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. Instrumentation and Control Engineering

(2024 Pattern) V1.1

(As per NEP 2020)

Academic Year 2025-26

(Copy for Student Circulation Only)

Program Specific Outcomes (PSOs).

PSO1: Students will have a strong foundation in mathematical, scientific, engineering and management fundamentals necessary to formulate, solve and analyze complex instrumentation problems.

PSO2: Apply instrumentation & control in multidisciplinary domains related to research & entrepreneurship development.

PSO3: Communicate effectively to work as a team with professional ethics for the benefit for society.

Program Educational Outcomes (PEOs).

PEO1: To build core competency in the multidisciplinary field of automation to cater the industry and research needs.

PEO2: Develop multi-disciplinary skills, team spirit and leadership qualities with ethics, to excel in professional career and higher studies in Instrumentation and Control Engineering.

PEO3: To learn and apply contemporary technologies for addressing impending challenges for the benefit of organizations and society.

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. Instrumentation and Control Engineering
Curriculum Structure (2024 Pattern) V1.1 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
103301	PCC-2	Sensors and Transducers	2	2	-	40	60	25	25	150	2	1	-	3
103302	PCC-3	Control System Components	2	2	-	40	60	25	25	150	2	1	-	3
103303	PCC-4	Electronic Instrumentation	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	-	-	2	2
103308	CEP/FP	Community Engagement / Field Project	-	4	-	-	-	50	-	50	-	2	-	2
Total			11	12	3	200	300	225	75	800	11	5	4	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. Instrumentation and Control Engineering
Curriculum Structure (2024 Pattern) V1.1 Semester - IV

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks					Credits			
			TH	PR	TU	CCE	ESE	TW	PR + OR	TOT	TH	PR	TU	TOT
103401	PCC-5	Process Control	2	2	-	40	60	25	25	150	2	1	-	3
103402	PCC-6	Analog and Digital Circuits	2	2	-	40	60	25	25	150	2	1	-	3
103403	PCC-7	Control Systems	2	-	-	40	60	-	-	100	2	-	-	2
170304/ 170404	MDM-2	Multi-Disciplinary Minor Course-2	2	-	-	40	60	-	-	100	2	-	-	2
171405	OEC-2	Open Elective Course-2	3	2	-	40	60	25	25	150	3	1	-	4
172306/ 172406	EEM-2	EEM Course-2	-	-	2	-	-	50	-	50	-	-	2	2
173307/ 173407	VEC-2	Value Education Course-2	-	2	1	-	-	50	-	50	-	-	2	2
174408	AEC-2	Ability Enhancement Course-2	-	-	2	-	-	50	-	50	-	-	2	2
103409	VSEC-3	Vocational & Skill Enhancement Course-3	-	4	-	-	-	50	-	50	-	2	-	2
Total			11	12	5	200	300	275	75	850	11	5	6	22

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 Course – 2	Course Code	VSEC Course – 3
171405A	Introduction to Cyber Security	174408	Foreign Language	103409	Systems Modeling and Simulation

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

Semester	Credits	Marks
III	20	800
IV	22	850
Total	**42**	**1650**

• 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: 103301		Course Name: Sensors and Transducers
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week **Practical :** 2 Hours/Week	**2** **1**	**CCE : 40 Marks** **ESE : 60 Marks** **TW : 25 Marks** **PR + OR : 25 Marks**

Prerequisite Courses:

- Engineering Physics.

Course Objectives:

- Students should learn the working principle, construction, operation, characteristics and features of different sensors and transducers.
- Students will examine the performance specifications of various sensors and transducers.
- Students will discuss the selection of sensors and transducers for different measurement applications.
- Design sensor/transducer circuits for measurement of physical parameters.

Course Outcomes:

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

CO1: Demonstrate displacement, velocity, force and torque sensors and transducers.

CO2: Apply pressure sensors and transducers for given application.

CO3: Select temperature sensors for a given application.

CO4: Select flow sensor for the given fluid flow measurement.

CO5: Demonstrate miscellaneous sensors according to their working principles**.**

Course Contents:

Unit-I: Displacement, Speed, Force and Torque Measurement 06 Hours

Need for sensors and transducers, Definition and classification of transducers, Performance characteristics and selection criteria.

Displacement Measurement: Resistive-potentiometers, inductive-LVDT and RVDT, capacitive, piezoelectric, ultrasonic, hall effect, optical and proximity sensors.

Speed Measurement: Tachometer, Magnetic pickups, Encoders, Photoelectric pickups, Stroboscopes, Shaft speed measurement.

Vibration Measurement: Piezoelectric, Seismic, Potentiometric, and LVDT.

Force and Torque Measurement: Elastic elements, strain gauges, load cells, piezoelectric, strain gauge torque meter, torsion bar dynamometers.

Unit-II: Pressure Measurement **06 Hours**

Units and their relations, manometers and their types, elastic sensors, Piezoelectric secondary transducers, differential pressure sensors, capacitive (delta cell), high-pressure gauges, vacuum gauges, dead weight tester and vacuum gauge tester.

Unit-III: Temperature Measurement **06 Hours**

Temperature scales, units and their relations, classification of temperature sensors, bimetallic thermometer, Resistance Temperature Detectors (RTD), types of RTD, lead wire compensation, thermistors, thermocouples, thermocouple tables, cold junction compensation techniques, thermopiles, thermos-well, pyrometers, temperature IC sensor LM35, signal conditioning circuits for RTD and thermocouple.

