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. Electrical Engineering (2024 Pattern)

(As per NEP 2020)

Academic Year 2025-26

(Copy for Student Circulation Only)

Program Specific Outcomes (PSOs).

PSO1: Apply principles of electrical engineering to effectively design, analyze, and solve engineering problems.

PSO2: Develop technical and professional skills through active engagement with industry and institutes.

PSO3: Acquire practical skills that contribute to societal advancements and benefits.

Program Educational Outcomes (PEOs).

PEO1: Graduates will work in diverse industries, government, public sectors, and research institutions.

PEO2: Graduates will pursue advanced studies in reputable institutions.

PEO3: Graduates will demonstrate communication skills, lifelong learning, integrity, teamwork, and commitment to safety, health, and environmental issues.

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 in 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. Electrical Engineering
Curriculum Structure (2024 Pattern) Semester - III

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks					Credits			
			TH	PR	TU	CCE	ESE	TW	PR + OR	TOT	TH	PR	TU	TOT
108301	PCC-2	Electrical Measurement	2	2	-	40	60	25	25	150	2	1	-	3
108302	PCC-3	Analog and Digital Electronics	2	2	-	40	60	25	25	150	2	1	-	3
108303	PCC-4	Power Generation Technologies	2	-	-	40	60	-	-	100	2	-	-	2
170304/ 170404	MDM-1	Multi-Disciplinary Minor Course-1	2	-	-	40	60	-	-	100	2	-	-	2
171305	OEC-1	Open Elective Course-1	3	2	-	40	60	25	25	150	3	1	-	4
172306/ 172406	EEM-1	EEM Course-1	-	-	2	-	-	50	-	50	-	-	2	2
173307/ 173407	VEC-1	Value Education Course-1	-	2	1	-	-	50	-	50	-	1	1	2
108308	CEP/FP	Community Engagement / Field Project	-	4	-	-	-	50	-	50	-	2	-	2
Total			11	12	3	200	300	225	75	800	11	6	3	20

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

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

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

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks					Credits			
			TH	PR	TU	CCE	ESE	TW	PR + OR	TOT	TH	PR	TU	TOT
108401	PCC-5	Electrical Machines-I	2	2	-	40	60	25	25	150	2	1	-	3
108402	PCC-6	Electrical Networks	2	2	-	40	60	25	25	150	2	1	-	3
108403	PCC-7	Power Systems and Equipment	2	-	-	40	60	-	-	100	2	-	-	2
170304/ 170404	MDM-2	Multi-Disciplinary Minor Course-2	2	-	-	40	60	-	-	100	2	-	-	2
171405	OEC-2	Open Elective Course-2	2	-	-	40	60	-	-	100	2	-	-	2
172306/ 172406	EEM-2	EEM Course-2	-	-	2	-	-	50	-	50	-	-	2	2
173307/ 173407	VEC-2	Value Education Course-2	-	2	1	-	-	50	-	50	-	1	1	2
174408	AEC-2	Ability Enhancement Course-2	-	-	2	-	-	50	-	50	-	-	2	2
108409	VSEC-3	Vocational & Skill Enhancement Course-3	-	4	-	-	-	50	-	50	-	2	-	2
Total			10	10	5	200	300	250	50	800	10	5	5	20

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

Course Code	Open Elective Course – 2	Course Code	AEC Course	Course Code	VSEC Course
171405A	Cyber Security and Laws	174408	Foreign Language	108409	Electrical Installation & Maintenance

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

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

• Definition of Credit :

The Under Graduate (U.G.) programmes will have credit system. The details of credit will be as follow.
1 Credit = 1 hour/week for lecture
= 2 hours/week for practical
= 1 hour/week for tutorial

- **Description of Various Courses:**

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

Semester - III

Course Code: 108301		Course Name: Electrical Measurement
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 Electrical Engineering, Fundamentals of Electronics Engineering.

Course Objectives:

- To familiarize students with a variety of measurement instruments used in engineering applications, such as voltmeters, ammeters, wattmeters, multimeters, oscilloscopes, and signal analyzers
- To know about various types of measurement techniques, instruments and sensors.
- To apply proper methods of measurement and use of sensors in instrumentation.

Course Outcomes:

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

CO1: Describe the working principles of various measuring instruments and classify measuring instruments along with range extension techniques.

CO2: Apply measurement techniques for measurement of resistance, inductance and capacitance.

CO3: Demonstrate construction, working principle of electro dynamometer type instruments for measurement of power and static energy meter for measurement of energy.

CO4: Analyze different measuring methods and transducers for electrical and physical quantity measurements.

CO5: Operate digital meters and oscilloscope**.**

Course Contents:

Unit-I: Measuring Instruments and Instrument Transformer 06 Hours

Classification of Measuring Instruments, Characteristics of measuring instruments: static and dynamic, deflecting, controlling and damping systems.

Measuring Instruments: Working Principle and construction of moving iron and dynamo meter-type instruments.

Instrument Transformers: Construction, connection of CT & PT in the circuit, advantages of CT / PT for range extension of MI Instruments, transformation ratio, turns ratio, nominal

ratio, burden, ratio and phase angle error. (descriptive treatment only).

Unit-II: Measurement of Resistance, Inductance and Capacitance 06 Hours

Measurement of Resistance: Measurement of low, medium and high resistance. Wheatstone bridge, Kelvin's double bridge, ammeter-voltmeter method, megger. Earth tester for earth resistance measurement.

Measurement of Inductance and capacitance: Introduction, sources and detectors for A.C. bridge, general equation for bridge at balance. Maxwell's inductance, Maxwell's inductance – Capacitance Bridge, Anderson's bridge, Schering Bridge.

Unit-III: Measurement of Power and Energy 06 Hours

Measurement of Power: torque equation, errors and their compensation, advantages and disadvantages of dynamometer type wattmeter, low power factor wattmeter, poly-phase wattmeter. Active & reactive power measurement in three phase system for balanced and unbalanced load using one, two and three wattmeter method.

