



Maratha Vidya Prasarak Samaj's
Karmaveer Adv. Baburao Ganpatrao Thakare College of Engineering
An Autonomous Institute affiliated to Savitribai Phule Pune University, Pune
Udoji Maratha Boarding Campus, Gangapur Road, Nashik - 422 013,
Maharashtra, India

Syllabus
Second Year B.Tech. Mechanical Engineering (2024 Pattern)
(As per NEP 2020)
Academic Year 2025-26
(Copy for Student Circulation Only)

Program Specific Outcomes (PSOs).

PSO1: Ability to design, analysis and problem-solving skills using basic principle of mechanical engineering.

PSO2: Ability to impart technical and professional skills through industry institute interaction.

PSO3: Develop practical skills for the benefits of society.

Program Educational Outcomes (PEOs).

PEO1: To prepare technocrats that can satisfy the need of mechanical and allied industries.

PEO2: To develop critical thinking, problem-solving skills, research aptitude, and career and professionalism among the students.

PEO3: To improve and expand technical and professional skills of students through effective teaching-learning and industry interaction.

Program Outcomes (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 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 differences.

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).

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 is the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use 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.

**Second Year B.Tech. Mechanical Engineering
Curriculum Structure (2024 Pattern) Semester - III**

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks					Credits			
			TH	PR	TU	CCE	ESE	TW	PR + OR	TOT	TH	PR	TU	TOT
101301	PCC-2	Engineering Thermodynamics	2	2	-	40	60	25	25	150	2	1	-	3
101302	PCC-3	Solid Mechanics	2	-	-	40	60	-	-	100	2	-	-	2
101303	PCC-4	Material Science and Metallurgy	2	-	-	40	60	-	-	100	2	-	-	2
170304/ 170404	MDM-1	Multi-Disciplinary Minor Course-1	2	-	-	40	60	-	-	100	2	-	-	2
171305	OEC-1	Open Elective Course-1	3	2	-	40	60	25	25	150	3	1	-	4
172306/ 172406	EEM-1	EEM Course-1	-	-	2	-	-	50	-	50	-	-	2	2
173307/ 173407	VEC-1	Value Education Course-1	-	2	1	-	-	50	-	50	-	1	1	2
101308	CEP/FP	Community Engagement / Field Project	-	4	-	-	-	50	-	50	-	2	-	2
101309	PCC-L1	Material Testing Laboratory	-	2	-	-	-	25	25	50	-	1	-	1
Total			11	12	3	200	300	225	75	800	11	6	3	20

Group	Course Code	MDM Courses - 1	Course Code	VEC Courses - 1	Course Code	EEM Courses – 1
A	170304A	Engineering Mathematics-III	173307	Universal Human Values	172306	Entrepreneurship Development
B	170404A	Artificial Intelligence	173407	Environmental Studies	172406	Business Economics

Course Code	Open Elective Course – 1
171305A	IPR and Ethics
171305B	Renewable Energy
171305C	Health, Care & Management System
171305D	Smart City and Infrastructure

**Second Year B.Tech. Mechanical Engineering
Curriculum Structure (2024 Pattern) Semester - IV**

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks					Credits			
			TH	PR	TU	CCE	ESE	TW	PR + OR	TOT	TH	PR	TU	TOT
101401	PCC-5	Fluid Mechanics	2	2	-	40	60	25	25	150	2	1	-	3
101402	PCC-6	Machines and Mechanisms	2	2	-	40	60	25	25	150	2	1	-	3
101403	PCC-7	Manufacturing Processes	2	-	-	40	60	-	-	100	2	-	-	2
170304/ 170404	MDM-2	Multi-Disciplinary Minor Course-2	2	-	-	40	60	-	-	100	2	-	-	2
171405	OEC-2	Open Elective Course-2	2	-	-	40	60	-	-	100	2	-	-	2
172306/ 172406	EEM-2	EEM Course-2	-	-	2	-	-	50	-	50	-	-	2	2
173307/ 173407	VEC-2	Value Education Course-2	-	2	1	-	-	50	-	50	-	1	1	2
174408	AEC-2	Ability Enhancement Course-2	-	-	2	-	-	50	-	50	-	-	2	2
101409	VSEC-3	Vocational & Skill Enhancement Course-3	-	4	-	-	-	50	-	50	-	2	-	2
Total			10	10	5	200	300	250	50	800	10	5	5	20

Group	Course Code	MDM Courses – 2	Course Code	VEC Courses – 2	Course Code	EEM Courses – 2
A	170404A	Artificial Intelligence	173407	Environmental Studies	172406	Business Economics
B	170304A	Engineering Mathematics-III	173307	Universal Human Values	172306	Entrepreneurship Development

Course Code	Open Elective Course – 2	Course Code	AEC Course	Course Code	VSEC Course
171405A	Cyber Security and Laws	174408	Foreign Language	101409	Machine Shop

- **Summary of Credits and Total Marks:**

Semester	Credits	Marks
III	20	800
IV	20	800
Total	40	1600

- **Definition of Credit :**

The Under Graduate (U.G.) programmes will have credit system. The details of credit will be as follow.

1 Credit = 1 hour/week for lecture
 = 2 hours/week for practical
 = 1 hour/week for tutorial

- **Description of Various Courses:**

Type of Course	Description
PCC	Programme Core Course
MDM	Multidisciplinary Minor Course
OEC	Open Elective Course
EEM	Entrepreneurship / Economics / Management Course
VEC	Value Education Course
CEP/FP	Community Engagement Project / Field Project
VSEC	Vocational and Skill Enhancement Course (Skill Courses)
AEC	Ability Enhancement Course

Semester - III

Course Code: 101301	Course Name: Engineering Thermodynamics	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 2 Hours/Week Practical : 2 Hours/Week	2 1	CCE : 40 Marks ESE : 60 Marks TW : 25 Marks PR + OR : 25 Marks

Prerequisite Courses:

- Engineering Physics, Engineering Mathematics.

Course Objectives:

- To learn the significance of thermodynamics, basic terms and definitions of Thermodynamics.
- To learn thermodynamic interactions, and balance of energy between system and its surroundings
- To learn laws of thermodynamics and understand the difference between high-grade and low-grade energies, limitations on energy conversion.
- To learn applications of thermodynamics laws to various thermal systems.
- To learn the concept of steam formation and use of Steam Tables, Mollier Chart for analyzing simple steam systems.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Describe the fundamental concepts of thermodynamics with energy interactions in thermodynamic systems.

CO2: Apply laws of thermodynamics to processes and cycles.

CO3: Determine changes in thermodynamic properties of substances.

CO4: Examine the properties of steam and their effect on performance of vapour power cycle.

CO5: Analyze the fuel combustion process and determine boiler performance.

Course Contents:

Unit-I: Fundamentals of Thermodynamics

06 Hours

Basic terms and definitions of thermodynamics, first law of thermodynamics, Joule's experiment, application of first law to flow and non-flow processes and cycles, limitations of first law of thermodynamics.

Unit-II: Second Law of Thermodynamics and Entropy

06 Hours

Concept of reversibility, statements of second law of thermodynamics, Carnot theorem, Carnot cycle for heat engine, refrigerator and heat pump, concept of entropy, applications of second

law to flow and non-flow processes and cycles.

Unit-III: Ideal Gas and Gas Processes**06 Hours**

Ideal gas definition, gas laws, gas properties, equation of state, study and analysis of gas processes; isobaric, isochoric, isothermal, isentropic, polytropic.

Unit-IV: Steam Properties and Vapour Power Cycle**06 Hours**

Steam properties, use of steam tables and Mollier diagram, steam calorimeters, non-flow and steady flow vapour processes, Rankine cycle, comparison of Carnot cycle and Rankine cycle, introduction to steam power plant, efficiency of Rankine cycle.

Unit-V: Fuel Combustion and Steam Generators**06 Hours**

Fuel Combustion: Types of fuels, proximate and ultimate analysis of fuel, theoretical and excess air requirements, equivalence ratio, analysis of products of combustion, calorific value - HCV & LCV. Bomb and Boys gas calorimeters.

Steam Generators: Classification, constructional details of low pressure boilers, boiler mountings and accessories, introduction to IBR act, boiler performance calculations-equivalent evaporation, boiler efficiency, heat balance sheet, introduction to boiler draught.

Learning Resources:**Text Books:**

1. Nag.P.K, Engineering Thermodynamics, 4th Edition, Tata McGraw-Hill, 2008.
2. Kothandaraman and Domkundwar, Thermodynamics and Heat Engines
3. Ballaney P. L, Thermal Engineering; Khanna Publishers.
4. Natarajan E., Engineering Thermodynamics: Fundamentals and Applications, Anuragam Publications, 2012.
5. R. K. Rajput, Engineering Thermodynamics, EVSS Thermo, Laxmi Publications.

Reference Books:

1. Cengel. Y. and M. Boles, Thermodynamics – An Engineering Approach, 7th Edition, Tata McGraw Hill, 2010.
2. G.VanWylen, R.Sonntag and C.Borgnakke, Fundamentals of Classical Thermodynamics, John Wiley & Sons
3. Holman J.P, Thermodynamics, McGraw Hill
4. M Achuthan, Engineering Thermodynamics, PHI.
5. Steam Tables/Data book.

Web link for MOOC / NPTEL Links:

1. <https://www.mooc-list.com/tags/thermodynamics>
2. https://onlinecourses.nptel.ac.in/noc20_ae09/preview

List of Practicals:

1. Joule's experiment to validate, first law of thermodynamics.
2. Determination of dryness fraction of steam using combined separating and throttling calorimeter.
3. Determination of HCV of solid or liquid fuel using Bomb calorimeter.
4. Demonstration and study of boiler mountings and accessories.
5. Trial on boiler to determine boiler efficiency, equivalent evaporation and energy balance.
6. Industrial visit to any process industry/plant having boiler equipped with accessories.

Course Code: 101302	Course Name: Solid Mechanics	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 2 Hours/Week	2	CCE : 40 Marks ESE : 60 Marks

Prerequisite Courses:

- Engineering Mechanics, Engineering Mathematics.

Course Objectives:

- To acquire basic knowledge of stress & strain due to various types of loading.
- To determine Shear Force and Bending Moment and draw SFD & BMD for transverse loading.
- To determine bending, shear stress & torsional shear stress.
- To solve problems of slope and deflection on beam.
- To utilize the concepts of principal stresses and theories of failure

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Calculate stress and strain developed on determinate and indeterminate members.

CO2: Determine Shear force and bending moment and draw SFD & BMD for various types of transverse loading.

CO3: Compute the bending stresses, shear stresses and Torsional stresses on a beam.

CO4: Calculate slope and deflection on beam.

CO5: Determine stresses on a 2-D element by applying the concept of principal stresses; analyze failure of members using different theories of failure.

Course Contents:**Unit-I: Simple Stresses and Strains****06 Hours**

Overview of material properties, concept of stress and strain, types of stresses and strains, interrelation between elastic constants, stresses and strains in determinate and indeterminate structures, homogeneous and composite bars under concentrated loads. Thermal stresses.

Unit-II: Shear Force and Bending Moment Diagrams**06 Hours**

Introduction to SFD, BMD, and relationship between rate of loading, shear force and bending moment, SFD & BMD diagrams for simply supported and cantilever beams for Point load, UVL, UDL and couple, maximum bending moment and position of points of contra flexure.

Unit-III: Stresses in Machine Elements**06 Hours**

Bending Stresses: Theory of simple bending, flexural formula, and bending stress distribution diagram.

Shear Stresses: Shear stress distribution formula and distribution diagrams for common cross sections.

Introduction to torsion on a shaft with application, torsion equation, torsion in stepped and composite shafts.

Unit-IV: Slope and Deflection of Beams**06 Hours**

Slope and deflection of determinate beams, Macaulay's method, slope and deflection for standard cases.

Unit-V: Principal Stresses and Strains, Theories of Failure**06 Hours**

Stresses on oblique plane, Principal planes and planes of maximum shear, Principal stresses and maximum shear stresses. Graphical solution using Mohr's circle of stresses, Theories of failure.

Learning Resources:**Text Books:**

1. S. Ramamurtham, Strength of material, Dhanpat Rai Publication
2. R. K. Bansal, Strength of Materials, Laxmi Publication
3. S.S. Rattan, Strength of Material, Tata McGraw Hill Publication Co. Ltd.
4. B.K. Sarkar, Strength of Material, McGraw Hill, New Delhi
5. Singer and Pytel, Strength of materials, Harper and Row Publication.

Reference Books:

1. Egor. P. Popov, Introduction to Mechanics of Solids, Prentice Hall Publication
2. Beer and Johnston, Strength of materials, CBS Publication
3. G. H. Ryder, Strength of Materials, Macmillan Publication
4. Timoshenko and Young, Strength of Materials, CBS Publication, Singapore
5. James M. Gere, Mechanics of Materials, CL Engineering.

