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. Electronics and Telecommunication Engineering (2024 Pattern)
(As per NEP 2020)
Academic Year 2025-26

Program Specific Outcomes (PSOs).

PSO1: Academics: Apply fundamentals of electronics/course in analog and digital domains.

PSO2: Interdisciplinary: Use of technique, skill & engineering tool necessary for engineering practices.

PSO3: Social Aspect: Demonstrate engineering knowledge, interpersonal skills for societal responsibilities.

Program Educational Outcomes (PEOs).

PEO1: To impart state-of-the-art technical education in Electronics & Telecommunication Engineering.

PEO2: To promote society beneficial projects and activities.

PEO3: To develop soft skill, team work, professional ethics and multidisciplinary approach for the carrier enhancement.

PEO4: To bridge the gap between Industry-Institute through collaboration with Industries, Institutions and Universities.

PEO5: To provide suitable infrastructure and facilities in tuned with advancing technological evaluation.

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 isakn 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. Electronics and Telecommunication 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
104301	PCC-2	Digital Electronics	2	2	-	40	60	25	25	150	2	1	-	3
104302	PCC-3	Electronics Devices and Circuits	2	2	-	40	60	25	25	150	2	1	-	3
104303	PCC-4	Network Theory	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
104308	CEP/FP	Community Engagement / Field Project	-	4	-	-	-	50	-	50	-	2	-	2
		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. Electronics and Telecommunication Engineering
Curriculum Structure (2024 Pattern) Semester - IV

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week) TH	PR	TU	Evaluation Scheme and Marks CCE	ESE	TW	PR + OR	TOT	Credits TH	PR	TU	TOT
104401	PCC-5	Analog Communication	2	2	-	40	60	25	25	**150**	2	1	-	**3**
104402	PCC-6	Signals and System	2	2	-	40	60	25	25	**150**	2	1	-	**3**
104403	PCC-7	Control System	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 Courses-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**
104409	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 Courses – 2	Course Code	AEC Courses	Course Code	VSEC Courses
171405A	Cyber Security and Laws	174408	Foreign Language	104409	Skill Development

- **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: 104301	Course Name: Digital Electronics	
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 - Boolean Algebra.

Course Objectives:

- Apply the knowledge of Boolean algebra and simplification of Boolean expressions to optimize digital circuits.
- Compare combinational & sequential circuits and implement it using VHDL.
- Study sequential circuit designing using Moore and Mealy Machines.
- Implement synchronous and asynchronous counters using state machines and VHDL.
- Study the characteristics digital logic family.

Course Outcomes:

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

CO1: Apply the knowledge of Boolean algebra and simplification of Boolean expressions to deduce optimal digital circuits.

CO2: Develop codes for combinational and sequential circuits using VHDL.

CO3: Design sequential circuits using Moore and Mealy Machines.

CO4: Design counters using VHDL.

CO5: Analyse electrical characteristics of TTL and CMOS logic families.

Course Contents:

Unit-I: Combinational Logic Circuits   07 Hours

Combinational logic circuits, k-map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (up to 4 variables with don't care condition) Full Adder, Full Subtractor, digital comparator, decoders, encoders, multiplexers, de-multiplexers, Realization of Boolean expressions- using decoders-using multiplexers, Hazards.

Unit-II: Sequential Circuits   06 Hours

Latches, flip flops, edge triggering, Excitation Table for flip flops. Conversion of flip flops (D to T and SR to JK). Registers, Shift registers, State diagram, State table, State reduction, State

assignment, Implementation. Mealy and Moore machines representation.

Unit-III: Counters   06 Hours

Binary counters – Synchronous and asynchronous up/down counters, mod N counter, finite state machine implementation, Sequence detector, and sequential circuit design.

Unit-IV: Hardware Description Language   06 Hours

Introduction to HDL, Language constructs, Data objects, Data types, Entity, Architecture, Structural, Dataflow and behavioral modelling of combinational and sequential logic circuits, Test bench.

Unit-V: IC Characteristics and PLD   08 Hours

Digital IC Characteristics: Speed of Operation, Power Dissipation, Figure of Merit, Fan in, Fan out, Current and Voltage Parameters, Noise Immunity, Logic Families: TTL, CMOS, ECL. Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM, ROM, EPROM, SRAM, DRAM.

Programmable Logic Devices: Detail architecture, Study of PROM, PAL, PLA, designing combinational circuits using PLDs. General Architecture of FPGA and CPLD.