Unit-IV: Flow Measurement **06 Hours**

Units, Newtonian and non-Newtonian fluids, Reynolds's number, laminar and turbulent flows, velocity profile, Bernoulli's equation for incompressible flow, head type flow meters (orifice, venturi meter and pitot tube), variable area type (rotameters), turbine, electromagnetic, ultrasonic, mass flow meter: Coriolis flow meter.

Unit-V: Level and Miscellaneous Measurement **06 Hours**

Level Measurement: Float, bubbler, DP cell, ultrasonic, capacitive, radar.

Viscosity: Saybolt, Searle's rotating cylinder, cone and plate, falling and rolling ball, rotameter. **Density:** Hydrometer (buoyancy type), U-tube type, hydrostatic head (air bubbler, DP cell). **Humidity:** Resistive and capacitive type sensors.

Miscellaneous Sensors: pH sensors, conductivity sensors. Introduction to SMART Sensors.

Learning Resources:

Text Books:

1. Instrumentation and Measurement Principles by D.V.S. Murty, PHI, New Delhi, 2ndEd.
2. Principle of Industrial Instrumentation by D. Patranabis, Tata McGraw Hill, 2nd Ed.
3. Electrical and Electronics Measurement and Instrumentation by A.K. Sawhney, Dhanpat Rai & Co, 2nd Ed.

Reference Books:

1. Process Measurement & Analysis by B.G. Liptak, CRC press, 04th Ed.
2. Instrumentation Devices and Systems by C. S. Rangan, G. R. Sharma and V. S. Mani, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 02nd Ed.

Web link for MOOC / NPTEL Links:

1. https://onlinecourses.nptel.ac.in/noc23_ee105/preview
2. https://archive.nptel.ac.in/courses/108/108/108108147/

List of Practicals:

Students are expected to perform a minimum of **eight** experiments: Any **seven** from 1 to 11 and **one** from 12 to 13.

1. Determine the characteristics of the LVDT for displacement measurement.
2. Determine characteristics of different proximity sensors.
3. Compare the performance of the encoder and tachometer for speed measurement.
4. Evaluate the performance characteristics of the strain gauge load cell for weight measurement.
5. Calibration of the pressure gauge using a dead weight pressure tester
6. Calibration of the pressure gauge using the vacuum gauge tester
7. Determine temperature using LM35.
8. Compare the performance of thermocouple and RTD for temperature measurement.
9. Compare the performance of Orifice and Venturi for flow measurement.
10. Level measurement using ultrasonic sensors.
11. Evaluate performance characteristics of the capacitive/ resistive/ air purge method for level measurement.
12. Design a signal conditioning circuit for temperature measurement using a thermocouple.
13. Design a signal conditioning circuit for temperature measurement using RTD.

Course Code: 103302		Course Name: Control System Components	
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:

- Fundamentals of Electronics Engineering, Basics of Electrical Engineering.

Course Objectives:

- To introduce students with concepts of switches, relays and contactors.
- To introduce electric motor interlocking and motors in sequence concepts.
- To explore pneumatic and hydraulic components and circuits.

Course Outcomes:

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

CO1: Verify logic gates truth tables using relays.

CO2: Read and interpret electrical wiring diagrams for electric motors and motor control centers.

CO3: Interpret hazardous area classification as per National Electrical Code (NEC) standards.

CO4: Select power devices such as MOSFETs and IGBTs in real world applications.

CO5: Analyze pneumatic and hydraulic circuits.

Course Contents:

Unit-I: Basic Control Components **06 Hours**

Construction, working, application and selection of switches like toggle switch, slide switch, DIP switch, rotary switch, thumbwheel switch, selector switch, push button, drum switch, internals circuits and international symbols (IEC or equivalent) of limit switch, temperature switch, pressure switch, level switch, flow switch. Construction, working principle, testing of relays (electro-magnetic/ electro-mechanical, reed, solid state relays). Contactors construction, working and comparison with relays including specifications.

Unit-II: Electrical Motors, Wiring Diagrams and Protection **08 Hours**

AC and DC Servo motors fundamentals, construction and working principle and comparison. Concept of motors sequencing and interlocking, starting, stopping, jogging/inching, emergency shutdown, Direct-On-Line (DOL), Star Delta starters. Reading and interpreting standard electrical wiring diagrams of electric motors and motor control centers.

Motor Protection: Short circuit protection, over load protection, low/under voltage protection, phase reversal protection, and bearing over temperature protection. Protection from reversing direction of rotation.

Unit-III: Power Devices **06 Hours**

Construction, working, characteristics, specifications, selection and applications of diodes, SCRs, thyristor family: DIAC, TRIAC, MOSFET, IGBT.

Unit-IV: Alarm Annunciators and Hazardous Area Classification **06 Hours**

Conceptual framework of alarm annunciator using ISA 18.2, alarm annunciators types, their components and specific sequences. Hazardous Area and Material classification as per NEC standards.

Unit-V: Pneumatic, Hydraulic Components and Circuits **06 Hours**

Working of Filter Regulator and Lubricator (FRL) unit, pneumatic power supply components, pneumatic cylinders and special purpose cylinders, their specifications and applications. Pneumatic logic gates and other direction control valves (relief valve, time delay valve). Different Operators of Valves: Push button, pilot, lever, pilot etc. Pneumatic circuits design and development, step sequence diagram reading and interpretation, reciprocating, sequencing and direction control with use of virtual labs.

Hydraulic supply, hydraulic pumps, actuator (cylinder & motor), hydraulic valves, and hydraulic circuits: meter in and meter out. Design constraints related with cylinder back pressure in case of lifting high loads and solution using pressure relief valve.