Web link for MOOC / NPTEL Links:

1. <https://archive.nptel.ac.in/courses/112/107/112107147/#>

Course Code: 101303	Course Name: Material Science and Metallurgy	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 2 Hours/Week	2	CCE : 40 Marks ESE : 60 Marks

Prerequisite Courses:

- Engineering Physics, Engineering Chemistry, Engineering Mathematics.

Course Objectives:

- To impart fundamental knowledge in material science
- To indicate the importance of heat treatment on structure and properties of materials
- To interpret the material selection process.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Determine Miller indices and identify imperfections in crystal.

CO2: Determine mechanical properties using destructive and non-destructive testing of materials.

CO3: Interpret iron carbon diagram.

CO4: Apply the knowledge of heat treatment to study various phases of materials.

CO5: Discuss the effects of alloying elements on ferrous and non-ferrous materials.

Course Contents:**Unit-I: Structure and Mechanical Behaviors of Materials 06 Hours**

Basic concepts of crystal structures, types of crystal systems, crystal structure of metals, lattice parameters, Miller indices, crystal classification and imperfections. Mechanism of elastic and plastic deformation, work hardening, changes in properties due to cold working and hot working, types of fractures.

Unit-II: Material Testing and Characterization Techniques 06 Hours

Destructive testing and non-destructive testing of materials, principles and procedure, advantages, disadvantages and Industrial applications.

Microscopic Techniques: Sample preparation and etching procedure, optical microscopy, electronic microscopy, macroscopy: Sulphur printing, flow line observation, spark test.

Unit-III: Iron Carbon alloy system and Cast Iron 06 Hours

Solid solutions and its types, Hume Rothery rule, solidification of pure metals and nucleation, types of cooling curves, phase diagram, iron carbon diagram, classification and application of steels and cast iron.

Unit-IV: Heat Treatments**06 Hours**

Transformation products of Austenite, Time Temperature Transformation diagrams, critical cooling rate, continuous cooling transformation diagrams. **Heat Treatment of Steels:** Annealing, Normalizing, Hardening and Tempering, retention of austenite, hardenability and hardenability testing, classification of surface hardening treatments.

Unit-V: Engineering Alloy Steels and Nonferrous materials**06 Hours**

Classification of alloy steels and effect of alloying elements, examples of alloy steels, stainless steels, tool steels, heat treatment of high-speed steel, designation for plane and alloy steels: IS, AISI, DIN etc. Importance of non-ferrous metals in engineering applications its compositions and properties bearing materials: important properties and applications.

Learning Resources:**Text Books:**

1. Textbook of Engineering Chemistry, Dr. S. S. Dara, Dr. S. S. Umare, S. Chand and Company Ltd.
2. Material Science and Metallurgy for Engineers, Dr.V.D. Kodgire and S.VKodgire, Tata McGraw Hill, Ed. 46, 2021.
3. Material science and Engineering an Introduction, W. D. Callister, Khanna Publication, Ed. 10, 2018.

Reference Books:

1. Material Science and Engineering, W.F.Smith, J.hashemi and R.Prakash ,Tata McGraw Hill Ed. 5, 2014.
2. Material Science and Engineeringm V. Raghvan, PHI Learning, Ed. 6, 2015.
3. Introduction to Physical Metallurgy, S.H.Avner, Tata McGraw Hill Ed. 2, 2022.
4. Engineering Metallurgy, R.A.Higgins,Viva Books Pvt.Ltd.Ed.6,2016.

Weblink for MOOC / NPTEL Links:

1. <https://www.tec-science.com/material-science/material-testing/non-destructive-material-testing-ndt/>
2. <https://www.youtube.com/watch?v=ZDT-DXtNIPg>
3. <https://www.youtube.com/playlist?list=PLyAZSyX8Qy5C8ciqBBlypbx91j4nowUbL>
4. https://www.youtube.com/playlist?list=PLyAZSyX8Qy5Am_2StOOQ5vCUE3VIcAenE

Course Code: 170304A	Course Name: Engineering Mathematics-III	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 2 Hours/Week	2	CCE : 40 Marks ESE : 60 Marks

Prerequisite Courses:

- Differential and Integral calculus, Differential equations of first order and first degree.

Course Objectives:

- To make the students familiarize with concepts and techniques in Ordinary Differential Equations, numerical methods, Laplace transform, Z-transform.
- To equip students with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Solve higher order linear differential equations using appropriate techniques.

CO2: Apply Laplace transform and Z-Transform to solve differential equations, difference equations.

CO3: Apply vector calculus concepts to analyze problems and solve system of linear equations by using numerical methods.

CO4: Analyze discrete and continuous random variables using Binomial, Poisson and Normal distributions.

CO5: Analyze data through hypothesis tests like Chi-square and *t*-tests.

Course Contents:**Unit-I: Linear Differential Equations 04 Hours**

Linear Differential Equations (LDE) of n^{th} order with constant coefficients, complementary function, particular integral by using shortcut methods.

Unit-II: Transforms 06 Hours

Laplace Transform: Laplace Transform, Inverse Laplace Transform & their theorems, Applications of LT for solving linear differential equations.

Z – Transform: Z-transforms and its region of convergence, properties of Z-transform, inverse Z-Transforms and its properties, application of Z-transform to solve difference equations.

Unit-III: Vector Calculus and Numerical Methods 08 Hours

Vector Differentiation: Scalar and vector fields, vector differential operator, gradient,

divergence & curl, solenoid, irrotational and scalar potential.

Vector Integration: Line integrals, surface integrals, Gauss's divergence theorem and Stoke's theorem (without proof).

Interpolation: Newton's forward interpolation, Newton's backward interpolation, Lagrange's interpolation.

Solution to System of Linear Simultaneous Equations:

Direct method: Determinant method, matrix inversion method, Gauss-Jordan method, Gauss-elimination method.

Iterative method: Gauss Jacobi, Gauss –Seidel method.

Unit-IV: Probability

06 Hours

Introduction to probability, random variable, discrete random variable, continuous random variable, binomial distribution, Poisson distribution, normal distribution.

Unit-V: Sampling and Inference

06 Hours

Testing of hypothesis, null hypothesis, alternate hypothesis, critical region, two types of errors, level of significance, Chi-square test for the goodness of fit, Student's t-test for single mean.

Learning Resources:

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill).
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication).

Reference Books:

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

Weblink for MOOC / NPTEL Links:

1. Advanced Probability Theory by Prof. Niladri Chatterjee, IIT Delhi
https://onlinecourses.nptel.ac.in/noc25_ma04/preview
2. Transform Calculus and its applications in DE by Prof. Adrijit Goswami, IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc25_ma56/preview
3. Numerical Methods by Prof. Ameeya Kumar Nayak, Prof. Sanjeev Kumar, IIT Roorkee
https://onlinecourses.nptel.ac.in/noc25_ma83/preview

Course Code: 170404A	Course Name: Artificial Intelligence	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 2 Hours/Week	2	CCE : 40 Marks ESE : 60 Marks

Prerequisite Courses:

- Fundamentals of Programming Language.

Course Objectives:

- To introduce fundamental concepts of Artificial Intelligence (AI) and its real-world applications across various engineering domains.
- To explore problem-solving strategies using AI techniques such as search, logic, and decision-making.
- To familiarize students with the basics of machine learning and data-driven decision systems.
- To demonstrate how AI is used in engineering design, automation, prediction, and optimization.
- To enable students to appreciate ethical considerations and societal impact of AI in engineering.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Explain the basic principles and scope of Artificial Intelligence and its relevance to different engineering disciplines.

CO2: Apply search algorithms for solving simple engineering problems.

CO3: Understand and differentiate between types of machine learning and data representations.

CO4: Identify and analyze AI applications in domains such as predictive maintenance, smart cities, automation, and control systems.

CO5: Recognize ethical, social, and professional issues in deploying AI solutions in engineering contexts.

Course Contents:**Unit-I: Introduction to Artificial Intelligence****06 Hours**

Definition and scope, history and evolution of AI, AI in daily life and industry, relevance of AI to different engineering disciplines, basics of intelligent agents and environments.

Unit-II: AI Problem Solving and Search Techniques**06 Hours**

Problem formulation and state space, Uninformed search (BFS, DFS), Informed search (Greedy, A*); **Use cases:** Path planning for robots, resource allocation in construction, fault detection in electrical circuits.

Unit-III: Fundamentals of Machine Learning**06 Hours**

Supervised vs Unsupervised learning vs Reinforcement Learning, concept of training, testing and validation. **Common algorithms:** Regression, k-NN, k-means, Introduction to neural networks, **Applications:** Quality control, load forecasting, image classification, Introduction to AI Tools (e.g., Python, scikit-learn, TensorFlow overview/ Excel / Google Colab).

Unit-IV: AI Applications in Engineering Domains**06 Hours**

AI in design and optimization (e.g., generative design), AI for predictive maintenance and diagnostics, smart manufacturing, building management systems and IoT, AI in traffic management and construction safety, AI in healthcare devices and embedded systems.

Unit-V: Ethical, Legal and Societal Aspects**06 Hours**

AI and Ethics: Bias, fairness, and transparency, data privacy and security concerns.

Social Impact of Automation: Job displacement, decision accountability. Responsible AI practices and guidelines, regulatory aspects in India and globally (brief overview).

Learning Resources:**Text Books:**

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivashankar B. Nair, ISBN: 9780070087705, Tata McGraw-Hill Education, 2009.
2. Introduction to Machine Learning, Ethem Alpaydin, ISBN: 9780262028189, MIT Press, 2014.
3. Machine Learning, Tom M. Mitchell, ISBN: 9780070428072, McGraw-Hill, 1997.

Reference Books:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, ISBN: 9780136042594, Pearson Education, 2010.
2. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller and Sarah Guido, ISBN: 9781449369415, O'Reilly Media, 2016.
3. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, and Jerome Friedman, ISBN: 9780387848570, Springer, 2009.
4. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, ISBN: 9780262035613, MIT Press, 2016.

Weblink for MOOC / NPTEL Links:

1. Google AI Education
<https://ai.google/education/>

2. MIT OpenCourseWare – Artificial Intelligence
<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2020/>
3. Coursera – AI For Everyone by Andrew Ng (Beginner Friendly)
<https://www.coursera.org/learn/ai-for-everyone>
4. Microsoft Learn – AI Fundamentals
<https://learn.microsoft.com/en-us/training/paths/introduction-artificial-intelligence/>
5. IBM SkillsBuild (Free Courses on AI & Data Science)
<https://skillsbuild.org/>
6. Google Colab (for coding practice)
<https://colab.research.google.com/>

Suggested In-Class Activities

Unit No.	Activity	Description
I	AI Around You	Group activity: Identify and present 5 real-life examples of AI in their domain (mechanical, civil, etc.).
II	Search Algorithm Simulation	Paper-based or Python/Excel simulation of BFS/DFS/A* for maze/pathfinding problems.
III	Hands-on with ML Tools	Use Google Colab to run a simple regression/classification example (k-NN or linear regression).
III	Model Demo with Data	Upload a dataset (e.g., student marks) and perform basic ML predictions in class.
IV	Domain Use Case Analysis	Groups present how AI is used in their engineering field (1 use case each).
V	Ethics Debate	Conduct a structured debate: <i>"Will AI lead to massive job loss in engineering?"</i>
V	AI Ethics Case Study	Review and discuss an AI failure (e.g., biased facial recognition, self-driving accidents).

Course Code: 171305A	Course Name: Intellectual Property Rights and Ethics	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 3 Hours/Week Practical : 2 Hours/Week	3 1	CCE : 40 Marks ESE : 60 Marks TW : 25 Marks PR + OR : 25 Marks

Prerequisite Courses:

- --.

Course Objectives:

- To understand basics of intellectual property rights (IPR).
- To learn copyright, trademarks and industrial design.
- To inculcate the ethical behaviour in the personal and professional lives.
- To facilitate the holistic development (life and profession) of students.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Understand the basics of intellectual property rights.

CO2: Learn the patent filing process.

CO3: Understand the copyright/trademark/industrial design and filing process.

CO4: Understand the importance of ethics in their personal and professional life.

CO5: Learn the workplace responsibilities and rights as an engineer in the industry.

Course Contents:

Unit-I: Introduction to IPR 08 Hours

Concept of property, concept and relevance of IPR, importance of IPR in socio-economic development and technological innovation, prosecution of patent, patent infringement, geographical indications, patent search.

Unit-II: Contents of IPR 08 Hours

Meaning of patent, concept of novelty, inventiveness and utility, inventions not patentable, process and product patents, prosecution of patent, patent infringement.

Patent search, IPR filing process and documents, IPR commercialization and portfolio management.

Unit-III: Copyrights and Trademarks 08 Hours

Copyright: Meaning & scope, concept of originality.

Trademarks and Industrial Design: certification marks, property marks, well known marks, domain name protection.