Learning Resources:

Text Books:

1. R.P. Jain, Modern Digital Electronics, Tata McGraw Hill Publication, 3rd Edition.
2. Thomas Floyd, Digital Electronics, 11th Edition.
3. M. Morris Mano, Digital Logic and Computer Design, PHI, 4th Edition.
4. Taub and Schilling, Digital Principles and Applications, TMH.
5. Anand Kumar, Fundamentals of Digital Circuits, Prentice Hall of India, 1st Edition.

Reference Books:

1. S. Brown and Z. Vranesic, Fundamentals of Digital Logic with Verilog Design, Tata Mc Graw Hill, 2008.
2. D. P. Leach, A. P. Malvino, Goutam Guha, Digital Principles and Applications, Tata Mc Graw Hill, New Delhi, 2011.
3. M. M. Mano, Digital Design, 3rd ed., Pearson Education, Delhi, 2003.
4. R. J. Tocci and N. S. Widner, Digital Systems – Principles & Applications, PHI, 10th Ed., 2007.
5. Roth C.H., Fundamentals of Logic Design, Jaico Publishers. V Ed., 2009.

Web link for MOOC / NPTEL Links:

1. https://nptel.ac.in/courses/108/105/108105113/
2. https://nptel.ac.in/courses/117/106/117106086/
3. https://nptel.ac.in/courses/108/105/108105132/

List of Practicals:

Part-A: Combinational Circuit (Any Three)

1. Design & implement [Any Two]

   a. 4-bit Gray to Binary

   b. 4-bit Binary to Gray

   c. BCD to EXCESS-3

   d. 3 bit odd/even parity generator using IC74LS86

2. Design and Implement [Any One]

   a. 4-bit Binary adder and sub tractor using IC-74LS83.

   b. BCD Adder using 74LS83.

3. Design & implement n-bit Magnitude Comparator (74LS85).

4. Design and Implement-[Any One]

   a. Full adder/subtractor using IC-74LS138(DeMUX)

   b. Full adder/subtractor using IC-74LS153 (MUX)

Part-B: Sequential Circuit (Any Three)

5. Truth table and Flip Flop Conversion

   a. Verify the truth table of JK FF/D FF (7476/7474)

   b. Design and Realization of: Flip Flop conversion (eg. D FF to JK FF)

6. Design & implement 4-bit bidirectional shift register using D flip-flop

7. Design of 4-bit Ripple up/down Counter using MS JK flip-flop.

8. Design of Synchronous 4-bit Up/Down Counter (OR MOD N Counter) using JK Flip Flop / D Flip Flop.

9. Design and Implement MOD-N and MOD-NN counter using IC-74LS90 and draw a Timing diagram.

10. Design & implement sequence generator.

11. Verify four voltage and current parameters for TTL and CMOS (IC 74LSXX, 74HCXX), (Refer Data-Sheet).

Part-C: VHDL Programming (Any Two)

12. Write and verify VHDL Code for Full adder using BEHAVIORAL, DATA FLOW and STRUCTURAL modelling.

13. Write and verify VHDL Code for 8:1 Multiplexor and 1:8 Demultiplexer using DATA FLOW & Structural modelling.

14. Write and verify VHDL Code for a Two-Bit Comparator.

15. Write and verify VHDL Code for JK/D/T flip flop with asynchronous reset.

16. Write and verify VHDL Code for BCD up/down counter.

Course Code: 104302		Course Name: Electronic Devices & Circuits	
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:

- Prior Knowledge of Conductors, Semiconductors, Insulators & P-N Junction.

Course Objectives:

- Understand the working principles of small signal and power BJT amplifiers and their applications.
- Introduce JFET structure, operation, biasing techniques, and its use in amplifier and switching circuits.
- Explain the construction and characteristics of EMOSFET and analyze its performance in amplifier and switch applications.
- Perform DC and AC analysis of EMOSFET-based amplifiers, including frequency response and biasing effects.
- Understand feedback concepts and evaluate their impact on amplifier performance and oscillator design.

Course Outcomes:

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

CO1: Analyze small signal and power BJT amplifier circuits and evaluate their performance parameters.

CO2: Apply working principle of JFET and describe its application as an amplifier and a switch.

CO3: Interpret the operation and characteristics of EMOSFET and analyze its use in amplifier and switching circuits.

CO4: Perform analysis of EMOSFET amplifiers and evaluate their frequency response.

