0B Course Name – Design Thinking & Ideation Lab		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 02 Hrs./ Week	**01**	**Term Work: 25 Marks**

Prerequisite Courses, if any: NIL

Companion Course, if any: NIL

Course Objectives:

- **Understand** the core principles of design thinking and its role in engineering.
- **Apply** knowledge of design thinking to analyze and solve complex problems.
- **Develop** creative and user-centered solutions to real-world challenges.
- **Demonstrat**e effective communication and collaboration in multidisciplinary teams.
- **Evaluate** and analyze design concepts and prototypes.
- **Develop** a mindset for continuous innovation and improvement

Course Outcomes: On completion of the course, learner will be able to –

On completion of the course, the learner will be able to -

CO1: Think out of box with the solid foundation of Design thinking and ideation.

CO2: Present Solutions to problems

Guidelines for Student's Lab Journal

1. Draw the diagram on blank pages. You can use colored pencils/sketch pens etc to make your work clear and presentable.
2. The content will be written on one side ruled pages.

The pictures can be pasted on the blank side.

Guidelines for TW Assessment (25)

1. 15 marks for the lab / journal work, which includes 5 marks for timely submission / task completion, 05 interests shown in the classroom and laboratory and 05 marks for file writing.
2. 05 marks is for theory attendance.
3. 05 marks class presentations.

Guidelines for CIE (50)

1. First evaluation based on presentation to be conducted around midterm for 10 marks.
2. Second presentation to be conducted at the time of submission for 10 marks.
3. The evaluation of the submitted report for 10 marks.
4. The final hard prototype will be evaluated for 20 marks.

[Creativity and originality (05), Clarity and completeness (05), Justification of prototype features (05), Quality (05)]

Guidelines for Laboratory Conduction

1. Come with a completed file.
2. Ensure the file is checked regularly.
3. Participate in class/lab activities.
4. Complete your tasks on time.

List of Assignments and Submission

1.	Explain design thinking process in 200 words
2.	Draw a flow chart of the steps involved in brainstorming and generation of key words to select your project of design thinking. Submit a list of brainstormed ideas along with justification for the selected one.
3.	Explain the topic selected for the project in 300 words, with the relevant diagrams/flow charts/pictures if any
4.	Write a report of 200 words on any one of the case studies discussed with the relevant diagrams/flow charts/pictures if any
5.	Write 300 words report on the site visit with the relevant diagrams/flow charts/pictures if any
6.	Create a mind map of your idea. It should have at least 3 branches. Colour code it for ease of understanding.
7.	Write a 500 words report on Primary research with conclusions, acknowledgements and references.
8.	Write 300 words report on Secondary research with conclusions drawn, along with the relevant diagrams / flow charts / pictures
9.	Use Scamper to fine tune the selected idea and redefine the problem statement with the help of meaningful actionable statements for creative idea solving.
10.	Make rough sketches of the idea and explain them in 200 words.

Annexure I:

• **Nike**: Renowned as a prominent influencer in the shoe design industry, Nike has maintained its status as a favorite among athletes for nearly five decades.

• **Airbnb**: Known as the pioneer of the experience economy, Airbnb today stands as a $75.4B company still dictating the fundamentals of user-friendly design. However, behind Airbnb's massive success lies its approach to human-centric design.
• **Netflix**: Credited for bringing in the phenomenon of 'binge-watching', Netflix has been known for keeping up with the changing market and producing customer-friendly solutions.
• **GE Healthcare**: Founded in 1994, GE Healthcare is headquartered in Chicago, Illinois, and operates in more than 100 countries. It was through design thinking that the brand revamped the typically scary experience that children face when undergoing a scan.
• **UberEats**: UberEats stands out among other delivery services as one of the fastest-growing platforms. Unlike a retrospective approach, which focuses on refining existing models, UberEats opted for a forward-thinking strategy, emphasizing the importance of creativity and user-centric design from the outset.
• **Oral B**: Oral-B, a renowned brand in oral hygiene products, has consistently leveraged design thinking principles across its product development and innovation endeavours.
• **Project Bloks**: Project Bloks was an experimental research project initiated by Google's Creative Lab in collaboration with IDEO to explore tangible programming for kids.
• **Tata Nano**: The People's Car: Explore how Tata Motors aimed to revolutionize the automobile industry by creating an affordable and compact car for the masses, known as the Tata Nano.
• **Aravind Eye Care System**: Investigate how Aravind Eye Care System in India used innovative design thinking to provide high-quality, affordable eye care services to a large population, often in remote areas.
• **Aadhaar**: India's Unique Identification Program: Explore how the Aadhaar program used biometric data and design thinking to provide millions of Indians with a unique identification system, enhancing access to government services and benefits.
• **Ola Cabs**: Transforming Transportation in India: Learn how Ola, an Indian ride-sharing platform, disrupted the traditional taxi industry by applying innovative design thinking to its services and business model.
• **Swiggy**: Redefining Food Delivery: Investigate how Swiggy, an Indian food delivery platform, leveraged design thinking to enhance the food delivery experience for customers and partner restaurants
• **Lifebuoy**: Promoting Hygiene in Rural India: Explore how Lifebuoy, a brand under Unilever, used design thinking to develop innovative marketing campaigns and products to promote hand washing and hygiene in rural India.
• **Amul**: The White Revolution in India: Analyze how the Amul cooperative transformed the dairy industry in India through a unique business model, design thinking, and innovative marketing strategies
• **Flipkart**: E-commerce Success Story: Study how Flipkart, one of India's leading ecommerce platforms, employed design thinking to grow its business and offer a wide range of products and services.
• **Designing Google's Self-Driving Car**: Explore how Google used design thinking to develop autonomous vehicles that redefine transportation.
• **Dyson**: Revolutionizing Vacuum Cleaners and Hand Dryers: Investigate how Dyson's innovative design thinking has transformed household appliances.
• **SpaceX**: Advancing Space Exploration Through Design Thinking: Analyze SpaceX's approach to space technology and how it has disrupted the aerospace industry.
• **Red Bull**: Creating an Energy Drink Empire: Learn how Red Bull's unique design thinking approach contributed to the success of their energy drink and brand.
• **McDonald's**: Evolution of Fast-Food Service: Study the design thinking principles applied by McDonald's to enhance their customer experience and streamline operations.
• **Nest**: Reinventing Thermostats and Home Automation: Examine how Nest Labs, a subsidiary of Google, reimagined home automation with their smart thermostats and other products.
• **LEGO**: Building a Design-Centric Toy Empire: Investigate how LEGO has used design thinking to create a global brand that fosters creativity and learning through play.
• **Starbucks**: Brewing Design Innovation in the Coffee Industry: Analyze how Starbucks incorporates design thinking into its store layouts, product offerings, and customer experiences.
• **Amazon**: Customer-Centric Design in E-commerce: Discover how Amazon's design thinking philosophy has played a pivotal role in its e-commerce dominance

Annexure II:

• Accops
• Vir Bike
• Udchalo
• Copper Cloud
• Vigyan Ashram
• Bhau Innovation Centre
• SPPU Innovation Centre
• NCL Innovation Centre

Course Code: BCC25116A0X Course Name: Indian Knowledge System		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 02 Hrs./ Week	**02**	**CIE: 50 Marks**

Prerequisite Courses, if any: NA

Companion Course, if any: NA

Course Objectives:

- To understand the nature of knowledge.
- To understand the evolution of the scientific approach in the Indian subcontinent.
- To study contributions made by different people to the various branches of knowledge before modernity evolved in India.

Course Outcomes: On completion of the course, learner will be able to -

CO1: The concept of the ancient intellectual knowledge tradition will be understood.

CO2: Developments in science from ancient times will be introduced.

CO3: Developments in humanities from ancient times will be understood.

Course Contents

Unit I: Introduction to Indian Knowledge System	**06 Hrs**
Definition, Scope and importance of knowledge, Nature of Indian Knowledge System, Evolution of scientific approach	
Mapping of Course Outcomes with POs & PSOs	**P08,11, PSO1, PO3**

Unit II: Development of Sciences	**12 Hrs**
Astronomy (Aryabhatta, Varahamihira, Sawai Jaisingh), Medicine (Ayurveda and Yunani), Metallurgy (Copper, Iron, Bronze & alloys)	
Mapping of Course Outcomes with POs & PSOs	**PO2**

Unit III: Role of Ancient Indian Engineering principles in modern practices	**12 Hrs**
Language (Prakrit, Sanskrit, Farsee), Philosophy (Vedic, Lokayat, Buddhism, Jainism), Education system in ancient India (Takshashila, Nalanda, Valabhi University), Architecture	
Mapping of Course Outcomes with POs & PSOs	**PO3**

Learning Resources

1. Abdur Rahman, Science and Technology in Medieval India: A Bibliography of Source Materials in Sanskrit, Arabic, and Persian, Indian National Science Academy, New Delhi, 1982.
2. Bag A. K. (ed), History of Technology in India (Vol I) (From Antiquity to C. 1200 A.D.), Indian National Science Academy, Delhi, 1997.
3. Abdur Rahman, Science and Technology in Medieval India: A Bibliography of Source Materials in Sanskrit, Arabic, and Persian, Indian National Science Academy, New Delhi, 1982.
4. Chattopadhyaya, Debiprasad, History of science and technology in ancient India: the beginnings, Firma KLM Pvt. Ltd. 1986
5. Dasgupta Surendranath, A History of Indian Philosophy, Cambridge University press, 1922. Gopal L. and V. C. Shrivastava, History of Agriculture in India (Upto 1200 A. D.), Concept Publishing, New Delhi, 2008.
6. Irfan Habib (ed.), People's History of India – Vol 20: Technology in Medieval India, c. 650–1750, Aligarh Historians Society and Tulika Books, 2016.
7. Jan Gonda, A History of Indian Literature, Otto Harrassowitz, Wiesbaden, 1975.
8. Padmanabha Thanu (ed.), Astronomy in India: A Historical Perspective, Indian National Science Academy, Springer, New Delhi. 2014.
9. Sohoni Pushkar, Introduction to the History of Architecture in India, IISER, Pune, 2020.
10. Tripathi Radhavallabh, Vāda in theory and practice: studies in debates, dialogues and discussions in Indian intellectual discourses, IIAS, Shimla, 2016.