Measurement of Energy: Block diagram and operation of single phase and three phase static energy meter, Calibration of static energy meter, TOD meter.

Unit-IV: Sensors 06 Hours

Transducers: Introduction, classification, types: resistive, inductive, capacitive, basic requirements for transducers, applications of transducers.

Pressure Measurement: Introduction, classification of pressure as low, medium & high, absolute, gauge, vacuum, static, dynamic & head pressure, pressure measurement methods.

Level Measurement: Introduction, importance, level measurement methods.

Displacement Measurement: LVDT & RVDT – construction, working, applications, specifications, advantages & disadvantages.

Unit-V: Digital Meters 06 Hours

Advantages of digital meters over analogue meters. Resolution & sensitivity of digital meters. Block diagram and operation of digital Voltmeter, Ammeter, Frequency meter, Energy meter and Multi-meter. Block diagram and operation of Digital Storage Oscilloscope.

Learning Resources:

Text Books:

1. A. K. Sawhney, "A Course in Electrical and Electronic Measurements & Instrumentation", Dhanpat Rai & Co.
2. J. B. Gupta, "A Course in Electronics and Electrical Measurements and Instrumentation", S. K. Kataria & Sons,
3. B. C. Nakra & K. K. Chaudhari, "Instrumentation Measurement and Analysis", Tata

McGraw Hill.
4. D. Patranabhis, “Sensors and Transducers”, 2nd Edition, PHI Publications.

Reference Books:

1. E. W. Golding & F. C. Widdies, “Electrical Measurements & Measuring Instruments”, Reem Publications.
2. Dr. Rajendra Prasad, “Electronic Measurements & Instrumentation”, Khanna Publishers.
3. Arun K. Ghosh, “Introduction to Measurements and Instrumentation”, PHI Publication.
4. M.M.S. Anand, Electronics Instruments and Instrumentation Technology, PHI Publication.

Web link for MOOC / NPTEL Links:

1. https://archive.nptel.ac.in/courses/108/105/108105153/

List of Practicals:

Minimum Eight experiments are to be conducted from 1 to 13. An industrial visit is compulsory.

1. Extension of Ammeter, Voltmeter and Wattmeter rage using instrument transformer (CT/PT).
2. Measurement of low resistance using Kelvin’s Double Bridge.
3. Measurement of inductance using Anderson’s bridge.
4. Measure unknown capacitance using the Schering Bridge.
5. Measurement of three phase active & reactive power by two wattmeter method procedure.
6. Measurement of reactive power by one wattmeter with all possible connections of current coil and pressure coil.
7. Measurement of active & reactive power in three phase balanced circuit using one wattmeter method with two way switch
8. To study and plot the characteristics of LVDT.
9. Calibration of single phase static energy meter at different power factors.
10. To measure earth resistance by using Earth Tester.
11. Study of programmable LCR meter; Measure L, C, R, Q, dissipation factor and power factor of given component.
12. Study of Digital Storage Oscilloscope: a. Different modes in DSO such as Roll, Average, Peak detection, b. Capture transients, c. Various MATH operations.
13. Study and demonstration of net meter and four quadrants TOD Meter.
14. Industrial Visit Report (Compulsory).

Course Code: 108302	Course Name: Analog & Digital Electronics	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week **Practical :** 2 Hours/Week	**2** **1**	**CCE : 40 Marks** **ESE : 60 Marks** **TW : 25 Marks** **PR + OR : 25 Marks**

Prerequisite Courses:

- Basic Electronics components - Transistors and diodes, OPAMPs, Number system, Logic Gates and their applications.

Course Objectives:

- To introduce students to the fundamentals of analog electronics, including Op-Amps, with practical applications.
- To enable students to design and analyse combinational and sequential digital circuits, including programmable logic devices.
- To develop skills in integrating analog and digital systems for efficient electronic applications.

Course Outcomes:

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

CO1: Understand the performance characteristics of operational amplifiers and design basic analog circuits such as waveform generators, comparators, and instrumentation amplifiers for practical applications.

CO2: Design analog circuits such as active filters, multivibrators, sequence generators, and voltage regulators using standard ICs like 555, 78xx/79xx, and LM317.

CO3: Demonstrate the operation and application of digital-to-analog and analog-to-digital converters using basic architectures and integrated circuits.

CO4: Design and simplify combinational logic circuits using Boolean algebra and Karnaugh maps.

CO5: Design sequential circuits and explain working of memory devices and digital logic families.

Course Contents:

Unit-I: Operational Amplifier Applications **05 Hours**

Op-Amp basics, Performance Parameters, Applications of Op-Amp: zero crossing detectors, Comparator, Schmitt trigger, V-I and I-V converters, Instrumentation amplifier, peak detector, Waveform generation using Op-amp: sine, square, saw tooth, triangular and PWM generator.

Unit-II: Design of Analog circuits **05 Hours**

Active filters: Its configuration with frequency response, Design of first order and second order low pass and high pass filters using OPAMP, IC 555: construction, working and modes of operation- astable monostable multi vibrators, and bi-stable, voltage regulators using IC78xx, 79xx, LM 317.

Unit-III: Analog and Digital converters **05 Hours**

Digital to Analog converters: Weighted resistor/converter, R-2R Ladder DAC, examples of DAC converter, sample and hold circuit, Analog to Digital converter: Dual slope A/D Conversion, Successive Approximation ADC, Voltage to Frequency, and Frequency to Voltage converter, Study of Integrated circuits for ADC and DAC.

Unit-IV: Design of Combinational Circuit **07 Hours**

Booleans algebra, De-Morgan theory etc, Karrnaugh map: structure for two, three and four Variables, SOP and POS form reduction of Boolean expressions by K-map. Design of combinational circuits using Boolean expression and K-map such as half and full adder, mux, demux, encoder, decoder and decoder driver IC for 7-segment display.

Unit-V: Sequential Circuits and Memory Devices **08 Hours**

Introduction to sequential circuit, flip-flops (SR, D, JK, MSJK, and T types), Shift registers, design of synchronous (K-map) and asynchronous counters. Up-down counters, N modulo /divide-by-N counters, ring and twisted ring counters, Digital memories: SRAM, DRAM, ROM, EPROM, Digital logic families: Characteristics, PLA, TTL vs CMOS.