Unit-IV: Ethics**08 Hours**

Concepts and principles, personal and professional ethics, emotional intelligence, code of conduct, roots of unethical behavior and ethics for engineers & managers.

Unit-V: Workplace Responsibilities and Rights**08 Hours**

Moral development, codes of ethics, ethical decision making, ethical dilemmas.

Learning Resources:**Text Books:**

1. WeGo Library Foundation Book (2025): Top 16 Secrets of Wealth Creation by Patent
2. Prabuddha Ganguli, (2001): Intellectual Property Rights. Tata McGraw Hill.
3. Mayall, Industrial Design, McGraw Hill.

Reference Books:

1. W.R. Cornish, (2013): Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights. Sweet and Max Well London
2. Fernando AC (2018). Business Ethics and Corporate Governance (2nd Ed). Pearson, Education India
3. Martin MW & Schinzinger R (2005). Ethics in Engineering (4th Ed). McGraw Hill.

Web link for MOOC / NPTEL Links:

1. <https://ipindia.gov.in/>
2. https://onlinecourses.nptel.ac.in/noc22_hs04/preview
3. <https://nptel.ac.in/courses/127105008>

List of Practicals:

1. Search any five product or process recent patents from Indian patent website, prepare and give the presentation on it.
2. Prepare the patent filing draft of any one process patent.
3. Prepare the patent filing draft of any one product patent.
4. Demonstrate the trademark for any five industrial designs based on market survey
5. Case study on copyright filing.
6. Case study on trademark/industrial design filing.

Course Code: 171305B	Course Name: Renewable Energy	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 3 Hours/Week Practical : 2 Hours/Week	3 1	CCE : 40 Marks ESE : 60 Marks TW : 25 Marks PR + OR : 25 Marks

Prerequisite Courses:

- Engineering Physics, Engineering Chemistry, Engineering Mathematics.

Course Objectives:

- To understand the principle of renewable energy generation such as hydro, solar, wind and bio-mass energy.
- To identify potential of renewable energy.
- To understand working of technologies to harness renewable energy.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Describe the basics of renewable energy.

CO2: Explain the constructional details and working of hydro-electric power plant.

CO3: Describe the fundamentals and technology to harness solar energy.

CO4: Explain the wind energy conversion system.

CO5: Discuss the bio-energy conversion pathways.

Course Contents:
Unit-I: Introduction to Renewable Energy **08 Hours**

Energy scenario in the World, energy scenario in India, need of renewable energy, scenario of renewable energy generation in India and government policies, fundamentals of hydro, solar, wind, biomass, geothermal, tidal, ocean thermal, magneto hydro-dynamic and hydrogen energy.

Unit-II: Hydroelectric Energy **08 Hours**

Basics of hydrology, Hydroelectric Power Plant (HEPP): Classification, site selection, types of turbines, spillways, surge tanks, advantages and disadvantages, major HEPPs in India, hydroelectric energy scenario in India.

Unit-III: Solar Energy **08 Hours**

Terminology, solar radiation data, solar energy collectors, solar energy storage, power conditioning equipment, economics of solar photovoltaic power plant, advantages and

disadvantages of solar energy, solar energy scenario in India.

Unit-IV: Wind Energy**08 Hours**

Wind availability data, basic components of wind mills, aerodynamics and design of wind turbine, performance operating characteristics, wind solar hybrid power plants, cost economics, wind energy scenario in India.

Unit-V: Biomass Energy**08 Hours**

Biomass types and characterization, biomass energy potential in India, Biomass energy pathways – chemical and thermal, conversion technologies - digester and gasifier, biofuels, biomass energy scenario in India.

Learning Resources:**Text Books:**

1. R.K.Rajput, Power Plant Engineering, Laxmi Publications New Delhi.
2. G. D. Rai, Energy Sources, Khanna Publications.

Reference Books:

1. B. H. Khan, Non-Conventional Energy Sources, Second Edition. Tata Mc-Graw Hill.
2. S P Sukhatme and J P Nayak, Solar Energy: Principles of Thermal Collection and Storage, McGraw-Hill Education, 2017.
3. G. N. Tiwari, Solar Energy: Fundamentals, Design, Modelling and Applications, Alpha Science, 2002.
4. J. F. Manwell, J. G. McGowan and A. L. Rogers., Wind Energy Explained- Theory, Design and Application. John Wiley and Sons Ltd.
5. Prabir Basu, Biomass Gasification, Pyrolysis and Torrefaction, Academic Press, Elsevier, 2013.

Web link for MOOC / NPTEL Links:

1. <https://nptel.ac.in/courses/103103206>
2. <https://nptel.ac.in/courses/103103207>
3. <https://nptel.ac.in/courses/108108078>

Web References:

1. Website of International Energy Agency
<https://www.iea.org/energy-system/renewables>
2. Website of Ministry of New and Renewable Energy
<https://mnre.gov.in/en/>
3. India_2020_Energy_Policy
https://iea.blob.core.windows.net/assets/2571ae38-c895-430e-8b62-bc19019c6807/India_2020_Energy_Policy_Review.pdf

List of Practicals:

1. Plotting of PV and IV curve of solar panel using simulation.
2. Finding Maximum Power Point Tracking (MPPT) of solar panel using simulation.
3. Design and component selection for solar photovoltaic power plant with net metering.
4. Measurement of wind speed using anemometer.
5. Visit to solar PV power plant / wind turbine power plant.
6. Visit to hydroelectric power plant / biomass power plant.
7. Case study on biomass digester or biomass gasifier and analysis of properties of products.
8. Case study on government policies on adoption of renewable energy.

Course Code: 171305C	Course Name: Health, Care and Management Systems	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 3 Hours/Week Practical : 2 Hours/Week	3 1	CCE : 40 Marks ESE : 60 Marks TW : 25 Marks PR + OR : 25 Marks

Prerequisite Courses:

- Basic of Biology and Human Body.

Course Objectives:

- To introduce the basics of human body systems relevant to healthcare.
- To understand common health issues and their engineering solutions.
- To explore biomedical instruments and hospital technologies.
- To gain awareness of digital healthcare systems and hospital management.

Course Outcomes:

After successful completion of the course, learner will be able to:

- CO1:** Understand the structure and function of key human body systems relevant to healthcare and diagnosis.
- CO2:** Identify common health issues and explain their causes, symptoms.
- CO3:** Describe the working principles and applications of basic biomedical instruments used in diagnosis and monitoring.
- CO4:** Analyze the role of advanced medical devices and imaging systems in clinical decision-making and treatment.
- CO5:** Explain the components of hospital management system and significance of digital health technologies like Electronic Health Records (EHR), telemedicine and emergency tracking.

Course Contents:
Unit-I: Introduction to Human Body Systems **08 Hours**

Overview of Major Body Systems: Heart and blood circulation (Cardiovascular system), Breathing system (Respiratory system), Nervous system, Muscular system. Five senses. Working of eyes and ears. Kidney and its functions.

Unit-II: Common Health Problems and Causes **08 Hours**

Health Issues Related to: Heart: Cardiac arrest, high/low blood pressure, Brain: Neurological disorders, Eye and ear: Vision issues, hearing loss, Lungs: Respiratory problems, Muscles:

Movement disorders, Blood flow. Kidneys: Kidney failure, Bones: Fractures.

Unit-III: Basic Engineering Devices in Healthcare**08 Hours**

Electro-Cardiography (ECG), Blood pressure monitor, Electro-Encephalography (EEG), Eye tools: Visual Acuity, Ear tools: audiometer, Lung tools: Spirometer, Muscle activity: Electro-Myography (EMG), Blood flow meters, Dialysis machine (artificial kidney).

Unit-IV: Advanced Technologies in Hospitals**09 Hours**

Digital X-ray machine, Pacemaker, Defibrillator, Ventilator, Ultrasound imaging, Computer Tomography (CT scan), Magnetic Resonance Imaging (MRI), Robotic-assisted surgery.

Unit-V: Hospital Management System**07 Hours**

Patient registration process, Health records: paper-based vs. electronic, Software used in hospitals, Electronic Health Records, Telemetry and telemedicine, Emergency systems (e.g., ambulance tracking), Real-world examples of hospital IT systems.

Learning Resources:**Text Books:**

1. R. S. Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill.
2. C. N. Chatterjee, Human Physiology (Vol 1 & 2), Medical Allied Agency.

Reference Books:

1. Leslie Cromwell, Biomedical Instrumentation and Measurements, Prentice-Hall of India.
2. John Enderle & Joseph Bronzino, Introduction to Biomedical Engg., Academic Press.
3. Anne Waugh & Allison Grant, Ross and Wilson Anatomy and Physiology in Health and Illness, Elsevier.

Web link for MOOC / NPTEL Links:

1. Biomedical Instrumentation
<https://nptel.ac.in/courses/108/105/108105101/>
2. Human Anatomy and Physiology
<https://www.khanacademy.org/science/health-and-medicine>
3. Coursera – Introduction to Medical Imaging
<https://www.coursera.org/learn/medical-imaging>
4. Anatomy and medical illustration videos.
<https://www.youtube.com/@armandohasudungan>
5. Simple demos of biomedical concepts.
<https://www.youtube.com/@BiomedicalEngineersTV/videos>
6. WHO eLearning Resources <https://openwho.org/>

List of Practicals:

1. Measure your own blood pressure using a digital Sphygmomanometer/APP.
2. Record and analyze heart rate using a pulse sensor/App.
3. To study ECG waveform and understand its parts.
4. To study Spirometer and understand its waveforms
5. To study and understand EEG waveforms.
6. To study and understand EMG waveforms.
7. To study Audiometer and understand Audiogram.
8. Case study on Hospital Information Systems (any one): Patient Registration (using MS Excel), EHR, Telemedicine, Emergency Systems and Healthcare IT Tools.
9. Presentation / report on a visit to a nearby clinic, use of a Health App or study of a related healthcare facility.

Course Code: 171305D	Course Name: Smart City and Infrastructure	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 3 Hours/Week Practical : 2 Hours/Week	3 1	CCE : 40 Marks ESE : 60 Marks TW : 25 Marks PR + OR : 25 Marks

Prerequisite Courses:

- Basic of Computer Knowledge, Indian Knowledge System.

Course Objectives:

- To introduce the concept and components of smart cities, including infrastructure, technology and sustainability.
- To enable the students to apply the basic need and planning concept to solve various infrastructure problems such as transportation, water supply and waste management, etc.
- To apply emerging technologies such as IoT, GIS and data analytics in designing and developing smart city infrastructure solutions.
- To encourage critical thinking through case studies and real-world examples of smart city projects, focusing on challenges and best practices.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Describe the concept, features, and components of smart cities with relevant examples.

CO2: Demonstrate the structure and regulatory mechanisms of smart city development in context of Indian and international benchmarks.

CO3: Apply GIS and remote sensing techniques for spatial analysis and infrastructure planning in smart cities.

CO4: Relate smart transportation technologies and their role in improving urban mobility and sustainability.

CO5: Suggest smart solutions for urban water, air and waste management using IOT technologies.

Course Contents:**Unit-I: Introduction to Smart Cities****08 Hours**

Definition and key features of smart cities, smart infrastructure components, urban planning's role in smart cities, challenges and opportunities in smart city development, successful smart city case studies from around the World.

Unit-II: Planning and Development of Smart Cities**08 Hours**

Smart city mission of India, global standards and performance benchmarks, practice codes, smart city planning and development, financing smart cities development, governance of smart cities, SDG goals.

Unit-III: Applications of GIS and Remote Sensing**08 Hours**

Fundamentals of GIS and remote sensing, role of GIS in urban planning and development, spatial data analysis and visualization for smart cities, applications in infrastructure management: roads, utilities and land use.

Unit-IV: Smart Urban Transportation Infrastructure**08 Hours**

Smart transportation systems, Intelligent Transportation Systems (ITS): sensors and communication, AI and machine learning in traffic management, public transport integration with smart technologies, EV infrastructure and sustainable urban mobility, successful smart transportation project case studies.

Unit-V: Smart Technologies for Sanitation Infrastructure**08 Hours**

Water demand and supply planning in smart cities, smart water grids: real-time monitoring, IoT integration in water and sewer management, air quality management and smart solid waste management.

Learning Resources:**Text Books/Guidelines:**

1. Smart Cities Mission, India: Localizing Sustainable Development Goals, UN-Habitat. MoHUA, GoI. 2023.
2. Smart Cities, Mission Statement & Guidelines, Ministry of Urban Development Government of India, June 2015.

Reference Books:

1. Role of Edge Analytics on Sustainable Smart City Development: Challenges and Solutions by G. R. Kanagachidambaresan.
2. Solving Urban Infrastructure Problems Using Smart City Technologies: Handbook on Planning, Design, Development, and Regulation by John R. Vacca.
3. Sustainable Smart Cities in India: Challenges and Future Perspectives (The Urban Book Series) by Poonam Sharma and Swati Rajput.
4. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony M. Townsend.
5. GIS for Urban and Regional Planning by Peter O'Connell.
6. Artificial Intelligence in the 21st Century by Stephen Lucci and Danny Kopec.
7. IoT for Smart Cities: Technologies, Big Data & Security by Zaigham Mahmood.