CO5: Explain the concept of feedback and analyze its application in amplifier design and oscillator circuits.

Course Contents:

Unit-I: Small Signal & Power BJT Amplifiers   06 Hours

Introduction to small signal BJT CE Amplifier, power amplifiers: Viz. Class-A (Directly Coupled & Transformer-Coupled) amplifier, Class-AB amplifier, comparison of   various power amplifiers.

Numerical on small signal and power amplifiers.

Unit-II: JEET   06 Hours

Introduction to JFET, types, n-JFET construction, operation, V-I characteristics and DC load line, n-JFET configurations (CS, CD & CG) and their comparison, self-biasing for CS n-JFET, CS n-JFET as an amplifier and as a switch, CS n-JFET amplifier frequency response.

Numerical on CS n-JFET amplifier.

Unit-III: MOSFET   06 Hours

Introduction to MOSFET, types, Construction, Operation, V-I Characteristics of n-EMOSFET and DC load line, EMOSFET configurations (CS, CD & CG) and their comparison, non-ideal voltage - current characteristics, voltage divider biasing for CS n-EMOSFET, CS n-EMOSFET as an amplifier and as a switch. Numerical on CS n-EMOSFET amplifier.

Unit-IV: MOSFET DC & AC Circuit Analysis   07 Hours

DC analysis of n-EMOSFET amplifier: DC biasing voltage, DC output voltage, DC output current. AC analysis of n-EMOSFET amplifier: voltage gain, input impedance, output impedance. CS n-EMOSFET amplifier frequency response with and without bypass capacitor.

Numerical on DC & AC analysis of CS n-EMOSFET amplifier.

Unit-V: Feedback Amplifiers and Oscillators   06 Hours

Feedback concept and types, topologies of negative-feedback, effect of Negative-Feedback on gain, input impedance, output impedance and bandwidth of amplifier.

R-C oscillators: Phase-Shift Oscillator, L-C Oscillator: Hartley Oscillator, Crystal Oscillator.

Numerical on feedback amplifiers and oscillators.

Learning Resources:

Text Books:

1. Donald Neaman, Electronic Circuit Analysis and Design,3rd Edition, Tata McGraw Hill.
2. Millman, Halkias, Integrated Electronics- Analog and Digital Circuits & Systems, TMH.

Reference Books:

1. R. L. Boylstad, L. Nashlesky, "Electronic Devices and circuits Theory", 9th Edition, Prentice Hall of India, 2006

Web link for MOOC / NPTEL Links:

1. Analog Electronic Circuits   https://nptel.ac.in/courses/108/105/108105158/
2. Analog Circuits   https://nptel.ac.in/courses/108/101/108101094/

List of Practicals:

Part-A: (Any Three) (Any one by using Open-Source Simulation Software)

1. Determine & compare theoretical & practical parameters of small signal BJT CE amplifier.

2. Determine & compare theoretical & practical parameters of class-A directly coupled power amplifier.

3. Determine & compare theoretical & practical parameters of Class-A transformer coupled power amplifier.

4. Determine & compare theoretical & practical parameters of Class-AB power amplifier.

Part-B: (Any Three) (Any one by using Open-Source Simulation Software)

1. Implement and test CS n-JFET amplifier circuit to determine & compare theoretical & practical parameters.

2. Implement and test CS n-JFET as a switch to operate electromagnetic relay, to determine & compare theoretical & practical parameters.

3. Implement and test CS n-EMOSFET amplifier, to determine & compare theoretical & practical parameters.

4. Implement and test CS n-EMOSFET as a switch to operate electromagnetic relay, to determine & compare theoretical & practical parameters.

Part-C: (Any Two) (Any one by using Open-Source Simulation Software)

1. Implement and test transistorized based Voltage-Series Feedback Amplifier, to determine & compare theoretical & practical parameters.

2. Implement and test transistorized based Voltage-Shunt Feedback Amplifier, to determine & compare theoretical & practical parameters.

3. Implement and test transistorized based Current-Series Feedback Amplifier, to determine & compare theoretical & practical parameters.

4. Implement and test transistorized based Current-Shunt Feedback Amplifier, to determine & compare theoretical & practical parameters.

5. Build & Test transistorized based R-C Phase Shift oscillator to determine & compare theoretical & practical parameters.