Learning Resources:

Text Books:

1. Industrial Electronics, Petruzella, McGraw-Hill, ISE Editions.
2. Pneumatic Systems Principles and applications, Majumdhar, TMH, First Edition.
3. Industrial Hydraulics, Pipenger, McGraw-Hill Education, 3rd Edition.
4. MD Singh, K B Khanchandani, Power Electronics, McGraw Hill Company, 2nd edition.

Reference Books:

1. P. C. Sen, Power Electronics, TMH, 2007, Second Edition.
2. Mohammad Rashid, Power Electronics, PHI, 2nd edition, 2004.
3. P. C. Sen, Power Electronics, TMH, 2007, Second Edition.
4. Mohammad Rashid, Power Electronics, PHI, 2nd edition, 2004.

Web link for MOOC / NPTEL Links:

1. Silicion Controlled Rectifier: https://www.youtube.com/watch?v=4JsR4xflPa4
2. Stepper Motors: http://www.digimat.in/nptel/courses/video/108102156/L24.html

List of Practicals (Any 8):

1. Implementation of Logic Gates using relays.
2. NO and NC push button switch, selector switch operation on 12 V or 24 VDC and continuity testing.
3. Study of pneumatic and hydraulic components and power supplies.
4. Implementation and testing of pneumatic circuits – like single and double acting operation.
5. Implementation hydraulic meter in or meter out circuits.
6. Study of servo motor characteristics / execution of servo motor operation.
7. Study of step motor characteristics / execution of step motor operation.
8. Study of Motor control Center based on industrial visit.
9. Demonstration & study of Alarm annunciator/ Design an alarm annunciator https://plccom-coep.vlabs.ac.in/exp/alarm-annunciator/
10. V-I characteristics of SCR.
11. Single Phase Full Wave Silicon Controlled Rectifier with R Load/ RL Load /RLE Load using Virtual lab IITR, https://pe-iitr.vlabs.ac.in/exp/single-full-silicon/theory.html
12. Three Phase Half Wave Silicon Controlled Rectifier with R Load / RL Load using virtual lab https://pe-iitr.vlabs.ac.in/exp/three-half-silicon/simulation.html
13. Determination of the incremental transfer function of an AC Servomotor, http://vlabs.iitkgp.ac.in/ctrl/Exp4/procedure.html
14. Determining threat levels at a location,
    E.g. https://www.epa.gov/cameo/aloha-software

Course Code: 103303	Course Name: Electronic Instrumentation	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week	**2**	**CCE :** 40 Marks **ESE :** 60 Marks

Prerequisite Courses:

- Fundamentals of Electronics Engineering, Basic Electrical Engineering.

Course Objectives:

- To explain the concept of different characteristics of measurement systems.
- To introduce various analog indicating instruments.
- To identify the various techniques for measurement of R-L-C.
- To explain the Analog to Digital and Digital to Analog converters.
- To explain the block diagrams of electronic instruments and introduce concept of Virtual instrumentation.

Course Outcomes:

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

CO1: Apply the fundamentals of instrumentation in measurements and calibration of instruments.

CO2: Demonstrate extension of ammeter and voltmeter measurement range.

CO3: Make use of appropriate method for measurement of R, L and C.

CO4: Select appropriate type of ADCs and DACs in different applications.

CO5: Utilize electronic instruments for different applications.

Course Contents:

Unit-I: Introduction to Instrumentation System **06 Hours**

General measurement system, classification of instruments, static and dynamic characteristics of instruments.

Error: Limiting error, types of errors, loading effect.

Calibration: Definition, calibration report & certification, traceability.

Unit-II: Analog Measuring Instruments **06 Hours**

D'Arsonaval galvanometer, PMMC and MI instruments, shunts and multipliers, construction and working principle of: ammeters, voltmeters, series and shunt ohmmeters, cathode ray oscilloscope, measurement of voltage, phase and frequency, instrument transformers: current and potential transformers.

Unit-III: Measurement of RLC **06 Hours**

Measurement of Resistance: Measurement of medium, low and high resistance using Wheatstone bridge, Kelvin bridge, Mega ohm bridge/Megger.

Measurement of Inductance: Maxwell and Hay Bridges, Quality (Q) factor.

Measurement of Capacitance: Schering bridge, Wien bridge, Dissipation (D) factor.

Unit-IV: Analog to Digital and Digital to Analog Converters 06 Hours

Sampling: Sampling theorem, sample and hold circuit, ADC: Various techniques like Flash, Counter, SAR and Dual-Slope, ADC specifications, ADC Numerical. DAC: Various techniques like Weighted-Resistor and R-2R ladder, DAC specifications, DAC numerical.

Unit-V: Electronic Instruments and Virtual Instrumentation Design 06 Hours

Digital Storage Oscilloscope: Sampling rate, bandwidth, roll mode, digital volt meter and its automations, digital multi meter, clamp meter.

Virtual Instrumentation: Define VI, need of VI, advantages of VI, block diagram and architecture of a virtual instrument, application of virtual instrumentation.

Learning Resources:

Text Books:

1. Sawhney A. K., Electrical and Electronics Measurements and Instruments, Dhanpat Rai & Co. 2nd Ed.
2. W. D. Cooper & A. D. Helfrick, 'Electronic Instrumentation and Measurement Techniques', PHI, 4th ed, 1987.
3. David Bell, 'Electronic Instrumentation and Measurements', PHI, 2ed.