Web link for MOOC / NPTEL Links:

1. https://onlinecourses.swayam2.ac.in/ntr25_ed38/preview
2. <https://www.edx.org/learn/urban-planning/world-bank-group-e-learning-course-on-smart-city?index=product&queryId=5033b061a1acb99dd13abd8a53491c99&position=1>
3. <https://www.coursera.org/learn/smart-cities>

List of Practicals/Assignments:

1. Prepare a report and presentation on a selected Indian smart city.
2. Analyze and evaluate smart city governance structures and funding models, highlighting major strategies, strengths, and concerns.
3. Introduction to GIS and remote sensing and create thematic maps showing land use or road network by using GIS.
4. Prepare a case study report on how AI and Machine Learning are used for traffic congestion management in a smart city project.
5. Design a conceptual model for a smart solid waste management with IoT-enables real time monitoring and tracking in collection and disposal process.
6. Design and run a simple smart water network using EPANET software.
7. Field visit at smart city project and prepare technical report.
8. Mini Project: Identify problems in the infrastructure facility of city and propose a smart solution for the identified problem.

Course Code: 172306	Course Name: Entrepreneurship Development	
Teaching Scheme	Credit	Evaluation Scheme
Tutorial : 2 Hours/Week	2	TW : 50 Marks

Prerequisite Courses:

- Professional Communication Skills.

Course Objectives:

- To equip to recognize the importance of entrepreneurship in economic and social development.
- To assist students in validating innovative business ideas.
- To inculcate principles of financial feasibility, revenue model, and funding options in an entrepreneurial context.
- To facilitate to pitch the business ideas effectively and develop a structured business plan.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Explain the concept of entrepreneurship and its importance in economic and social development.

CO2: Identify, evaluate, and validate innovative business ideas using market research techniques.

CO3: Analyze startup funding options, revenue models, and financial feasibility of new businesses.

CO4: Demonstrate the ability to pitch business ideas effectively to potential stakeholders.

CO5: Develop a structured business plan incorporating all key aspects of entrepreneurship.

Course Contents:**Unit-I: Understanding Entrepreneurship****04 Hours**

Definition and importance of entrepreneurship, characteristics of successful entrepreneurs, types of entrepreneurs (innovators, imitators, social entrepreneurs, corporate entrepreneurs, etc.), entrepreneurial mindset and problem-solving approach, startup ecosystem in India – govt. Schemes (Startup India, Mudra, etc.).

Unit-II: Business Idea Generation and Validation**04 Hours**

Sources of business ideas (personal experience, market gaps, innovations, etc.), design thinking approach to problem solving, concept of ideation, prototyping and experimentation, feasibility

analysis: market feasibility, technical feasibility, financial feasibility.

Unit-III: Market Research and Business Model Canvas

04 Hours

Introduction to market research – primary vs. Secondary data, competitive analysis and market segmentation, understanding customer pain points and buying behavior, business model canvas and lean startup approach.

Unit-IV: Startup Finance and Funding

04 Hours

Introduction to startup funding (bootstrapping, angel investment, VC, IPO), revenue models and financial planning for startups, break-even analysis and risk management in startups.

Unit-V: Pitching and Business Prototyping

04 Hours

Essentials of a good startup pitch, how to develop a prototype or Minimum Viable Product (MVP), how to persuade investors and customers.

Learning Resources:

Text Books:

1. Entrepreneurship Development and Small Business Enterprises – Poornima M. Charantimath. Pearson Publication.
2. Innovation and Entrepreneurship – Peter F. Drucker, Harper Business.
3. Startup Success: The Indian Way – Prachi Garg, Bloomsbury India.
4. Entrepreneurship: New Venture Creation – David H. Holt, Prentice Hall India

Reference Books:

1. Entrepreneurship: Theory, Process, and Practice – Donald F. Kuratko and T.V. Rao, Cengage India.
2. Make in India: The Road Ahead – I.K. Menon, Rupa Publications.

Web link for MOOC / NPTEL Links:

1. Steve Jobs' Stanford Commencement Speech.
www.youtube.com/watch?v=Hd_ptbiPoXM.
2. How to Generate Business Ideas. www.onlinecourses.nptel.ac.in/noc21_mg63/preview
3. Business Model Canvas Explained. www.youtube.com/watch?v=z6-Ly8Bl4Hc
4. Basics of Startup Funding. www.razorpay.com/blog/business-banking/all-about-startup-funding/
5. How to Pitch a Startup Idea. www.onlinecourses.nptel.ac.in/noc25_ge11/preview..

List of Activities:

1. **Meet the Entrepreneur – Guest Lecture and Interview:** Arrange an interactive session with a local entrepreneur. Students will prepare interview questions, conduct discussions, and submit a report. Expected Outcome: Understanding real-world

entrepreneurial challenges and decision making. Case Study: Dhirubhai Ambani – The Entrepreneurial Journey.

2. **Idea Lab – Brainstorming and Idea Pitching:** Students will brainstorm ideas, assess feasibility, and pitch concepts. Expected Outcome: Enhanced creativity, ability to identify opportunities. Case Study: Airbnb's Pivot Story.
3. **Market Pulse – Conducting a Market Survey:** Students will conduct market surveys, analyse responses, and interpret insights. Expected Outcome: Understanding of market demand and consumer preferences. Case Study: Zomato's Market Entry Strategy
4. **Investor's Desk – Creating a Business Plan and Financial Projection:** Students draft a business plan with basic financial estimates. Expected Outcome: Understanding financial viability of a startup. Case Study: OYO Rooms – Funding Rounds
5. **Startup Shark Tank – Business Pitch Presentation:** Students prepare and present a business pitch to a jury. Expected Outcome: Confidence in pitching ideas and persuasive communication. Case Study: Shark Tank Success Stories.

Course Code: 172406	Course Name: Business Economics	
Teaching Scheme	Credit	Evaluation Scheme
Tutorial : 2 Hours/Week	2	TW : 50 Marks

Prerequisite Courses:

- Professional Communication Skills.

Course Objectives:

- To equip students to recognize the importance of economics and business decision-making.
- To assist students in applying demand, supply principles, and pricing strategies.
- To inculcate the understanding of cost–structure, profitability, and break–even points from the business perspective.
- To facilitate the students to understand the real-life business eco-system.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Understand the role of economics in business decision-making and analyze real-world economic scenarios.

CO2: Apply demand and supply principles to determine market equilibrium and pricing strategies.

CO3: Analyze cost structures, profitability and break-even points in business operations.

CO4: Evaluate the impact of business cycles, inflation, and government economic policies on industries.

CO5: Develop pricing strategies based on competitive analysis and consumer demand.

Course Contents:**Unit-I: Basics of Business Economics****04 Hours**

Introduction to micro and macro-economics, concept of scarcity, choice and opportunity cost, role of economics in business decision making, real-world applications in Indian industries.

Unit-II: Demand, Supply and Market Equilibrium**04 Hours**

Law of demand and supply, elasticity of demand and its business implications, market equilibrium and price determination, case studies on demand forecasting.

Unit-III: Cost, Revenue and Profitability**04 Hours**

Types of costs – fixed, variable, marginal costs, break-even analysis and profit maximization

strategies.

Unit-IV: Business Cycles and Economic Policies

04 Hours

Understanding inflation, recession, boom cycles, impact of govt. policies on business and economy.

Unit-V: Pricing Strategies and Competition

04 Hours

Pricing strategies – skimming, penetration, cost-based pricing, other pricing strategies, understanding market structures – monopoly, oligopoly and perfect competition.

Learning Resources:

Text Books:

1. Managerial Economics – D.N. Dwivedi, Vikas Publishing.
2. Business Economics – H.L. Ahuja, Publication by S. Chand.
3. Microeconomics for Business – Satya P. Das, Oxford University Press India.
4. Macroeconomics for Managers – Shankar Acharya, Sage Publications.

Reference Books:

1. Indian Economy – Ramesh Singh, McGraw Hill.
2. Economic Environment of Business – Veena Keshav Pailwar, PHI Learning.

Web link for MOOC / NPTEL Links:

1. Introduction to Business Economics – NPTEL Lecture by IIT Madras.
<https://nptel.ac.in/courses/130106118>.
2. How Economic Principles Shape India's Startup Ecosystem" – Published in the Economic Times. <https://economictimes.indiatimes.com/tech/startups/national-startup-day-2025-how-nine-years-of-policies-shaped-indias-startup-ecosystem/articleshow/117291674.cms?from=mdr>
3. Law of Demand and Supply Explained with Real-Life Examples" – Dr. Vivek Bindra.
<https://www.youtube.com/playlist?list=PL0xBmXq4mdMOd3RQ3bAWxz8siZ4pnOtjI>
4. How Patanjali Capitalized on Demand Elasticity to Dominate Indian FMCG Market" – Business Standard. https://www.business-standard.com/article/management/the-patanjali-effect-116020800204_1.html
5. Break-Even Analysis and Its Business Applications – Harvard Business Review.
<https://hbr.org/2014/07/a-quick-guide-to-breakeven-analysis>
6. How Indian Airlines Manage Costs and Profit Margins – The Hindu Business Line.
<https://www.thehindubusinessline.com/economy/logistics/will-indian-aviation-market-turn-profitable-as-it-heads-towards-duopoly/article67453093.ece>

7. Business Cycles Explained with Real-Life Examples – NPTEL Economics.
<https://www.investopedia.com/terms/b/businesscycle.asp>
8. Indian Government's Response to Economic Slowdowns: A Policy Review – Economic Survey of India. <https://www.indiabudget.gov.in/budget2024-25/economicsurvey/doc/echapter.pdf>
9. Types of Market Structures and Their Business Implications – Investopedia.
<https://www.investopedia.com/terms/m/market.asp>
10. Indian Government's Response to Economic Slowdowns: A Policy Review – Economic Survey of India. <https://www.indiabudget.gov.in/budget2024-25/economicsurvey/doc/echapter.pdf>

List of Activities:

1. **Economic Detective – Identifying Economic Principles in Real Businesses:** Students analyze news reports to find economic applications. Expected Outcome: Understanding economic impact on business. Case Study: "How Amul Uses Economic Principles for Business Expansion" – Discusses pricing strategies, production decisions, and supply chain management.
2. **Local Market Analysis – Demand-Supply Survey:** Students visit local markets to analyse pricing and customer behavior. Expected Outcome: Real-world application of demand-supply principles. Case Study: "Why Uber Uses Surge Pricing: A Demand and Supply Analysis.
3. **Profit Calculator – Cost and Revenue Analysis:** Students analyze cost structures of local businesses. Expected Outcome: Practical understanding of business profitability. Case Study: How Swiggy and Zomato Optimize Costs and Pricing to Stay Profitable.
4. **Economic Trends Report – Analysing GDP and Policies:** Students analyse recent economic trends and policies. Expected Outcome: Awareness of macroeconomic factors affecting business. Case Study: "How the 2008 Global Financial Crisis Impacted Indian Startups.
5. **Competitive Pricing Challenge – Designing a Pricing Strategy:** Students set competitive prices for a product and justify pricing. Expected Outcome: Real-world pricing strategy application. Case Study: Why Jio's Pricing Strategy Disrupted the Indian Telecom Market.

Course Code: 173307	Course Name: Universal Human Values	
Teaching Scheme	Credit	Evaluation Scheme
Practical : 2 Hours/Week Tutorial : 1 Hour/Week	1 1	TW : 50 Marks

Prerequisite Courses:

- UHV-I (Student Induction Program).

Course Objectives:

- To equip students to recognize the harmony between "VALUES" and "SKILLS" for success and long-term fulfillment.
- To assist students to initiate an internal dialogue process to determine their true goals for their lives and careers.
- To inculcate principles of harmonious living within the family and society and to apply effective strategies for fostering trust, respect, and ethical values in interpersonal relationships.
- To facilitate the students to understand harmony at all the levels of human existence.
- To prepare students for the natural acceptance of human values and transform towards value based life.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Explore a holistic vision of life, including the self and surroundings.

CO2: Recognize the co-existence of self, realize harmony, and comprehend the true happiness.

CO3: Apply strategies that foster harmony in family and society through effective communication and relationship-building to cultivate social well-being.

CO4: Execute self-regulations to mutually fulfilling human behavior and enriching interaction with nature to realize harmony.

CO5: Emphasize the implications of a holistic approach in terms of ethical human conduct, and transit towards value based life.

Course Contents:**Unit-I: Introduction to Value Education****06 Hours**

Overview of UHV-I (SIP) to highlight basic Universal human values truth (satya), peace (shanti), love (prem), nonviolence (ahimsa), scientific temper, citizenship values, and also life-skills; character, seva/service (social), education to be ethical, rational, compassionate, and caring, gainful and fulfilling employment.

