Savitribai Phule Pune University, Pune

Maharashtra, India

Faculty of Science and Technology

National Education Policy (NEP)-2020 Compliant Curriculum

SE - Second Year Engineering (2024 Pattern)

Electronics & Telecommunication Engineering

(With effect from Academic Year 2025-26)

DRAFT COPY

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Contents

Nomenclature

CEP Community Engagement Project

MDM Multidisciplinary Minor

OE Open Elective

PCC Program Core Course

PEO Programme Educational Objectives

VEC Value Education Course

WK Knowledge and Attitude Profile

Preface by Board of Studies

Dear Students and Teachers,

We, the members of Board of Studies Electronics and Telecommunication Engineering, are very happy to present Second Year Electronics and Telecommunication Engineering syllabus effective from the Academic Year 2025-26. The present curriculum will be implemented for Second Year of Engineering from the academic year 2025-26. Subsequently this will be carried forward for TE and BE in AY 2026-27, 2027-28, respectively.

Electronics and Telecommunication Engineering is a dynamic discipline that lies at the intersection of electronics engineering and communication technology. It provides the foundation for the design, development, and application of electronic systems and communication devices. This curriculum is designed to provide students with a comprehensive understanding of the fundamental principles, theories, and practices of Electronics and Telecommunication engineering, while also preparing them for the ever-evolving technological landscape.

The revised syllabus falls in line with the objectives of NEP-2020, Savitribai Phule Pune University, AICTE New Delhi, UGC, and various accreditation agencies by keeping an eye on the technological developments, innovations, and industry requirements. Wherever possible, additional resource links of platforms such as NPTEL, Swayam are appropriately provided at the end of each course. Learners are now getting sufficient time for self learning either through online courses or additional projects for enhancing their knowledge and skill sets. Learners can be advised to take up online courses, on successful completion they are required to submit certification for the same. This will definitely help learners to facilitate their enhanced learning based on their interest.

This curriculum is the result of extensive consultation with academic experts, industry professionals, and alumni to ensure relevance and excellence. It is designed not only to meet the current industry standards but also to prepare students for higher studies and research in the field of Electronics and Telecommunication engineering.

We hope that this curriculum will inspire students to become competent professionals, responsible citizens, and contributors to the technological advancement of society.

Dr. S. D. Shirbahadurkar
Chairman
Board of Studies

Programme Educational Objectives (PEO)

Program Educational Objectives (PEOs): Program Educational Objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

PEO	PEO Focus	PEO Statements
PEO1	Core competence	Attainment of key principles and practices of computation, mathematics and basic principles of engineering to ensure that graduates are able to apply their software development skills in design and implementation of practical systems consisting of software and/or hardware components.
PEO2	Problem solving skills and Ethics	Analyze real-life problems and impart science-based engineering education to develop professional skills that will prepare the students for immediate employment in the industry.
PEO3	Professionalism and Lifelong Learning	Imbibe lifelong learning, professional and ethical attitude for embracing global challenges and make positive impact on environment and society.

Knowledge and Attitude Profile (WK)

A Knowledge and Attitude Profile (KAP), often represented as WK (Knowledge and Attitude Profile) in some contexts, is a framework or assessment tool used to evaluate an individual's knowledge and attitudes related to a specific area, topic, or domain.

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.

Programme Outcomes (PO)

Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, attitude and behaviour that students acquire through the program. On successful completion of B.E. in Electronics and Telecommunication Engineering, graduating students/graduates will be able to:

PO1	Engineering knowledge	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem analysis	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	Design / Development of Solutions	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct Investigations of Complex Problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	Engineering Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	The Engineer and the World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.
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)

General Rules and Guidelines

- Course Outcomes (CO): Course Outcomes are narrower statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.
- Assessment: Assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of Program Educational Objectives and Program Outcomes.
- Evaluation: Evaluation is one or more processes, done by the Evaluation Team, for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which Program Educational Objectives or Program Outcomes are being achieved, and results in decisions and actions to improve the program

Guidelines for Examination Scheme

Theory Examination: The theory examination shall be conducted in two different parts Comprehensive Continuous Evaluation (CCE) and End-Semester Examination (ESE).

Comprehensive Continuous Evaluation (CCE) of 30 marks based on all the Units of course syllabus to be scheduled and conducted at institute level. To design a Comprehensive Continuous Evaluation (CCE) scheme for a theory subject of 30 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Sr.	Parameters	Marks	Coverage of Units
1	Unit Test	12 Marks	Units 1 & Unit 2 (6 Marks/Unit)
2	Assignments / Case Study	12 Marks	Units 3 & Unit 4 (6 Marks/Unit)
3	Seminar Presentation / Open Book Test/ Quiz	06 Marks	Unit 5

Format and Implementation of Comprehensive Continuous Evaluation (CCE)

- **Unit Test**
  - **Format :** Questions designed as per Bloom's Taxonomy guidelines to assess various cognitive levels (Remember, Understand, Apply, Analyze, Evaluate, Create).
  - **Implementation**: Schedule the test after completing Units 1 and 2. Ensure the question paper is balanced and covers key concepts and applications.
- **Sample Question Distribution**
  - Remembering (2 Marks): Define key terms related to [Topic from Units 1 and 2].
  - Understanding (2 Marks): Explain the principle of [Concept] in [Context].
  - Applying (2 Marks): Demonstrate how [Concept] can be used in [Scenario].
  - Analyzing (3 Marks): Compare & contrast [Two related concepts] from Units 1 and 2.
  - Evaluating (3 Marks): Evaluate the effectiveness of [Theory/Model] in [Situation].

- **Assignments / Case Study** : Students should submit one assignment or one Case Study Report based on Unit 3 and one assignment or one Case Study Report based on Unit 4.
  - **Format:** Problem-solving tasks, theoretical questions, practical exercises, or case studies that require in-depth analysis and application of concepts.
  - **Implementation:** Distribute the assignments or case study after covering Units 3 and 4. Provide clear guidelines and a rubric for evaluation.
- **Seminar Presentation:**
  - **Format:** Oral presentation on a topic from Unit 5, followed by a Q&A session.
  - **Deliverables:** Presentation slides, a summary report in 2 to 3 pages, and performance during the presentation.
  - **Implementation:** Schedule the seminar presentations towards the end of the course. Provide students with ample time to prepare and offer guidance on presentation skills.
- **Open Book Test:**
  - **Format:** Analytical and application-based questions to assess depth of understanding.
  - **Implementation:** Schedule the open book test towards the end of the course, ensuring it covers critical aspects of Unit 5.
- **Quiz :**
  - **Format:** Quizzes can help your students practice existing knowledge while stimulating interest in learning about new topic in that course. You can set your quizzes to be completed individually or in small groups.
  - **Implementation:** Online tools and software can be used create quiz. Each quiz is made up of a variety of question types including multiple choice, missing words, true or false etc
- **Example Timeline for conducting CCE:**
  - Weeks 1-4 : Cover Units 1 and 2
  - Week 5 : Conduct Unit Test (12 marks)
  - Weeks 6-8 : Cover Units 3 and 4
  - Week 9 : Distribute and collect Assignments / Case Study (12 marks)
  - Weeks 10-12 : Cover Unit 5
  - Week 13 : Conduct Seminar Presentations or Open Book Test or Quiz (6 marks)
- **Evaluation and Feedback:**
  - **Unit Test:** Evaluate promptly and provide constructive feedback on strengths and areas for improvement.
  - **Assignments / Case Study:** Assess the quality of submissions based on the provided rubric. Offer feedback to help students understand their performance.

- **Seminar Presentation:** Evaluate based on content, delivery, and engagement during the Q&A session. Provide feedback on presentation skills and comprehension of the topic.
- **Open Book Test**: Evaluate based on the depth of analysis and application of concepts. Provide feedback on critical thinking and problem-solving skills.