Course Code: BCC25117A0X Course Name : Communication Skills & Human Values		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 01 Hrs. / Week	**01**	**CIE: 50 Marks**

Prerequisite Courses, if any:

Companion Course, if any:

Course Outcomes: On completion of the course, learner will be able to:

CO1: To make the engineering students understand, analyze and interpret the essentiality of grammar, vocabulary and phonetics and their proper usage facilitated by professors and a Language Laboratory.

CO2: To encourage self-awareness by exploring beliefs, values, strengths, weaknesses, and aspirations to facilitate students to construct a career development plan (roadmap) that outlines the skills required for the type of job, recognizing individual skill strengths and gaps, and identify activities that can be used to acquire the skills associated with the gaps.

CO3: To teach professional skills like communication skills, presentation skills, technical writing skills, paper reading, networking skills through instruction, knowledge acquisition, and demonstration.

CO4: To train future engineers to prepare for interviews and adapt to a diverse socio-economic arena while functioning effectively in multi-disciplinary and heterogeneous teams through the knowledge of teamwork, interpersonal relationships, conflict management and leadership quality.

CO5: To understand the significance of universal human values in promoting harmony, compassion, and mutual respect in society and to cultivate mindfulness practices for personal well-being and societal harmony.

Unit 1:	**Language Skills**	**3 Hrs.**

Articles, Tenses, Prepositions, Adverbs, Adjectives, Pronunciation Guide, and Exposure to technical terms related to the field of technology and phrases, idioms, proverbs, significant abbreviations, formal (business) vocabulary.

Unit 2:	**Personal Skills**	**3 Hrs.**

Introduction to Soft-Skills, Self-Awareness, Stress Management, Taking Criticism, Self Confidence, Adaptability, Assertiveness, Self-Assessment, Motivational Skills, Organization, Planning

Unit 3:	**Communication Skills**	**3 Hrs.**

Concept, Methods and Models of Communication, Verbal Communication, Body Language, Listening Barriers, Listening Ethics, Creative Writing, Storytelling, Visual Communication, Listening Skills, Reading Skills, Public Speaking.

Unit 4:	**Professional Skills**	**3 Hrs.**

Interview Skills, Email Writing, Note Writing, Summarization, CV Writing, Cover-Letter, Minute Writing, Report Writing, writing effective Proposals, Meeting Management, Entrepreneurial Thinking, Decision Making, Problem Solving, Crisis Management, Negotiation Skills, Team Building Strategies

Unit 5:	**Human Values**	**(3 Hrs.)**

Work Ethics, Universal Human Values, Time Management, Goal Setting, Value based action plan, Community Service, Ethics in Innovation, How to avoid Plagiarism

Useful Links/Resources

1. "Idioms and proverbs are fun", Wilco books(author) Soft Skills – An Integrated Approach to Maximize Personality by Gajendra Singh Chauha and Sangeeta Sharma
2. An Approach to Communication Skills by Indrajit Bhattacharya
3. Communication Skill, Oxford University Press by Sanjay Kumar and Pushpa Lata
4. Creative English for Communication by Krishnaswami N. and Sriraman T
5. Soft skills Training – A workbook to develop skills for employment by Fredrick H. Wentz
6. Personality Development and Soft skills, OxfordUniversity Press by Barun K. Mitra
7. The Time Trap: The Classic book on Time Management by R. Alec Mackenzie
8. Priyadarshani Patnaik, "Group Discussion and Interview Skills", Foundation Books
9. M.S. Rao, "Strategies for improving your business communication", SPD
10. Aswalthapa, K (1991) OrganisationalBehaviour, Himalayan Publication, Mumbai.
11. Bahl,J.C. and Nagamia,S.M. (1974) Modern Business Correspondence and Minute Writing.
12. Balan,K.R. and Rayudu C.S. (1996) Effective Communication, Beacon, New Delhi.

13. Bangh, L Sue, Fryar,Maridell and Thomas David A. (1998) How to Write First Class Business Correspondence, N.T.C. Publishing Group USA.
14. BoveeCourtland,L and Thrill, John V(1989) Business Communication Today
15. Eyre, E.C. (1985) Effective Communication Made Simple, Rupa and Co. Calcutta.
16. Ghanekar,A(1996) Communication Skills for Effective Management, Everest Publishing House, Pune.
17. Ludlow,Ron.(1995) The Essence of Effective Communication, Prentice , New Delhi.
18. Monippalli, M.M. (1997), The Craft of Business Letter Writing, T.M.H. New Delhi.
19. Raman, Meenakshi and Sharma, Sangeeta (2004) Technical Communication: Principles and Practice.
20. Rutherford A. J., “Communication skills for Technical Communication”, Pearson Education
21. Kishna Mohan, “Developing Communications Skills”, MacMillan Publishers, 2nd Edition
22. Murphy, “Essential English Grammar”, Cambridge
23. Duttet.al, “A course in Communication Skills”, Foundation Books
24. Peter Roach, “English Phonetics and Phonology”, 4th Edition, Cambridge

Course Code: BCC25117A0C Course Name: Communication Skills & Human Values Tutorial		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Tutorial: 01 Hrs. / Week	**01**	**Term Work: 25 Marks**

Prerequisite Courses, if any:

Companion Course, if any:

Course Outcomes: On completion of the course, learner will be able to:

CO1: To make the engineering students understand, analyze and interpret the essentiality of grammar, vocabulary and phonetics and their proper usage facilitated by professors and a Language Laboratory.

CO2: To encourage self-awareness by exploring beliefs, values, strengths, weaknesses, and aspirations to facilitate students to construct a career development plan (roadmap) that outlines the skills required for the type of job, recognizing individual skill strengths and gaps, and identify activities that can be used to acquire the skills associated with the gaps.

CO3: To teach professional skills like communication skills, presentation skills, technical writing skills, paper reading, networking skills through instruction, knowledge acquisition, and demonstration.

CO4: To train future engineers to prepare for interviews and adapt to a diverse socio-economic arena while functioning effectively in multi-disciplinary and heterogeneous teams through the knowledge of teamwork, interpersonal relationships, conflict management and leadership quality.

CO5: To understand the significance of universal human values in promoting harmony, compassion, and mutual respect in society and to cultivate mindfulness practices for personal well-being and societal harmony.

Guidelines for Student's Lab Journal

The student must prepare a file that will include all the assignments performed in the class. Continuous assessment of laboratory work is to be done based on overall performance and laboratory assignment's performance of student. Each Laboratory assignment assessment will be assigned grade/marks based on parameters with appropriate weightage.

Guidelines for Lab /TW Assessment

Each laboratory assignment assessment includes timely completion, performance, punctuality, neatness, enthusiasm, participation and contribution in various activities. Attendance of the student will also be considered while granting term work.

Guidelines for Laboratory Conduction

The instructor may frame assignments to enhance skills supporting career aspects. Multiple set of activity based assignments can be prepared and distributed among batches. Every student must be given opportunity to participate actively in each activity. The assignments must aim to enhance language skills, communications skills, personal skills, professional skills and human values.

List of Laboratory Experiments

Group A- Language Skills	
1.	Grammar Test
2.	Vocabulary Test
3.	Comprehension
Group B- Personal Skills	
1.	Flag
2.	SWOC
3.	Self-Awareness Questionnaire
4.	Johari Window
5.	Time Management Activity
Group C- Communication Skills	
1.	Extempore
2.	Inner Monologue
3.	Role Play
4.	GD
5.	Creative Writing
6.	Article Reading
Group D- Professional Skills	
1.	Mock Interview

2.	CV
3.	Cover Letter
4.	Report Writing
5.	Paper Summarising
6.	Problem Solving
Group E- Human Values	
1.	Time Management
2.	Presentation
3.	GD
4.	Personal & Career Goal setting – Short term & Long term
5.	Paper Writing

Course Code: BCC25118A0X Course Name – Environmental Science		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 01 Hr. / Week Online Learning, Presentations, MOOC courses, Guest lectures, Hands-on Assignments, Team Activities etc	**(Mandatory Non-Credit Course)**	**Audit Course**

Prerequisite Courses, if any: Environmental Science basic knowledge learnt till 12th Standard.

Companion Course, if any: NIL

Audit course for Environmental Science is mandatory but non-credit course. Assessment has to be conducted at the end of Semester for award of grade at college level. Grade awarded for audit course shall not be calculated for grade point & CGPA.

Course Objectives:

- To explain the concepts related to sustainable development and various components of environment.
- To provide a comprehensive overview of environmental pollution and the science and technology associated with the monitoring and control.
- To gain an understanding of the value of biodiversity and current efforts to conserve biodiversity at national and local level.
- To examine a range of environmental issues in the field, and relate these to scientific theory and find their solutions using technology.

Course Outcomes: On completion of the course, learner will be able to -

CO1: Demonstrate an integrative approach to environmental issues with a focus on sustainability.

CO2: To provide a comprehensive overview of environmental pollution and the science and technology associated with the monitoring and control.

CO3: Identify key threats to biodiversity and develop technological options for conserving biodiversity in different settings

CO4: Learn skills required to research and analyze environmental issues scientifically and these skills in applied situations such as careers that may involve environmental issues.