Reference Books:

1. Anand M. M. S., Electronic Instruments and Instrumentation Technology, PHI, 2004, 2nd Ed.
2. Kalsi H. S., Electronic Instrumentation, TMH, 3rd ed, 2010.
3. R. Subburaj, Calibration the Foundation for ISO 9000 and TQM
4. Bouwens A. J., Digital Instrumentation, McGraw-Hill, 2nd ed.

Weblink for MOOC / NPTEL Links:

1. https://onlinecourses.nptel.ac.in/noc19_ee44/preview

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

Prerequisite Courses:

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

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

Course Contents:

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

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

Unit-II: Transforms **06 Hours**

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

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

Unit-III: Vector Calculus and Numerical Methods 08 Hours

Vector Differentiation: Scalar and vector fields, vector differential operator, gradient, divergence & curl, solenoid, irrotational and scalar potential.

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

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

Solution to System of Linear Simultaneous Equations:

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

Iterative method: Gauss Jacobi, Gauss –Seidel method.

Unit-IV: Probability 06 Hours

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

Unit-V: Sampling and Inference 06 Hours

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

Learning Resources:

Text Books:

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

Reference Books:

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

Weblink for MOOC / NPTEL Links:

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

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

Prerequisite Courses:

- Fundamentals of Programming Language.

Course Objectives:

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

Course Outcomes:

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

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

CO2: Apply search algorithms for solving simple engineering problems.

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

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

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

Course Contents:

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

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

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

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

Unit-III: Fundamentals of Machine Learning 06 Hours

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

Unit-IV: AI Applications in Engineering Domains 06 Hours

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

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

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

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

Learning Resources:

Text Books:

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

Reference Books:

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

Weblink for MOOC / NPTEL Links:

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

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

Suggested In-Class Activities

Unit No.	Activity	Description
I	AI Around You	Group activity: Identify and present 5 real-life examples of AI in their domain (mechanical, civil, etc.).
II	Search Algorithm Simulation	Paper-based or Python/Excel simulation of BFS/DFS/A* for maze/pathfinding problems.
III	Hands-on with ML Tools	Use Google Colab to run a simple regression/classification example (k-NN or linear regression).
III	Model Demo with Data	Upload a dataset (e.g., student marks) and perform basic ML predictions in class.
IV	Domain Use Case Analysis	Groups present how AI is used in their engineering field (1 use case each).
V	Ethics Debate	Conduct a structured debate: *"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 in smart city planning
4. Prepare a case study report on how AI and Machine Learning are used for traffic congestion management in a smart city project.
5. Identify the applications for smart solid waste management with IoT.
6. Introduction to EPANET software and its application in smart city development.
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	**2**	**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	**2**	**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: 103308	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: 103401	Course Name: Process Control	
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:

- Sensors and Transducers, Fundamentals Electronics Engineering.

Course Objectives:

- To understand the basics of process control, including variables, system types, and real-world applications of control loops.
- To learn about transmitters, signal standardization, communication protocols, and converters used for accurate measurement in process control.
- To explore control actions and tuning methods to optimize controller performance and prevent issues like reset windup.
- To understand control valve design, terminology, types, and sizing using Cv calculations in line with industry standards.
- To learn about valve accessories and actuators, focusing on their design and function for optimal control system performance.

Course Outcomes:

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

CO1: Analyze process variables, control system types, and process characteristics, and evaluate examples of process control loops in industry.

CO2: Apply knowledge of transmitters, signal standards, protocols, and converters to evaluate their role in process control systems.

CO3: Design and apply control actions and tuning methods to optimize controller performance and system stability.

CO4: Evaluate control valve selection, sizing, and design based on key characteristics and industry standards.

CO5: Analyze and evaluate valve accessories and actuators for optimal performance in process control systems.

Course Contents:

Unit-I: Introduction to Process Control **06 Hours**

Key Concepts in Process Control: Process variables, definition and differentiation of manipulated, disturbance and output variables.

Control System Types: Understanding Open-Loop vs. Closed-Loop systems.

Block Diagram Representation: Structure and components of control loops. Examples of process control loops. Application examples of control loops in industries - temperature, flow, level and pressure.

Process Characteristics: Process behavior analysis: Process equations, capacity, self-regulation, Disturbances and Control Lags: Understanding process lag, control lag, velocity lag, and dead time.

Unit-II: Transmitters and Converters 06 Hours

Transmitters and Signal Standardization: Importance of transmitters in process control systems. Standardization of signals: current (4-20 mA), voltage (0-10 V), and pressure signal standards.

Types of transmitters: Live zero vs. dead zero, and the concept of two-wire and four-wire transmitters.

Field Communication Protocols: Overview of communication protocols: HART, foundation fieldbus. SMART Transmitters: Key features and applications.

Differential Pressure Transmitters (DPT): Types, installation, and calibration of DPTs. Application in level and flow measurement. Zero elevation, suppression and manifold configurations.

Converters: Understanding the difference between converters and transmitters. Types: Current-to-pressure and pressure-to-current converters.

Unit-III: Control Actions and Tuning Techniques 06 Hours

Types of Control Actions: *Discontinuous Control:* On-Off, multi-position, and floating control modes. *Continuous Control:* Proportional (P), Integral (I), Derivative (D), PI, PD, and PID control modes. Reset Windup: Techniques to prevent reset windup, rate before reset, and bumpless transfer.

Controller Tuning Methods: Introduction to process reaction curve. Tuning techniques: Ziegler-Nichols and Frequency Response methods for optimal controller performance.

Unit-IV: Control Valve: Design, Sizing, and Selection 06 Hours

Control Valve Fundamentals: Key terminology: Rangeability, turndown ratio, cavitation, flashing, noise, viscosity index, valve capacity, AO, AC and fail-safe actions. Valve **Characteristics:** Linear, equal percentage, and quick-opening characteristics.