6. Build & Test transistorized based L-C oscillator circuit to determine & compare theoretical & practical parameters.

Course Code: 104303		Course Name: Network Theory	
Teaching Scheme		**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week		2	**CCE** : 40 Marks **ESE** : 60 Marks

Prerequisite Courses:

- Engineering Mathematics - Linear Algebra, Engineering Physics.

Course Objectives:

- Analyze the simple DC and AC circuit with circuit simplification techniques.

- Analyze the system subjected to transient for driven and source free RL and RC circuits.

- Recognize network by formulating the various network parameters.

- Develop the ability to analyze and design frequency-selective networks.

- Recognize and describe key aspects of the frequency response of various types networks

Course Outcomes:

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

CO1: Analyze the simple DC and AC circuit using appropriate circuit simplification techniques.

CO2: Analyze driven and source free RL, RC and RLC circuits.

CO3: Analyze a network by formulating the network parameters of a given network.

CO4: Evaluate the performance of frequency selective filters and Attenuators networks.

CO5: Learn to analyze the frequency response of different filter types.

Course Contents:

Unit-I: Circuit Simplification Techniques   **06 Hours**

Dependent and Independent sources. Nodal analysis, super node and super mesh. Norton's theorem, maximum power transfer theorem. Solution of problems with DC sources. Millman's theorem. Convolution theorem and its application.

Unit-II: Transient Analysis   **06 Hours**

Transient analysis of RL, RC, and RLC electrical circuits with and without initial conditions. Solution of problems with DC sources. Over damped and under damped series RLC circuit.

Unit-III: Two Port Network Parameters and Functions   **06 Hours**

Terminal characteristics of network, Z, Y, h, ABCD Parameters; Reciprocity and symmetry conditions, applications of the parameters.

Application of Laplace Transforms to circuit analysis, network functions for one port and two port networks, poles and zeros of network functions and network stability.

Unit-IV: Frequency Selective Networks	06 Hours

Series Resonance: Voltage and current variation with frequency. Bandwidth, selectivity, magnification factor.

Parallel Resonance: Resonance frequency and admittance variation with frequency, bandwidth, Selectivity.

Applications of series and parallel resonant circuits.

Unit-V: Filters and Attenuators	06 Hours

Filters: Fundamentals of filter, constant K-LPF, HPF, BPF and BSF, concept of m-derived filter.

Attenuators: Symmetrical T and π type attenuators.

Case study on role of network theory concepts to real-world scenarios.

Learning Resources:

Text Books:

1. Network Analysis & Synthesis by Ravish R Singh, Ed. II, 2019. (McGraw-Hill Education.)
2. Electrical Circuit Analysis, by A. Sudhakar & Shyammohan S. Palli, Tata McGraw-Hill Education.

Reference Books:

1. William H. Hayt, Jack E. Kimmerly and Steven M. Durbin, Electrical Circuit Analysis, Tata McGraw Hill publication, 7th Edition.

Weblink for MOOC / NPTEL Links:

1. https://archive.nptel.ac.in/courses/108/104/108104139/
2. https://asnm-iitkgp.vlabs.ac.in/exp/maximum-power-transfer-theorem/

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 nth 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: *"Will AI lead to massive job loss in engineering?"*
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. Internet of Things for Smart Cities: Technologies, Big Data and 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.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: S**tudents 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=PLOxBmXq4mdMOd3RQ3bAWxz8siZ4pnOtjI

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 kantak, 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, Ahemadabad 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: 104308	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

Semester - IV

Course Code: 104401		Course Name: Analog Communication	
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:

- Prior knowledge of Linear Algebra, Elementary Signals, Fourier Transforms.

Course Objectives:

- To analyze analog and digital communication systems.

- To emphasize Analog modulation techniques.

- To emphasize angle modulation techniques.

- To emphasize Analog and angel demodulation techniques.

- To learn the concept of sampling theorem and pulse modulation techniques.

Course Outcomes:

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

CO1: Interpret the concepts of analog & digital communication system.

CO2: Analyze the techniques of generation, transmission of analog modulation systems.

CO3: Analyze techniques of generation, transmission & reception of angle modulation systems.

CO4: Analyze the techniques of reception of analog modulation systems.

CO5: Exhibit the importance of sampling theorem and correlate with pulse modulation technique.