Learning Resources:

Text Books:

1. Gaikwad R., “Operational Amplifier”, PHI New Delhi.
2. Muhammad H. Rashid, “Power Electronics: Circuits, Devices and Applications”, 3rd edition, Pearsons Education.
3. R. P. Jain, “Digital Electronics”, Tata McGraw Hill, New Delhi
4. A.P. Malvino, Electronic Principles, Tata Mcgraw Hill Publications.
5. A Anand Kumar, Fundamental of digital circuits, 4th Edition, PHI learning private limited publication.
6. Floyd and Jain, “Digital Fundamentals”, Pearson Education.

Reference Books:

1. M. S. Tyagi, Introduction to Semiconductor Materials and Devices, John Wiley & Sons In.
2. Michael Shur, Introduction to Electronic Devices, John Wiley & Sons Inc., 2000.

3. Jacob Millman, and C.C. Halkias, “Electronic devices and circuits”, TMH Publications
4. P John Paul, “Electronics Devices and circuits”, New Age international Publications.
5. P. S. Bimbhra, “Power Electronics”, Khanna Publications
6. Tokheim, “Digital Electronics-Principles and Application”, 6th edition, Tata McGraw Hill, New Delhi
7. K. R. Botkar, “Integrated Circuits”, Khanna Publication, New Delhi.

Web link for MOOC / NPTEL Links:

1. https://nptel.ac.in/courses/108108111
2. https://nptel.ac.in/courses/108105132

List of Practicals (Any 8):

1. Find phase angle difference between same frequency signal using ZCD and AND gate. (Hardware)
2. Design of comparator and Schmitt trigger. (Hardware)
3. Study of Instrumentation amplifier using three Op-amp, CMRR measurement (Hardware)
4. Design sine and triangular wave generator. (Hardware)
5. Design first order high pass and low pass filter using OPAMP in any open source software. (Software)
6. Design of astable and monostable multivibrators using IC555 and observe output waveforms. (Hardware)
7. Voltage Regulation using IC 78xx/79xx and LM317. (Hardware)
8. Study and Verification of ADC and DAC Operation. (Hardware/Software)
9. Design of logical circuit for display of decimal number on seven segment display. (Hardware)
10. Deign 3:8 decoder for binary to octal decoding. (Hardware)
11. Design three bit full adder using any open source software. (Software)
12. Design a logical circuit to convert code from one numbering system to another. (Software)
13. Design digital clock or stop watch using decade counter.(IC74192) (Hardware).

Course Code: 108303	Course Name: Power Generation Technologies	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week	**2**	**CCE :** 40 Marks **ESE :** 60 Marks

Prerequisite Courses:

- Engineering Physics, Engineering Chemistry and Basic Electrical Engineering.

Course Objectives:

- To introduce conventional energy conversion systems with steam, hydro based and nuclear based power plants.
- To initiate non-conventional energy conversion systems with solar, wind, fuel cell, tidal ocean, geothermal, biomass, biofuel etc.
- To commence interconnection of energy sources to grid, standalone and hybrid systems.

Course Outcomes:

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

CO1: Analyze the operation and performance of thermal power plants using thermodynamic principles and heat rate calculations.

CO2: Explain the working of nuclear, diesel, and gas power plants.

CO3: Demonstrate understanding of hydro power plant and its components.

CO4: Assess wind energy systems by interpreting turbine characteristics and calculating power output under various wind conditions.

CO5: Analyze solar and other renewable energy technologies and evaluate their integration into standalone and grid-connected systems.

Course Contents:

Unit-I: Thermal Power Plant **06 Hours**

Basic Thermodynamic Cycles: Carnot cycle, Rankine cycle, Actual Rankine cycle, Reheat cycle (theoretical only), heat rate (Numerical on Heat rate).

Thermal Power Plants: Site selection, Main parts and its working. Types of boilers (Fire tube, and water tube). Assessment of heat recovery systems Steam turbines Fuel Handling, Ash disposal and dust collection, Draught systems, electrostatic precipitator.

Unit-II: Nuclear, Diesel, Gas Power Plant **06 Hours**

Nuclear Power Plant: Introduction, atomic physics, nuclear reaction, materials, site selection, nuclear reactors and working of each part, classification of nuclear reactor, nuclear waste disposal.

Diesel Power Plants: Main components and its working, Diesel plant efficiency and heat

balance (Numerical), Site selection of diesel power plant.

Gas Power Plant: Introduction to gas cycles. Simple gas turbine power plant, methods to improve thermal efficiency, open loop and closed loop cycle power plants, gas fuels, gas turbine materials, plant layout. Combined cycle power plants, concept of heat to power ratio.

Unit-III: Hydro Power Plant 06 Hours

Site selection, Hydrology, storage and pondage, general arrangements and operation of hydro power plant, Hydraulic turbines, turbine size, Pelton wheel turbine, Francis and Kaplan turbines, selection of turbines, Dams, Spillways, gates, intake and out take works, canals and layout of penstocks, water hammer and surge tank, simple numerical on hydro graphs and number of turbine required. Small, mini and micro hydro power plant (Introduction only).

Unit-IV: Wind Energy Systems 06 Hours

Historical Development of Wind Power, Types of wind turbine, Power in the Wind. MPPT for Wind Applications, Average Power in the wind (Numerical). Wind Turbine Generators (WTG) - Synchronous and Asynchronous (block diagrams only), Wind Turbine Economics, Simple Estimates of Wind Turbine Energy, Environmental Impacts of Wind Turbines. Change in wind pattern and its effect on power generation. Control of wind turbine generators.

Unit-V: Solar Energy, Other Sources and Grid Connection 06 Hours

Principles of solar radiations, solar energy collectors (solar thermal applications), principle of energy conversion, collection systems and their features, types of collectors with comparison. Solar thermal power plants. A generic photovoltaic cell, photovoltaic cells, modules to arrays, numerical on number of solar panel selection. Standard Test Conditions (STC), Impacts of Temperature and Insolation, Types of Solar PV Systems - Grid connected, standalone and hybrid systems. Introduction to biomass energy, geothermal energy, ocean energy & fuel cell Energy.