Valve Types and Applications: Overview of different valve types: Globe, Ball, Butterfly, Diaphragm, and specialty valves for high-temperature and high-pressure applications.

Valve Sizing and Selection: Cv Calculation: Methods for sizing valves for gas, vapor and liquid services (ANSI/ISA 75.01 Standard).

Unit-V: Control Valve Accessories and Actuator Design 06 Hours

Valve Accessories: Detailed discussion on accessories such as petitioners (pneumatic, electro-

pneumatic, and digital), I/P converters, volume boosters, air lock, limit switches, solenoid valves, and hand wheels.

Actuator Types and Design: Understanding different actuator types: Spring and diaphragm, piston cylinder, and smart actuators. Actuator design considerations for optimal performance in process control systems.

Learning Resources:

Text Books:

1. C. D. Johnson, Process Control and Instrument Technology, Tata McGraw Hill Publications, 8th Ed.
2. N. A. Anderson, Instrumentation for Process Measurement and Control, CRC Press.

Reference Books:

1. G. Liptak, "Process Control", Instrument Engineering Hand book CRC Press, 3rd Ed.

Web link for MOOC / NPTEL Links:

1. Industrial Automation and Control, By Prof. Siddhartha Mukhopadhyay, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc22_me59/preview
2. Process Control and Instrumentation, by Dr. P.K. Saha, IIT Guwahati https://nptel.ac.in/courses/103103037

List of Practicals (Any 8):

1. Study of D.P. Transmitter and its application for flow measurement.
2. Measurement of level using DPT.
3. Study and calibration of I/P converter
4. Study and calibration of P/I converter
5. Study & verification of different control actions (P, I, D, PI, PD, PID) for step input.
6. Study of on-off control mode for temperature control process.
7. Tuning of PID controller for temperature/pressure control loop.
8. Tuning of PID controller for level/flow control loop.
9. Study of control valve & plot installed characteristics of control valve
10. Control valve design using any software package.

Course Code: 103402		Course Name: Analog and Digital 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:

- Basic Electronics and Circuits, Fundamentals of Digital electronics, and Boolean Algebra.

Course Objectives:

- Understand the fundamental principles of operational amplifiers and their applications.
- Explore advanced operational amplifier configurations and special purpose ICs to develop non-linear analog circuits.
- Apply Boolean algebra and logic design techniques to create and evaluate combinational logic circuits using digital components.
- Analyze and implement sequential logic circuits, including shift registers and counters, to understand their functionality and applications.
- Develop comprehensive design skills for various types of counters, emphasizing their applications in digital systems.

Course Outcomes:

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

CO1: Design linear applications using an operational amplifier.

CO2: Design non-linear and special purpose applications using operational amplifiers and special purpose ICs.

CO3: Design combinational digital circuits using logic gates.

CO4: Demonstrate sequential logic circuits used in shift registers and counters.

CO5: Design synchronous, asynchronous sequential, and non-sequential counters.

Course Contents:

Unit-I: Linear Applications of Operational Amplifier **06 Hours**

Introduction to Opamp, characteristics, negative feedback amplifier (Inverting, Non-inverting, Differential, Buffer), Instrumentation amplifier with three Op-amps, voltage summer/scalar/average circuit, integrator and practical integrator, differentiator and practical differentiator, isolation amplifiers, Opamp filters (first and second order Butterworth low-pass, high pass, band-pass and band-reject filters).

Unit-II: Non-linear Applications and Special Purpose ICs **06 Hours**

Basic comparator, zero crossing detector, Schmitt trigger with hysteresis, Precision full wave rectifiers. Barkhausen criteria, Wein bridge oscillator, Astable, and Monostable Multivibrators using LM555, Voltage Regulators, Performance parameters (line regulation, load regulation, ripple rejection), Fixed voltage regulators (IC78xx, 79xx), Linear voltage regulator IC 723 (High voltage, low voltage regulator circuits).

Unit-III: Combinational Logic Circuits **06 Hours**

Introduction to Logic Gates, Representation of Boolean equations (SOP/POS forms), K-map techniques, Design of Adders, subtractors, multiplexers, demultiplexers, encoders, decoders, BCD to 7 segment decoder circuits.

Unit-IV: Sequential Logic Circuits **06 Hours**

Introduction to Flip-flops, Latches, FIFO and LIFO Buffers, Types of Flip-flops such as SR, JK, MSJK, D, and T types, their truth tables and excitation tables, Conversion from one type to another type, Preset & Clear, Introduction to types of Memories.

Unit-V: Counter Design **06 Hours**

Registers, shift registers, definition of counter, modulus of counter, types of counters: asynchronous counters, synchronous counters, state diagram representation, design of synchronous, binary, up-down, pre-settable and programmable counters, decade/BCD counters, Ring and Johnson counters, divide by N counter, timing diagram of counters. Applications of digital circuits.

Learning Resources:

Text Books:

1. Ramakant Gaikwad, “Operational Amplifiers” PHI, 3rd Ed., 1992.
2. Floyd “Digital Principles”, Pearson Education, 11th Ed.

Reference Books:

1. William D. Stanley, “Operational Amplifiers with Linear Integrated Circuits”, 4th ed., Pearson Education India, 2002.
2. D. Roy Choudhury, “Linear Integrated Circuits” New Age International, 4th ed.
3. Paul Horowitz, Winfield Hill, “The Art of Electronics”, 2 nd Ed., Cambridge University Press, 2008.
4. Gothman, ‘Digital Electronics’, 2nd ed, PHI
5. M. Morris Mano,’ Digital Design’, Pearson Education, 3rd Ed.
6. R. P. Jain; Modern Digital Electronics; 4th Edition, McGraw Hill.