Course Contents:

Unit-I: Introduction to Communication Systems   **05 Hours**

Elements of communication systems, analog and digital communication System. Modes of communication. Block diagram of an analog and digital communication system electromagnetic spectrum – details noise in communication systems, types of noise essence of calculations and measurements is to determine the Signal power to Noise power ratio, i.e. the (S/N) ratio or (S/N) expression in dB Modulation definition, need for modulation, types of modulation and their details.

Unit-II: Amplitude Modulation   **07 Hours**

Basic concept of Amplitude Modulation, Definition, block diagram and waveform, Expressions of modulating signal, Carrier signal, modulated signal, modulation index in terms

of modulating voltage (Vm) and carrier voltage (Vc), Mid Modulation, Full Modulation, Over Modulation Modulation index in terms of maximum voltage (Vmax) and minimum voltage (Vmin), modulation index in case of simultaneous modulations, LSB and USB, Bandwidth, Power in AM wave. Solve simple problems. Generation of AM wave : Amplitude Modulator circuit using diode. Square law modulator, Switching Modulator.

Amplitude Modulator circuit using diode. Definition with working principal of SSBSC, DSBSC, VSB and comparison between them.

Unit-III: Angel Modulation   07 Hours

Basic concepts of Frequency Modulation: definition, block diagram and waveform, expressions of frequency deviation, modulation index. Relationship between frequency deviation and modulation index Single tone frequency modulation Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Carson's rule for bandwidth. Varactor diode method of generating FM Basic concepts, Phase Modulation: Comparison of AM, FM, PM . Merits and demerits of FM over AM, Definition of Phase modulation.

Unit-IV: Radio Transmitters and Receivers   06 Hours

Block diagram of AM and FM Receivers, Super heterodyne Receiver, TRF – Block Diagram Performance Characteristics: Definition of Selectivity, Sensitivity, Gain, Fidelity, Image Frequency and its Rejection, Double Spotting, Noise Figure AM Detection: Rectifier detection, Envelope detection Demodulation of AM wave, working of AM Linear diode detector circuit. FM detectors: Foster Seeley discriminator and Ratio detector. Need for pre-emphasis and de-emphasis circuits.

Unit-V: Discrete Modulation and Noise   06 Hours

Sampling theorem for low pass signal, Aliasing, Sampling techniques, aliasing error and aperture effect. Analog Pulse Techniques: PAM, PWM, PPM generation and applications TDM, FDM, Noise in Communication system.

Learning Resources:

Text Books:

1. George F. Kennedy, Electronic Communication System, Tata McGraw Hill.
2. Taub, Schilling and Saha, "Principles of Communication Systems", McGraw-Hill, 4th Edition.
3. B P Lathi, Zhi Ding, "Modern Analog and Digital Communication System", Oxford University Press, 4th Edition.

Reference Books:

1. Bernard Sklar and Prabitra Kumar Ray, "Digital Communications Fundamentals and Applications", Pearson Education 2nd Edition.
2. Wayne Tomasi, "Electronic Communications System", Pearson Education, 5th Edition.

3. A.B Carlson, P B Crully and J C Rutledge, "Communication Systems", Tata McGraw Hill Publication, 5th Edition.

4. Simon Haykin, "Communication Systems", John Wiley & Sons, 4th Edition.

Web link for MOOC / NPTEL Links:

1. Principles of Communication Systems-I:

   https://nptel.ac.in/courses/108/104/108104091/

2. Digital Communications: https://nptel.ac.in/courses/108/102/108102096/

List of Practicals:

1. Amplitude modulation and demodulation.

2. DSB-SC modulator & detector.

3. SSB-Sc modulator & detector (Phase shift method)

4. Frequency modulation and demodulation.

5. Spectrum analyzer and analysis of am and fm signals.

6. Pre-emphasis & de-emphasis.

7. Time Division Multiplexing & De multiplexing.

8. Frequency Division Multiplexing & De multiplexing.

9. Verification of Sampling Theorem.

10. Pulse Amplitude Modulation & Demodulation.

11. Pulse Width Modulation & Demodulation.

12. Pulse Position Modulation & Demodulation

13. Frequency Synthesizer.

14. AGC Characteristics.

15. PLL as FM Demodulator.

Course Code: 104402		Course Name: Signals and System		
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:

- Basic Concepts of Fourier series, Fourier Transform, Laplace transform and Z Transform.

Course Objectives:

- To classify and represent various types of signals and apply different operations on them within the context of signals and systems.

- Apply the convolution operation to determine the output of linear time invariant (LTI) systems for both continuous and discrete-time signals.