End-Semester Examination (ESE)

End-Semester Examination (ESE) of 70 marks written theory examination based on all the unit of course syllabus scheduled by university. Question papers will be sent by the University through QPD (Question Paper Delivery). University will schedule and conduct ESE at the end of the semester.

- **Format and Implementation :**
  - **Question Paper Design** : Below structure is to be followed to design an End-Semester Examination (ESE) for a theory subject of 70 marks on all 5 units of the syllabus with questions set as per Bloom's Taxonomy guidelines and 14 marks allocated per unit.
  - **Balanced Coverage**: Ensure balanced coverage of all units with questions that assess different cognitive levels of Bloom's Taxonomy: Remember, Understand, Apply, Analyze, Evaluate, and Create. The questions should be structured to cover:
    - Remembering: Basic recall of facts and concepts.
    - Understanding: Explanation of ideas or concepts.
    - Applying: Use of information in new situations.
    - Analyzing: Drawing connections among ideas.
    - Evaluating: Justifying a decision or course of action.
    - Creating: Producing new or original work (if applicable).
  - **Detailed Scheme:** Unit-Wise Allocation (14 Marks per Unit): Each unit will have a combination of questions designed to assess different cognitive levels. By following this scheme, you can ensure a comprehensive and fair assessment of students' understanding and application of the course material, adhering to Bloom's Taxonomy guidelines for cognitive skills evaluation.

NEP 2020 Compliant Curriculum Structure

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Semester I

Level 5.0														
Course Code	Course Type	Course Name	Teaching Scheme (Hrs/week)			Examination Scheme and Marks					Credits			
			Theory	Tutorial	Practical	CCE*	End Sem	Term Work	Practical	Oral	Theory	Tutorial	Practical	Total
Semester I														
PCC-201-ETC	Program Core Course	Electronics Circuits	3	-	-	30	70	-	-	-	3	-	-	3
PCC-202-ETC	Program Core Course	Engg Mathematics-III	3	-	-	30	70	-	-	-	3	-	-	3
PCC-203-ETC	Program Core Course	Digital Electronics	3	-	-	30	70	-	-	-	3	-	-	3
PCC-204-ETC	Program Core Course-Lab	Electronics Circuits Lab	-	-	2	-	-	25	50	-	-	-	1	1
PCC-205-ETC	Program Core Course-Lab	Digital Electronics Lab	-	-	2	-	-	25	50	-	-	-	1	1
OEL-220-ETC	Open Elective	Open Elective - I	3	-	-	30	70	-	-	-	3	-	-	3
MDM-230-ETC	Multi-disciplinary Minor	Data Structures & Algorithms	-	1	2	-	-	50	50	-	-	1	1	2
EEM-240-ETC	Entre-preneurship / Economics / Management	Engineering Economics & Applications	-	1	2	-	-	25	-	-	-	1	1	2
VEC-250-ETC	Value Education	Universal Human Values & Professional Ethics	-	1	2	-	-	25	-	-	-	1	1	2
CEP-260-ETC	Community Engagement Project	Community Engagement Project	-	-	4	-	-	25	-	-	-	-	2	2
Total			**12**	**03**	**14**	**120**	**280**	**175**	**125**	**–**	**12**	**03**	**07**	**22**

Open Elective - I	
OEL-220 A- ETC	Supply Chain Management
OEL-220 B- ETC	Digital Marketing

NEP 2020 Compliant Curriculum Structure

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Semester II

Level 5.0														
Course Code	Course Type	Course Name	Teaching Scheme (Hrs/week)			Examination Scheme and Marks					Credits			
			Theory	Tutorial	Practical	CCE*	End Sem	Term Work	Practical	Oral	Theory	Tutorial	Practical	Total
Semester II														
PCC-206-ETC	Program Core Course	Communication Engineering	3	-	-	30	70	-	-	-	3	-	-	3
PCC-207-ETC	Program Core Course	Signals and Systems	3	-	-	30	70	-	-	-	3	-	-	3
PCC-208-ETC	Program Core Course	Control Systems	3	-	-	30	70	-	-	-	3	-	-	3
PCC-209-ETC	Program Core Course-Lab	Communication Engineering Lab	-	-	2	-	-	25	50	-	-	-	1	1
PCC-210-ETC	Program Core Course-Lab	Control Systems & Signals and Systems Lab	-	-	2	-	-	25	-	25	-	-	1	1
OEL-221-ETC	Open Elective	Open Elective - II	3	-	-	30	70	-	-	-	3	-	-	3
MDM-231-ETC	Multi-disciplinary Minor	Object oriented Programing	-	1	2	-	-	50	50	-	-	1	1	2
VSE-270-ETC	Vocational and Skill Enhancement Course	Electronics Skill Development Lab	-	-	2	-	-	25	-	-	-	-	1	1
AEC-281-ETC	Ability Enhancement Course	Modern Indian Languages (Marathi/Hindi)	-	-	2	-	-	25	-	-	-	-	1	1
EEM-241-ETC	Entre-preneurship /Economics/ Management	Entrepreneurship skill Development	-	1	2	-	-	25	-	-	-	1	1	2
VEC-251-ETC	Value Education Course	Environment Awareness	-	-	4	-	-	-	-	-	-	-	2	2
Total			**12**	**02**	**16**	**120**	**280**	**175**	**100**	**25**	**12**	**02**	**08**	**22**

Open Elective - II	
OEL-221 A- ETC	Business Analytics
OEL-221 B- ETC	Project Management

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Semester III

With effect from Academic Year 2025–26

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PCC-201-ETC: Electronics Circuits

Teaching /scheme	Credits	Examination Scheme
Theory : 03 Hours/Week	03	**CCE* Marks** : 30 Marks **End Semester (Theory) :** 70 Marks

Prerequisite Courses, if any: ESC-101-ETC - Basic Electronics Engineering

Companion Course, if any: PCC-201-ETC - Electronic Circuits Laboratory

Course Objectives:

To make students understand

- Semiconductor device MOSFET, its characteristics, parameters & applications.
- Concepts of feedbacks in amplifiers & oscillators.
- Operational amplifier, concept, parameters & applications.
- ADC, DAC as an interface between analog & digital domains.
- Concepts, characteristics & applications of PLL.
- Voltage to current and current to voltage converters.

Course Outcomes:

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

CO1: Assimilate the physics, characteristics and parameters of MOSFET towards its application as amplifier.

CO2: Design MOSFET amplifiers, with and without feedback, & MOSFET oscillators, for given specifications.

CO3: Design, Build and test Op-amp based analog signal processing and conditioning circuits towards various real time applications.

CO4: Understand and compare the principles of various data conversion techniques and PLL with their applications.

CO5: Analyze and assess the performance of linear and switching regulators, with their variants, towards applications in regulated power supplies.

Course Contents

Unit I	MOSFET & its Analysis	(07 Hours)

Enhancement MOSFET: MOSFET DC Load line, AC equivalent circuit, Parameters.

Non ideal characteristics: Finite output resistance, Body effect, Sub-threshold conduction, breakdown effects, temperature effect, effect of W/L ratio, Common source amplifier & analysis, Source follower: circuit diagram, comparison with common source, Frequency response for CS amplifier. Comparison between BJT & MOSFET.

Mapping of Course Outcomes for Unit I

CO1: Assimilate the physics, characteristics and parameters of MOSFET towards its application as amplifier.

Unit II	MOSFET Circuits	(07 Hours)

MOSFET as switch, CMOS inverter, resistor & diode. Current sink & source, Current mirror. Types of feedback, Four types of feedback topologies, Effects of feedback, Voltage series & current series feedback amplifiers and analysis. Barkhausen criterion, Types of Oscillator, RC phase shift oscillator, Crystal Oscillator.