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.

Practice Sessions (Any Two):

1. **Self-Reflection** – Writing daily reflections on happiness, prosperity, and relationships.
2. **Natural acceptance** – Exploring natural acceptance.
3. **Human consciousness** – Exploring human consciousness
4. **Case Study Analysis** – Analyzing real-life scenarios related to materialism, relationships, and inner happiness.

Unit-II: Harmony in the Human Being**06 Hours**

Human beings are more than just the body, harmony of the self with the body, understanding myself as co-existence of the self and the body, understanding needs of the self and the needs of the body, understanding the activities in the self and the activities in the body.

Practice Sessions (Any Two):

1. **Self-Introductory** – Introduce yourself in detail, your goals and plans to achieve goals in life.
2. **Group Discussion** – How do you differentiate right and wrong? What have been your achievements and shortcomings in your life? Observe and analyze them?
3. **Need of Self and Body** – Explore the difference in need of self and body.
4. **Harmony in Self and Body** – Exploring harmony of self with the body.

Unit-III: Harmony in the Family and in Society**06 Hours**

Family Harmony and Well-Being, Trust – The Core Foundation of Relationships, Respect – Proper Acknowledgment and Appreciation, Ethical Values in Interpersonal Relationships, Comprehending Social Harmony, Aspirations for a Universal Human Order, Key Aspects of the Human Order, The Five Pillars of Human Organization.

Practice Sessions (Any Two):

1. **Role-Playing** – Exercise on Family Communication & Conflict Resolution,
2. **Group Discussion** – Exploring the feeling of trust and respect, trust-building activities

in personal and professional relationships.

3. **Debate** – Debate on social harmony and universal human order.
4. **Human Goal** – Exploring Systems to fulfil Human Goal.

Unit-IV: Harmony in Nature/Existence

06 Hours

Understanding harmony in nature, self-regulation, and mutual fulfillment among the four orders of nature, realizing existence as coexistence, and holistic perception of harmony in existence.

Practice Sessions (Any Two):

1. **Orders of Nature** – Exploring the four orders of nature.
2. **Harmony in Nature** – Discussion on harmony in nature.
3. **Self-expression** – On Exploring co-existence in existence.
4. **Discussion** – Self-regulation and mutual fulfillment among the four orders of nature.

Unit-V: Implications of Holistic Understanding: A Look at Professional Ethics 06 Hours

Natural acceptance of human values, definitiveness of ethical human conduct, a basis for humanistic education, humanistic constitution and universal human order, competence in professional ethics, holistic technologies, production systems and management models-typical case studies, strategies for transition towards value-based life and profession.

Practice Sessions (Any Two):

1. **Discussion** – Exploring ethical human conduct.
2. **Humanistic Models** – in education.
3. **Case Studies** – Holistic technologies, production systems and management models.
4. **Transformation** – Steps of transition towards universal human order.

Learning Resources:

Text Books:

1. An Introduction to Indian Philosophy, Chatterjee, S.G. and Datta, D.M., University of Calcutta Press, 1960.
2. Manav Vyavahar Darshan, Nagraj A., Jeevan Vidya Prakashan, 3rd edition, 2003.
3. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), ISBN 978-93-87034-47-1, Excel Books, New Delhi
4. Professional ethics and Human Values, R. S. Naagarazan, New age International publishers
5. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1.

6. The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G.
7. Harmony in the House: A Family Values Model by David A. Stallman. ECHOES Press -David A. Stallman; 1st edition (7 June 2013)
8. Professional Ethics and Human Values, Premvir Kapoor, ISBN: 978-93-86173-652, Khanna Book Publishing Company, New Delhi, 2022.

Reference Books:

1. Human Values and Professional Ethics – R. R. Gaur, Rajeev Sangal, G.P. Bagaria, Excel Books, New Delhi
2. Vyavaharvadi Samajshastra, Nagraj, A., Jeevan Vidya Prakashan, 2nd edition, 2009.
3. Sociology & Economics for Engineers, Premvir Kapoor, Khanna Publishing House, New Delhi, 2018
4. Human Values, 2003, A. N. Tripathy, New age International Publishers
5. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999.
6. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
7. The Story of Stuff by Annie Leonard, Publisher Simon and Schuster
8. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi Public Affairs Press of Washington, D.C.
9. Small is Beautiful - E. F Schumacher. Publisher Harper Collins
10. Slow is Beautiful - Cecile Andrews, New Society Publishers
11. Economy of Permanence - J C Kumarappa, Sarva Seva Sangh Prakashan
12. Bharat Mein Angreji Raj – Pandit Sunderla, Prabhat Prakashan, New Delhi
13. Rediscovering India - by Dharampal, SIDH, Mussoorie, 2003.
14. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi, Navajivan Publishing House, Ahemdabad 380014, Gujarat, India
15. India Wins Freedom - Maulana Abdul Kalam Azad, published in 1988 by Orient BlackSwan
16. Vivekananda - Romain Rolland (English) Advaita Ashram, Calcutta
17. Gandhi - Romain Rolland (English) Shiva lal Agarwala & company, Agra.

Web link for MOOC / NPTEL Links:

1. <https://nptel.ac.in/courses/109104068>
2. https://onlinecourses.nptel.ac.in/noc24_hs169/preview
3. https://archive.nptel.ac.in/content/syllabus_pdf/109104068
4. <https://www.skillindiadigital.gov.in/courses/detail/d7db86f0-d2d8-42aa-a8c0-502467563b5a>
5. <https://uhv.org.in/>

Tutorial and Term Work:

Term work shall be consists of following 08 activities from PART-A and 10 short reports from PART-B.

PART-A

1. **Digital Detox Experiment:** Avoiding social media and unnecessary digital distractions for a day and reflecting on mental clarity and happiness.
2. **Community Interaction Task:** Engaging with different social groups to understand diverse perspectives on happiness and prosperity.
3. **Health Awareness Program:** List down all your important desires. Observe whether the desire is related to Self (I) or the Body
4. **Role playing activity:** Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study
5. **Family Dialogue Circle:** Participants engage in a structured conversation where they assume different family roles and practice active listening, empathy, and resolution strategies.
6. **Blindfold Trust Walk:** Participants pair up, with one guiding a blindfolded partner through obstacles to build trust and reliance.
7. **Reduce Waste:** Plastic / E-Waste / Medical/Hospital Waste/Pharmaceutical/Industrial Waste and its Management
8. **Value-based Life:** Strategies for Transition towards Value-based Life and Profession.

PART-B

Total 10 reports in brief, of practice session (02 from each unit).

Course Code: 173407	Course Name: Environmental Studies	
Teaching Scheme	Credit	Evaluation Scheme
Practical : 2 Hours/Week Tutorial : 1 Hour/Week	1 1	TW : 50 Marks

Prerequisite Courses:

- Basic Science.

Course Objectives:

- To describe the scope, importance and need for public awareness of environmental studies and natural resources.
- To explain the structure, function, and diversity of ecosystems and biodiversity, along with related case studies.
- To identify the causes, effects and control measures of various types of environmental pollution.
- To discuss major environmental and social issues, policies, and acts related to sustainable development.
- To observe and document environmental features, pollution sites, and ecosystems through field visits.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Describe the importance of environmental studies and the sustainable use of natural resources.

CO2: Explain the structure and function of ecosystems and the significance of biodiversity.

CO3: Identify various types of environmental pollution and their control measures.

CO4: Discuss key environmental issues, policies and their impact on society.

CO5: Observe and report environmental conditions and features through field activities.

Course Contents:**Unit-I: Introduction to Environmental Studies****06 Hours**

Definition, scope and importance, components of environment, Need for Public awareness, Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems a) Forest b) Water c) Mineral d) Food e) Land f) Energy. Role of an individual in conservation of natural resources, use of resources for sustainable lifestyle.

Unit-II: Ecosystems and Biodiversity**06 Hours**

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, producers,

consumers and decomposer, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids, characteristic features, case study on forest ecosystem, aquatic ecosystem.

Biodiversity: Introduction – definition: genetic, species and ecosystem diversity, biogeographical classification of India, value of biodiversity: consumptive use, productive use, social, ethical, aesthetic values, biodiversity at global, national and local levels, India as a mega-diversity nation, hotspots of biodiversity, threats to biodiversity, conservation of biodiversity, case study on any one hotspot of biodiversity.

Unit-III: Environmental Pollution

06 Hours

Definition, cause, effects and control measures of different pollution: a) Air, b) Water, c) Soil, d) Noise, e) Thermal, f) Nuclear hazards, industrial pollution and control, solid waste management: control measures of urban and industrial waste, role of an individual in prevention of pollution. Case studies.

Unit-IV: Environment and Social Issues

06 Hours

Environment from unsustainable to sustainable development, urban problems related to energy water conservation, rainwater harvesting, watershed management, resettlement and rehabilitation of people: its problems and concerns, case studies, environmental ethics: issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies, wasteland reclamation, consumerism and waste products. Environment (protection) act, air (prevention and control of pollution) act, water (prevention and control of pollution) act, wildlife (protection) act, forest (conservation) act, issues involved in enforcement of environmental legislation, public awareness.

Unit-V: Field Wok

06 Hours

Visit to water treatment plant/Municipal solid waste treatment plant and detail report on it.

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.

Learning Resources:

Text Books:

1. Environmental Studies, Erach Bharucha, University Grants Commission, New Delhi
2. Environmental Science, Y. K. Singh, New Age International Publishers, 2006, .
3. Environmental Studies: From Crisis to Cure, Rajagopalan R., Oxford University Press, USA, ISBN:9780199459759, 0199459754.

4. A text book of Environmental Science, Shashi Chawla, Tata Mc Graw-Hill New Delhi
5. A Text Book of Environmental science, Arvind Kumar, APH Publishing New Delhi.

Web link for MOOC / NPTEL Links:

1. Challenges to Sustainable Development:
<https://www.un.org/en/development/desa/financial-crisis/sustainable-development.html>
2. NPTEL course on sustainable development: <https://nptel.ac.in/courses/109105190>
3. Swayam Course on Environmental studies (Natural Resources, Biodiversity and other topics): https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
4. NPTEL course on environmental studies which encompasses SDGs, Pollution, Climate issues, Energy, Policies and legal framework:
https://onlinecourses.nptel.ac.in/noc23_hs155/preview
5. SWOT analysis of Biodiversity: <https://www.cbd.int/development>
6. India's Strategies to progress across the SDGs.:
<https://sustainabledevelopment.un.org/memberstates/india>
7. IGNOU's Initiative for online study material on Environmental studies:
<https://egyankosh.ac.in/handle/123456789/61136>
8. IGNOU's Initiative for online study material on sustainability:
<https://egyankosh.ac.in/handle/123456789/50898>
9. United Nation's website mentioning Sustainability goals:
<https://sdgs.un.org/goals>
10. Green Belt Movement's work on tree plantation, soil conservation and watershed management techniques:
<http://www.greenbeltmovement.org/what-we-do/tree-planting-for-watersheds>

List of Activities:**Part-A: Assignments**

1. Study and report on the role of individuals in conserving natural resource or engineering material.
2. Research and write a case study on one biodiversity hotspot in India. Include location, species richness, threats, and conservation efforts.
3. Choose one type of pollution (e.g., air or water or soil) and illustrate/analyse its causes, effects, and possible control measures in your city or town.
4. Prepare a presentation on any one issue: global warming, climate change, acid rain, or ozone depletion. Include current data and case studies.

Part-B: Field Work

5. Visit a water treatment plant or municipal waste treatment plant. Submit a detailed report with process description and photos/diagrams.
6. Visit to an area to document environmental assets; river/forest/flora/fauna, etc.
7. Report on a local polluted site – Urban/Rural/Industrial/Agricultural.
8. Study of common plants, insects, birds and basic principles of identification.

Part-C: Project/Activity

9. Branch-specific environmental studies/sustainability related Project/Activity.

Part-D: Report

10. Document your active participation in an environmentally friendly or sustainability-related activity, highlighting your role, the engineering relevance, and the impact of the initiative on promoting sustainable practices.

Course Code: 101308	Course Name: Community Engagement / Field Projects	
Teaching Scheme	Credit	Evaluation Scheme
Practical : 4 Hours/Week	2	TW : 50 Marks

Prerequisite Courses:

- Professional Communication Skills, Programming and Problem Solving.

Course Objectives:

- To enhance the quality of teaching learning by bridging the gap between theory and practice through community engagement.
- To promote strong interactions between educational institutions and local communities for detection and solution of real-life problems.
- To create awareness about social responsibility to develop empathy for complex global challenges.
- To recognize the need for research and innovations in collaboration with society through community-based research methods.
- To catalyze the acquisition of values of public service and inculcate citizenship among the students.
- To involve educational institutions with local communities in order to make the curriculum, courses, and pedagogies more appropriate to achieve the goals of national development.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Explore relevance between theory and practice through community-based problem learning.