- Analyze the impulse and step responses of systems and understand their significance in determining system behavior.

- Solve linear differential and difference equations that describe continuous-time and discrete-time systems.

- Explore frequency domain concepts and tools such as the Fourier series, Fourier transform the Z-transform for analyzing signals and systems in the frequency domain.

Course Outcomes:

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

CO1: Classify different signals and apply different operations on signals.

CO2: Apply the convolution to determine system output.

CO3: Analyze periodic and non-periodic signals using Fourier series and Fourier transform.

CO4: Analyze systems using Laplace Transform and evaluate system stability.

CO5: Analyze discrete time systems using Z-Transform.

Course Contents:

Unit-I: Introduction to Signals   **06 Hours**

Definition, Continuous time (CT) and Discrete time (DT) signals, basic elementary signals like impulse, unit step, unit ramp, sinusoidal, exponential, signum function, sinc function, Representations of signals, Types of signals like even and odd, periodic and nonperiodic, energy and power, deterministic and random , Operations on signals like time shifting, time reversal, time scaling, amplitude scaling, signal addition, signal multiplication.

Unit-II: Introduction to Systems   06 Hours

Definition, types of systems like Lumped Parameter and Distributed Parameter System, static and dynamic systems, causal and non-causal systems, Linear and Non- linear systems, time variant and time invariant systems, stable and unstable systems, invertible and non- invertible systems, properties of systems, Continuous time LTI systems- Convolution integral, Graphical Representation of convolution integral, discrete time LTI systems- Convolution sum, representation of signals in terms of impulses.

Unit-III: Fourier series   06 Hours

Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, Amplitude and phase response, FS representation of CT signals using trigonometric and exponential Fourier series, properties of Fourier series and their physical significance, Gibbs phenomenon.

Unit-IV: Fourier Transform   06 Hours

Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, Properties and their significance, Discrete time Fourier transform (DTFT).

Unit-V: Laplace Transform and Z Transform   06 Hours

Introduction of Laplace transform, Need of Laplace Transform, Region of Convergence, Inverse Laplace Transform, Properties of Laplace transform, Initial and Final value Theorem, Inverse Laplace transform based on partial fraction expansion, stability considerations in S domain.

Introduction of Z Transform, properties of Z Transform, Pole-zero concepts, stability criteria for systems, Relation between S-plane and Z-plane.

Learning Resources:

Text Books:
1. M.J.Roberts, Govind Sharma, Fundamentals of Signals and Systems, 2nd Edition, Tata McGraw-Hill, 2017.
2. Simon Haykin, Barry Van Veen, Signals and Systems, 2nd ed., Wiley Publications, 2021.
3. Alan V.Oppenheim, Alan S.Willsky, with S.Hamid Nawab, "Signals and Systems", Prentice-Hall of India.2nd Edition, 2016.

Reference Books:
1. Nagrath I. J., Sharan S. N. and Ranjan R., Signal & Systems, 2nd Ed., 2010.
2. Charles Phillips, Signals, Systems and Transforms, Pearson Education, 3 rd Edition, 2014.

3. A. Nagoor Kanni "Signals and Systems", Mc Graw Hill, 2 nd Edition, 2022

4. Lathi B.P., Signals, Systems and Communications, 2nd Edition, BS Publications 2019.

Weblink for MOOC / NPTEL Links:

1. NPTEL Course Principles of Signals & System

   https://nptel.ac.in/courses/108/104/108104100/

2. Lecture Series on, Signals & Systems http://www.nptelvideos.in/2012/12/signals-and-system.html

List of Practicals:

1. Generate and plot the signals in time domain and also sketch its amplitude and phase Spectrum. Verify the result: A] Impulse   B] Unit Step   C] Exponential   D] Unit ramp   E] Sinc   F] Rectangular

2. Write the codes to plot the sine and cosine signals with phase shift also simulate the signals.

3. Develop codes to simulate, and plot the results for an exponential signal.

4. To perform different operations on signals and sequences such as addition, multiplication, scaling, shifting, and folding.

5. Find convolution integral of Unit step and exponential signals and write a program to sketch out response of system. Also verify commutative property of convolution integral.

6. To evaluate the convolution of finite discrete time signals and to verify the commutative, associative, distributive property.

7. Take any one periodic signal and find its Fourier series coefficients using exponential or trigonometric FS method. Write a program to find its Fourier series coefficients. Also using FS coefficients, reconstruct the signal. Observe the effect of Gibb's phenomenon.