Mapping of Course Outcomes for Unit II

CO2: Design MOSFET amplifiers, with and without feedback, & MOSFET oscillators, for given specifications.

Unit III	Operational amplifier and linear Applications	(08 Hours)

Block diagram, Op amp parameters, Current mirror, Op-amp characteristics (AC & DC). Inverting amplifier (Voltage series), non-inverting amplifier(voltage shunt), Effect on Ri, Ro, gain & bandwidth., Voltage follower, Summing amplifier, Differential amplifier, Practical integrator, first Order Low pass, Practical differentiator, High Pass Filter, Precision half-wave Rectifier

Mapping of Course Outcomes for Unit III

CO3: Design, Build and test Op-amp based analog signal processing and conditioning circuits towards various real time applications.

Unit IV	Op-amp and Non Linear Applications	(07 Hours)

Comparator, Schmitt trigger, Square & triangular wave generator, PWM Generator

DAC & ADC: Resistor weighted and R-2R DAC, SAR, Flash and dual slope ADC Types / Techniques, Characteristics, block diagrams, Circuits, Specifications, Merits, Demerits, Comparisons.

Mapping of Course Outcomes for Unit IV

CO4: Understand and compare the principles of various data conversion techniques and PLL with their applications.

Unit V	Voltage Regulators	(07 Hours)

Three terminal voltage regulators: Block diagram of power supply, transistor series voltage regulator Types: Fixed and Variable, Block diagram of linear voltage regulator, IC 317 and IC337, Features and specifications, typical circuits, current boosting, Low Dropout Regulator (LDO).

SMPS: Block diagram, Types, features and specifications, typical circuits buck and boost converter

Mapping of Course Outcomes for Unit V

CO5: Analyze and assess the performance of linear and switching regulators, with their variants, towards applications in regulated power supplies.

Mapping of Course Outcomes for Unit V: CO5

Learning Resources

Textbooks:

1. Donald Neaman, “Electronic Circuits - Analysis and Design”, Mc Graw Hill, 3rd Edition.
2. Ramakant Gaikwad, “Op Amps & Linear Integrated Circuits”, Pearson Education.

Reference Books:

1. Millman Halkias, “Integrated Electronics”.
2. Phillip E. Allen and Douglas R. Holberg, “CMOS Analog Circuit Design”, Oxford, 2nd Edition.
3. Salivahan and Kanchana Bhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill.

MOOC / NPTEL Courses:

1. NPTEL Course “Analog Electronic Circuits” https://nptel.ac.in/courses/108/105/108105158/
2. NPTEL Course on “Analog Circuits”: https://nptel.ac.in/courses/108101094

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PCC-202-ETC: Engineering Mathematics III

Teaching /scheme	Credits	Examination Scheme
Theory : 03 Hours/Week	03	**CCE* Marks** : 30 Marks **End Semester (Theory) :** 70 Marks

Prerequisite Courses: Differential and Integral calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Vector algebra and Algebra of complex numbers.

Course Objectives:

To familiarize the students with concepts and techniques in Ordinary differential equations, Fourier Transform, Z-Transform, Numerical methods, Vector calculus and Statistics & Probability. The aim is to equip them 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 equation using appropriate techniques for modelling, analyzing of electrical circuits and control systems.

CO2: Apply concept of Fourier transform & Z-transform and its applications to continuous & discrete systems, signal & image processing and communication systems.

CO3: Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.

CO4: Perform Vector differentiation & integration, analyze the vector fields and apply to electro-magnetic fields & wave theory.

CO5: Apply Statistical methods like correlation, regression and Probability theory as applicable to analyze and interpret experimental data related to signal, communication and information theory.

Course Contents

Unit I	Linear Differential Equations (LDE) and Applications	(08 Hours)

LDE of n^{th} order with constant coefficients, Complementary Function, Particular Integral, General method, Short methods, Method of variation of parameters, Cauchy's and Legendre's differential equations, Simultaneous differential equations, Modeling of electrical circuits.

Unit II	Numerical Methods	(08 Hours)

Interpolation: Finite Differences, Newton's and Lagrange's interpolation formulae, Numerical differentiation.

Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error.

Solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta 4th order method, Predictor-Corrector methods.

Unit III	Fourier and Z-Transforms	(08 Hours)

Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral representation, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms and their inverses.

Z-Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses, Solution of difference equations.

Unit IV	**Vector Calculus**	**(08 Hours)**

Vector differentiation: Gradient, Divergence and Curl, Directional derivative, Solenoidal and Irrotational fields, Vector identities.

Vector integration: Line, Surface and Volume integrals, Green's Lemma, Gauss's Divergence theorem and Stokes' theorem.

Applications to problems in Electro-magnetic fields.

Unit V	**Statistics and Probability**	**(08 Hours)**

Statistics: Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation and Regression, Reliability of Regression estimates.

Probability: Probability density function, Probability distributions – Binomial, Poisson, Normal.

Test of Hypothesis: Chi-square test.

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, Delhi).

Reference Books:

1. Advanced Engineering Mathematics, 10e, by Erwin Kreyszig (Wiley India).
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
3. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).
4. Differential Equations, 3e by S. L. Ross (Wiley India).
5. Numerical Methods for Engineers, 7e by S. C. Chapra and R. P. Canale (McGraw-Hill Education).
6. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross (Elsevier Academic Press).

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PCC-203-ETC: Digital Electronics

Teaching /scheme	Credits	Examination Scheme
Theory : 03 Hours/Week	03	**CCE* Marks** : 30 Marks **End Semester (Theory) :** 70 Marks

Prerequisite Courses: Basic gates, Number Systems and their conversations of BXE

Companion Course: Laboratory Practicals

Course Objectives:

To make students understand

- To understand K-map and its use to the design the various applications of combinational digital circuits.
- To analyze sequential logic using flip flops and their applications viz. counters, processes and implement logical operations.
- To understand the concepts of sequential circuits and apply them in state machines.
- To understand the digital logic families and system design using programmable logic devices.
- CTo understand the concepts of VHDL and its fundamental applications.

Course Outcomes:

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

CO1: Analyze, design and implement combinational logic circuits.
CO2: Analyze, design and implement sequential circuits.
CO3: Analyze, design FSM and ASM.
CO4: Understand various digital parameters and analyze digital system design using PLD.
CO5: Understand the fundamentals of VHDL.

Course Contents

Unit I	Combinational Logic Design	(08 Hours)

Definition of combinational logic, Standard representations for logic functions, k-map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don't care conditions, Design Examples: Half Adder, Full adder, Half Subtractor, Full Subtractor, Adder and their use as subtractor, look ahead carry generator, Code converters (BCD to Gray, BCD to Excess-3, 4-bit Binary to Gray), 2-bit Comparator, Multiplexers, multiplexer trees, Demultiplexers, Demultiplexer trees and 3: 8 Decoders.

Exemplar: Arithmetic Logic Unit (ALU), Scientific calculator, computing engines, industrial control systems, consumer electronics.

Mapping of Course Outcomes for Unit I: CO1

Unit II	Sequential Logic Design	(08 Hours)

1-Bit Memory Cell/latch, Clocked SR flip flop, J-K flip flop, M-S J-K flip flop, D and T flip-flops. Use of preset and clear terminals in flip flops, Excitation Table for flip flops, Conversion of flip flops, Registers, Shift registers, Counters (ring counters, twisted ring counters), ripple counters, Mod-n counters, up/down counters, synchronous counters, Sequence Generators using flip flops.

Exemplar: Memories, Rolling display boards, Microprocessors, Consumer electronics.

Mapping of Course Outcomes for Unit II: CO2

Unit III	State Machines	(08 Hours)

Moore and Mealy machines, State diagram, State table, State reduction, State assignment, Finite state machine implementation, Sequence detector. Introduction to Algorithmic state machines- construction of ASM chart and realization for sequential circuits.