CO2: Identify real-life socio-technical problems and develop the solution.

CO3: Implement a wisdom of empathy and social responsibility to meet complex global challenges.

CO4: Develop innovative ideas in collaboration with society through community-based research methods.

CO5: Analyze the need of research projects and develop a plan for betterment of public service values through active citizenship.

Course Contents:

A community engagement / field project is essential for second-year engineering students as it

bridges the gap between theoretical knowledge and real-world application. At this stage, students have gained foundational technical skills, and engaging with the community allows them to apply these skills to address practical challenges faced by society. It fosters a sense of social responsibility, encouraging students to consider the human and environmental impact of engineering solutions. Moreover, such projects help develop vital soft skills like communication, teamwork, and problem-solving, as students interact with diverse groups and learn to explain complex ideas in simple terms. By working on real-life issues, students also enhance their creativity and innovation, preparing them for future professional roles while contributing positively to their communities.

Guidelines for Conduction:

1. Formation of groups: 4 to 5 students /group.
2. Identification of one student representative for each class (if required).
3. Identification of communities (sectors / villages / nearby vicinity) as per the students' skills under respective departments.
4. Collection of different ideas or real-world problem statements from students through any open platform (Google forms / spreadsheets / handwritten applications).
5. Allocation of groups to an identified community (sectors / villages / nearby vicinity).
6. Allocating a faculty / mentor to a group. It is expected that a mentor can get assigned to a maximum three groups.
7. Students will be allowed to visit communities (sectors / villages / nearby vicinity) once in a week with prior permission.
8. Mentors can monitor field work and progress of projects through worksheets circulated by the coordinator.
9. Coordinator will keep a record of spreadsheets / reports / evaluation sheets.
10. Mentors are expected to approve the real-world problem and to encourage students to provide some solution / representation of a problem / volunteer-ship to any activity conducted by government / responsible authorities.
11. Mentors will collect all the project reports submitted by each group.

Guidelines for Evaluations:

1. Evaluation to be done based on the active participation of the student and marks could be awarded. For the community engagement project each student must get engaged and the coordinator / mentor must evaluate the projects / groups as well as the individual student twice in a semester. Mid-term evaluation must be done internally while end semester evaluation will be done by domain experts in specific domains or any other expert in the field. The average of these two evaluations will be considered as final

evaluation.

2. Students must represent a problem through power point presentations / posters / reels / short movies or any other effective media.
3. Project report shall be submitted by each group. Other than these, any required innovative process to make CEP effective and easy learning for students should be incorporated.

Guidelines for Students:

1. Community Engagement / Field Project is an opportunity for students to step out of their comfort zone, use knowledge, energy and creativity to contribute meaningfully to society.
2. It is an opportunity to discover the human side of engineering. Project reports shall be submitted by each student/group of students. All the students are expected to follow the phase wise instructions given by their CEP Coordinator / mentor.

Learning Resources:

Reference Books:

1. James Jacob W., Stewart E. Sutin, John C. Weidman, John L. Yeager, 2015, A Community Engagement in Higher Education: Policy Reforms and Practice, Sense publisher.
2. Jane Krauss, Suzanne K. Boss, Thinking Through Project-Based Learning: Guiding Deeper Inquiry.
3. John Larmer and Suzie Boss, Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences.
4. John Larmer, John R. Mergendoller, and Suzie Boss, 2013, Setting the Standard for Project Based Learning, Corwin Press.
5. Suzie Boss, Jane Krauss, Leslie Conery, Reinventing Project-Based Learning: Your Field Guide to Real-World Projects in the Digital Age, 2007, Int'l Society for Tech. in Education.
6. Judyth Sachs, Lindie Clark, 2017, Learning Through Community Engagement Vision and Practice in Higher Education, Springer Singapore.

Web link for MOOC / NPTEL Links:

1. https://onlinecourses.swayam2.ac.in/ugc25_ge01/preview.
2. https://www.uvm.edu/sites/default/files/community_engagement_handout.pdf

Course Code: 101309	Course Name: Material Testing Laboratory	
Teaching Scheme	Credit	Evaluation Scheme
Practical : 2 Hours/Week	1	TW : 25 Marks PR + OR : 25 Marks

Prerequisite Courses:

- Engineering Physics, Engineering Chemistry.

Course Objectives:

- Impart fundamental knowledge of material science and engineering.
- Acquire basic knowledge of stress, strain due to various types of loading.
- Determine bending and shear stress induced in a beam.
- Indicate the importance of heat treatment on structure and properties of materials.

Course Outcomes:

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

CO1: Determine mechanical properties using destructive and non-destructive testing of materials.

CO2: Analyze effect of alloying element and heat treatment on properties of ferrous and non-ferrous alloy.

CO3: Identify and estimate different parameters of the system viz; phases, grains, grain boundary, etc.

CO4: Determine various types of stresses and strain developed on members.

CO5: Compute bending stresses and shear stresses on a beam.

List of Practicals:

1. Tension test for ductile material on universal testing machine.
2. Compression test for brittle material using virtual lab.
3. Shear test of ductile material on universal testing machine.
4. Experimental verification of flexural formula in bending for simple supported beam.
5. Impact test for steel, aluminum, brass and copper (Charpy/Izod).
6. Non-destructive testing - dye penetrant test/ magnetic particle test.
7. Specimen preparation for microscopic examination and demonstration of optical microscope.
8. Jominy end quench test for hardenability
9. Self-learning study practical: following topics are distributed among the group of 3-5 students and groups need to present and also submit the slides/poster on TW file.
 - a. Experimental stress analysis, strain gauges rosette with case study.
 - b. Residual stresses and fatigue life with case study.
 - c. Effect of heat treatment on the mechanical properties of a metal with case study.
 - d. Mechanical properties of materials, stresses and design of components with case study.

Learning Resources:**Text Books:**

1. S. Ramamurtham, Strength of Material, Dhanpat Rai Publication.
2. Dr. V. D. Kodgire and S. V. Kodgire, Material Science and Metallurgy For Engineers, Everest Publication.
3. William D. Callister, Materials Science & Engg. Introduction, Jr, John Wiley & Sons, Inc.

Reference Books:

1. Egor. P. Popov, Introduction to Mechanics of Solids, Prentice Hall Publication.
2. Beer and Johnston, "Strength of materials", CBS Publication.
3. Raghvan V., Material Science & Engineering, Prentice Hall of India, New Delhi. 2003.
4. Avner, S.H., Introduction to Physical Metallurgy, Tata McGraw-Hill, 1997.
5. Higgins R. A., Engineering Metallurgy, Viva books Pvt. Ltd.

Weblink for MOOC / NPTEL Links:

1. Strength of Materials Virtual Lab. <https://sm-nitk.vlabs.ac.in/>
2. <https://nptel.ac.in/courses/112107146>
3. <https://archive.nptel.ac.in/courses/113/106/113106101/>
4. <http://digimat.in/nptel/courses/video/113106070/L01.html>
5. <https://archive.nptel.ac.in/courses/113/104/113104096/>

Semester - IV

Course Code: 101401	Course Name: Fluid Mechanics	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 2 Hours/Week Practical : 2 Hours/Week	2 1	CCE : 40 Marks ESE : 60 Marks TW : 25 Marks PR + OR : 25 Marks

Prerequisite Courses:

- Engineering Mathematics, Engineering Physics, Engineering Mechanics.

Course Objectives:

- To develop the fundamental knowledge of fluid and its properties as well as laws of fluid statics, principle of buoyancy and Metacentric height.
- To understand kinematics of fluid flow.
- To apply basic laws and equations used for analysis of fluids dynamics.
- To analyze behavior of fluid under different conditions of internal flows and also different losses occurring in pipes.
- To analyze fluid behavior under different conditions of external flows and relationship between physical quantities using Dimensional analysis.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Determine various properties of fluid and apply the laws of fluid statics and concepts of buoyancy.

CO2: Understand types of fluid flow and terms associated with fluid kinematics.

CO3: Solve fluid flow problems using Euler's and Bernoulli's equations.

CO4: Analyze internal flows and losses through pipes.

CO5: Analyze external flow and relationship between physical quantities using Dimensional analysis.

Course Contents:

Unit-I: Introduction to Fluid Properties and Fluid Statics

06 Hours

Properties of Fluids: Definition of fluid, distinction between a solid and a fluid, macroscopic and microscopic point of view, concept of continuum, fluid density, specific weight, specific gravity, dynamic viscosity, kinematic viscosity, Newton's law of viscosity, surface tension, capillarity, vapour pressure.

Fluid Statics: Hydrostatic law, Pascal's law, pressure at a point, units and scale of pressure measurement, total pressure, centre of pressure, total pressure on submerged surfaces (inclined), Archimedes' principle, buoyancy and metacentric height.

Unit-II: Kinematics of Fluid Flow**06 Hours**

Flow field – velocity, acceleration (local (temporal) and convective acceleration), description of fluid motion, types of flow, continuity equation, visualization of flow field (pathline, streamline and streakline), velocity potential function, stream function, flow net.

Unit-III: Dynamics of Fluid Flow**06 Hours**

Euler's equation of motion, Bernoulli's equation of motion, Introduction to Navier-Stokes equation, applications of Bernoulli's equation (Venturimeter, Orificemeter and Pitot tube).

Unit-IV: Internal Flow and Losses in Pipes**06 Hours**

Internal Flow: Laminar flow analysis through pipe and fixed parallel plates- Velocity and Shear stress distribution.

Losses in Pipes: TEL, HGL, Energy losses through pipe, Darcy-Weisbach equation, Minor losses in pipes, pipes in series and parallel, Siphons, Transmission of power

Unit-V: External Flow and Dimensional analysis**06 Hours**

External Flow: Boundary layer on a flat plate, separation of boundary layer and its prevention methods, forces on submerged surfaces (drag and lift).

Dimensional Analysis: Methods of dimensional analysis (Buckingham's Pi theorem), model analysis, similitude, dimensionless numbers, Model laws (Similarity laws).

Learning Resources:**Text Books:**

1. R.K. Bansal, Fluid Mechanics, Laxmi Publication (P) Ltd. New Delhi.
2. R.K. Rajput, Fluid Mechanics & Hydraulic Machines, S.Chand & Company Ltd.
3. Modi P. N. and Seth S. M., Hydraulics and Fluid Mechanics, Standard Book House.
4. Kumar K. L., Engineering Fluid Mechanics, S.Chand & Company Ltd, Eurasia Publishing House.

Reference Books:

1. Frank M. White, Fluid Mechanics, McGraw Hill Publication.
2. James A. Fay., Introduction to Fluid Mechanics.
3. Cengel and Cimbala Fluid Mechanics, Tata McGraw-Hill.
4. Streeter V. L. and Wylie E. B. Fluid Mechanics, McGraw Hill International Book Co.

Web link for MOOC / NPTEL Links:

1. <https://nptel.ac.in/courses/112105171>
2. <https://nptel.ac.in/courses/112104118>
3. <https://nptel.ac.in/courses/112105269>
4. http://www.efluids.com/efluids/books/Smits_text_part1.pdf
5. http://www.efluids.com/efluids/books/Intro_to_Grad_Fluid%20Mech_ed_IV_2023.pdf
6. <https://www.youtube.com/watch?v=iTanaNwMDKo&list=PL9RcWoqXmzaLnlGN3>

[9w2-1jyFyI_ALVa3](#)**List of Practicals:**

1. Determination of viscosity of liquids and its variation with temperature.
2. Study of pressure measuring devices.
3. To determine the metacentric height of a floating body.
4. To draw flow net by using electrical analogy method.
5. To verify Bernoulli's theorem experimentally.
6. To determine coefficient of discharge for Venturimeter.
7. To study laminar and turbulent flow by Reynold's apparatus.
8. Perform any one experiment (out of 1 to 7) using Virtual Lab.

Course Code: 101402	Course Name: Machines and Mechanisms	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 2 Hours/Week Practical: 2 Hours/Week	2 1	CCE : 40 Marks ESE : 60 Marks TW : 25 Marks PR + OR : 25 Marks

Prerequisite Courses:

- Engineering Mathematics, Engineering Physics, Engineering Mechanics

Course Objectives:

- Identify and analyze various types of kinematic chains, mechanisms and machine components.
- Apply graphical method to analyze displacement, velocity and acceleration in mechanisms.
- Apply analytical technique to synthesize the mechanisms
- Analyze the kinematics of gear pairs, velocity ratios, relative motion between mating gears.
- Analyze the motion of the follower for different cam profile.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Demonstrate mechanisms in real life applications and calculate the degrees of freedom.

CO2: Analyze velocity and acceleration of mechanisms by graphical method.

CO3: Synthesize a four bar and slider crank mechanism by analytical method.

CO4: Apply fundamentals of gear theory as a prerequisite for gear design.

CO5: Construct cam profile for given follower motions.