Course Contents

Unit I: Introduction to Environmental Science	**(02 Hrs)**
Multidisciplinary nature of subject environmental science; study of natural systems and the application of technology to protect and improve the environment. Scope and importance; Concept of sustainability and sustainable development and ethical environmental practices. UN sustainable development goals.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO4, PO6, PO11**

Unit II: Environmental Pollution and Control	**(04 Hrs)**
Environmental pollution: types, causes, effects and controls; Air, water, soil, chemical and noise pollution, nuclear hazards and human health risks, solid waste management. Control measures for urban and industrial waste, technology in controlling pollution.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO4, PO6, PO11**

Unit III: Biodiversity and Conservation	**(04Hrs)**
Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; emerging solutions for conservation of biodiversity; In-situ and Ex-situ conservation of biodiversity.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO4, PO6, PO11**

Unit IV: Field Work	**(06Hrs)**
• Visit to an area to document environmental assets; river / forest / flora / fauna, etc. • Visit to a local polluted site – urban / rural / industrial /agricultural. • Study of common plants, insects, birds and basic principles of identification. • Site visit for emerging solution for environmental issues.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO4, PO6, PO11**

Learning Resources

Text Books:

1. Air Pollution: H. V. N. Rao and M. N. Rao, TMH Publications
2. Environmental Engineering: Peavy and Rowe, McGraw Hill Publications
3. Biodiversity Conservation: Present Scenario and Future Prospects, Dr. Amar Nath Singh and Dr. Awadh Kishore Roy, Walnut publication.
4. Environment Pollution Control and Environmental Engg. C. S. Rao , Tata McGraw Hill, New Delhi.

Reference Books:

1. Principals of Conservation Biology, Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll.. Sunderland: Sinauer Associates.
2. 1999. Global Ethics and Environment, Gleeson,B. and Low, N. (eds.) London, Routledge.
3. Something New Under the Sun: An Environmental History of the Twentieth Century,McNeil, John R.
4. Environmental Science; S. C. Santra; New Central Book Agency (P) Ltd.; 2nd Edtn.

MOOC / NPTEL Courses/Other Resources:

1. https://swayam-plus.swayam2.ac.in/courses
2. https://swayam.gov.in/explorer
3. https://nptel.ac.in/courses

ARMY INSTITUTE OF TECHNOLOGY, PUNE

Autonomous Institute

Affiliated to Savitribai Phule Pune University, Maharashtra, India

National Education Policy (NEP) Compliant Curriculum

Semester - II

First Year B. Tech. in Mechanical Engineering (2025 Pattern)

www.aitpune.com

Course Code: BME25121A0A Course No – Engineering Mathematics II		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 03 Hrs. / Week	**03**	**CIE (Theory): 50 Marks** **SEE (Theory): 50 Marks**

Prerequisite Courses, if any: 1. Elementary Mathematics 2. Elementary Calculus

Companion Course, if any:

Course Objectives:

- To understand and familiarize with concept of double integration.
- To understand and familiarize concept of triple integration for finding volume.
- To understand and familiarize with concept of partial differentiation to find extreme values, error and approximation and jacobians.
- To understand and apply concept of statistical analysis.
- To understand and apply concept of probability distributions.

Course Outcomes: On completion of the course, learner will be able to -
CO1: Understand and apply techniques of double integration to find area and Mass of two-dimensional objects.
CO2: Understand and apply techniques of triple integration to find volume and Mass of solids.
CO3: Apply the concepts of partial differentiation to find extreme values and error and approximations.
CO4: Apply the concepts of statistics to **analyze** and interpret data.
CO5: Understand probability theory and distributions to **create** models of random events.

Course Contents

Unit I: Double Integration	**(08 Hrs)**

Double integrals over a rectangle, Double integrals over regions, Change of order of integration, Introduction of Jacobians determinant for two variables, Double integral in polar coordinates, The Gaussian integral, Applications of double integral: Area of plane Lamina, Mass of plane lamina, Surface area.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO4, PO5, PO11, PSO1, PSO2, PSO4**

Unit II: Triple Integration	**(08 Hrs)**

Triple integral over a box, Triple integrals by iterated integration, Change of variables, Cylindrical and spherical coordinates, The jacobian determinant for three variables, Evaluation of triple integral, Applications of triple integral: volume, mass of solid.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO4, PO5, PO11, PSO1, PSO2, PSO4**

Unit III: Partial Differentiation	**(09 Hrs)**

Partial derivatives, Composite function, Chain Rule, Variable to be treated as constant, Total derivatives. Euler's theorem for homogeneous functions.
Application of Partial derivatives: Jacobian for explicit function, Errors and approximations, Maxima and minima of two variable functions.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO4, PO5, PO11, PSO1, PSO2, PSO4**

Unit IV: Statistics	**(07 Hrs)**

Measures of central tendency: mean, median, mode. Measurement of variability and dispersion: Standard deviation, standard error, variance, range. Measure of shape: skewness, Kurtosis. Statistical diagram: scattered diagram, histogram and pie Charts, Measure of association between two Variables: Correlation: Karl Pearson's Coefficient of correlation and its mathematical properties, Spearman's Rank correlation and its interpretations.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO4, PO5, PO11, PSO1, PSO2, PSO4**

Unit V: Probability	**(08 Hrs)**

Joint, Conditional and marginal probability, Bayes' theorem, Independence, Theorem of total probability, Expectation and variance, Random variables. Probability distributions: Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Normal and Chi square.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO4, PO5, PO11, PSO1, PSO2, PSO4**

Learning Resources
Text Books: 1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Edition. 2. B.S. Grewal, "Higher Engineering Mathematics", 3. S. S. Sastry, "Engineering Mathematics Volume I", New Delhi PHI Publication. Covers multiple integrals, partial derivatives, and probability topics with engineering applications. 4. Michael D. Greenberg, "Advanced Engineering Mathematics", Prentice Hall. 5. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, and Keying E. Ye "Probability and Statistics for Engineers and Scientists", Pearson Education India.
Reference Books: 1. James Stewart, "Calculus: Early Transcendentals", Cengage Learning India. 2. Henry Stark and John W. Woods, "Probability, Statistics, and Random Processes for Engineers" Pearson. 3. Dennis Wackerly, William Mendenhall, and Richard L. Scheaffer, "Mathematical Statistics with Applications", Duxbury Press. 4. William Navidi, "Statistics for Engineers and Scientists", McGraw-Hill Education.
MOOC / NPTEL Courses/Other Resources: 1. https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/pages/4.-triple-integrals-and-surface-integrals-in-3-space/part-a-triple-integrals/session-74-triple-integrals-rectangular-and-cylindrical-coordinates/ 2. https://archive.nptel.ac.in/courses/111/105/111105090/ 3. https://onlinecourses.nptel.ac.in/noc23_ma35/preview 4. https://onlinecourses.nptel.ac.in/noc25_ma48/preview **5.** https://archive.nptel.ac.in/courses/127/101/127101233/

Course Code: BME25121A0C Course No - Engineering Mathematics-II Tutorial		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Tutorial : 01 Hrs. / week	**01**	**Term Work: 25 Marks**

Prerequisite Courses, if any: 1. Elementary Mathematics 2. Elementary Calculus

Companion Course, if any: Calculus and Statistics

Course Objectives:

- To understand and familiarize with concept of double integration.
- To understand and familiarize concept of triple integration for finding volume.
- To understand and familiarize with concept of partial differentiation to find extreme values, error and approximation and jacobians.
- To understand and apply concept of statistical analysis.
- To understand and apply concept of probability distributions.

Course Outcomes: On completion of the course, learner will be able to -
CO1: Understand and apply techniques of double integration to find area and Mass of two-dimensional objects.
CO2: Understand and apply techniques of triple integration to find volume and Mass of solids.
CO3: Apply the concepts of partial differentiation to find extreme values and error and approximations.
CO4: Apply the concepts of statistics to **analyze** and interpret data.
CO5: Understand probability theory and distributions to **create** models of random events.

Guidelines for Lab /TW Assessment

For TW assessment - weightage given to

- Attendance
- Completion of Assignments (at least one assignment per unit)
- In time Submission

List of Assignments

Unit I Double Integration

Study of double integration and applications to find area of plane lamina, mass of plane lamina and surface area.

Unit II Triple Integration

Study of triple integration and its applications to find volume and mass of solid.

Unit III Partial Differentiation

Study of partial derivatives and their applications to find Jacobian, Error, approximations, Maxima and Minima.

Unit IV Statistics

Study of descriptive and inferential statistics with the help of Microsoft Excel/Suitable software tools.

Unit V Probability

Study of various probability distributions with the help of Microsoft Excel/ Suitable software tools.

MOOC / NPTEL Courses/Other Resources:

1. https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/pages/4.-triple-integrals-and-surface-integrals-in-3-space/part-a-triple-integrals/session-74-triple-integrals-rectangular-and-cylindrical-coordinates/
2. https://archive.nptel.ac.in/courses/111/105/111105090/
3. https://onlinecourses.nptel.ac.in/noc23_ma35/preview
4. https://onlinecourses.nptel.ac.in/noc25_ma48/preview
5. https://archive.nptel.ac.in/courses/127/101/127101233/

Course Code: BME25122A0A Course Name: Applied Science for Mechanical Engineering - II		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 03 Hrs. / Week	**03**	**CIE (Theory): 50 Marks** **SEE (Theory): 50 Marks**

Prerequisite Courses, if any:

Companion Course, if any:

Course Objectives:

- The objectives of this course are to make students to learn basics of Engineering Mechanics concepts and its application to the real-world problems, solve problems involving Forces, loads and Moments and know their applications in allied subjects.
- Familiarize the concept of equilibrium and friction
- Study and analyze motion of moving particles/bodies.

Course Outcomes: On completion of the course, the learner will be able to -

CO1: Understand basic concept of forces, moments and couples and apply concept of free body diagram for static equilibrium in two-dimension force system

CO2: Analyze rectilinear and curvilinear motion of particle.