Weblink for MOOC / NPTEL Links:

1. https://nptel.ac.in/courses/117107094

List of Practicals:

Practical for the subject shall be conducted in minimum three batches (batch size of 23 students maximum) per division. Term work shall be awarded on the basis of performance of students during practicals as continuous internal assessment.

Perform the minimum four practical using **analog ICs**, and four practical using **Digital ICs**.

1. Measure the bandwidth of Inverting/Non-inverting Amplifier using LM741.
2. Study the characteristics of OPAMP (CMRR/Slew-rate/Offset voltage etc).
3. Designing and implementation of Instrumentation amplifier using LM741/LM324.
4. Designing and implementation of Integrator/Differentiator using LM 741.
5. Designing and implementation of Wien bridge oscillator using LM 741.
6. Designing and implementation of Basic Comparators/Zero Crossing Detector/Schmitt trigger using LM 741.
7. Designing and implementation of Astable/Monostable multivibrator using LM 555.
8. Design and implement first/second order Butterworth High Pass/ Low Pass/ Band Pass Filter using LM 741.
9. Design and implement Voltage regulators: 78xx/79xx/linear variable regulator LM723.
10. Study of Logic families and Verification of different Logic Gates
11. Design and Implementation of adder/subtractor using logic gates.
12. Study of Multiplexer ICs (74151/74153/74157/CD4051)
13. Study of Flip-Flop ICs 7476 (JK),7474 (D) and conversion of flip-flop from one other
14. Design and Implementation of synchronous/asynchronous 2-bit/3-bit counter.
15. Design of 1-bit/2-bit comparator using logic gates.
16. Interfacing of 7 segment LED display using IC 7447.
17. Study of Up / Down counter using IC 74193.

Course Code: 103403	Course Name: Control Systems	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week	**2**	**CCE** : 40 Marks **ESE** : 60 Marks

Prerequisite Courses:

- Engineering Mathematics, Basics of Electrical Engineering.

Course Objectives:

- To provide a basic understanding of the concepts and techniques involved in control schemes for dynamic systems.
- To introduce Modelling of a control system, theory of transfer functions, poles, zeros, block diagram algebra and signal flow graph.
- To understand the transient and steady state response of first and second order systems.
- To apply Routh's stability criteria, root locus approach for stability analysis of control systems.

Course Outcomes:

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

CO1: Differentiate between various types of control systems such as open-loop and closed-loop, linear and nonlinear, time-variant and time-invariant, and stable and unstable systems.

CO2: Determine the mathematical model of physical systems using differential equation and Laplace transform.

CO3: Solve the complicated control system using block diagram algebra and signal flow graph techniques.

CO4: Analyze the first, second order control systems performance based on the time domain specifications.

CO5: Investigate the stability of the control systems in time domain using root locus approach.

Course Contents:

Unit-I: Fundamentals of Control System **06 Hours**

Basic concept of control system, classification of control systems: open loop and closed loop control system, linear and nonlinear, time variant and invariant, stable and unstable control system.

Transfer function: Concept of transfer function, its properties and poles and zeros.

Unit-II: Mathematical Modelling of Control Systems 06 Hours

Representation of Physical Systems: Series and parallel RLC electrical circuits, translational and rotational type mechanical system using integral-differential equations and Laplace transform.

Analogous Systems: Force to Voltage analogy of MSD system. Force to current analogy of MSD system.

Unit-III: Block Diagram Algebra and Signal Flow Graph Technique 06 Hours

Block Diagram (BD): Introduction to BD and its components, block diagram reduction rules.

Signal Flow Graph (SFG): Introduction to signal flow graph, terminologies used in SFG, Mason's gain formula, conversion of block diagrams to signal flow graph and vice-versa.

Unit-IV: Time Domain Analysis of Control Systems 06 Hours

Transient Response Analysis: Standard test signals like: impulse, step, ramp (velocity) and parabolic (acceleration), Time domain specifications of first order and second order systems.

Steady Sate Response Analysis: Static error constants K_p, K_v, K_a and steady state error for type 0, type 1 and type 2 or higher type systems.

Unit-V: Stability Analysis of Control Systems 06 Hours

Concept of Stability in s- plane, types of response of the system various pole location in s-Plane, stability analysis by Hurwitz criterion and Routh array.

Stability Analysis using Root Locus: definition, angle and magnitude condition of root locus. Rules to construct root locus, determination of system gain at any point on root locus.

Learning Resources:

Text Books:

1. I. J. Nagrath, M. Gopal, "Control System Engineering", New Age International Publishers, 5th Ed.
2. B. S. Manke, "Linear Control Systems", Khanna Publishers, New Delhi, 2nd Ed. '
3. A. K. Jairath, "Problems and Solutions of Control Systems", CBS Publishes, New Delhi, 6th Ed.
4. S. K. Bhattacharya, "Control System Engineering", Pearson India, 2nd Ed.
5. M. Gopal "Control Systems" principles and design The McGraw-Hill Companies, 3rd Ed.

Reference Books:

1. K. Ogata, "Modern Control Engineering", PHI, New Delhi, 6th Ed.
2. Norman S. Nise, "Control System Engineering", John Wiley and Sons, 7th Ed.
3. B. C. Kuo, "Automatic Control Systems", PHI, New Delhi, 7th Ed.