8. To evaluate discrete time Fourier transform (DTFT) of a signal.

9. To compute frequency response of LTI system from impulse response.

10. To compute frequency response of LTI system by difference equation.

11. Analyze a CT system using Laplace Transform.

12. Analyze a DT system using ZT, draw its pole-zero plot. Checking linearity/non-linearity of a system using SIMULINK.

Course Code: 104403		Course Name: Control System	
Teaching Scheme		**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week		2	**CCE** : 40 Marks **ESE** : 60 Marks

Prerequisite Courses:

- Engineering Mathematics - Laplace Transform, Representation of Signals.

Course Objectives:

- To introduce elements of control system and their modeling using various techniques.
- To get acquainted with the methods for analyzing the time response and stability of system.
- To introduce concept of root locus, bode plots, Nyquist plots
- To introduce and analyze the frequency response and stability of system.
- To introduce state variable analysis method.

Course Outcomes:

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

CO1: Apply the Knowledge of model of physical system to analyze and check the stability of the control system.

CO2: Apply the knowledge of time domain analysis to check the stability of a closed-loop control system.

CO3: Apply and analyze the time domain technique to check the stability of system.

CO4: Analyze the response and stability of control systems using frequency domain techniques.

CO5: Perform state space analysis and design state feedback control.

Course Contents:

Unit-I: Systems and their Representations   **06 Hours**

Basic elements in control systems: Open loop and closed loop, transfer functions of mechanical, electrical and electro-mechanical systems, electrical analogous systems; block diagram reduction, signal flow graphs.

Unit-II: Time Response Analysis   **06 Hours**

Standard test signals, time response of first and second order systems, time domain specifications; steady state error, static error constants and system type.

Unit-III: Stability Analysis and Root Locus   06 Hours

Stability: Concept and definition, characteristic equation, location of poles, Routh Hurwitz criterion; Root locus technique: Construction, properties and applications.

Unit-IV: Frequency Response Analysis   06 Hours

Frequency domain specifications; Bode plot, Polar plot; correlation between frequency domain and time domain specifications. Relative stability: Gain margin, phase margin; stability analysis using frequency response methods, Nyquist stability criterion.

Unit-V: State Space Analysis   06 Hours

Concepts of state variable and state model, solution of state equation, state space to transfer function conversion, state space decomposition methods, Controllability, Observability, pole placement control, observer design.

Learning Resources:

Text Books:

1. N. J. Nagrath and M. Gopal, Control System Engineering, New Age International Publishers, 5th Edition.

2. K. Ogata, Modern Control Engineering, Prentice Hall India Learning Private Limited; 5th Edition.

Reference Books:

1. C. Kuo and Farid Golnaraghi, Automatic Control Systems by Benjamin, Publisher: McGraw-Hill Education.

2. Gene Franklin, J.D. Powell, and Abbas Emami-Naeini, Feedback Control of Dynamic Systems, Publisher: Pearson Education

3. G.C. Goodwin, S.F. Graebe, Control System Design,Ed., Prentice Hall of India Private Limited, 2006.

4. J.J.D. Azzo, C.H. Houpis, Feedback Control System Analysis and Sythesis, 2nd Ed, Mcgraw-Hill International, 2006.

MOOC / NPTEL/YouTube Links

1. Control System: https://nptel.ac.in/courses/107/106/107106081/

2. Control System Design: https://nptel.ac.in/courses/115/108/115108104/

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(Samskrit-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 Samskrit, Prathama Diksha. Delhi: Rashtryia Sanskrita Samsthana.
6. Vishwasa (2014). Abhyāsa-pustakam, New Delhi: Samskrita Bharati

Basic German Language Course

1. NETZWERK Deutsch alsFremdspracheA1(Goyal, New Delhi, 2015).
2. Schulz-Griesbach: Deutsch alsFremdsprache. 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: 104409		Course Name: Skill Development	
Teaching Scheme	Credit	Evaluation Scheme	
Practical : 4 Hours/Week	2	TW : 50 Marks	

Prerequisite Courses:

- --.

Course Objectives:

- Introduces Arduino-based embedded system design with a focus on hardware-software integration.
- Implement and optimize Embedded C programming, integrating digital & analog I/O operations with sensor interfacing to develop efficient embedded system applications
- Implements communication protocols (UART, I2C, SPI) and wireless IoT applications using ESP8266.