Learning Resources:

Text Books:

1. P. K. Nag, “Power Plant Engineering”, Tata McGraw Hill Publications. [T2] Dr. P. C. Sharma,“Power Plant Engineering”,S.K.Kataria Publications.
2. R. K. Rajput, “A text book on Power System Engineering ”, Laxmi Publications (P) Ltd. [T4] Chakrabarti, Soni, Gupta, Bhatnagar, “A text book on Power System Engineering”, Dhanpat Rai publication.
3. R. K. Rajput, “Non-Conventional Energy Sources and Utilization”, S. Chand Publications. [T6] M. M. Wakil, “Power Plant Engineering”, McGraw Hill, Indian Edition.
4. G. D.Rai, “Renewable Energy Sources”, Khanna Publications.
5. Chetan singh solanki “ Solar Photovoltaics: Fundamentals, Technology and

Application" PHI Publications.

Reference Books:

1. Arora And Domkundwar, " A Course in Power Plant Engineering ",Dhapat Rai Publication. [R2] Dr. S. P. Sukhatme, "Solar Energy", Tata McGraw Hill Publication.
2. Mukund Patel,"Wind and Solar Power Plants", CRC Press.
3. Gilbert Masters John, "Renewable Energy", Wiley and sons' publications.
4. Robert Foster, Majid Ghassemi, Alma Cota "Solar Energy" CRC Press.

Weblink for MOOC / NPTEL Links:

1. https://onlinecourses.swayam2.ac.in/nou25_es04/preview
2. https://onlinecourses.nptel.ac.in/noc23_ge47/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 concept, features and components of smart cities with relevant examples.

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

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

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

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

Course Contents:

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

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

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

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

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

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

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

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

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

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

Learning Resources:

Text Books/Guidelines:

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

Reference Books:

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

Mahmood.

Web link for MOOC / NPTEL Links:

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

List of Practicals/Assignments:

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

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

Prerequisite Courses:

- Professional Communication Skills.

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

Course Contents:

Unit-I: Understanding Entrepreneurship 04 Hours

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

Unit-II: Business Idea Generation and Validation 04 Hours

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

analysis: market feasibility, technical feasibility, financial feasibility.

Unit-III: Market Research and Business Model Canvas 04 Hours

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

Unit-IV: Startup Finance and Funding 04 Hours

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

Unit-V: Pitching and Business Prototyping 04 Hours

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

Learning Resources:

Text Books:

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

Reference Books:

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

Web link for MOOC / NPTEL Links:

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

List of Activities:

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

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

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

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

Prerequisite Courses:

- Professional Communication Skills.

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

Course Contents:

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

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

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

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

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

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

strategies.

Unit-IV: Business Cycles and Economic Policies 04 Hours

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

Unit-V: Pricing Strategies and Competition 04 Hours

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

Learning Resources:

Text Books:

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

Reference Books:

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

Web link for MOOC / NPTEL Links:

1. Introduction to Business Economics – NPTEL Lecture by IIT Madras. https://nptel.ac.in/courses/130106118.
2. How Economic Principles Shape India's Startup Ecosystem" – Published in the Economic Times. https://economictimes.indiatimes.com/tech/startups/national-startup-day-2025-how-nine-years-of-policies-shaped-indias-startup-ecosystem/articleshow/117291674.cms?from=mdr
3. Law of Demand and Supply Explained with Real-Life Examples" – Dr. Vivek Bindra. https://www.youtube.com/playlist?list=PLOxBmXq4mdMOd3RQ3bAWxz8siZ4pnOtjI
4. How Patanjali Capitalized on Demand Elasticity to Dominate Indian FMCG Market" – Business Standard. https://www.business-standard.com/article/management/the-patanjali-effect-116020800204_1.html
5. Break-Even Analysis and Its Business Applications – Harvard Business Review. https://hbr.org/2014/07/a-quick-guide-to-breakeven-analysis
6. How Indian Airlines Manage Costs and Profit Margins – The Hindu Business Line. https://www.thehindubusinessline.com/economy/logistics/will-indian-aviation-market-turn-profitable-as-it-heads-towards-duopoly/article67453093.ece

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

List of Activities:

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

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

Prerequisite Courses:

- UHV-I (Student Induction Program).

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

Course Contents:

Unit-I: Introduction to Value Education 06 Hours

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

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

Practice Sessions (Any Two):

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

Unit-II: Harmony in the Human Being 06 Hours

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

Practice Sessions (Any Two):

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

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

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

Practice Sessions (Any Two):

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

in personal and professional relationships.

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

Unit-IV: Harmony in Nature/Existence 06 Hours

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

Practice Sessions (Any Two):

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

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

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

Practice Sessions (Any Two):

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

Learning Resources:

Text Books:

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

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

Reference Books:

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

Web link for MOOC / NPTEL Links:

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

Tutorial and Term Work:

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

PART-A

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

PART-B

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

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

Prerequisite Courses:

- Basic Science.

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

Course Contents:

Unit-I: Introduction to Environmental Studies 06 Hours

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

Unit-II: Ecosystems and Biodiversity 06 Hours

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

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

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

Unit-III: Environmental Pollution 06 Hours

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

Unit-IV: Environment and Social Issues 06 Hours

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

Unit-V: Field Wok 06 Hours

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

Visit to an area to document environmental assets; river/forest/flora/fauna, etc.

Visit to a local polluted site – Urban/Rural/Industrial/Agricultural.

Study of common plants, insects, birds and basic principles of identification.