CO3: Apply Newton's second law, work energy and impulse momentum principles for particles.

CO4: Analyze the practical example involving friction and application of two force members.

CO5: Understand use of Lifting Machnes and Trusses.

Course Contents

Unit I: Physics of Force systems and Equilibrium	**(08 Hrs)**

Introduction: Introduction to Physics, Beginning and Development of Engineering Mechanics, Division of Mechanics, Type of motion, fundamental concepts and principle of Physical Laws in nature

Physics of Force systems: Introduction to force, types, force system, resolution and composition of forces, resultant of concurrent force system, moment of a force, Varignon's theorem, resultant of parallel force system, couple and resultant of general force system. Introduction, centroid of basic figures, centroid of composite figure, moment of inertia of simple geometrical figure, parallel axis theorem, perpendicular axis theorem, moment of inertia of composite figure.

Equilibrium: Introduction, free body diagram, equilibrium of coplanar forces, equilibrium of two forces, three force principle, equilibrium of concurrent, parallel and general force system, type of load, type of support, type of beam and support reaction

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2**

Unit II: Kinematics of Particle and Rigid Bodies	**(08 Hrs)**

Kinematics of Particle: Introduction, basic concept, rectilinear motion: motion with uniform acceleration, gravitational acceleration and variable acceleration, curvilinear motion: rectangular components, Motion curves (a-t, v-t, s-t curves), projectile, normal and tangential components.

Kinematics of Rigid Body: Introduction to rigid body, Translation, Rotation and General Plane motion of Rigid body. The concept of Instantaneous center of rotation (ICR) for the velocity. Location of ICR for 2 link mechanism. Velocity analysis of rigid body using ICR.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3**

Unit III: Kinetics of Particle and Rigid Bodies	**(08 Hrs)**

Introduction, Newton's second law of motion, equation of motion, Newton's law of gravitation, application of Newton's second laws to rectilinear and curvilinear motion, conservative and nonconservative forces, work energy principle, conservation of energy, impulse momentum principle and impact, Formulation of differential equation of motion (Newton, D'Alembert and energy method), Application of Work- Energy principle to a system consists of connected masses and Springs.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3**

Unit IV: Principle and Applications of Friction	**(08 Hrs)**

Principle of Friction: Introduction, sliding and rolling friction, laws of coulomb friction, coefficient of friction, angle of repose, angle of friction, cone of friction, friction on inclined plane, ladder friction and belt friction.

Applications of Friction: Introduction, Ladder Friction, Wedge Friction, Screw Friction, Relation Between Effort and Weight Lifted by a Screw Jack, Relation Between Effort a and Weight Lowered by a Screw Jack, Efficiency of a Screw Jack

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3**

Unit V: Lifting Machnes and Trusses	(08 Hrs)
Lifting Machines: Introduction, Types, Simple Machine and Compound Machine, Mechanical Advantage, Efficiency of a Machine, Ideal Machine, Velocity Ratio, Reversibility of a Machine, Self-locking Machine, Friction in a Machine, Law of a Machine, Types of Lifting Machines, Simple and Differential Wheel and Axle, Weston's Differential Pulley Block, Geared Pulley Block, Worm and Worm Wheel, Worm Geared Pulley Block, Crab Winch, Simple Pulley, System of Pulleys, Simple and Differential and Worm Geared Screw Jack, **Trusses**: Introduction, Types, Classification, two force and multi force member, assumption of analysis, analysis of truss, identification of zero force members, method of joint and method of section.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3**

Learning Resources

Text Books:

1. Engineering Mechanics, Ferdinand Singer, 3rd edition, Harper and Row
2. Engineering Mechanics (Statics and Dynamics) by Hibbeler R. C., Pearson Education.

Reference Books:

1. Engineering Mechanics, S Timoshanko and Young, Tata McGraw Hill Education Pvt. Ltd. New Delhi.
2. Vector Mechanics for Engineers – Statics, Beer and Johnston, Tata McGraw Hill
3. Vector Mechanics for Engineers – Dynamics, Beer and Johnston, Tata McGraw Hill.
4. Engineering Mechanics - Statics and Dynamics, Meriam J. L. and Kraige L.G., John Wiley and Sons

MOOC / NPTEL Courses/Other Resources:

1. Engineering Mechanics
https://archive.nptel.ac.in/courses/112/106/112106286/#

2. Engineering Mechanics
https://archive.nptel.ac.in/courses/112/106/112106286/#

3. Engineering Mechanics: Statics and Dynamics
https://archive.nptel.ac.in/courses/112/106/112106180/

Course Code: BME25122A0B Course Name- Applied Science for Mechanical Engineering - II Lab		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 02 Hrs. / Week	**01**	**Term Work: 25 Marks**

Prerequisite Courses, if any:

Companion Course, if any:

Course Objectives:

- The objectives of this course are to make students to learn basics of Engineering Mechanics concepts and its application to the real-world problems, solve problems involving Forces, loads and Moments and know their applications in allied subjects.
- Familiarize the concept of equilibrium and friction
- Study and analyze motion of moving particles/bodies.

Course Outcomes: On completion of the course, the learner will be able to -

CO1: Understand basic concept of forces, moments and couples and apply concept of free body diagram for static equilibrium in two-dimension force system

CO2: Analyze rectilinear and curvilinear motion of particle.

CO3: Apply Newton's second law, work energy and impulse momentum principles for particles.

CO4: Analyze the practical example involving friction and application of two force members.

CO5: Understand use of Lifting Machnes and Trusses.

Guidelines for Student's Lab Journal

1. Draw the diagram on the left side of the first page, in front of the aim in pencil, on a blank page.
2. The observations will be written on blank age with a pencil, followed by the calculations on the same page.
3. The graph will face the observation table. Show the slope and any related calculations on the graph, in pencil.

Guidelines for Lab /TW Assessment

1. 10 marks for the lab/journal work, which includes 5 marks for timely submission/practical completion, 05 marks for the interest shown while performing the practical, calculations, etc.
2. 05 marks for file writing.
3. 05 marks for theory attendance.
4. 05 marks for class seminars/viva.

Guidelines for Laboratory Conduction

1. Come with a completed file in the laboratory.
2. Ensure the file is checked regularly.
3. Do not enter the lab/work in the lab without an instructor.

List of Laboratory Experiments

Group A - Experimental (Any ten)

1	To verify triangle, parallelogram and polygon law of forces with the help of Force Polygon Apparatus.
2	To verify the conditions required for a system to be in equilibrium under the influence of coplanar forces, and confirm Newton's first law of motion using Force Table Apparatus
3	To determine the forces in Jib and Tie with the help of Jib Crane Apparatus. (Co-Planer Concurrent force system)
4	To understand the vector quantities and find out axial forces in a Non-coplanar force system.
5	To verify the coordinates of the centroid of different laminae determined from the experiment with theoretical result.
6	To determine the center of gravity of irregular objects.
7	To verify Newton's laws of motion and hence establish relation among motion parameters.
8	To determine the radius of gyration and moment of inertia of a Simple/Compound Pendulum.
9	To determine the Polar Mass moment of Inertia of a Fly Wheel.
10	To understand the relationships among mass moment of inertia and angular acceleration of disk rolling down on an inclined plane.
11	To determine the Coefficient of friction between an Inclined Plane (Glass) and Trolley (Iron) using Rolling Friction Apparatus
12	To determine the co-efficient of friction between the slider and the inclined plane using Sliding Friction Apparatus
13	To determine the coefficient of restitution.
14	To verify the law of moment with the help of Bell Crank Lever Apparatus.
15	To determine the mechanical advantage, velocity ratio and efficiency of a simple/compound screw jack.

16	To determine law of machine for worm and worm wheel Apparatus.
17	To determine law of machine for single/double purchase crab.
18	To determine law of machine for differential wheel and axle Apparatus.
19	To verify the principle of forces and determination of reactions at the supports of a simply supported beam using Parallel Forces Apparatus
20	To find the axial forces in all the bars of the triangular truss and find out the type of force using Member Truss Apparatus.
Group B - Graphical (Any five)	
1	Equilibrium of concurrent force system
2	Equilibrium of parallel force system
3	Forces in the member of pin jointed truss
4	Centroid of different laminae
5	Moment of Inertia
6	To Verify Lami‘s theorem using universal force table apparatus.
Group C - Assignment/Numerical	
1	Assignment on each unit: minimum 03 Example/Numerical on each unit

Useful Links/Resources:

1. Mechanics Virtual Lab
   https://vlab.amrita.edu/index.php?sub=1&brch=74

Course Code : BME25123A0A Course Name: Programming for Problem Solving Techniques		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 03 Hrs. / Week	**03**	**CIE (Theory): 50 Marks** **SEE (Theory): 50 Marks**

Prerequisite Courses, if any: Basics of Computers and Basic Mathematics

Companion Course, if any:

Course Objectives: Primary objective of the course is to give students a basic introduction to programming and problem-solving using python language and to introduce students not merely to the coding, but to computational thinking, the methodology of computer programming, and the principles of good program design including modularity and encapsulation.

- To understand methods of problem solving, its aspects, and basics of programming.
- To learn basics of Python programming, its features and syntax.
- To acquaint with data types, input output statements in Python.
- To learn decision making/control statements, iterative constructs, function, strings, file handling in Python.
- To learn principles of Object-Oriented Programming using python.

Course Outcomes: On completion of the course, learner will be able to -
CO1: Inculcate and **apply** skills in problem solving.
CO2: Choose most appropriate programming constructs and features such as looping, arrays, structures etc. to **solve** the problems in diversified domains.
CO3: Exhibit the programming skills for the problem-solving using functions and string manipulations in Python.
CO4: Demonstrate File handling and dictionaries in Python.
CO5: Apply Object Oriented concepts in Python.