Exemplar: ATM machine, vending machine and traffic lights

Mapping of Course Outcomes for Unit III: CO3

Unit IV	Digital Logic Family and Programmable Logic Devices	(08 Hours)

Digital Logic Family: Performance parameters of digital ICs- fan in, fan out, noise margin, propagation delay, power dissipation. Operation of TTL NAND gate. CMOS inverter, NAND, NOR gates. Comparison of CMOS and TTL.

Programmable Logic Devices: Detail architecture of PROM, PAL, PLA and Designing combi-national circuits using PLDs. General Architecture and specifications of FPGA and CPLD.

Exemplar: High speed computing boards, automotive electronics

Mapping of Course Outcomes for Unit IV: CO4

Unit V	Introduction to VHDL	(08 Hours)

Introduction to Library, Entity and Architecture Modeling styles, Data objects, Concurrent and sequential statements, Design examples using VHDL for basic gates, full adder, full subtractor, multiplexer and D & T flip-flops using behavioral modelling style.

Exemplar: Hardware lock and serial port communication.

Mapping of Course Outcomes for Unit V: CO5

Learning Resources

Textbooks:

1. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill Publication
2. Thomas Floyd, "Digital Fundamentals", Pearson Publication, India

Reference Books:

1. John. F. Wakerly, "Digital Design- Principles and Practices", Pearson Publication
2. M. M. Mano, "Digital Design," Prentice Hall India.
3. Stephen Brown, "Fundamentals of digital logic design with VHDL" Tata McGraw Hill Publication

e-Books:

https://www.mheducation.co.in/modern-digital-electronics-9789355321770-india

MOOC / NPTEL/YouTube Links:

https://nptel.ac.in/courses/108/105/108105132/

Exemplar: These are real-life examples to create interest in the teaching learning process. No question should be asked in examinations on exemplars.

Savitribai Phule Pune University
Second Year of Electronics and Telecommunication Engineering (2024 Course)

PCC-204-ETC: Electronics Circuits Lab

Teaching /scheme	Credits	Examination Scheme
Practical : 02 Hours/Week	01	**TW:** 25 Marks , **Practical** : 50 Marks

Prerequisite Courses, if any:

Companion Course, if any: Electronics Circuits

List of Laboratory Experiments

Group A: Compulsory

1. Design, build single stage CS configuration & verify DC operating point and comment on results.
2. Implement current series feedback amplifier & measure R_{if}, R_{of}, G_{mf} and comment on result.
3. Design, build & test integrator/differentiator using Op-Amp and comment on result.
4. Design, build & test Schmitt trigger using Op-Amp and comment on result.
5. Design & implement adjustable voltage regulator using IC LM317/LM337 and comment on result.

Group B: Any Three to be Performed

6. Simulate voltage series feedback amplifier & measure R_{if}, R_{of}, A_{vf}, bandwidth and comment on result.
7. Design, build & test square and triangular waveform generator using Op-Amp.
8. Design, build & test 2 or 3-bit R-2R ladder DAC.
9. Design, build & test half-wave and full-wave rectifier.
10. Design, build & test first order active low pass / high pass filter.

Group C: Course Project (Any 1 – Group of 3 Students)

11. Case Study 1: Design and implement a linear regulator variable power supply.
12. Case Study 2: Design and implement signal conditioning circuit for temperature measurement and control system.

Virtual LAB Links:

1. **Integrated Circuits:** http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/electronerds/index.html
2. **Basic Electronics Virtual Lab:** http://vlabs.iitkgp.ernet.in/be/

Note:

1. One practical from each Group should be performed as simulation practical (using any available tool).
2. Additional (min. 2) practicals are to be performed using Virtual Lab.

	PCC-205-ETC: Digital Electronics Lab , Pract: 2hrs/week **(TW: 25 Marks, PR: 25 Marks)**
Guidelines for Student's Lab Journal	
1	Title of the experiment
2	Problem Statement
3	Logic Design of given problem statement
4	Logic diagram with IC number pin connections
5	Observation table / Truth table
6	Timing diagram
7	Result table
8	Conclusions
9	Mention real life examples concerned with the respective experiments
Guidelines for Laboratory / Term Work Assessment	
1	Continuous assessment of laboratory work based on overall performance and laboratory performance of students.
2	Each laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3	Suggested parameters include timely completion, performance, efficiency, punctuality, and neatness.
Suggested List of Laboratory Experiments (Any 8)	
1	Design and Implement 8:1 MUX using IC-74153 & Verify its Truth Table. Design & implement the given 4-variable function using IC-74153. Verify its Truth Table.
2	Design and implement full adder and full subtractor function using IC-74138.
3	Design and implement 3-bit Binary to Gray code converter and BCD to Excess-3 code converter using IC-74138.
4	Design and Implement 1-digit BCD adder using IC-7483.
5	Design and Implement 4-bit Binary adder and subtractor with mode control using IC-7483.
6	Design and Implement MOD-N and MOD-NN using IC-7490 and draw Timing diagram.
7	Design & Implement Up/down Counter with mode control using IC-74191 / IC-74193. Draw Timing Diagram.
8	Design and Implement 4-bit right shift and left shift register using D-flip flop IC-7474.
9	Design and Implement Pulse train generator using IC-74194 / IC-7495 (Use right/left Shift).
10	Design and Implement 4-bit Ring Counter / Twisted ring Counter using shift registers IC-74194 / IC-7495.

Note: Additional (min. 2) practicals based on applications are to be performed using Virtual Lab.

1. **Digital Applications Lab:** https://da-iitb.vlabs.ac.in/List%20of%20experiments.html
2. **Hybrid Electronics Lab:** https://he-coep.vlabs.ac.in/List%20of%20experiments.html

Note:

1. One practical from each Group should be performed as simulation practical (using any available tool).
2. Additional (min. 2) practicals are to be performed using Virtual Lab.

Savitribai Phule Pune University
Second Year of Electronics and Telecommunication Engineering (2024 Course)

OEL-220 A- ETC: Supply Chain Management

Teaching /scheme	Credits	Examination Scheme
Theory : 03 Hours/Week	03	**CCE** : 30 Marks **End-Semester:** 70 Marks

Course Objectives:

- To gain an understanding of how supply chain structure work for smooth transition.
- To become familiar with flow of supply chain and its management.
- To study the supply chain management building blocks.
- To study the customer requirements and expected services.

Course Outcomes:

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

CO1: Describe the key concepts of Supply Chain Management
CO2: Explain the structure of modern-day supply chains
CO3: Identify the various flows in real world supply chains
CO4: Understand the key Operational Aspects in Supply Chain Management
CO5: Evaluate the relationship between Customer Value and Supply Chain Management

Course Contents		
Unit I	**Supply Chain Structure**	**(08 Hours)**
Shift from enterprise to network, Structure of a SC, Push based SC, Pull based SC, Tradeoff between Push & Pull, Identifying appropriate Push & Pull Strategy for SC, Commodity & cost centric SC, Agile		
Unit II	**Flows in Supply Chain**	**(08 Hours)**
Forward & Reverse SC, Product, Services, Information, Funds, Demand, Forecast flows in Up-stream & Downstream direction		
Unit III	**Total Supply Chain management**	**(08 Hours)**
business landscape – driving forces: Shift from Operations to Services, Impact of globalization & technological revolution, shift from linear SC to collaborative networks, power shifts in the SC- demands for flexibility of partnerships, core competencies, growth in outsourcing		
Unit IV	**Supply Chain management Building Blocks**	**(08 Hours)**
Overview of customer focus & demand, resources & capacity management, procurement & supplier focus, inventory management, operations management, distribution management in SCM		
Unit V	**Customer Value**	**(08 Hours)**