Learning Resources:

Text Books:

1. Environmental Studies, Erach Bharucha, University Grants Commission, New Delhi
2. Environmental Science, Y. K. Singh, New Age International Publishers, 2006, .
3. Environmental Studies: From Crisis to Cure, Rajagopalan R., Oxford University Press, USA, ISBN:9780199459759, 0199459754.
4. A text book of Environmental Science, Shashi Chawla, Tata Mc Graw-Hill New Delhi

5. A Text Book of Environmental science, Arvind Kumar, APH Publishing New Delhi.

Web link for MOOC / NPTEL Links:

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

List of Activities:

Part-A: Assignments

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

Part-B: Field Work

5. Visit a water treatment plant or municipal waste treatment plant. Submit a detailed report with process description and photos/diagrams.

6. Visit to an area to document environmental assets; river/forest/flora/fauna, etc.
7. Report on a local polluted site – Urban/Rural/Industrial/Agricultural.
8. Study of common plants, insects, birds and basic principles of identification.

Part-C: Project/Activity

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

Part-D: Report

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

KBTCOE

Course Code: 108308	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: 108401	Course Name: Electrical Machine - I	
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:

- Magnetic circuit, induced EMF, force on current carrying conductor, Flemings LHR & RHR, Electromechanical energy conversion.

Course Objectives:

- To understand selection of machines for specific applications.
- To understand the construction, principle of operation of transformers & Induction Machine.
- To test & analyze the performance of machine.

Course Outcomes:

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

CO1: Analyze the performance and characteristics of DC machines, including armature reaction, commutation, and torque generation.

CO2: Analyze transformer performance, including voltage regulation, efficiency, and losses under different load conditions.

CO3: Examine polyphase transformer testing, connections, and parallel operation for various industrial applications.

CO4: Analyze the torque-slip characteristics and their dependence on rotor resistance to optimize motor performance for specific mechanical loads.

CO5: Compare single-phase and three-phase induction motor characteristics and self-starting methods.

Course Contents:

Unit-I: DC Machines **06 Hours**

Construction, Generating action, E.M.F equation, Motoring action, Types of DC motors, back E.M.F, torque equation, losses, power flow diagram and efficiency, armature reaction, Characteristics and applications of D.C. Shunt and Series Motors, Starting of DC motors, starters for series and shunt motor, speed control of DC motors, process of commutation, time of commutation, reactance voltage.

Unit-II: Single Phase Transformer **06 Hours**

Ideal transformer, useful and leakage flux, leakage & their effects on voltage regulation and

efficiency. Exact and approximate equivalent circuits, Phasor diagrams for no-load and on load conditions. losses variation with load, voltage & Frequency, Efficiency and condition for maximum efficiency, all day Efficiency, auto transformers, comparison with two winding transformers.

Unit-III: Polyphase Transformer & Testings 06 Hours

Transformers: OC- SC tests, Polarity test. Back to back Sumpner's test, Parallel operation of single-phase transformers, load sharing under various conditions, welding Transformer

Three Phase Transformers: Standard connections, phasor diagrams and vector groups, descriptive treatment of parallel operation of three phase transformers Scott connection and V connections, three winding (tertiary windings) transformers.

Unit-IV: Fundamentals and Characteristics of 3-Φ Induction Motors 06 Hours

Construction, Squirrel cage & wound rotors, rotating mmf, working principal, slip, frequency of rotor emf and rotor currents, mmf produced by rotor currents, speed of rotor and stator mmf, production of torque, condition for maximum torque, torque-slip characteristics, effect of rotor resistance on torque-slip characteristics, relation between starting torque, full load torque and maximum torque, losses, power-flow diagram, relation between rotor input power, rotor copper loss & gross mechanical power developed, efficiency.

Unit-V: Testing and Applications of 3-Φ Induction Motors 06 Hours

Induction motor as a generalized transformer, phasor diagram, exact & approximate equivalent circuit, no load and blocked rotor tests to determine the equivalent circuit parameters and plotting the circle diagram, performance characteristics, performance curves, starter, double cage motors, speed control methods, cascade connections, cogging and crawling, regenerative braking, plugging, rheostat braking, 3-phase induction motor as induction generator, applications of induction generator.

Learning Resources:

Text Books:

1. Edward Hughes "Electrical Technology", ELBS, Pearson Education.
2. Ashfaq Husain, "Electrical Machines", Dhanpat Rai & Sons.
3. S. K. Bhattacharya, "Electrical Machine", Tata McGraw Hill publishing Co. Ltd, 2nd Edition.
4. Nagrath & Kothari, "Electrical Machines", Tata McGraw Hill.
5. Bhag S Guru, Husein R. Hiziroglu, "Electrical Machines", Oxford University Press.
6. K Krishna Reddy, "Electrical Machines- I and II", SCITECH Publications (India) Pvt. Ltd. Chennai.

Reference Books:

1. I. J. Nagrath and D. P. Kothari, Electric Machines, Tata McGraw Hill, New Delhi, 2005.

2. M. G. Say, The performance and design of alternating current machines, CBS Publishers and distributors, Delhi, 1983.
3. Fitzgerald, Kingsley and Umans, Electric Machinery, Tata McGraw Hill, New Delhi, 2003
4. S. K. Sen, Electrical Machinery, Khanna Pub., Delhi, 2012.
5. Mukherjee and Chakravorty, Electrical Machines, Dhanpat Rai Pub., New Delhi, 2005.

Web link for MOOC / NPTEL Links:

1. https://onlinecourses.nptel.ac.in/noc19_ee69/preview
2. https://archive.nptel.ac.in/courses/108/102/108102146/

List of Practicals (Any 8):

1. Speed control of D.C. Shunt motor and series motors.
2. Brake test on D.C. Shunt motor
3. Hopkinson's test on D.C. shunts machines
4. O.C. and S.C. test on single phase Transformer a. Determination of equivalent circuit parameters from the test data b. Determination of voltage regulation and efficiency
5. Parallel operation of two single phase transformers and study of their load sharing under various conditions of voltage ratios and leakage impedance.
6. Polarity test on single phase and three phase transformer.
7. Standard connections for three-phase transformer (Y-Y, Δ-Δ, Y-Δ, Δ-Y, V-V, T-T, Z-Z)
8. Determination of efficiency & regulation of single-phase transformer from Sumpner's test.
9. Load test on 3-phase squirrel cage induction motor.
10. No load & blocked-rotor test on 3-phase induction motor: a) Determination of parameters of equivalent circuit. b) Plotting of circle diagram.
11. Speed control of three phase squirrel cage induction motor by V/F method
12. Speed control of three phase slip ring induction motor by rotor resistance control method.