MOOC / NPTEL/YouTube Links:

1. Lecture series on “Automatic Control” by Dr. Anil Kumar IIT Roorkee. https://youtube.com/@automaticcontrol-iitr6709?si=ERIs8I1mNGMdpvOY
2. Lecture series on “Control Systems” by Prof. C. S. Shankar Ram IIT Madras. https://www.youtube.com/watch?v=RcuGxWc0HyQ&t=2s
3. Lecture series on “Control Engineering” by Prof. Ramkrishna Pasumarthy IIT Madras. https://youtube.com/@controlengineering5957?si=GHBDxvuukMdrTlsp

Course Code: 171405A		Course Name: Introduction to Cyber Security
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:

- Fundamentals of Computer & Programming, Operating System, Basic concept of Networks.

Course Objectives:

- To develop an understanding of the fundamental concepts, issues, and challenges in the field of cyber security.
- To create awareness about various types of cyber offenses, their legal remedies, and the procedures for reporting such crimes.
- To sensitize students to privacy and security concerns on social media and promote responsible usage through knowledge of legal aspects and best practices.
- To familiarize students with e-commerce and digital payment systems, including RBI guidelines and preventive measures against online frauds.
- To enable students to understand and apply basic security practices and tools for safeguarding computers and mobile devices.

Course Outcomes:

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

CO1: Explain the architecture, communication and governance of cyberspace and web technologies.

CO2: Identify and relate specific cybercrime incidents to relevant provisions of the IT Act 2000.

CO3: Apply basic practices to ensure privacy and security on social media platforms.

CO4: Apply security practices and legal guidelines to ensure safe E-Commerce and digital payment systems.

CO5: Demonstrate configuration and management of secure digital devices and tools**.**

Course Contents:

Unit-I: Introduction to Cyber Security **08 Hours**

Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Internet

infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

Unit-II: Cyber Crimes and Cyber Law 08 Hours

Cybercrime- Classification, Common Cybercrimes, Cybercriminals modus-operandi, reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of Cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organisations dealing with Cybercrime and Cyber security in India.

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

Unit-III: Social Media Overview and Security 08 Hours

Introduction to social networks, social media: Types, platforms, monitoring, hashtag, viral content, marketing, privacy, challenges, opportunities and pitfalls in online social networks, security issues related to social media, flagging and reporting of inappropriate content, laws regarding posting of inappropriate content, best practices for the use of social media.

Case Study: WhatsApp Spyware incident, Facebook–Cambridge Analytica Data Harvesting Scandal.

Unit-IV: E-Commerce and Digital Payments 08 Hours

Commerce Basics: Definition, components, security elements, and threats, E-commerce security best practices. **Digital payments**: Introduction, components and stake holders, modes of digital payments, digital payments related common frauds and prevention. RBI Guidelines on digital payments and customer protection. Relevant provisions of Payment Settlement Act, 2007. **Case Study:** Cosmos Bank Cyber Attack.

Unit-V: Digital Devices Security, Tools and Technologies 08 Hours

End Point device and mobile security, password policy, security patch management, data backup, management of third-party software, device security policy, cyber security best practices, host firewall and Antivirus - Significance & management, Wi-Fi security, configuration of basic security policy and permissions. **Case Study:** The Pegasus Airlines.

List of Practical / Assignments: (Guidelines for course teacher)

- The course instructor should design assignments that reflect essential cyber security principles and consider students' level of familiarity with digital tools and platforms.
- Assignments must reflect current cyber threats, technologies, laws and best practices followed in the industry.
- Assignments should be based on real-life cyber incidents, case studies and practical security problems.
- Practical demonstration tasks such as identifying vulnerabilities, analyzing cybercrime scenarios, or applying security controls in digital payment system. Study of social media platforms, should be included to improve readiness for future projects / professional roles.

Learning Resources:

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives Sumit Belapure & Nina Godbole, Wiley India Pvt. Ltd.
2. Cyber Crime and Laws Dr. Santosh Kumar & Dr. Gagandeep Kaur, Whitesmann Publishing.
3. Cyber Crime Impact in the New Millennium R. C. Mishra, Authors Press.
4. Fundamentals of Network Security E. Maiwald, McGraw Hill.

Reference Books:

1. Network Security Bible (2nd Edition) Eric Cole, Ronald Krutz, James W. Conley, Wiley India Pvt. Ltd.
2. Security in the Digital Age: Social Media Security Threats and Vulnerabilities Henry A. Oliver- Pearson.
3. Electronic Commerce Elias M. Awasd, Prentice Hall of India Pvt Ltd.
4. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Pub.
5. Cryptography and Network security, Atul Kahate, The McGraw Hill, second Edition.

Web link for MOOC / NPTEL Links:

1. Cyber Security and Privacy by Prof. Saji K Mathew, IIT Madras
   https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. Practical Cyber Security for Practitioners by Prof. Sandeep K. Shukla, IIT Kanpur
   https://onlinecourses.nptel.ac.in/noc25_cs120/preview
3. Introduction To Cyber Security by Dr. Jeetendra Pande, Uttarakhand OU, Haldwani.
   https://onlinecourses.swayam2.ac.in/nou24_cs04/preview
4. Cyber Laws by Dr Vishal Goyal, Professor in Computer Science, Department of Computer Science, Punjabi University, Patiala.
   https://onlinecourses.swayam2.ac.in/cec24_cs14/preview

Important DOs and DON'Ts in Cyber Security:

DOs

- Use strong passwords and enable two-factor authentication on all accounts.
- Keep your devices, apps, and antivirus updated regularly.
- Verify sources before clicking links or downloading files; report phishing emails.
- Backup important data and secure your devices.
- Follow ethical and legal practices; understand IT Act and cyber laws.