Course Contents:**Unit-I: Fundamentals of Mechanism****06 Hours**

Kinematic link, types of links, kinematic pairs, types of constrained motions, mechanism, machine, kinematic chain, types of kinematic chain, four-bar chain and its inversions, slider crank chain and its inversions, double slider crank chain and its inversions, types of joints, degree of freedom.

Unit-II: Analysis of Mechanisms: Graphical Method**06 Hours**

Velocity and acceleration analysis mechanisms by relative velocity method, instantaneous centre of velocity, Kennedy's theorem, angular velocity ratio theorem, analysis of mechanism by ICR method.

Unit-III: Synthesis of Mechanisms**06 Hours**

Steps in Synthesis: Type synthesis, number synthesis, dimensional synthesis, tasks of kinematic synthesis - path, function and motion generation (body guidance), precision positions, Chebychev spacing, mechanical and structural errors.

Analytical Synthesis: Three position synthesis of four-bar mechanism using Freudenstein's equation.

Unit-IV: Kinematics of Gears**06 Hours**

Gear: Classification

Spur Gear: terminology, law of gearing, involute and cycloidal tooth profile, path of contact, arc of contact, sliding velocity.

Helical: Terminology, geometrical relationships, virtual number of teeth for helical gears.

Worm and Worm Wheel: Terminology, geometrical relationships.

Bevel Gear: Terminology, geometrical relationships.

Unit-V: Cams and Followers**06 Hours**

Introduction, classification of followers and cams, terminology of cam, displacement diagram for the motion of follower as uniform velocity, Simple Harmonic Motion (SHM), uniform acceleration and retardation motion, cycloid motion, cam profile construction for knife-edge follower and roller follower, cam jump phenomenon.

Learning Resources:**Text Books:**

1. Theory of Machines by S S Ratan Ed. III, (McGraw Hill Education (India) Pvt. Ltd.).
2. Theory of Machines and Mechanisms by J. J. Uicker, G. R. Pennock, J. E. Shigley, Edition V, International Student Edition, Oxford.
3. Theory of Machines by Bevan T, Edition III, (Longman Publication).

Reference Books:

1. Theory of Mechanism and Machines, Ghosh Malik (East-West Pvt. Ltd.).
2. Theory of Machines, Sadhu Singh (Pearson Education).
3. Theory of Machine, V.P. Singh, Dhanpatrai and Sons.

Weblink for MOOC / NPTEL Links:

1. Kinematics of Machines, Prof. Ashok K Mallik, IIT Kanpur.
<https://nptel.ac.in/courses/112104121/>
2. Theory of Mechanism, Prof. Sujatha Srinivasan, IIT Madras
<https://nptel.ac.in/courses/112/106/112106270/>
3. Kinematics of Mechanisms and Machines, Prof. Anirvan DasGupta, IIT Kharagpur.
<https://nptel.ac.in/courses/112/105/112105268/>

List of Practicals:

Following practicals must be performed. Term Work of the student is evaluated based on the

completion of Practical, Assignments using Drawing Aids, and Detailed Industrial Visit Report.

Experiments

1. To make a model of any mechanism by using waste material by the group of 4 to 6 students and to give a presentation using PPTs.
2. To study and verify cam jump phenomenon.
3. To study manufacturing of gear using gear generation with rack as a cutter and to generate an involute profile.

Assignments using Drawing Aids: Graphical assignments on Half Imperial drawing sheet.

1. Identify mechanisms in real life and analyze for types and number of links, pairs, obtain degrees of freedom. Submit the sheet.
2. To solve two problems on velocity and acceleration analysis using relative velocity and acceleration method.
3. To solve two problems on velocity analysis using the ICR method.
4. To draw conjugate profile for any general type of gear tooth.
5. To draw cam profile for any two problems with combination of various follower motion with radial and off-set cam.

Virtual Laboratory: Exploring experiments on kinematics of machinery using Virtual Laboratory. Write brief reports of using Virtual Laboratory to perform following assignment.

1. Mechanisms and Robotics - Quick Return Mechanism,

<http://vlabs.iitkgp.ernet.in/mr/index.htm>

Industrial Visits: A compulsory industrial visit must be arranged to industries/ establishments consisting automation and mechanization during semester to provide awareness and understanding of the course. The Industrial Visit must be preferably to

1. Manufacturing industries with Assembly-line Automation
2. Sugar factory
3. Bottle filling plants

Student must submit properly documented detailed Industrial Visit report in his/her own words.

Course Code: 101403	Course Name: Manufacturing Processes	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 2 Hours/Week	2	CCE : 40 Marks ESE : 60 Marks

Prerequisite Courses:

- Engineering Physics, Engineering Mathematics, Material Science and Metallurgy.

Course Objectives:

- To understand the working of conventional machining processes.
- To illustrate suitability of different welding processes for varying requirements.
- To describe various sand and permanent mould casting methods, procedure and mould design aspects.
- To understand basics of metal forming processes, equipment and tooling.
- To know about composites, its fabrication processes.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Explain the construction and working of conventional machining processes.

CO2: Discuss different welding processes and their characteristics.

CO3: Describe casting processes and their applications.

CO4: Apply the knowledge of press working to design press components.

CO5: Explain different moulding processes.

Course Contents:**Unit-I: Conventional Machining Processes 06 Hours**

Lathes: Types, specifications, construction, working, different operations, tools, attachments and accessories. **Drilling machine:** Fundamentals of drilling processes, drill geometry, types of drilling machines. Reaming process. **Milling:** Construction, working and indexing methods.

Unit-II: Joining Processes 06 Hours

Arc welding. TIG, MIG, gas welding, resistance welding, ultrasonic welding, electron beam welding laser beam welding. Soldering, brazing. Welding defects and quality.

Unit-III: Metal Casting 06 Hours

Types of patterns, pattern making allowances, sand casting, properties of sands and testing, types of cores, gating system in casting, shell moulding, investment casting, die-casting, centrifugal casting, and continuous casting. Cleaning and finishing of casting, defects and

remedial measures in casting.

Unit-IV: Metal Forming**06 Hours**

Hot working and cold working processes, principle and working of rolling, forging, extrusion, wire drawing. Sheet metal working operations, types of presses, types of dies, design calculations of press working.

Unit-V: Processing of Polymers**06 Hours**

Introduction to engineering plastics. Molding processes – injection moulding, blow moulding, transfer moulding, extrusion, compression moulding.

Learning Resources:**Text Books:**

1. Hajra Chaudhary S.K., Elements of Workshop Technology-Vol. I& II, Media Prom & Pub, Mumbai, Twelfth Edition, 2007.
2. P. C. Sharma, Production Engineering, Khanna Publishers.
3. M.P. Groover, Fundamental of Modern Manufacturing: Materials, Processes and Systems. John Wiley and Sons, Fourth Edition, 2010.

Reference Books:

1. Campbell J.S., Principles of Manufacturing Materials and Processes, McGraw-Hill, New York, First Revised, 1984.
2. Production Technology – HMT Handbook, Tata McGraw-Hill Education Private Limited First Revised Edition, Twenty-eighth Reprint, 2017.
3. Roy A. & Lindberg, Processes and Materials of Manufacturing, Prentice Hall of India Delhi, Fourth Edition, 2008.
4. R. K. Jain, Production Technology, Khanna Publishers.

MOOC / NPTEL/YouTube Links:

1. <https://archive.nptel.ac.in/courses/112/107/112107144/>
2. <https://archive.nptel.ac.in/courses/112/107/112107219/>

Course Code: 171405A	Course Name: Cyber Security and Laws	
Teaching Scheme	Credit	Evaluation Scheme
Theory : 2 Hours/Week	2	CCE : 40 Marks ESE : 60 Marks

Prerequisite Courses:

- Basic concept of Computer Networks, Internet Fundamentals.

Course Objectives:

- To learn fundamental concepts of cybersecurity.
- To learn about different types of threats and cybercrimes.
- To understand the basics of cyber forensics, network forensics, Email forensics, web forensics, and crypto currency forensics.
- To analyze how particular social engineering attacks take advantage of specific features of the Internet and human nature.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Understand the basics of cyber security.

CO2: Study ethical hacking techniques and hacker methodologies.

CO3: Identify and classify various types of cyber crimes and related cyber laws.

CO4: Apply methods for cyber forensics.

CO5: Use of AI in cyber security.

Course Contents:**Unit-I: Introduction to Cyber Security****06 Hours**

Information security definition and concepts, overview of security threats, goals of security, limitations and challenges in cyber security, types of security attacks, network security, malicious codes, intrusion detection systems, password cracking, insecure network, connections, concept of firewall and security.

#Case Study: WannaCry Ransomware Attack – A Global Wake-Up Call

Unit-II: Ethical Hacking**06 Hours**

Introduction to hacking & hackers: black hat, white hat, grey hat, ethical hacking. Legal and ethical considerations, phases of ethical hacking: reconnaissance, scanning, gaining access, maintaining access, covering tracks, hacker methodology.

#Case Study: The Hacktivist Approach – Anonymous and the Sony Hack.

Unit-III: Cyber Laws**06 Hours**

Cyber Crime: introduction and overview, nature and scope, types of cyber crime: crime against an individual, crime against property, cyber extortion, drug trafficking, cyber terrorism.

Introduction, definition and origin, cybercrime and information security, classification of cybercrimes, the legal perspectives- Indian perspective- IT Act 2000, global perspective, categories of cybercrime, reasonable security practices.

#Case Study: Aarushi Talwar Case and the Role of Cyber Law in Evidence Handling or the Infosys Whistleblower Case: Data Protection and Ethics.

Unit-IV: Cyber Forensics**06 Hours**

Computer forensics, use of computer forensics in law enforcement, computer forensics assistance to human resources/employment proceedings, computer forensics services, benefits of professional forensics methodology, steps taken by computer forensics specialist types of computer. Forensics technology: types of military computer forensic technology, types of law enforcement — computer forensic technology, types of business computer forensic technology computer forensics evidence and capture: data recovery defined, data back-up and recovery, the role of back-up in data recovery, the data-recovery solution.

#Case Study: Capital one data breach and the role of forensics.

Unit-V: AI in Cyber Security & Case Studies**06 Hours**

Introduction to AI - applying ai in cyber security, real life example - use of AI in cyber crime detection illustrations, examples and mini-cases: introduction, real-life examples, mini-cases, illustrations of financial frauds in cyber domain, digital signature-related crime scenarios, digital forensics case illustrations, online scams.

#Case Study: Darktrace: AI-driven threat detection in enterprise networks.

Learning Resources:**Text Books:**

1. William Stallings, Computer Security: Principles and Practices, Pearson 6 Ed, ISBN: 978-0-13 335469-0
2. Nina Godbole, Sunit Belapure, Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India Pvt.Ltd, ISBN- 978-81-265-2179-1.

Reference Books:

1. Nina Godbole, “Information Systems Security”, Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
2. Mark Merkow, “Information Security-Principles and Practices”, Pearson Ed., ISBN-

978-81-317 1288-7

3. Bernard Menezes, “Network Security and Cryptography”, Cengage Learning, ISBN-978-81-315 1349-1
4. The Information Technology Act, 2000; Bare Act – Professional Book Publishers
5. Berouz Forouzan, “Cryptography and Network Security”, TMH, 2 edition, ISBN -978-00-707- 0208-0. 5

Web link for MOOC / NPTEL Links:

1. Cyber Security and Privacy By Prof. Saji K Mathew
https://onlinecourses.nptel.ac.in/noc25_cs116
2. Introduction to Cyber Security By Dr. Jeetendra Pande,
https://onlinecourses.swayam2.ac.in/nou25_cs18
3. Cyber Laws By Dr Vishal Goyal,
https://onlinecourses.swayam2.ac.in/cec25_cs04

Suggested Activities In-Class:

1. Case study – cyber frauds.
2. Investigating any cyber crime using cyber forensics.

Course Code: 174408	Course Name: Foreign Languages	
Teaching Scheme	Credit	Evaluation Scheme
Tutorial : 2 Hours/Week	2	TW : 50 Marks

Prerequisite Courses:

- Professional Communication Skills.

Course Objectives:

- To develop Foundational Language Skills, Enhance Communication Competence, Promote Multilingual Proficiency, Support Career and Academic Opportunities, Boost Confidence and Motivation in Language Learning.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Learn the basic phonetics, alphabets and sounds of the selected foreign language.

CO2: Interpret and use everyday vocabulary to manage simple social interaction.

CO3: Form simple sentences using basic grammatical structures and sentence patterns.

CO4: Participate in simple conversations and everyday communication situations relevant to academic, social and professional contexts.

CO5: Demonstrate cultural awareness and appropriate language behaviour to facilitate global and cross-cultural interactions.