Course Code: 108402		Course Name: Electrical Networks
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:

- Basics of Electrical Engineering.

Course Objectives:

- To develop a strong foundation in analyzing and solving electrical networks using topology, Laplace transforms, transient and steady-state analysis, and network functions.
- To enable students to assess power transfer, harmonics, and circuit behavior for practical and theoretical applications in electrical engineering.

Course Outcomes:

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

CO1: Analyze mesh and nodal analysis techniques to determine currents and voltages in electrical networks.

CO2: Analyze network topology using graph theory, loop, nodal analysis, and dual networks.

CO3: Solve transient and steady-state responses of first- and second-order circuits.

CO4: Analyze the behavior of the network by its transient response (Frequency domain).

CO5: Evaluate network functions, pole-zero configurations, and multi-port parameters.

Course Contents:

Unit-I: Basic Circuit Analysis and Simplification Techniques 06 Hours

Mesh, Super mesh, Node and Super Node analysis. Source transformation and source shifting. Thevenins, Superposition, Norton, Reciprocity, Millman theorems Maximum Power Transfer, and Tellegin's theorem applied to electrical networks with all types of sources. Magnetic coupling and dot convention.

Unit-II: Network Topology 06 Hours

Network graph, tree, co-tree, and loops. Incidence matrix, tie-set, cut-set matrix. Formulation of equilibrium equations in matrix form, solution of resistive networks and principle of duality.

Unit-III: Transient Analysis of Basic RC, RL and RLC Circuits 06 Hours

Initial and final conditions in network elements, forced and free response, time constants steady state and transient state response. Classical solution of first and second order differential

equations for Series and parallel R-L, R-C, R-L-C circuits.

Unit-IV: Transient Analysis in Frequency Domain 06 Hours

Laplace Transform its properties, Complex frequency. LT of standard mathematical functions, LT of standard test signals, LT of R, L and C. Inverse LT. LT for analysis of RL, RC and RLC circuits.

Unit-V: Two Port Network Parameters and Functions 06 Hours

Terminal characteristics of network: Z, Y, h, ABCD Parameters, Reciprocity and Symmetry conditions, Applications of the parameters. Application of. Network functions for one port and two port networks, Pole-zeros of network functions and network stability.

Learning Resources:

Text Books:

1. Charles K. Alaxander and Matthew N.O. Sadiku, Fundamentals of electric circuits, Tata McGraw Hill, 5th Edition, 2013.
2. Higher Engineering Mathematics by B. S. Grewal, Ed. I, 2023, Khanna Publication.
3. D. Roy Chaudhary, “Network and Systems”, New Age International Publications, 2nd edition.

Reference Books:

1. William H. Hayt, Jack E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill International, 5th edition corrections), Jaico Publishing, 1998.
2. James W. Nilsson and Susan A. Riedel “Electric Circuits” Prentice Hall, 10th Edition, 2015, ISBN: 0131989251.

Weblink for MOOC / NPTEL Links:

1. NPTEL Video lectures Prof. Tapas Bhattacharya, IIT Kharagpur https://nptel.ac.in/courses/108105159
2. https://onlinecourses.nptel.ac.in/noc25_ee53/preview

List of Practicals:

1. Verification of Superposition theorem in A.C. circuits.
2. Verification of Thevenin’s theorem in A.C. circuits.
3. Verification of Reciprocity theorem in A.C. circuits.
4. Verification of Millmans’ theorem.
5. Verification of Maximum Power Transfer theorem in A.C. circuits.
6. Determination of time response of R-C circuit to a step D.C. voltage input. (Charging and discharging of a capacitor through a resistor)
7. Determination of time response of R-L circuit to a step D.C. voltage input. (Rise and decay of current in an inductive circuit)

8. Determination of time response of R-L-C series circuit to a step D.C. voltage input.
9. Determination of parameter of Two Port Network.
10. Determination of current under parallel Resonance condition.
11. Determination of Resonance, Bandwidth and Q factor of R-L-C series circuit.

K B T C O E

Course Code: 108403	Course Name: Power Systems and Equipment	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 2 Hours/Week	**2**	**CCE : 40 Marks** **ESE : 60 Marks**

Prerequisite Courses:

- Basic Electrical Engineering, Network theory, Power Generation Technology.

Course Objectives:

- To learn the basic structure of electrical power systems, various electrical terms related with power system and understand various types of tariffs.
- To get the knowledge of mechanical and electrical design of overhead and underground transmission system.
- To analyze line parameter of transmission lines.

Course Outcomes:

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

CO1: Classify and analyze the electrical power transmission and distribution.

CO2: Compute the cost of power generation and the cost of electricity.

CO3: Design the transmission line and analyze the performance of transmission lines.

CO4: Analyze the performance of the underground cable.

CO5: Simulate/model the power system components in MATLAB/ETAP platforms and analyze the numerical results.

Course Contents:

Unit-I: Structure of Electrical Power Systems and Supply System 06 Hours

Structure of electrical power system, Different factors associated with generating stations such as Connected load, Maximum demand, Demand factor, Average load, Load factor, Diversity factor, Plant capacity factor, Reserve capacity, Plant use factor, Load curve, Load duration curve, Concept of base load and peak load stations, Advantages of interconnected grid system, fitting of available generating station into the area load duration curve. AC and DC power supply systems, comparison of ac and dc transmission, advantages of high transmission voltage, various systems of power supply, comparison of conductor materials in overhead system and underground cable system, economic choice of conductor size and economic choice of voltage.

Unit-II: D.C. And A. C. Distribution **06 Hours**

Types of dc distributors, dc distribution calculations, ac distributor, fed at one and fed at both the ends with concentrated loads and uniformly distributed loads, ring distributors with inter connectors, current distribution in three wire and four wire ac systems, overview of distribution automation.