Course Outcomes:

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

CO1: Apply Embedded C programming to develop Arduino-based embedded system.

CO2: Implement digital and analog I/O operations for sensor and actuator control.

CO3: Integrate various sensors to acquire, process, and analyze real-time data.

CO4: Utilize communication protocols (UART, I2C, SPI) for device interfacing.

CO5: Develop IoT-based applications using ESP8266 for wireless data transmission**.**

Learning Resources:

Text Books:

1. Simon Monk Programming Arduino: Getting Started with Sketches, McGraw-Hill Education.

Reference Books:

1. Jeremy Blum, Exploring Arduino: Tools and Techniques for Engineering Wizardry, Wiley Publication.
2. Richard H. Barnett, Sarah Cox, Larry O'Cull, Embedded C Programming and the Atmel AVR**,** Delmar Cengage Learning Publication.
3. Jack Purdum, Beginning C for Arduino: Learn C Programming for the Arduino, Apress Publication.
4. Tero Karvinen, Kimmo Karvinen, Ville Valtokari, Make: Sensors – A Hands-On Primer for Monitoring the Real World with Arduino and Raspberry Pi, Maker Media.
5. Michael Margolis, Arduino Cookbook, O'Reilly Media Publication.

Web link for MOOC / NPTEL Links:

1. Arduino Project Hub: https://create.arduino.cc/projecthub
2. ESP8266 with Arduino Guide (Random Nerd Tutorials): https://randomnerdtutorials.com
3. Tinkercad Circuits (for simulation): https://www.tinkercad.com/

List of Practicals:

1. Getting Started with Arduino and Embedded C.

    a. Blinking an LED: Write a program to blink an LED at 1-second intervals.

    b. Reading and Displaying Serial Data: Use the Serial Monitor to send and receive data from Arduino.

2. Performing Digital and Analog I/O Operations

    a. LED Control using a Push Button:Interface a push button to turn an LED on/off.

    b. Controlling LED Brightness using a Potentiometer : Use PWM (analog-write()) to adjust LED brightness.

3. Interfacing Sensors and Acquiring Real-Time Data

    a. Measuring Temperature & Humidity using DHT11: Read and display temperature & humidity values from a DHT11 sensor.

    b. Distance Measurement using an Ultrasonic Sensor: Measure the distance of an object using the HC-SR04 Ultrasonic Sensor and display it on the Serial Monitor.

    c. Light Intensity Detection using an LDR: Interface an LDR sensor and display the light intensity on the Serial Monitor.

    d. Motion Detection using a PIR Sensor : Detect motion using a PIR sensor and activate an LED when movement is detected.

4. Controlling Actuators for Real-Time Applications

    a. Controlling a DC Motor with a Potentiometer:Use PWM to control the speed of a DC motor via an L298N motor driver.

    b. Servo Motor Control with a Potentiometer: Rotate a servo motor to different angles using an analog input.

    c. Switching a Relay with Arduino: Control an electrical appliance using a relay module.

5. Displaying Sensor Data on LCD and OLED Interfaces

    a. Displaying Text on a 16x2 LCD using I2C:Display sensor readings (e.g., temperature) on a 16x2 LCD with an I2C module.

    b. Displaying Data on an OLED Screen: Interface an OLED display and show custom text/graphics.

6. Implementing Wired Communication Protocols

   a. Serial Communication between Arduino & PC:Send and receive data via the Serial Monitor.

   b. I2C Communication Between Two Arduino Boards:Connect two Arduino boards and exchange data using I2C protocol.

   c. SPI Communication with an External Sensor:Interface a sensor using the SPI protocol.

7. Integrating Wireless Communication and IoT Platforms

   a. Sending Sensor Data to Blynk IoT Platform: Connect ESP8266 to Arduino and send temperature data to Blynk.

   b. Bluetooth Communication using HC-05: Control an LED using a smartphone via Bluetooth.

   c. Designing Mini Projects and Case Studies using Embedded C

8. Develop an Arduino-based real-time system that integrates sensor data acquisition, processing, and actuator control to solve a practical problem in automation, IoT, or embedded systems. The case study should focus on designing, implementing, and optimizing the system while ensuring reliability, efficiency, and scalability

   a. Develop an Arduino-based embedded system that utilizes digital and analog I/O operations, sensor interfacing, and basic communication protocols to automate a real-world task. The project should focus on implementing Embedded C programming, data acquisition, and actuator control.

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