Course Contents

Unit I: Problem Solving, Programming and Python Programming	**(8 Hrs)**

General Problem-Solving Concepts: Problem solving in everyday life, types of problems, problem solving with computers, difficulties with problem-solving, problem-solving aspects, top-down design, Problem Solving Strategies - Divide and Conquer, Merge Solutions, Building Block Approach, Algorithmic Problem Solving
Program Solving Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms.
Basics of Python Programming: Features of Python, History and Future of Python, Programming Paradigm, Features of Object-Oriented Programming, Applications of Python Languages.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PSO1, PSO2**

Unit II: Advance Data Types and Decision Control Statements	**(7 Hrs)**

Advance data types: Tuples, Lists, Sets and Dictionary.
Decision Control Statements: Decision control statements, Selection/conditional branching
Statements: if, if-else, nested if, if-elif-else statements
Iterative statements: Do-while / while loop, for loop, selecting appropriate loop. Nested loops, *break, continue, pass, else* statements used with loops.

Mapping of Course Outcomes with POs & PSOs	**PO2, PO3, PO5, PSO1, PSO2**

Unit III: Functions and Strings	**7 (Hrs)**

Functions: Need for functions, definition, call, variable scope and lifetime, the return statement, Defining functions, Lambda or anonymous function, documentation string, good programming practices.
Modules/Packages in Python: Introduction to modules, Introduction to packages in Python, Introduction to standard library modules.
String Operations: concatenation, appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, Iterating strings, the string module.

Mapping of Course Outcomes with POs & PSOs	**PO2, PO3, PO5, PSO1, PSO2**

Unit IV: File Handling and Dictionaries	**7 (Hrs)**

Files: Introduction, File path, Types of files, Opening and Closing files, Reading and Writing files.
File Handling: File Positions, Renaming and deleting files. Directory Methods, Dictionaries creating, assessing, adding and updating values.
Case Study: Study design, features, and use of any recent, popular and efficient system developed using Python. (This topic is to be excluded for theory examination)

Mapping of Course Outcomes with POs & PSOs	**PO02, PO3, PO5, PSO1. PSO2**

Unit V: Object Oriented Programming	7 (Hrs)
Structured and object oriented: Features of Object-oriented programming-classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation. **Classes and Objects**: classes and objects, class method and self-argument, __init__() method, class variables and object variables, __del__() method, public and private members, Built in function to check, Get, Set and Delete class attribute, Garbage collection, class methods, Static Method.	
Mapping of Course Outcomes with POs & PSOs	**PO2, PO3, PO5, PSO1. PSO2**

Learning Resources

Text Books:

1. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press; Second edition ISBN10:938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

Reference Books:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978-0132492645
2. Romano Fabrizio, "Learning Python", Packt Publishing Limited, ISBN: 9781783551712, 1783551712
3. Paul Barry, "Head First Python- A Brain Friendly Guide", SPD O'Reilly, 2nd Edition, ISBN:978-93-5213-482-3
4. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, ISBN-10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
5. Jeeva Jose, P. Sojan Lal, "Introduction to Computing & Problem Solving with Python", Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978-9382609810

MOOC / NPTEL Courses/Other Resources:

1. **The Joy of Computing using Python**
   https://nptel.ac.in/courses/106106182
2. **Scientific Computing using Python**
   https://nptel.ac.in/courses/115104135
3. **Computational Science and Engineering Using Python**
   https://nptel.ac.in/courses/115104095
4. **Computational Science and Engineering Using Python**
   https://archive.nptel.ac.in/courses/115/104/115104095/
5. **Introduction to Python Programming**
   https://www.udemy.com/course/introduction-to-python-programming-for-beginners/
6. **Programming for Everybody (Getting Started with Python)**
   https://www.coursera.org/learn/python

Course Code : BME25123A0B Course Name: Programming for Problem Solving Techniques Lab		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 02 Hrs. / Week	**01**	**Term Work: 25 Marks**

Prerequisite Courses, if any:

Companion Course, if any:

Course Outcomes: On completion of the course, learner will be able to:
CO1: Apply principles of problem solving to arrive at a solution of given problem statement and implement, test and analyses the same using Python programming tools
CO2: Work in team, communicate with peers and write report of the work done.

Guidelines for Student's Lab Journal

- Every Experiment is to be written and completed using given template by faculty.
- Every experiment should include – Title, Algorithm, Source Code and Output.

Guidelines for Lab /TW Assessment

For TW assessment - weightage given to

- Attendance
- Understanding of Logic
- Hands On Completion of Exercise
- In time Submission

Guidelines for Laboratory Conduction

- Minimum 14 experiments to be completed
- Programming exercises to be conducted using Python based Modules, Modules, etc.
- Each program to be tested / validated using minimum 3 test cases.

List of Laboratory Experiments

Group-A Unit Specific Assignments	
Group-A Unit I: Problem Solving, Programming and Python Programming (Any Two)	
Program Design Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms. Writing and executing Python program, Literal constants, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Expressions in Python.	
1	Installation of Python
2	Program to display data of different types using variable and literal constants.
3	Program to read variables from the user.
4	Program to exhibit indentation errors.
5	Program to perform all operation (addition, multiplication, subtraction, division, modules) and expression.
6	Program to convert degree Fahrenheit into degree Celsius.
7	To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions
Group-A Unit II: Advance Data Types and Decision Control Statements (Any Two)	
1	Type Conversion, Type casting, Comment.
2	Program to demonstrate operation on lists.
3	Program to determine whether a person is eligible to vote or not.
4	Program to find whether the given number is even or odd.
5	Program to determine whether the character entered is a vowel or not.
6	Program to calculate the sum and average of first 10 numbers
7	Program to find whether the given number is an Amstrong number or not.
8	Program to enter a number and then calculate the sum of its digits.
9	Program to print the multiplication table of n, where n value is entered by user.
Group-A Unit III: Functions and Strings (Any Three)	
1	Program to concatenate two string using + operator.
2	Program to append a string using += operator.
3	Program to display power of a number without using formatting characters.
4	Program to display power of a number using formatting characters.
5	Program to demonstrate slice operation on string objects.
6	Program to understand how characters in a string are accessed using negative indexes.

7	Program to understand ord() and char() function.
8	Program that uses split() to split a multiline string.
9	Program that counts the occurrences of a character in a string. Do not use built in function.
10	Program to reverse of string by user defined function.
11	Write a python program that accepts a string from user and perform following string operations- i. Calculate length of string ii. String reversal iii. Equality check of two strings iii. Check palindrome ii. Check substring.
Group-A	**Unit IV: File Handling and Dictionaries (Any Three)**
1	Program to open a file and print its attribute values.
2	Program to access a file after it is closed.
3	Program to write a file using the writelines() method.
4	Program to append data to an already existing file.
5	Program to display the contents of a file.
6	Program to split the line into a series of words and use space to perform the split operation.
7	Program that tells and sets the position of the file pointer.
8	Program that reads data from a file and calculates the percentage of vowels and consonants in the file.
9	Program that changes the current directory to our newly created directory.
10	Program to print the absolute path of a file using os.path.join.
11	Program that counts the number of tabs, space and newline character in a file.
12	To copy contents of one file to another. While copying a) all full stops are to be replaced with commas b) lower case are to be replaced with upper case c) upper case are to be replaced with lower case.
Group-A	**Unit V: Object Oriented Programming (Any Two)**
1	Program to access class variable using class object.
2	Program to access class members using class object.
3	Program to illustrating the use of __int__() method.
4	Program to differentiate between class and object variable.
5	Program to illustrating the use of __del__() method.
6	Program to illustrating the difference between public and private variable.
7	The program should subtract the DOB from todays date to find out whether a person is eligible to vote or not.
8	Create class EMPLOYEE for storing details (Name, Designation, gender, Date of Joining and Salary). Define function members to compute a)total number of employees in an organization b) count of male and female employee c) Employee with salary more than 10,000 d) Employee with designation “Asst Manager”.
Group-B	**Application Specific Practical Problem Solving (Any Two)**
Faculty from these course branches to design and conduct the practical sessions. Faculty should frame assignments from Mechanical Engineering application domains. Some Examples are given below:	
1	On a certain planet a correctly calibrated spring balance shows the weight of a body 12 N, the mass of which is 4.893 kg. Write a program to find the value of gravity on this planet.
2	Write a program to estimate the heat loss through a red brick wall of length 5m, height 4m and thickness 0.25m, if the temperatures of the wall surfaces are maintained at 110 degree centigrade and 40 degree centigrade respectively. K for red brick is 0.70 W/mk.
3	Assume five liters of Oil weigh 61.80 N. Write a program to calculate i) Specific Weight ii) Specific mass using python.

Useful Links/Resources:

1. Python For Beginners - https://www.python.org/about/gettingstarted/
2. Learn Python - Free Interactive Python Tutorial - https://www.learnpython.org/
3. Google's Python Class - https://developers.google.com/edu/python

Course Code: BME25124A0A Course Name – Engineering Drawing & Graphics		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 03 Hrs. / Week	**03**	**CIE: 50 Marks** **SEE: 50 Marks**

Prerequisite Courses, if any: Basic Geometric Shapes, Basic geometrical measurements (linear and angular) and construction, Computer literacy

Companion Course, if any:

Course Objectives:

- This course aims to cultivate students' ability to conceptualize physical objects and effectively translate them onto paper for communication in engineering contexts.
- This course enhancing manual drawing skills, honing drawing interpretation abilities, and fostering a practical understanding of object dimensions.
- This course seeks to introduce students to essential drawing and drafting software tools for a well-rounded skill set.

Course Outcomes: On completion of the course, learner will be able to -

CO1: Explain the fundamentals of Engineering Graphics and basic principles of geometric construction and apply the knowledge of Projections, Methods to prepare the drawings for points and lines.