Unit-III: Economic Aspects of Power System **06 Hours**

Power factor improvement, power factor improvement equipments, calculation of power factor correction, importance of power factor improvements, tariff structure flat demand rate tariff straight-line meter rate tariff, block meter rate tariff, two-part tariff, power factor tariff, seasonal rate tariff, peak load tariff, three-part tariff, availability-based tariff, economic aspects of power generation.

Unit-IV: Underground Cables **06 Hours**

Underground cables, construction of cables, classification of cables, cables for three phase services, insulation resistance of a single core cable, capacitance of a single core cable, dielectric stresses in a single core cable, most economical conductor size in a cable, grading of cables, capacitance grading and inter-sheath grading, capacitance of three core cable and measurements of capacitances, dielectric loss and tan(δ) measurement.

Unit-V: Calculation of Line Parameters **06 Hours**

Conductors, types of conductors in use, bundled conductor, spacing of conductors, symmetrical and unsymmetrical spacing, equivalent spacing, transposition, transmission line constants, calculation of resistance, inductance and capacitance for simple arrangements and multi-circuit lines, symmetrical and unsymmetrical spacing, concept of self GMD, mutual GMD and their uses in calculations of parameters of overhead lines, skin and proximity effects.

Learning Resources:

Text Books:

1. V.K.Meheta, Rohit Mehta, "Principles of Power System", S. Chand Publication.
2. J.B.Gupta, "Transmission and Distribution", S.K.Kataria and Sons, New Delhi.
3. J.B.Gupata,"Generation and Economic Considerations",S.K.Kataria & Sons, New Delhi.
4. Dr.B.R.Gupta, "Generation of Electrical Energy", S. Chand Publication.
5. A Chakraborty, M.L.Soni, P.V. Gupta, U.S.Bhatnagar,"A text book on Power System Engineering", Dhanpatrai & Co, Delhi.
6. S.N.Singh, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India.

Reference Books:

1. Nagrath & Kothari, "Power System Engineering", Tata McGraw Hill Publications

2. D. Das," Electrical Power System", New Age Publication
3. W.D.Stevenson, "Power System Analysis", Tata McGraw Hill Publications.
4. M.V.Deshpande," Elements of Power Station Design", Wheeler Publishing.
5. I.J. Nagrath and D.P.Kothari," Modern Power System Analysis", Tata McGraw Hill
6. W. D. Stevenson, Element of Power System Analysis, McGraw Hill, 4 th Edition 1982.

MOOC / NPTEL/YouTube Links:

1. NPTEL course on Power System Engineering, IIT Kharagpur
   https://nptel.ac.in/courses/108105104
2. NPTEL course on Power System Analysis, IIT Kharagpur
   https://nptel.ac.in/courses/108105067

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

Prerequisite Courses:

- Basic concept of Computer Networks, Internet Fundamentals.

Course Objectives:

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

Course Outcomes:

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

CO1: Understand the basics of cyber security.

CO2: Study ethical hacking techniques and hacker methodologies.

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

CO4: Apply methods for cyber forensics.

CO5: Use of AI in cyber security**.**

Course Contents:

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

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

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

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

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

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

Unit-III: Cyber Laws 06 Hours

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

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

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

Unit-IV: Cyber Forensics 06 Hours

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

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

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

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

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

Learning Resources:

Text Books:

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

Reference Books:

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

978-81-317 1288-7

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

Web link for MOOC / NPTEL Links:

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

Suggested Activities In-Class:

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

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

Prerequisite Courses:

- Professional Communication Skills.

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

Course Guidelines:

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

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

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

Baskets for Language Courses:

1. Basic English Language Course:

Unit-I: Basic of Communication **06 Hours**

An introduction to phonetics and phonology.

Unit-II: Vocabulary for Communication **06 Hours**

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

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

Unit-III: Grammar for Communication **06 Hours**

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

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

Unit-IV: English for the Real World **06 Hours**

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

Unit-V: Language Skills for Functional Communication **06 Hours**

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

2. Basic Sanskrit Language Course:

Unit-I: Characteristics of Sanskrit **06 Hours**

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

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

Unit-II: Sentence Structure and Vocabulary for Communication 06 Hours

Basic vocabulary and sentence construction.

Introducing different declensions and tenses – 2.

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

Unit-III: Grammar for Communication 06 Hours

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

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

Unit-IV: Daily Conversation 06 Hours

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

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

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

Unit-V: Comprehension and Conversations 06 Hours

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

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

3. Basic German Language Course:

Unit-I: Introduction to the Alphabet Articulation **06 Hours**

Introduction, greetings and alphabet articulation.

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

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

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

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

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

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

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

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

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

Professions / Grammar: perfect tense.

Clothes / Grammar: perfect tense and dative.

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

Contacts, writing letters / Grammar: dative.

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

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

Holiday and weather.

4. Basic French Language Course:

Unit-I: Introduction to Alphabets Articulation **06 Hours**

Introduction, greetings and alphabet articulation.

Unit-II: Grammar of French-I **06 Hours**

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

Unit-III: Grammar of French-II **06 Hours**

Words of politeness, pronouns and conversation.

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

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

Unit-V: Basic of Communication in French Language **06 Hours**

Pieces of communication.

5. Basic Japanese Language Course:

Unit-I: Japanese Scripts **06 Hours**

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

Unit-II: Language and Grammar **06 Hours**

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

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

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

Unit-IV: Japanese Culture, Festivals and Lifestyle **06 Hours**

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

Unit-V: Basic of Communication in Japanese Language **06 Hours**

Audio and pictures: Association and meaning. |

Guidelines for Evaluation:

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

Learning Resources:

Text / Reference Books / Web Links:

Basic English Language Course

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

Basic Sanskrit Language Course

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

Basic German Language Course

1. NETZWERK Deutsch alsFremdspracheA1(Goyal, New Delhi, 2015).
2. Schulz-Griesbach: Deutsch alsFremdsprache. Grundstufe in einem Band (for Grammar).