Empowered consumer, Customer focused Marketing & SC service outputs, customer service – availability, operational performance, reliability. Customer satisfaction – customer expectations, enhancing customer satisfactions, limitations of customer satisfaction. Customer success – achieving customer success, value added services, customer value requirement mapping

Learning Resources

Textbooks:

1. Supply Chain & Logistics Management, Bowersox, Closs & Cooper, Tata McGraw Hill
2. Designing & Managing the SC – Concepts, Strategies & Case studies, Levi, Kaminsky et. al., Tata McGraw Hill
3. Supply Chain Management: Strategy Planning & Operations, Sunil Chopra, Peter Meindl, Pearson

Reference Books:

1. Supply Chain Management Process, System & Practice, Chandrasekaran, Oxford
2. Total Supply Chain Management, Basu & Wright, Elsevier
3. Logistics Management & Strategy, Harrison and van Hoek, Prentice Hall
4. Supply Chain Management, Mentzer, Response Books.
5. Logistics Management: The Supply Chain Imperative, Vindo Sople, Pearson Education

Savitribai Phule Pune University Second Year of Electronics and Telecommunication Engineering (2024 Course)		
OEL-220 B-ETC: Digital Marketing		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 03 Hours/Week	03	**CCE** : 30 Marks **End-Semester**: 70 Marks

Companion Course : Information and Cyber Security Laboratory

Course Objectives: The course aims to:

1. To understand the basic Concepts of Digital marketing and the road map for successful Digital marketing strategies.
2. To know the importance of Social Media Platforms importance in Digital Marketing
3. To understand the technological importance of Search Engine Optimization (SEO)

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Learn and understand the basic Concepts of Digital marketing
- CO2: Apply digital marketing tools for suitable applications
- CO3: Examine the various social media and design Advertising campaigns
- CO4: Learn search engine optimization (SEO) techniques and apply it for suitable application to increase page views.
- CO5: Explore YouTube Digital Advertising

Course Contents

Unit I - Introduction to Digital Marketing (08 Hours)

Fundamentals of Digital marketing & Its Significance, Traditional marketing Vs Digital Marketing, Evolution of Digital Marketing, Digital Marketing Landscape, Key Drivers, The Digital users in India, Digital marketing Strategy- Consumer Decision journey Digital advertising Market in India, Skills in Digital Marketing, Digital marketing Plan.

Unit II - Digital Marketing Terminology (08 Hours)

Terminology used in Digital Marketing, PPC and online marketing through social media, Social Media Marketing, Google web-master and analytics overview, Email Marketing, Mobile Marketing Display adverting, Buying Models, different type of ad tools, Display advertising terminology, types of display ads, different ad formats

Unit III - Social Media Marketing (08 Hours)

Fundamentals of Social Media Marketing& its significance, Necessity of Social media Marketing Facebook Marketing: Facebook for Business, Facebook Insight, Different types of Ad formats, setting up Facebook Advertising Account, Facebook audience & types, Designing Facebook Advertising campaigns, Facebook Avatar, Apps, Live, Hashtags

Unit IV - Search Engine Optimization (SEO) (08Hours)

Introduction to SEO, How Search engine works, SEO Phases, History Of SEO, How SEO Works, Googlebot (Google Crawler), Types of SEO technique, Keyword Planner tools

Social media Reach- Video Creation & Submission, Maintenance- SEO tactics, Google search Engine

Unit V - Digital Advertising (08 Hours)

Different Digital Advertisement, Display Advertising Media

YouTube Advertising:- YouTube Channels, YouTube Ads, Type of Videos, Buying Models, Targeting & optimization, Designing & monitoring Video Campaigns, Display campaigns

Intrusion Detection System: IDS fundamentals, Different types of IDS. Intrusion Prevention.

Learning Resources

- **Text Books:**

1. V. Ahuja, Digital Marketing, Oxford University Press
2. D. Ryan, C. Jones, "Understanding Digital Marketing Strategies for Engaging the Digital Generation", Koganpage Publication, (2nd Edition)
3. Chinmay Kamat, Nitin Kamat, "Digital Marketing", Himalaya Publishing House, (2nd Edition)

- **Reference Books:**

1. H. Annmarie , A. Joanna, "Quick win Digital Marketing", Paperback edition, Oak Tree Press
2. Seema Gupta, "Digital Marketting", Mc Graw Hill (3d Edition)

Savitribai Phule Pune University
Second Year of Electronics and Telecommunication Engineering (2024 Course)

MDM-230-ETC: Multidisciplinary Minor-1 Data Structures and Algorithms

Teaching /scheme	Credits	Examination Scheme
Tutorial : 01 Hour/Week **Practical** : 02 Hours/Week	01 01	**TW** : 50 Marks **Practical:** 50 Marks

Prerequisite Courses: Fundamentals of Programming Languages, Basics of C Programming

Course Objectives:

To make students understand

- To understand the significance of data structures and implement searching and sorting methods using the C language.
- To learn the concept and understand the importance of time and space complexity.
- To understand data representation, implementation and applications of linear and nonlinear data structures.

Course Outcomes:

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

CO1: Apply and implement the principal sorting and searching algorithms on the given data using the C language.
CO2: Develop applications of stack and queue using arrays.
CO3: Implement and demonstrate the applicability of a Linked List.
CO4: Build, represent and traverse a Binary Search Tree.
CO5: Build, represent and traverse graphs.

Course Contents		
Unit I	**Introduction to Data Structures and Complexity Analysis**	**(04 Hours)**
Overview of Data Structures – Linear vs. Non-linear structures, Abstract Data Types (ADT), **Algorithm Analysis** – Time and Space Complexity, **Asymptotic Notations** – Big O, Omega, Theta, Best, Worst, and Average Case Analysis, **Searching Algorithms** – Linear Search, Binary Search, **Sorting Algorithms** – Bubble, Selection, Insertion		
Unit II	**Stack and Queue**	**(04 Hours)**
Stack – Implementation using Arrays, Applications (Infix to Postfix, Expression Evaluation), **Queue** – Implementation, Circular Queue, Priority Queue		
Unit III	**Linked List**	**(04 Hours)**
Pointers: Basic concepts, Pointer declaration and initialisation, **Dynamic Memory Allocation** (malloc, calloc, realloc, free), **Linked Lists** – Singly, Doubly, and Circular Linked Lists; Stack and Queue implementation using Linked list		
Unit IV	**Non-linear Data Structure: Tree**	**(03 Hours)**

Trees – Terminology, Binary Trees, Binary Search Trees (BST), Operations, **Tree Traversals** – Inorder, Preorder, Postorder (Recursive and Iterative)		
Unit V	**Non-linear Data Structure: Graphs**	**(03 Hours)**
Graphs: Representation (Adjacency Matrix/List), Traversal: BFS, DFS; Minimum Spanning Tree (Prim's and Kruskal's Algorithm)		
Learning Resources		
Textbooks: 1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Books Source, 2nd Edition 2. Richard. F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C," Cengage Learning, 2nd Edition.		
Reference Books: 1. Reema Thareja, "Data Structures using C", Oxford University Press, 2nd Edition 2. Yedidyah Langsam, Moshe J Augenstein and Aaron M Tenenbaum "Data structures using C and C++" PHI Publications, 2nd Edition.		
MOOC / NPTEL Courses: 1. Data Structure using C Programming by Dr. Dipti Verma and Mr. Aditya Tiwari: https://onlinecourses.swayam2.ac.in/nou23_cs13/preview 2. Data Structures and Algorithms: https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013842032404848640104 70_shared/overview 3. Data Structures in C: https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01329962520388403237 9/overview		