CO2: Apply the types of Projections, Methods to prepare the drawings for planes.

CO3: Apply the concept of orthographic projection of an object to draw several 2D views for visualizing the physical state of the object

CO4: Apply the visualization skill to draw an isometric projection from given orthographic views.

CO5: Construct the various engineering curves and illustrate the application of various engineering curves and draw the development of the lateral surface of solid.

Course Contents	
Unit I: Engineering Drawing and Engineering Curves	**10 Hrs**

Engineering Drawing: Introduction to drawing instruments and their uses, Drawing sheets sizes and their layouts, Types of Lines, Dimensioning methods, General rules of dimensioning, Introduction to AutoCAD, Basic commands for 2D drawing (Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style, etc.)

Engineering Curves: Conic Sections (Ellipse, Parabola and Hyperbola) by directrix- focus and rectangle method, Helix (one convolution) on Cylinder and Cone, Cycloid, Involute of a circle, Archimedean spiral (one convolution)

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PO7, PO09, PSO1, PSO2**

Unit II: Projection of Points, Lines and Planes	**10 Hrs**

Projection of Point & Lines: Introduction to principal planes of projections, Method of Projections, Projection of Points in all possible quadrants, True length and inclination with the reference planes, Projection of line when parallel to both the reference planes, Projections of lines when it is perpendicular to one of the reference planes, when line is inclined to one and parallel to other reference plane, Line inclined to both reference planes (first angle projection).

Projection of Planes: Introduction, Projection of plane when plane is Parallel to one and perpendicular to other, Projection of plane when plane is inclined to one plane and perpendicular to other, Projections of planes when it is inclined to both reference planes, Concept of auxiliary plane method for projections of the plane.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PO7, PO09, PSO1, PSO2**

Unit III: Projections of Solids and Development of Lateral Surfaces	**08 Hrs**

Projections of Solids: Projections of Complete Solids (Cylinder, Cone, Prism, Pyramid [6 Edges])

Development of Lateral Surfaces: Introduction, Method of development, development of lateral surfaces of right solids, cube, prisms, cylinder, pyramids, and cone.

Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PO7, PO09, PSO1, PSO2**

Unit IV: Orthographic Projection	(08 Hrs)
Types of Projections, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method, full sectional view, Hidden features, Curved features, Typical problems by first angle projection method.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PO7, PO09, PSO1, PSO2**
Unit V: Isometric Projection	**(08 Hrs)**
Introduction of isometric projection, Isometric scale, Isometric projection and view, Construction of isometric view/ projection from given orthographic views.	
Mapping of Course Outcomes with POs & PSOs	**PO1, PO2, PO3, PO5, PO7, PO09, PSO1, PSO2**

Learning Resources

Text Books:

1. Bhatt, N. D. and Panchal, V. M., (2016), "Engineering Drawing", Charotar Publication, Anand, India
2. K. Venugopal, K, (2015), "Engineering and Graphics", New Age International, New Delhi
3. Jolhe, D. A., (2015), "Engineering Drawing with introduction to AutoCAD", Tata McGraw Hill, New Delhi
4. Rathnam, K., (2018), "A First Course in Engineering Drawing", Springer Nature Singapore Pte. Ltd., Singapore

Reference Books:

1. Madsen, D. P. and Madsen, D. A., (2016), "Engineering Drawing and design", Delmar Publishers Inc., USA
2. Bhatt, N. D., (2018), "Machine Drawing", Charotor Publishing House, Anand, India
3. Dhawan, R. K., (2000), "A Textbook of Engineering Drawing", S. Chand, New Delhi
4. Luzadder, W. J. and Duff, J. M., (1992), "The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production", Peachpit Press, USA
5. Giesecke, F. E., Mitchell, A., Spencer, H. C., Hill, I. L., Loving, R. O., Dygon, J. T., (1990), "Principles of Engineering Graphics", McMillan Publishing, USA

MOOC / NPTEL Courses/Other Resources:

1. NPTEL Course: Engineering Graphics and Design
   https://onlinecourses.nptel.ac.in/noc21_me128/preview
2. NPTEL Course: Introduction and Geometric Construction
   https://archive.nptel.ac.in/content/storage2/courses/112103019/module1/lec3/1.html
3. NPTEL Course: Computer Aided Design and Manufacturing
   https://archive.nptel.ac.in/courses/112/102/112102101/

Course Code : BME25124A0B Course Name: Engineering Drawing & Graphics Lab		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 02 Hrs. / Week	**01**	**Term Work :25 Marks**

Prerequisite Courses, if any: Basic Geometric Shapes, Basic geometrical measurements (linear and angular) and construction, Computer literacy

Companion Course, if any:

Course Objectives:

- This course aims to cultivate students' ability to conceptualize physical objects and effectively translate them onto paper for communication in engineering contexts.
- This course enhancing manual drawing skills, honing drawing interpretation abilities, and fostering a practical understanding of object dimensions.
- This course seeks to introduce students to essential drawing and drafting software tools for a well-rounded skill set.

Course Outcomes: On completion of the course, learner will be able to -

CO1: Explain the fundamentals of Engineering Graphics and basic principles of geometric construction and apply the knowledge of Projections, Methods to prepare the drawings for points and lines.

CO2: Apply the types of Projections, Methods to prepare the drawings for planes.

CO3: Apply the concept of orthographic projection of an object to draw several 2D views for visualizing the physical state of the object

CO4: Apply the visualization skill to draw an isometric projection from given orthographic views.

CO5: Construct the various engineering curves and illustrate the application of various engineering curves and draw the development of the lateral surface of solid.

Guidelines for Lab /TW Assessment

- Continuous assessment of laboratory work is conducted based on overall performance.
- Each lab assignment/ experiment assessment will assign grade / marks based on parameters with appropriate weightage.
- Suggested rubrics for overall assessment as well as each lab assignment / experiment assessment:

Parameter [Marks]	Low	Medium	High
Understanding (Viva) [02]	The student did not answer any viva questions asked (0 mark)	The student answered few viva questions asked (1 mark)	The student answered all viva questions asked (2 marks)
Assignment Completion [08]	The assignment was not submitted in the lab session (0 marks)	The assignment was submitted in the lab session but was incomplete (1-4 marks)	Completed assignment was submitted in the lab session (5-8 marks)

Guidelines for Laboratory Conduction

- Work deliberately and carefully.
- Keep your work area clean.
- Students should have their own mini drafter, pencil, eraser, etc.
- Handle the models carefully.
- Do not wander around the room and distract other students.
- Do not eat food, drink beverages or chew gum in the Drawing Hall.
- Do not open any irrelevant internet sites on mobile.

Guidelines for Student's Lab Journal

Assignment problems to be drawn on A2 size drawing sheet and two problems must be drawn by using any CAD software.

List of Assignments

1	Draw two problems on Engineering curves
2	Draw two problems on projection of lines
3	Draw two problems on projection of planes

4	Draw two problems on Projections of Solids
5	Draw two problems on Development of Lateral Surfaces
6	Draw two problems on Orthographic projections
7	Draw two problems on Isometric views
8	Computer Aided Drafting of two problems on Engineering curves
9	Computer Aided Drafting of two problems on Orthographic projections
10	Computer Aided Drafting of two problems on Isometric views

Useful Links/Resources:

1. NPTEL Course: Engineering Graphics and Design
   https://onlinecourses.nptel.ac.in/noc21_me128/preview
2. NPTEL Course: Computer Aided Design and Manufacturing
   https://archive.nptel.ac.in/courses/112/102/112102101/

Course Code: BCC25125A0X Course Name: Design Thinking, Innovation and Prototyping		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 01 Hrs. / Week	**01**	**CIE: 50 Marks**

Prerequisite Courses, if any: Nil

Companion Course, if any: Nil

Course Objectives:

- **Understand** the core principles of design thinking and its role in engineering.
- **Apply** knowledge of design thinking to analyze and solve complex problems.
- **Develop** creative and user-centered solutions to real-world challenges.
- **Demonstrate** effective communication and collaboration in multidisciplinary teams.
- **Evaluate** and **analyze** design concepts and prototypes.
- **Develop** a mindset for continuous innovation and improvement.

Course Outcomes:

On completion of the course, the learner will be able to –

CO1: Generate innovative ideas and solutions through brainstorming and ideation.

CO2: Conceptualize a product based on design requirements and evaluate prototypes to validate design specifications.

CO3: Prototype and test design solutions to refine and improve them.

CO4: Present and communicate design ideas effectively

CO5: Collaborate with peers and industry professionals to address real-world design challenges.