Course Guidelines:

1. **Course Selection:** Students will choose one foreign language course from the provided basket, based on their interest and career aspirations.
2. **Course Allocation:** Each student will be allotted their selected language course, ensuring dedicated participation and meaningful learning.
3. **Expert Instruction:** Courses will be taught by qualified language instructors using an engaging mix of activities, group discussions, cultural presentations, and lectures, either in-person or online.
4. **Activity Documentation:** Students must prepare and submit a hard copy report of the language-learning activities they participated in, along with a certificate of participation from the instructor or institution.
5. **Evaluation Criteria:** Assessment will focus on the completeness, quality, and reflection demonstrated in the submitted activity report.
6. **Mentorship:** Faculty mentors will be assigned to each student to guide them in the

learning process, assist with linguistic challenges, and support their overall progress in the selected language.

7. **Activity Framework:** Faculty members, in consultation with language experts, will design a set of language-related activities (e.g., vocabulary building, basic conversations, and cultural immersion tasks) that align with the objectives of each course.
8. **Personal Growth:** Emphasis is placed on selecting a language that aligns with the student's personal interests, academic goals, or global career opportunities, fostering long-term motivation and growth.
9. **Balance and Engagement:** Students are encouraged to choose a course that they are genuinely curious or passionate about, ensuring consistent engagement and maximum benefit from the learning experience.

Baskets for Language Courses:

1. Basic English Language Course:

Unit-I: Basic of Communication

06 Hours

An introduction to phonetics and phonology.

Unit-II: Vocabulary for Communication

06 Hours

Basic vocabulary and sentence construction, idioms and phrases, antonyms, synonyms.

Part of speech: Noun, pronoun, verb, adjective, adverb, preposition, conjunction, interjection.

Unit-III: Grammar for Communication

06 Hours

Articles, tense, change the voice, direct- indirect speech, degree, punctuation.

Grammar usage in sentences, sentence structure error, grammar error.

Unit-IV: English for the Real World

06 Hours

Everyday communication: Introduction, shopping, meeting friends, travelling, telephonic communication, negotiation, etc.

Unit-V: Language Skills for Functional Communication

06 Hours

Reading skill, listening skills, speaking skills, writing skills. Email correspondence, dialogue writing. Spell check and writing presentation.

2. Basic Sanskrit Language Course:

Unit-I: Characteristics of Sanskrit

06 Hours

Introduction: Some unique characteristics of Sanskrit. Basic introduction of oneself, simple

verbs daily vocabulary. Introducing different declensions and tenses - 1.

Unit-II: Sentence Structure and Vocabulary for Communication

06 Hours

Basic vocabulary and sentence construction.

Introducing different declensions and tenses – 2.

Practice with various verbs in different moods and tenses summary of the sentence structure with different questions.

Unit-III: Grammar for Communication

06 Hours

Revision of the main features of part 1 of introduction to basic spoken Sanskrit, different verb forms, daily vocabulary.

Introduction of different declensions in the plural and tenses – 1, daily vocabulary, poetic verses, conversations and stories.

Unit-IV: Daily Conversation

06 Hours

Practice with various verbs in different moods and tenses, summary of the sentence structures using the plural with different questions.

Introduction of a few more words ending with consonants and their declensions, an alternative conjugation of verbs, daily vocabulary, poetic verses, conversations and stories.

Introduction to their different declensions in singular, dual and plural, new verb forms, daily vocabulary, poetic verses, conversations and stories.

Unit-V: Comprehension and Conversations

06 Hours

Introduction to Sandhi, vowel with vowel / vowel with consonant / consonant with consonant / aspirant with vowel or consonant, poetic verse, reading and comprehension, conversations.

Practice with a variety of word endings, various verbs in different moods and tenses, summary of the sentence structures using the plural with different questions.

3. Basic German Language Course:**Unit-I: Introduction to the Alphabet Articulation****06 Hours**

Introduction, greetings and alphabet articulation.

Introducing oneself and others; Grammar: W questions, personal pronouns, simple sentence, verb conjugation.

Themes: Hobbies, the week, numbers, the alphabet, months, seasons / **Grammar:** Articles, plural, the verbs to have and to be.

Unit-II: Word and Sentence Structure**06 Hours**

Theme: In the city / naming places and buildings, means of transport, basic directions / **Grammar:** definite and indefinite articles; negation - kein and nicht; imperative.

Themes: food, drink, family / groceries and meals / **Grammar:** the accusative.

Unit-III: Daily Conversation**06 Hours**

Theme: Everyday life, telling time, making appointments / **Grammar:** prepositions am, um, von, bis; modal verbs, possessive articles: leisure activity, celebrations.

Unit-IV: Writing Skills**06 Hours**

My apartment, rooms, furniture, colours / Grammar: changing prepositions.

Professions / Grammar: perfect tense.

Clothes / Grammar: perfect tense and dative.

Grammar: separable verbs, the accusative, past tense of to have and to be.

Contacts, writing letters / Grammar: dative.

Unit-V: Basic of communication in German Language**06 Hours**

Health and the body / Grammar: imperative and modal verbs.

Holiday and weather.

4. Basic French Language Course:

Unit-I: Introduction to Alphabets Articulation

06 Hours

Introduction, greetings and alphabet articulation.

Unit-II: Grammar of French-I

06 Hours

Indefinite articles and numbers, family vocabulary, colours and numbers.

Unit-III: Grammar of French-II

06 Hours

Words of politeness, pronouns and conversation.

Unit-IV: Daily Conversation

06 Hours

6 points to self-introduction, simple propositions and verbs.

Unit-V: Basic of Communication in French Language

06 Hours

Pieces of communication.

5. Basic Japanese Language Course:

Unit-I: Japanese Scripts

06 Hours

Japanese Scripts: Hiragana, Katakana, Kanji, Ideograms and Pictograms.

Unit-II: Language and Grammar

06 Hours

Language and Grammar: Particles, sentence construction, demonstratives, interrogatives, conjunctions, vocabulary, nouns, verbs conjugations, adverbs, other parts of speech, verbs and tense, requests and commands, comparisons, expressions and phrases, idioms, etc.

Unit-III: Daily Conversation

06 Hours

Introduction, time, daily conversation, usage of interrogatives, asking direction, conversation on phone, giving and receiving, making requests and commands, likes and dislikes, potential, permission, conditionals, direct in direct speech, learning to make speeches, writing mails, polite Japanese.

Unit-IV: Japanese Culture, Festivals and Lifestyle

06 Hours

Japanese culture, festivals and lifestyle: Japanese lifestyle, learning about culture, customs and festivals, idioms and phrases.

Unit-V: Basic of Communication in Japanese Language

06 Hours

Audio and pictures: Association and meaning. |

Guidelines for Evaluation:

1. Self-Introduction on different occasions (Formal and informal).
2. Public speaking exercises.
3. Common grammar errors/ Sentence structure errors.
4. Writing articles.
5. Vocabulary level test.

Learning Resources:

Text / Reference Books / Web Links:

Basic English Language Course

1. Raymond Murphy's English Grammar in Use Cambridge University Press. 2019
2. A Practical English Grammar, Thomson and Martinet. New Delhi: Oxford University Press, 1986.
3. Study Skills in English: A Course in Reading Skills for Academic Purposes, Michael J. Wallace, Cambridge University Press, 2004.
4. Cambridge English Pronouncing Dictionary (17thEdn.), Cambridge University Press, 2006

Basic Sanskrit Language Course

1. Kumari, S. (1993) Sanskrita Chitrapadakoshah, Mysuru: Bharatiya Bhasha Sansthanam.
2. Samkrita-vyavahaara-saahasree(Sanskrit-English, New Delhi: Sanskrita Bharati.
3. Sampad, & Vijay. (2005). The Wonder that is Sanskrit. Pondicherry: Sri Aurobindo Society.
4. Satvlekar, S. D. (2013). Sanskrit Swayam Shikshak. Delhi: Rajpal & Sons (Rajpal Publishing).
5. Shastri, V K. (2012). Teach Yourself Sanskrit, Prathama Diksha. Delhi: Rashtriya Sanskrita Samsthana.
6. Vishwasa (2014). Abhyāsa-pustakam, New Delhi: Sanskrita Bharati

Basic German Language Course

1. NETZWERK Deutsch als Fremdsprache A1 (Goyal, New Delhi, 2015).
2. Schulz-Griesbach: Deutsch als Fremdsprache. Grundstufe in einem Band (for Grammar).

Web Resources:

1. Facts about Germany: <https://www.tatsachen-ueber-deutschland.de/en>

2. Online German-English dictionary www.leo.org.

Practice materials:

1. <https://www.goethe.de/en/spr/kup/prf/prf/sd1/ueb.html>
2. https://www.deutschkurse-passau.de/JM/images/stories/SKRIPTEN/a1_skript_gr.pdf
3. https://www.schubert-verlag.de/aufgaben/arbeitsblaetter_a1_z/a1_arbeitsblaetter_index_z.htm

Basic French Language Course

1. Saisons 1 Méthode de français
2. <https://www.frenchcircles.ca/>
3. <https://blog.rosettastone.com/french-accent-marks/>

Basic Japanese Language Course

1. Minna no Nihongo Textbook 1 & II (3 A Network).
2. Japanese for Busy people. (Association for Japanese Language Teaching).
3. Nihongo Dekimasu (Japan Foundation).
4. Shin Nihongo no Kiso (Association for Overseas Technical scholarship).
5. First steps in Japanese (3 A Corporation).
6. Kanji and Kana by Wolfgang Hadamitzky and Mark Spahn.
7. 250 Essential Kanji for everyday use Vol. I & 2 by Kanji Research group University of Tokyo.

Course Code: 101409	Course Name: Machine Shop	
Teaching Scheme	Credit	Evaluation Scheme
Practical : 4 Hours/Week	2	TW : 50 Marks

Prerequisite Courses:

- Manufacturing Processes, Material Science, Engineering Drawing.

Course Objectives:

- Acquire skills to handle conventional machines and CNC machine for manufacturing of a component.
- Study and implement manual part program using M code and G code for given component as per ISO standards.
- Demonstrate the procedure of polymer processing.
- Explain the tolerance built up and dimensional inaccuracies.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Apply the knowledge of machining technique to prepare a component on lathe machine.

CO2: Apply the knowledge of injection moulding to prepare a component.

CO3: Apply 'M' Codes and 'G' codes of part programming to prepare a component on CNC machine.

CO4: Summarize the knowledge gained during industry visit.

Learning Resources:**Text Books:**

1. H.S.Bawa, Workshop Practice, Tata McGraw Hill Education (Publisher).
2. S. K. Hajra Choudhary, Nirjhar Roy, Element of Workshop Technology: Vol. I and II, Media Promoters and Publishers Pvt. Ltd., 15th Edition, 2012.
3. P. N. Rao, Manufacturing Technology, Vol. I & II, Tata McGraw Hill Publishers.

Reference Books:

1. K. Jain, Production Technology, Khanna Publishers.
2. P. C. Sharma, Production Engineering, Khanna Publishers.

Web link for MOOC / NPTEL Links:

1. https://www.youtube.com/watch?v=Rf90Jbbcr3M&list=PLSGws_74K018JY-1RyIj0cm4yppa1h54r&index=17
2. https://www.youtube.com/watch?v=1AwOzDv7j6o&list=PLSGws_74K018JY-1RyIj0cm4yppa1h54r&index=13

List of Practicals:

1. Preparation of a mechanical component using conventional machines such as lathe as per requirement. Manufacturing drawing with appropriate geometrical and dimensional tolerances, detailed process planning to be included.
2. Manufacturing of any one job using plastic injection moulding machine.
3. Manufacturing of mechanical component using CNC Lathe machine. Manufacturing drawing with appropriate geometrical and dimensional tolerances, detailed process planning to be included.
4. Preparing manual CNC part program using G Codes and M Codes for CNC Lathe machine.
5. Visit to any manufacturing industry to acquire skills related to mechanical engineering.

Curriculum Design and Development**Chairman - Board of Studies and Advisors**

Dr. A. B. Kakade	Mr. Rahul Shirwadkar
Dr. A. G. Thakur	Mr. Abhinav Shinde
Dr. P. V. Bhale	Dr. P. J. Pawar
Dr. V. M. Phalle	

Course Design Team Members

Ms. V. A. Tamboli	Dr. S. A. Talekar
Dr. S. B. Sonawane	Dr. S. P. Awate
Mr. P. D. Aher	Mr. S. R. Pandit
Dr. N. J. Salunke	Dr. K. T. Patil
Mr. M. B. Patil	Mr. A. P. Shiralkar
Ms. R. S. More	Dr. N. P. Patil
Dr. S. P. Mogal	Dr. V. C. Shewale
Mr. Y. B. Chaudhary	Dr. A. A. Kapse
Mr. N. K. Kharate	Dr. S. Y. Pawar
Dr. D. B. Uphade	Mr. D. D. Kulkarni
Dr. P. C. Shete	Mr. R. S. Thakare
Mr. N.V. Lokare	Mr N.S.Gaikwad
Mr. V. V. Shinde	Dr. S. J. Suryawanshi
Mr. S. N. Palhe	Mr. D. V. Kushare
Dr. P. S. Tile	Mr. M. S. Patil