Group A: Compulsory	
1	**Student Database Management** *You are developing a student result management system. The database should support updating records, adding new entries, searching for specific students, and sorting based on performance.* Using an array of structures, implement a student database with attributes: roll no, name, program, course, subject marks, total, and average. Support operations: display, search, and sort. (Students can additionally perform modify, append.)
2	**Stack or Queue using Array (Static Implementation)** *Simulate a parcel handling system at a post office where packages are stacked (LIFO) or queued (FIFO).* Use an array to implement a stack (push, pop, display) or a queue (add, delete, display). Choose the appropriate model based on the scenario.
3	**Singly Linked List Operations** *You are building a text editor where lines of text are stored dynamically. You need to allow insertion and deletion of lines at any position, and display text both normally and in reverse.* Use a singly linked list to implement: display, insert (front/end/middle), delete (front/end/middle), display in reverse, and reverse the list.
4	**Binary Search Tree Operations** *An online directory system uses a BST to keep names in a sorted manner and support fast searching.* Create a binary search tree and implement recursive traversals (inorder, preorder, postorder) and search for a specific name in the directory.
5	**Graph Traversal** *You are designing a navigation system for a campus with multiple buildings. The system should explore possible paths (routes) using BFS or DFS.* Create a graph using an adjacency matrix and implement Breadth-First Search and Depth-First Search to explore the building connectivity.
Group B: [Any 5 to be performed]	
6	**Write a program in C to display the following patterns like** Right-angle triangle with a number: 1 12 123 1234 Diamond shape with numbers: 1 2 2 3 3 3 4 4 4 4 3 3 3 2 2 1 Pyramid with an asterisk: * * * * * * * * * * Pyramid using the alphabet: A A B A A B C B A A B C D C B A

7	**Searching Techniques** *You are building a contact manager app. A user wants to search for a contact either by scanning one by one or by using a fast lookup if the list is sorted.* Write a program that locates a specific name using both sequential and binary search techniques.
8	**Sorting Algorithms** *An online store wants to sort its product prices to help customers compare them easily. Choose suitable sorting techniques for small to medium datasets.* Implement bubble sort, selection sort, and insertion sort to reorder product prices.
9	**Stack or Queue using Linked List (Dynamic Implementation)** *Design a service window system where customers arrive and are served in order (FIFO), or a browser history system where the last visited page is accessed first (LIFO).* Use a linked list to implement a dynamic stack (push, pop, display) or queue (add, delete, display) based on the given use case.
10	**Balanced Parentheses or Decimal to Binary** Write a program to check for balanced parentheses in a given expression (including (), {}, []) using a stack implemented with arrays or linked lists. **OR** Write a program to convert a Decimal number to a binary number using a stack.
11	**Height and Depth in BST** Develop a program that constructs a Binary Search Tree and computes the height of the tree and the depth of a given node.
12	**Count and Classify Nodes** Write a program to count the number of: - Leaf nodes - Internal nodes - Nodes with only one child in a given binary tree.
13	**Train Ticket Booking System:** Implement a system to manage train ticket bookings using queues. Confirm bookings if seats are available; otherwise, add passengers to a waiting list. On cancellation, shift the first waiting passenger to confirmed status.

Group Assignment

Group Assignment Guidelines:

– Make a Group of 4 students in a batch (Batch of 20).

– The group will select any of the listed group assignments or propose a similar one with the course teacher's approval.

– After completing the assignment, the group will present it during the practical slot.

The distribution of work in a group during a presentation may include:

- Algorithm / Flowchart
- Program Explanation
- Applications

Group Assignments

1	**Matchstick Game (AI vs Human):** Design and implement a console-based **Matchstick game** where the total number of matchsticks is 21. Two players (user and computer) take turns to pick 1 to 4 match-sticks. The player forced to pick the last matchstick loses. Implement logic so that the computer never loses the game. Use control structures and functions in C. **Key Concepts:** Loops, conditionals, basic AI, user input validation
2	**Tic-Tac-Toe Game (2-Player Console Version):** Create a **2-player Tic-Tac-Toe game** that runs in the console. The game board is a 3x3 grid where players take turns marking X or O. The game should detect a win, loss, or draw condition and display the result accordingly. Use arrays and functions for board management and input handling. **Key Concepts:** 2D arrays, game logic, functions, modular programming
3	**Tower of Hanoi (Recursive Approach):** Write a program to simulate the **Tower of Hanoi** puzzle using recursion. The user provides several disks, and the program outputs the sequence of moves to transfer all disks from the source peg to the destination peg following the game rules. **Key Concepts:** Recursion, stack behavior, algorithm design
4	**Banking Transactions – Mini Statement Generator:** Develop a **Banking Transaction System** that allows the user to enter their account number and perform basic transactions such as deposit and withdrawal. Maintain a log of the last 5 transactions and display them as a **mini statement**. Use structures to simulate user accounts and transaction history. **Key Concepts:** Structures, arrays, file handling, menu-driven programs
5	**Typing Tutor (Accuracy and Speed Tracker):** Build a **Typing Tutor** that displays a random sentence for the user to type. After typing, the program calculates the typing speed (WPM), accuracy (%), and suggests corrections for misspelt words. **Key Concepts:** Strings, time library, error handling, user input analysis
6	**Calendar Generation by Year:** Create a program that accepts a **year as input** and displays the **calendar for the entire year**. It should accurately calculate leap years and place correct dates under weekdays. Use arrays and functions to handle months, days, and leap year conditions. **Key Concepts:** Control structures, arrays, functions, date-time logic

Savitribai Phule Pune University
Second Year of Electronics and Telecommunication Engineering (2024 Course)

EEM-240-ETC: Engineering Economics & Applications

Teaching /scheme	Credits	Examination Scheme
Tutorial : 01 Hour/Week **Practical** : 02 Hours/Week	01 01	**TW** : 25 Marks

Course Objectives:

To make students understand

- To understand key economic principles and the time value of money for engineering decisions.
- To learn demand forecasting, cost analysis, and decision-making under uncertainty.
- To explore market structures, pricing strategies, and value engineering in electronics.
- To develop investment evaluation skills and grasp macroeconomic impacts on tech businesses.

Course Outcomes:

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

CO1: Apply economic principles and time value of money concepts using practical tools.
CO2: Perform break-even and CVP analyses to support engineering decisions.
CO3: Analyze market competition and pricing strategies with case studies.
CO4: Evaluate projects with capital budgeting and interpret macroeconomic effects on electronics.

Course Contents		
Unit I	**Theories and Laws of Economics for Engineers**	**(04 Hours)**
Introduction to Engineering Economics, Basic economic concepts: Utility, scarcity, opportunity cost, Economic systems and firm objectives, Laws of demand and supply, elasticity, Value, wealth, and equilibrium price, Time value of money (Present Value, Future Value, annuity basics)		
Unit II	**Principles of Engineering Economics and Costing**	**(04 Hours)**
Demand forecasting techniques and applications in tech markets, Cost behaviour: Fixed, variable, marginal, total, Cost-volume-profit and break-even analysis, Decision-making under uncertainty (intro to decision theory), Economies of scale in electronics manufacturing		
Unit III	**Applications of Economics in Electronics Industry**	**(04 Hours)**
Market structures: Perfect competition, monopoly, monopolistic competition, Pricing strategies and product lifecycle costing, Game theory basics and strategic behaviour, Make-or-buy decisions and Value Engineering in electronics, Kaizen and productivity in technical operations		
Unit IV	**Investment Analysis and Applied Macroeconomics**	**(04 Hours)**

Capital budgeting: Payback period, Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index, Equipment replacement decisions, Overview of macroeconomic indicators: Gross Domestic Product (GDP), Consumer Price Index (CPI), Business cycles, inflation, interest rates, and impact, CSR, sustainability, and policy impacts on tech firms, Exposure to areas like IPR, R&D, and innovation economics

Tutorials

Any Six Tutorials can be carried out:

1. Case examples from electronics industries (e.g., Telecom spectrum pricing, consumer electronics)
2. Excel-based Time Value of Money (TVM) computations
3. Forecast demand for a telecom device (Routing and Switching Networking communication devices /AI enabled Smart IOT devices and sensor)
4. Perform break-even and Cost-Volume-Profit (CVP) analysis using spreadsheets
5. Case study: Comparison of Pricing strategy between two service providers such as of Jio, Airtel, BSNL etc.
6. To carryout mini project based on market and pricing strategy analysis of a smart device or IoT product
7. Evaluate a small-scale engineering project (e.g., setup of a lab or unit based)
8. Group discussion: Impact of government policies and budget on electronics and telecom sector

Textbooks:

1. A Textbook of Engineering Economics: The Principles and Applications, D. R. Kiran, BS Publications, 2021.
2. Engineering Economics Test & Cases, D N Dwivedi, Dr H L Bhatia & Dr S N Maheshwari, Vikas Publishing House Pvt. Ltd.