Course Contents	
Unit I: Redefining Problem (CO1)	**03 Hrs**
OIOR tool, redefining problem statement, Storyboarding, visual representation of how the prototype will function in real world scenarios, user journey/interaction with product, Persona creation	
Mapping of Course Outcomes with POs & PSOs	**PO: 03, 05, 06**
Unit II: Concept Evaluation (CO2&CO3)	**03 Hrs**
Ideation: Concepts and approach for innovation, Synectics, Analogical thinking, Metaphors, Inspiration from nature, Concept evaluation, Concept maps, Introduction to Process of Prototyping, rough sketches, wireframes, draft layouts, paper prototypes, Mockups with clay, paper, wood, etc.	
Mapping of Course Outcomes with POs & PSOs	**PO: 04, 08, 10**
Unit III: Prototyping (CO2&CO3)	**03 Hrs**
Minimum Viable Product, Proof of Concepts (PoC) (to demonstrate the feasibility of the core Concept in order to get feedback from its users), medium prototyping. Process of final prototyping (Human Factors / Ergonomics, Systems Mapping, Hi-fidelity prototyping, Hard prototyping).	
Mapping of Course Outcomes with POs & PSOs	**PO: 03, 04, 05**
Unit IV: User Feedback (CO3, CO4 &CO5)	**02 Hrs**
Usability Studies and User Feedback: User feedback on product before, during and after usage, Observation of product usage in Natural settings and Observation in Laboratory/Workshop settings, User feedback evaluation.	
Mapping of Course Outcomes with POs & PSOs	**PO: 08, 09**
Unit V: Business Model (CO3,CO4 &CO5)	**03 Hrs**
Innovative Business Model (Key resources, Revenue streams, Cost structure, Customer segment, Channels to reach customer future plan), SWOT & SWOR Analysis, Pitch presentation	
Mapping of Course Outcomes with POs & PSOs	**PO: 01 to 11**

Group Structure:

1. Working in faculty monitored groups. The students plan, manage and complete a task / project / activity which address the stated problem. 2. There should be a of team / group of 3 – 4 students

Learning Resources
Reference Books: 1. Design Thinking: Understanding How Designers Think and Work by Nigel Cross 2. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by Tim Brown 3. Design Thinking for Visual Communication" by Ranjan Nayar and Jaidip Subedi 4. The Design of Everyday Things" by Don Norman• "Design Thinking: Creativity and Innovation" by S. Balaram 5. Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days" by Jake Knapp 6. Creative Confidence: Unleashing the Creative Potential Within Us All" by Tom Kelley and David Kelley (with a foreword by Ratan Tata)
MOOC / NPTEL Courses/Other Resources: 1. https://swayam-plus.swayam2.ac.in/courses 2. https://swayam.gov.in/explorer 3. https://nptel.ac.in/courses

Course Code: BCC25125A0B Course Name: Design Thinking, Innovation and Prototyping Lab		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 02 Hrs. / Week	**01**	**Term Work :25 Marks**

Prerequisite Courses, if any: Basic Geometric Shapes, Basic geometrical measurements (linear and angular) and construction, Computer literacy

Companion Course, if any:

Course Outcomes: On completion of the course, learner will be able to -
CO1: Work in team to think out of box with the solid foundation of Design thinking and ideation concepts.
CO2: Create Prototype of Problem present and document the same.

Guidelines for Student's Lab Journal

1. Draw the diagram on blank pages. You can use colored pencils/sketch pens etc to make your work clear and presentable
2. The content will be written on one side ruled pages.
3. The pictures can be pasted on the blank side.

Guidelines for TW Assessment (25)

1. 15 marks for the lab / journal work, which includes 5 marks for timely submission/task completion, 05 interest shown in the classroom and laboratory and 05 marks for file writing.
2. 05 marks is for theory attendance.
3. 05 marks class presentations.

Guidelines for CIE (50)

1. First evaluation based on presentation to be conducted around midterm for 10 marks.
2. Second presentation to be conducted at the time of submission for 10 marks.
3. The evaluation of the submitted report for 10 marks.
4. The final hard prototype will be evaluated for 20 marks.

[Creativity and originality (05), Clarity and completeness (05), Justification of prototype features (05), Quality (05)]

Guidelines for Laboratory Conduction

1. Come with a completed file. 2. Ensure the file is checked regularly. 3. Participate in class/lab activities.
4. Complete your tasks on time.

List of Assignments and Submission

1	Using OIOR or some other appropriate tool redefine the problem statement
2	Submit a completed storyboard outlining the user experience with your prototype. (both in graphical form and in text of 200 words) Use the relevant diagrams/flow charts/pictures.
3	Design a function map for the persona using your product. Use the relevant diagrams/flow charts/pictures.
4	Draw a concept Evaluation map along with a text of 200 words describing it.
5	Write 200 words report on the soft prototype created with the relevant diagrams/flow charts/pictures, with a list of features to be included in the prototype.
6	Create a mind map for proof of concept of your idea. Explain it in 200 words.
7	Write a detailed report of 300 words on the hard prototype created, along with the relevant diagrams/flow charts/pictures.
8	Discuss user feedback on your prototype in 300 words along with the relevant diagrams/flow charts/pictures.
9	Draw an evaluation matrix and a map of user feedback and the actions taken in 200 words.
10	Make a business model of your idea, giving it a title, mission etc along with its SWOT and SWOR analysis and the pitch.

Course Code: BCC25126A0X Course Name: Entrepreneurship Skills and Professional Ethics		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 02 hrs. / week	**02**	**CIE: 50 Marks**

Prerequisite Courses, if any:

Companion Course, if any:

Course Objectives: Primary objective of the course is to give students a basic understanding and awareness about "Entrepreneurship", its significance and skills required to pursue the same. The course also gives an overview of process of building a startup.

- To introduce fundamental concepts of entrepreneurship
- To develop basic entrepreneurial skills
- To foster financial and marketing literacy for startups
- To understand of professional and ethical responsibility
- To acquaint with leadership and teamwork skills

Course Outcomes: On completion of the course, learner will be able to -

CO1: Identify various types of entrepreneurships, discuss its economic impact, and outline the entrepreneurial mindset and characteristics of successful entrepreneurs.

CO2: Perform basic ideation, identify viable opportunities, and create a simple business plan, including understanding key elements of a business model.

CO3: Apply basic budgeting, funding options, and marketing strategies relevant to new businesses and identify ways to reach and satisfy customers.

CO4: Understand and apply ethical principles, resolve ethical dilemmas responsibly, and recognize the role of corporate social responsibility in modern business.

CO5: Exhibit essential leadership qualities, work effectively in teams, manage conflicts, and make sound, ethical decisions in diverse professional settings.

Course Contents

Unit I: Introduction to Entrepreneurship and the Entrepreneurial Mindset.	**8 Hrs**

To provide students with foundational knowledge of entrepreneurship, covering its role in economic development, types of entrepreneurships, and the entrepreneurial mindset.

- Basics of Entrepreneurship: Definition, characteristics, and types of entrepreneurships.
- Role in Economy and Society: How entrepreneurship drives innovation and growth. Different models – Micro, Small, and Medium Enterprises
- Developing an Entrepreneurial Mindset: Characteristics, and skills like risk-taking, creativity, and resilience.
- Understanding Different Domains Entrepreneurship – Techno, Social, Women, Healthcare, Education, Manufacturing, Entrepreneurship etc.

Activities:

1. Quiz on definitions and types of entrepreneurships.
2. Role-play scenarios focusing on decision-making and risk-taking.
3. Panel discussion or guest lecture on diverse entrepreneurial domains.

Case study - Women entrepreneurs' success story / A Successful MSME.

Mapping of Course Outcomes with POs & PSOs	**PO6, PO7**

Unit II: The Entrepreneurial Process and Business Models	**7 Hrs**

To enable students to identify business opportunities, understand the entrepreneurial process, and create simple business models.

- Ideation and Opportunity Recognition: Generating and evaluating business ideas.
- Feasibility and Business Planning: Basics of market research and planning.
- Business Models: Overview of various models (B2B, B2C, subscription, etc.).
- Components of a Business Plan: Key elements of a simple business plan.

Activities:

1. Group ideation exercise to generate start-up ideas.
2. Workshop on creating a simple business plan.
3. Role-play exercise to explain different business models to a layperson.
4. Interactive session on key business plan components.

Mapping of Course Outcomes with POs & PSOs	**PO6 – PO11, PSO1**

Unit IV: Professional Ethics and Corporate Social Responsibility (CSR)	**7 Hrs**

To help students recognize the importance of ethics in engineering and business, promoting integrity, accountability, and social responsibility in their professional behavior.

- Introduction to Ethics: Importance and principles of ethics in personal and professional life.
- Professional and Engineering Ethics: - Ethics in management, organizational Ethics, Ethical aspects of Marketing, Intellectual property and Ethics
- Corporate Social Responsibility (CSR): Basics and examples.
- Common Ethical Dilemmas in Engineering and Business: Case Studies

Activities/ Tutorial

1. Group activity to identify unethical practices in real-world case studies.
2. Case study analysis on ethical issues in engineering and management.
3. Workshop on integrating CSR into business strategies.
4. Role-play scenarios depicting ethical dilemmas.

Mapping of Course Outcomes with POs & PSOs	**PO6 – PO11, PSO1**

Unit V: Leadership and Team Work	**7 Hrs**

• Leadership and Team Skills: Effective communication, teamwork, and conflict resolution.
• Compliance and Social Responsibility: Environmental and societal obligations.
• Human Resource Management, Customer Care
• Trends and Future Opportunities in Entrepreneurship: Emerging fields like green tech and digital transformation

Activities/ Tutorial

1. Conduct a role-play simulating leadership challenges. 2. Case study - Environmental compliance in businesses.
3. Guest lecture / Workshop on effective customer service techniques. 4. Role-play customer service scenarios

Learning Resources

Text Books:

1. "Entrepreneurship Development and Management" by S. S. Khanka - Publisher: S. Chand Publishing
- This book provides a comprehensive introduction to entrepreneurship, focusing on Indian entrepreneurial scenarios. It includes topics on startup strategies, government initiatives, and managerial skills.
2."Fundamentals of Entrepreneurship" by H. Nandan - Publisher: PHI Learning
- This book explains entrepreneurship concepts with a focus on small and medium enterprises (SMEs) in India. It provides insights into entrepreneurial competencies, business planning, and government support systems.
3. "Engineering Ethics" by Charles B. Fleddermann - Publisher: Pearson Education
- This book focuses on engineering ethics, covering case studies, ethical theories, and professional responsibilities. It's particularly suitable for students looking to understand ethical considerations in engineering practices

Reference Books:

1. "Innovation and Entrepreneurship" by Peter F. Drucker - Publisher: Harper Business
- Drucker's classic text explores how innovation drives entrepreneurship. It's ideal for understanding the role of creativity and innovation in the entrepreneurial process.
2. "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses"** by Eric Ries - Publisher: Penguin Random House
- This book introduces the lean startup methodology, focusing on rapid prototyping, validated learning, and customer feedback. It's helpful for understanding modern approaches to building startups.
3. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger - Publisher: McGraw-Hill Education
- This book provides a thorough overview of ethical responsibilities for engineers, covering case studies and moral dilemmas in engineering.
4. "Entrepreneurship" by Robert D. Hisrich, Michael P. Peters, and Dean A. Shepherd - Publisher: McGraw-Hill Education
- This is an advanced textbook on entrepreneurship, covering opportunity identification, venture capital, and managing growth. It provides an international perspective with case studies and examples.
5. "Corporate Social Responsibility in India" by Sanjay K. Agarwal - Publisher: SAGE Publications

- This book covers CSR from an Indian perspective, discussing relevant policies, case studies, and CSR strategies. It's useful for understanding the ethical and social responsibilities of businesses in India.