DON'Ts

- Never share passwords, OTPs, or sensitive banking information.
- Do not click on suspicious links or open unknown attachments.
- Never attempt hacking or bypass security without permission.
- Do not overshare personal information on social media or online platforms.
- Do not ignore suspicious activity - report it through official channels.

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. 174408A: Basic English Language

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. 174408B: Basic Sanskrit Language

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. 174408C: Basic German Language

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. 174408D: Basic French Language

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. 174408E: Basic Japanese Language

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: 103409	Course Name: Systems Modeling and Simulation	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical : 4 Hours/Week	**2**	**TW** : 50 Marks

Prerequisite Courses:

- Engineering Mathematics, Control Systems, Fundamentals of Instrumentation.

Course Objectives:

- To get familiarize with MATLAB, LabVIEW and Simulink interface.
- To introduce the fundamentals of system modeling and simulation and highlight their relevance in instrumentation and control engineering.
- To formulate mathematical models for physical systems such as electrical, mechanical, thermal, and electromechanical domains.
- To develop understanding of system dynamics and response characteristics using time-domain and state-space methods.
- To design and analyze control strategies such as PID controllers through simulation experiments.

Course Outcomes:

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

CO1: Understand the fundamentals of modeling and simulation and their significance in instrumentation and control engineering.

CO2: Develop mathematical models of electrical, mechanical, and electromechanical systems using fundamental engineering principles.

CO3: Analyze the dynamic response of physical systems using time-domain approach.

CO4: Simulate control systems using MATLAB/Simulink, LabVIEW and interpret system behavior for standard input.

CO5: Design and evaluate control strategies (e.g., P, PI, PD and PID controllers) for control systems through simulation experiments**.**

List of Practicals:

The following is the list of experiments students need to understand. Students have to perform minimum 14 experiments using any of the software packages like MATLAB, Scilab (Optional), LabVIEW etc. Also, students can use python environment like google Colab to simulate few of the following experiments.

Module-1: Introduction to MATLAB or LabVIEW Simulation Software

1. Introduction to MATLAB Environment: Basic operations, plotting, working with variables and functions in MATLAB.
2. Introduction to MATLAB Simulink Environment: Model file, commonly used blocks, Continuous System Blocks, Discrete System Blocks, Source, Sinks etc.
3. Introduction to LabVIEW Environment: Front Panel, Block Diagram

Module-2: Modeling and Simulation of Electrical Systems

1. Simulation of First Order Electrical Systems: To study series RC network transfer function and simulate its step response.
2. Simulation of Second Order Electrical Systems: To study series RLC network transfer function and simulate its step response.

Module-3: Modeling and Simulation of Mechanical Systems

1. Simulation of Second Order Mechanical Systems: To study transfer function model of Mass-Spring-Damper system and simulate its step response.

Module-4: Modeling and Simulation of Electro-Mechanical Systems

1. Simulate the angular displacement w. r. t. input voltage characteristic of DC motor.
2. Simulate the angular displacement w. r. t. current characteristic of DC motor.

Module-5: Time Domain Analysis and Stability Analysis

1. Write a program that will compute the step response characteristics of a second order system i.e. percent overshoot, rise time, peak time and settling time.
2. To study under damped, over damped and critically damped response of given second order system by considering different values of damping ratio.
3. Plot the root locus of the given system model and analyze the stability using root locus method.
4. Determine the Gain Margin(GM), Phase Margin(PM), Gain Cross-Over frequency (ω_{gc}) and Phase Cross-Over Frequency (ω_{pc}) of the given control system using bode plot method.

Module-6: Design and Simulation of Conventional PID Controller

1. Determine the tuning parameters of P, PI and PID controller using Ziegler-Nichols open loop method and compare the step response of the system.
2. Determine the tuning parameters of P, PI and PID controller using Ziegler-Nichols closed loop method and compare the step response of the system.

Module-7: System Identification

1. Estimate the mathematical model parameters from the input and output data of the physical system.
2. Simulation of a Process Control System (e.g., Tank Level or Temperature Control).

Module-8: State-Space Modeling and Simulation

1. Convert the given transfer function model into state space model and vice-versa.
2. Determine the state controllability of the given control system with state-space model.
3. Determine the state observability of the given control system with state-space model.

Learning Resources:

Text Books:

1. Gilat A, "Matlab an Introduction with Applications", Wiley India.
2. R. L. Woods & K. L. Lawrence, "Modeling and Simulation of Dynamic Systems", Pearson.
3. B. S. Manke, "Linear Control Systems", Khanna Publishers, New Delhi, 2nd Ed.
4. Hasan Saeed Automatic Control Systems: With Matlab Programs S. K. Kataria & Sons.

Reference Books:

1. K. Ogata, "Modern Control Engineering", PHI, New Delhi, 6th Ed.
2. R. V. Dukkitpati, "Solving Engineering System Dynamics Problem with Matlab", New Age International Publication.

Web link for MOOC / NPTEL Links:

1. Modeling and Simulation of dynamic systems by Dr. P. M. Pathak IIT Roorkee https://onlinecourses.nptel.ac.in/noc21_me25/preview
2. MATLAB Programming for Numerical Computation, IIT Madras Dr. Niket S. Kaisare https://nptel.ac.in/courses/103106118
3. Control System using Matlab by Dr. Sachin Sharma, https://www.youtube.com/playlist?list=PL6izMgVOG4_P9uCClwhA_H9a3eV438uVA

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