Reference Books:

1. Principles of Engineering Economics with Applications, Zahid A. Khan, Arshad N. Siddiquee, Brajesh Kumar, Mustufa H. Abidi 2nd edition, Cambridge University.
2. Practical Applications of Engineering Economics, Kal R. Sharma, Momentum Press. Engineering Economics, R. Panneerselvam, PHI Learning Private Ltd.

MOOC / NPTEL Courses:

1. Data Structure using C Programming by Dr. Dipti Verma and Mr. Aditya Tiwari: https://onlinecourses.swayam2.ac.in/nou23_cs13/preview
2. Data Structures and Algorithms: https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013842032404848640104 70_shared/overview
3. Data Structures in C: https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013299625203884032379/overview

Savitribai Phule Pune University
Second Year of Electronics and Telecommunication Engineering (2024 Course)

VEC-250-ETC: Universal Human Values & Professional ethics

Teaching /scheme	Credits	Examination Scheme
Tutorial : 01 Hour/Week **Practical** : 02 Hours/Week	01 01	**Term Work** : 25 Marks

Prerequisite Courses: UHV-1 of Student Induction Program (SIP) (desirable)

Companion Course: Universal Human Values (Practical)

Course Objectives:

The objective of this course is to provide students with

- To help the students develop a holistic, humane world-vision, and appreciate the essential complementarity between values and skills to ensure mutual happiness and prosperity
- To elaborate on 'Self-exploration' as the process for Value Education
- To facilitate the understanding of harmony at various levels starting from self and going towards family and society
- To elaborate on the salient aspects of harmony in nature and the entire existence
- To explain how the Right understanding forms the basis of Universal human values and definitiveness of Ethical human conduct
- To provide the vision for a holistic way of living and facilitate transition from chaotic life to an orderly life

Course Outcomes:

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

CO1: Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.

CO2: Explore the human being as the coexistence of self and body to see their real needs / basic aspirations clearly.

CO3: Explain relationship between one self and the other self as the essential part of relationship and harmony in the family.

CO4: Interpret the interconnectedness, harmony and mutual fulfilment inherent in the nature and the entire existence.

CO5: Draw ethical conclusions in the light of Right understanding facilitating the development of holistic technologies production systems and management models.

Course Contents		
Unit I	**Introduction to Value Education**	**(03 Hours)**

Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations and their Fulfilment, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations

Explore real life applications using Practical No. 1, 2, 3, 4

Exemplar: Personal Growth and Self-Development, Family and Relationships.

Mapping of Course Outcomes for Unit I: CO1

Unit II	**Harmony in the Human Being**	**(03 Hours)**

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health.

Explore real life applications using Practical No. 5, 6

Exemplar: Journey Towards Self and Body Awareness, Experience of Balancing Self and Body.

Mapping of Course Outcomes for Unit II: CO2

Unit III	**Harmony in the Family and Society**	**(03 Hours)**

Harmony in the Family - the Basic Unit of Human Interaction, "Trust' - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Values in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Explore real life applications using Practical No. 7, 8

Exemplar: A Rebuilding Family Relationships through Trust and Respect, Building Social Harmony through Value-Based Living

Mapping of Course Outcomes for Unit III: CO3

Unit IV	**Harmony in the Nature (Existence)**	**(03 Hours)**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Explore real life applications using Practical No. 9, 10, 11

Exemplar: Realization through Observing Nature's Cycles, Applying Harmony Principles in Life.

Mapping of Course Outcomes for Unit IV: CO4

Unit V	**Implications of the Holistic Understanding - Professional Ethics**	**(03 Hours)**

Basis for Universal Human Values, Definitiveness of (Ethical) Human Conduct, Professional Ethics in the light of Right Understanding, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Holistic Technologies, Production Systems and Management Models Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Explore real life applications using Practical No. 12, 13, 14

Exemplar: A Young Engineer's Journey to Ethical Professionalism, Commitment to Humanistic Education and Social Change.

Mapping of Course Outcomes for Unit V: CO5

Learning Resources

Textbooks:

1. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), 978-81-957703-6-6 (e-book)
2. Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)

1. Nagaraj A. (1999). Jeevan Vidya: Ek Parichaya. Jeevan Vidya Prakashan. Amarkantak.
2. Dhar, P. L., Gaur, R. R. (1992). Science & Humanism, Towards a Unified World View. India: Commonwealth Publishers.
3. A. Nagraj, 2003, Manav Vyavhar Darshan, Jeevan Vidya Prakasana, Amarkantak.
4. Banerjee, B. P. (2005). Foundations of Ethics in Management. India: Excel Books.
5. Satya, S. (2013). Sah-Astitva Siddhant Evam Samagra Vikas, Part-1(compiled articles of Dr. Yashpal Satya). Jeevan Vidya Pratishthan

e-Books:

https://uhv.org.in/frontend/download/A%20Foundation%20Course%20in%20Human%20Values%20and%20Professional%20Ethics%20(eBook)v2.pdf

MOOC / NPTEL/YouTube Links:

1. Swayam Course on "Understanding Human Being Nature and Existence Comprehensively" by Dr. Kumar Sambhav, Director, UP Institute of Design (UPID), Noida. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
2. NPTEL Course on "Exploring Human Values: Visions of Happiness and Perfect Society" by Prof. A. K. Sharma, Department of Humanities and Social Sciences, IIT Kanpur. https://nptel.ac.in/courses/109104068
3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
4. https://www.youtube.com/playlist?list=PLoVRJrAl0FT1DNRtDpYa3SGeMEm06O3Dv

e- Resources

-https://fdp-si.aicte-india.org/download.php#1/

-https://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/

Exemplar: Exemplar for Universal Human Values lies in demonstrating how values are applied practically in real-life situations to achieve harmony at all levels.

VEC-250-ETC	Universal Human Values	(TW: 25 Marks)

Guidelines for TW Assessment

For Each Practical (14 Sections)

1. Title of Practical: E.g., *Practical 1: Sharing about Oneself*

2. Objective: Briefly state the goal of the activity.

3. Activity Description: Describe what was done — e.g., discussion, video viewed, list prepared, analysis conducted, etc.

4. Your Observations/Responses:

- Share your personal experience and reflections.
- Describe what you learned.
- Mention any change in your perspective or feelings.

5. Learning Outcome: Summarize what you understood or internalized. Align it with the expected outcome listed for the practical.

Final Reflection (1–2 Pages)

Include a reflective conclusion to your report covering:

– How this course helped you know yourself better.

– Realizations about relationships, society, and nature.

– Any transformation in your thinking or conduct.

– Your commitment to ethical values and aspirations in your personal/professional life.

Formatting Instructions

- Font: Times New Roman
- Size: 12 pt
- Line Spacing: 1.5
- Margins: 1 inch on all sides
- Length: 25–30 pages (for all 14 practicals)
- Submission: Soft copy (PDF preferred) or spiral-bound hard copy as per instructor's requirement

List of Experiments

1	**Sharing about Oneself** Introduction of students with following points: yourself, family, friends, achievements and failures, your aspirations from life. How do you expect to fulfil these aspirations and live a life of fulfilment? **Expected Outcome:** The students start exploring themselves; get comfortable with each other and with the teacher and start appreciating the need and relevance of the course.