MOOC / NPTEL Courses/Other Resources:

1. Entrepreneurship Development Course- "Wharton Entrepreneurship Specialization" by the University of Pennsylvania on Coursera: This course covers the full entrepreneurial journey, from idea generation to business growth. It's a comprehensive series that addresses opportunity identification, market analysis, and securing financing, ideal for beginners and early-stage entrepreneurs
2. Professional Ethics Course - "Global Impact: Business Ethics" by the University of Illinois on Coursera: This course introduces foundational business ethics and its application in global contexts, covering issues like corporate responsibility and ethical decision-making in various industries.
3. Entrepreneurship Development Program (EDP), by Thought Power
https://www.youtube.com/watch?v=pseWtIpC5ko&t=3s

Course Code: BCC25126A0C Course Name: Entrepreneurship Skills and Professional Ethics Tutorial		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Tutorial: 01hr /week	**01**	**Term Work : 25 Marks**

Prerequisite Courses, if any:

Companion Course, if any:

Course Outcomes: On completion of the course, -
CO1: Student will have awareness about each component of business.
CO2: Student will be able to define a minimum viable product for an innovative idea

Guidelines for Student's Lab Journal

- Every Experiment is to be written and completed using given template by faculty.

Guidelines for Lab /TW Assessment

For TW assessment - weightage given to

- Attendance, Participation in each activity, Completion of Assignment, In time Submission

Guidelines for Laboratory Conduction

- Minimum 10 assignments to be completed

List of Laboratory Experiments	
Unit I	
1	Create a comparative chart / info graphic poster highlighting key features of each domain (e.g., social vs. tech entrepreneurship).
2	Case study: Successful Women Entrepreneur / Social Entrepreneur / Any other
Unit II	
1	Conduct a group ideation exercise to generate start-up ideas. Create a mind map connecting various business opportunities in a given sector.
2	Conduct Market research for the initiated idea and analyze the same.
Unit III	
1	Develop a mini business plan or a business model canvas for a new idea.
2	Create a simple marketing strategy or pitch deck for a business idea.
Unit IV	
1	Enlist various funding resources for a startup and create a comparative chart of advantages and disadvantages of funding sources.
2	Study of different types of companies with significance of each. Register your hypothetical company for any suitable type. Complete hypothetically the registration process.
3	Study and Analyse different categories of IPR relevant to your business.
Unit V	
1	Analyze a case study on an ethical dilemma in engineering or business. And create a visual representation (poster/video) of ethical principles.
2	Write a report on best HR practices in startups.

Course code: BCC25127A0X Course Name - Life Skills & Liberal Learning		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 02 Hrs. / Week	**01**	**Term Work: 25 Marks**

Prerequisite Courses, if any: NIL

Companion Course, if any: NIL

Course Objectives: Students are required to go through the list of following Co-curricular Courses and select any one of their interests. They will be allocated one course from the list. Experts from respective course will conduct classes on campus / online through activities, discussions, presentations, and lecture methods.
Students are required to submit hard copy of a report on the activities performed related to topics of opted Co-curricular Course. If student is doing course online on Swayam, NPTEL platform, submission of completion / grade certificate is mandatory. Evaluation will be done based on the report of activities submitted by student. Faculty members will be allotted for mentoring the activities related to Co-curricular Courses. They will frame the activities list to be performed by students with the help of experts in respective course. Continuous evaluation will be done for term work marks.

Course Outcomes: On completion of the course, learner will be able to –

CO1: Understand basic concept of the selected course.

CO2: Learn co-curricular course that aligns his / her interest.

CO3: Enrich educational experience.

CO4: Explore strengths and talents outside of academics

Basket of Co-curricular Course:

1. Yoga and Meditation
2. Dancing
3. Singing
4. Basics of Music Composition
5. Painting
6. Photography
7. Short Film making / Cinematography
8. Green Initiatives
9. Applied Arts
10. Applied Writing Skills

Here are some tips and ideas to help you choose the right courses

1. Consider Your Interests and Hobbies. Think about what you enjoy doing in your free time or what activities you have always wanted to try. Co-curricular courses can be a great opportunity to pursue passions outside your major.
2. Explore Different Fields. Choosing courses from different areas can provide a well-rounded experience.
3. Balance Your Schedule Ensure that the co-curricular courses fit well with your academic schedule and personal commitments. Avoid overloading yourself, as these courses should enhance your experience, not add undue stress.
4. Look at Course Benefits Some co-curricular courses offer skills that can be beneficial in your future career or personal development.
5. Consult with Advisors or Seniors Talking to academic advisors, professors, or senior students can give you insights into which courses are popular, have good instructors, or offer valuable experience

MOOC / NPTEL Courses/Other Resources:

1. https://swayam-plus.swayam2.ac.in/courses
2. https://swayam.gov.in/explorer
3. https://nptel.ac.in/courses

Course Code: BCC25128A0X Course Name - The Constitution of India		
Teaching Scheme:	**Credits**	**Examination Scheme:**
Theory: 01 Hr. / Week Online Learning, Presentations, MOOC courses, Guest lectures, Hands-on Assignments, Team Activities etc	**(Mandatory Non-Credit Course)**	**Audit Course**
Prerequisite Courses, if any: Nil		
Companion Course, if any: Nil		
Course Objectives: • To learn and understand the democracy and its advantages. • To learn and understand parliamentary system and its working • To learn and understand provisions made in Constitution of India. • To learn and understand constitutions of other Countries and global perspective.		
Course Outcomes: On completion of the course, learner will be able to – **CO1:** Explain various aspects of democracy and parliamentary system **CO2:** Understand and explain various aspects of constitution of India **CO3:** Apply the concepts of Sustainable Development Goals in his life and work.		
UNIT 1: Democracy		
Society, Nation and its constitution, Various Definitions of democracy, Definition of Democracy in Indian context, Dimensions of Democracy- Social, Economic, and Political Necessary conditions for successful working of democracy		
UNIT 2: Parliamentary system		
Parliamentary system of democracy, Pillars of Indian democracy, Separation of power, Elections: Political party- Registration, Rules for Recognition, Delimitation Commission: Constitutional Provisions		
UNIT 3: The Constitution of India		
Preamble, Overview of The Constitution of India (COI), Definition of State, Fundamental rights, Fundamental duties, Directive Principles of state policies, Themes for understanding our Constitution, Constitutional morality		
UNIT 4: Amendment of The Constitution		
Basic structure doctrine, Power of Parliament to amend the Constitution and procedure therefor, Procedure for Amendment of The Constitution before and after 42nd Amendment Case studies: Self case study of 24th and 42nd Amendment.		
UNIT 5: Comparative studies		
Comparison of COI and Constitution of Presidential system (e.g. USA), Constituent Assembly of India and Constituent assembly of Pakistan, COI and Constitution and situations in neighboring countries like Pakistan, Bangladesh, Nepal etc.		
UNIT 6: Global perspective		
Human and Sustainable Development, Global goals for Sustainable development and The Constitution of India, Challenges for India and its solutions within constitutional framework. COI & PESTLE analysis		
Hands-on Assignments:		
Group-A Assignments		
Assignment 1. Translate the Preamble of The Constitution of India in any Indian language.		
Assignment 2. Visit: https://secure.mygov.in/read-the-preamble-india Read the Preamble of The Constitution of India Get the online GOI Certificate Inform, Motivate, help your friends and relatives for getting certificate Email copy of certificate to: HOD and Faculty in-charge		
Assignment 3. Download the copy of The Constitution of India from Union Govt. web site. https://legislative.gov.in/constitution-of-india Read titles of articles, Prepare Hand-written or Softcopy of only titles of all articles and Schedules.		

Find which article is repeated in which parts of our Constitution. Read and translate this article in any Indian language
Group B Assignments (Any one)
1. Prepare Street play script and perform Street play for enlightenment on the subjects related to The Constitution of India (Minimum. 5 Min., Max. 15 Min.) [Team work] 2. Making movie for enlightenment on the subjects related to The Constitution of India (Minimum. 5 Min., Max. 15 Min.) [Team work] 3. Prepare and deliver written speech on The Constitution of India (Minimum. 5 Min., Max. 15 Min.)
Group C Assignments (Optional Extra Co-curricular)
Create/Join AIT_FE Constitution Club2025 WhatsApp group of your class Create/Join AIT_FE Constitution Club2025 Facebook/twitter/social media group/page of your class Regularly read/write posts about COI
References: 1.The Constitution of India Gov. of India 2. Basu, D. D. “Introduction to the Constitution of India” Prentice Hall of India. 3.Debate and discussion in Constituent assembly, Different volumes (GOI) 4.Sudhir Krishnaswamy “Democracy and Constitutionalism in India” Oxford University Press 5.Fali S. Nariman “You Must Know Your Constitution” 6.Sustainable development goals UNO 7.www.constitutionofindia.net 8. MOOC courses available on the subject, recommended by Board of studies.