Web Resources:

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

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

Practice materials:

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

Basic French Language Course

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

Basic Japanese Language Course

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

Course Code: 108409	Course Name: Electrical Installation & Maintenance	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical : 4 Hours/Week	**2**	**TW** : 50 Marks

Prerequisite Courses:

- Basics of Electrical Engineering.

Course Objectives:

- To equip students with fundamental knowledge of electrical systems, wiring, troubleshooting, and maintenance, ensuring safe and efficient handling of residential and small commercial electrical setups.
- To develop hands-on skills in electrical installation, fault diagnosis, and repair of wiring systems and household appliances, preparing students for real-world electrical maintenance and troubleshooting challenges.

Course Outcomes:

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

CO1: Demonstrate an understanding of basic electrical systems, circuits, and safety practices while using essential electrical tools.

CO2: Apply fundamental wiring principles, including wire selection, safe connections, and adherence to electrical codes, in residential electrical installations.

CO3: Identify common electrical faults in household appliances and perform basic troubleshooting, repairs, and component replacements.

CO4: Diagnose and resolve electrical faults in circuits and appliances using systematic troubleshooting methods and preventive maintenance strategies.

CO5: Integrate knowledge of electrical systems, wiring, troubleshooting, and maintenance to design, install, and test a complete electrical setup with fault detection and resolution**.**

Learning Resources:

Text Books:

1. Madhvi Gupta, “Installation Maintenance and Repair of Electrical Machines and Equipment’s”, S.K. Kataria & Sons, 2nd edition.

Reference Books:

1. Electrical Installation Work by Brian Scaddan.
2. Practical Electrical Wiring by David P. Lindsley.

List of Practicals:

Part-A: Hands-On Experiments

1. Introduction to Electrical Tools, Safety Measures & Basic Wiring Techniques
    a. Objective: Acquaint students with electrical tools, safety practices, and basic wiring techniques.
    b. Equipment:
        i. Multimeter (for voltage, current, and resistance testing)
        ii. Insulation Resistance Tester (for testing electrical insulation integrity)
    c. Activity: Introduction to electrical tools and safety procedures, followed by basic wire stripping, connection techniques, and testing of simple circuits.
2. Construction of Series and Parallel Circuits with Measurement Techniques
    a. Objective: Build and test basic electrical circuits, measure voltage, current, and analyze circuit behavior.
    b. Equipment:
        i. Breadboard (for circuit assembly)
        ii. Power Supply Unit (to power circuits)
    c. Activity: Design and build series and parallel circuits, measure and analyze voltage, current, and overall circuit behavior.
3. Electrical Wiring Basics & Cable Selection for Residential Installations
    a. Objective: Learn about different types of cables, their ratings, and proper wire selection for residential wiring.
    b. Equipment:
        i. Wire Strippers (for proper wire preparation)
        ii. Digital Multimeter (for continuity testing)
    c. Activity: Select and use different cables based on current ratings, practice wire stripping, and make safe connections.
4. Installing and Testing Electrical Outlets, Switches, and Basic Circuits
    a. Objective: Gain practical experience installing electrical outlets, switches, and testing basic circuits.
    b. Equipment:
        i. Insulated Screwdriver (for installation)
        ii. Voltage Tester (for socket testing)
    c. Activity: Install a light switch, socket outlet, and basic circuit. Test for proper voltage, continuity, and grounding.
5. Fault Diagnosis in Residential Wiring (Short Circuit Simulation)

a. Objective: Simulate and diagnose short circuits in residential wiring and troubleshoot the issue.
b. Equipment:
    i. Circuit Breaker (for short circuit protection)
    ii. Digital Multimeter (for fault diagnosis)
c. Activity: Simulate a short circuit, trace the fault using a multimeter, and correct the issue using circuit protection devices.

6. Disassembly and Reassembly of Household Appliances (Small Appliances)
    a. Objective: Learn to disassemble and reassemble small household appliances.
    b. Equipment:
        i. Screwdriver Set (for disassembly)
        ii. Multimeter (for testing electrical faults)
    c. Activity: Disassemble and reassemble small appliances (e.g., lamps, toasters), identify faulty components, and perform repairs.
7. Disassembly and Reassembly of Major Household Appliances (Refrigerator, Washing Machine)
    a. Objective: Disassemble and reassemble larger household appliances like refrigerators and washing machines.
    b. Equipment:
        i. Wrench Set (for disassembly)
        ii. Multimeter (for component testing)
    c. Activity: Disassemble refrigerators and washing machines, inspect electrical components, perform repairs, and reassemble.
8. Replacing Fuses, Power Cords, and Electrical Components in Appliances
    a. Objective: Learn to replace fuses, damaged power cords, and other electrical components in appliances.
    b. Equipment:
        i. Soldering Iron (for component soldering)
        ii. Multimeter (for testing replaced components)
    c. Activity: Replace fuses, power cords, and faulty components, then test the appliance's functionality using a multimeter.

Part-B: Software-Based Experiments

1. Basic Circuit Design and Testing using Proteus or Tinkercad.
    a. Objective: Design, simulate, and test basic electrical circuits using simulation software.
    b. Software: Proteus or TinkerCAD

c. Equipment:
   i. Proteus Simulation Software (for circuit design and analysis)
   ii. TinkerCAD Simulation Software (for simple circuit building and testing)
d. Activity: Use simulation software to design basic electrical circuits (e.g., series and parallel circuits), test the circuits' voltage, current, and behavior in a virtual environment.

2. Simulation of Residential Wiring Systems and Fault Diagnosis
   a. Objective: Simulate residential wiring systems with lighting and power circuits and troubleshoot common faults.
   b. Software: AutoCAD Electrical or PSIM
   c. Equipment:
      i. AutoCAD Electrical (for schematic drawing and simulation)
      ii. PSIM Simulation Software (for fault diagnosis and troubleshooting)
   d. Activity: Create a residential wiring system using simulation software, test for common faults (e.g., short circuits, open circuits), and troubleshoot using virtual tools.

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