2	**Exploring Human Consciousness** Watch and discuss the documentary video "Story of Stuff". It is about the materials economy – its motivation, process and outcome. (Source: https://storyofstuff.org/movies/story-of-stuff) **Expected Outcome:** The students start finding that right understanding is the basic need of human being; followed by relationship and physical facility. They also start feeling that lack of understanding of human values is the root cause.
3	**Exploring Right Understanding** Make a list of your desires. Now for each item on the list, find out what would be necessary to fulfill it. i.e. will it require: (a) Right understanding? (b) Relationship (right feeling)? (c) Physical facility? **Expected Outcome:** Students start feeling that lack of understanding of human values is the root cause of all problems and the sustained solution could emerge only through understanding human values and value-based living.
4	**Exploring Natural Acceptance** Observation within the faculty of 'Natural Acceptance', based on which you can verify what is right or what is not right for you. Make a list of the problems in your family. For each problem, find out the most significant reason: is it related to lack of right understanding, lack of feelings in relationship or lack of physical facility? Also, find out how much time and effort you have devoted for each in the last one week. **Expected Outcome:** The students are able to see that self-verification must be based on their natural acceptance. In many cases, their actual living is not in accordance with their natural acceptance. In addition, lack of feeling in relationship is the major cause of problems in their family and with friends.
5	**Exploring the Difference of Needs of Self and Body** Take the list of desires you made in Practical 2. Update it if required. Now classify the desires as being related to the need of the Self or need of the Body. **Expected Outcome:** The students are able to relate their desires to need of the Self and the Body distinctly. They are able to see that the Self and the Body are two distinct realities, and large parts of their desires are related to the need of the Self (and not the Body).
6	**Exploring Sources of Imagination in the Self** Recall the times that your body has been ill (in disharmony) in the last 3 years. What steps were taken to restore the harmony of the Body? If you were to take full responsibility for your body (i.e., you had the feeling of self-regulation), what kind of daily schedule would you have? Approximately how much time would you allocate for keeping your body in good health? **Expected Outcome:** The students are able to list down activities related to proper upkeep of the Body and practice them in their daily routine. They are also able to appreciate the plants growing in and around the campus, which can be beneficial in maintaining their health and even curing common ailments.

7	**Exploring the Feeling of Trust** Show & discuss the video "Right Here Right Now". It is a short film directed by Anand Gandhi about human behavior and its propagation. Part 1: https://www.youtube.com/watch?v=OVAokeqQuFM Part 2: https://www.youtube.com/watch?v=gIYJePEnvUY **Expected Outcome:** The students are able to see that the natural acceptance (intention) of everyone is to be happy and make others happy! It is the competence is lacking in themselves and in others. They are able to distinguish between reaction and response, appreciate the need for 100% response in human-human interaction and make effort towards it.
8	**Exploring the Feeling of Respect** List out ten or more of your interactions with other people in your family and friends in the last one week. Now analyse these interactions were over-evaluation, under-/otherwise evaluation or right evaluation of the other? In each interaction, were you comfortable within, uncomfortable within or unaware of your state? **Expected Outcome:** The students are able to see that respect is the right evaluation (of intention and competence). Only right evaluation leads to fulfilment in relationship. Over evaluation leads to ego and under/otherwise evaluation leads to depression.
9	**Exploring Systems to Fulfil Human Goal** Assuming that you would like to see your hostel/educational institution/workplace/neighborhood as a model of human society, write down its goal(s) and the system to achieve these goals. **Expected Outcome:** The students are able to see that as a family, a society, the comprehensive human goal is naturally acceptable to all. They are able to see that the systems required for their fulfilment include: Education–Sanskar, Health–Self regulation, Production–Work, Justice–Preservation and Exchange–Storage. Meaningful participation by every individual, every family, every family cluster… every village, town, city… country and the whole world is required in these systems for the human goals to be fulfilled.
10	**Exploring the Four Orders of Nature** Watch and discuss the documentary video "An Inconvenient Truth". It is about global climate change presented by Former US Vice President Al Gore. He raises the question "What were you doing when you had the time to do something?" (Source: http://an-inconvenient-truth.com/) **Expected Outcome:** The students are able to appreciate the interconnectedness, interdependence and the relationship of mutual fulfilment existing in nature. They are able to see that they have a natural acceptance to participate in a mutually fulfilling manner in nature.

11	**Exploring Co-existence in Existence** Observe your Self. Are you in space? Are you getting energy from the body? Is your energy dependent on the body? When your body is sick, does your energy to think diminish? Are you energized in space? Is the body dictating you? Are you self-organized in space? **Expected Outcome:** The students are able to obtain a holistic vision about the existence. It is in the form of co-existence, rather than a chaos. Every unit is energized, self-organized and is participating with other units in an orderly manner for mutual-fulfilment. It is only the human being without right understanding, which is violating this underlying co-existence. They are able to appreciate the need to understand the co-existence in existence.
12	**Exploring Ethical Human Conduct** Watch and discuss the video "Hiware Bazaar". It is a documentary about a progressive village in Maharashtra, India about how good governance, along with the people of the village have made significant change in their society. (Source: https://www.youtube.com/watch?v=cb0Qvh9BJ0s) **Expected Outcome:** The students are able to clearly visualize the co-relation between lack of Human Values and the prevailing problems. They are also able to visualize tangible steps and a roadmap for moving in the cherished direction – for a humane society.
13	**Exploring Humanistic Models in Education** By careful analysis, identify some important features to make our education more humanistic. What are the right expectations in terms of the outcome from humanistic education? Explain with justification. **Expected Outcome:** The students are able to detail out various social systems essential for their own fulfilment, as well as the fulfilment of future generations. In particular, they are able to visualize the education system required for individual, and then societal transformation. They are also able to appreciate those many efforts made in the tradition that were in line with desirable human goals. Thus, they are able to learn from tradition and develop a deep sense of gratitude for the effort, for the people, for the tradition, culture etc.
14	**Exploring Steps of Transition towards Universal Human Order** Suggest ways in which you can use your knowledge of Technology/Engineering/Management/Medicine etc. for universal human order, from your family order to the world family order. Evaluate your state before and after the course in terms of (a) Thought (b) Behaviour (c) Work (d) Realization **Expected Outcome:** The students are able to visualize an appropriate utilization of the knowledge in their respective streams to ensure mutually enriching and sustainable systems. They are able to sincerely evaluate the course and the transformation experienced in this process. They are also able to envision the road map for moving towards a happy and prosperous life, including an ethical conduct of their profession.

Learning Resources
Textbooks: 1. *A Foundation Course in Human Values and Professional Ethics*, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), 978-81-957703-6-6 (e-book) 2. *Teacher's Manual for A Foundation Course in Human Values and Professional Ethics*, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)
Reference Books: 1. Nagaraj A. (1999). *Jeevan Vidya: Ek Parichaya*. Jeevan Vidya Prakashan, Amarkantak. 2. Dhar, P. L., Gaur, R. R. (1992). *Science & Humanism, Towards a Unified World View*. India: Commonwealth Publishers. 3. A. Nagaraj, (2003), *Manav Vyavhar Darshan*, Jeevan Vidya Prakashan, Amarkantak. 4. Banerjee, B. P. (2005). *Foundations of Ethics in Management*. India: Excel Books. 5. Satya, S. (2013). *Sah-Astitva Siddhant Evam Samagra Vikas*, Part-1 (compiled articles of Dr. Yashpal Satya). Jeevan Vidya Pratishthan.

Savitribai Phule Pune University Second Year of Electronics and Telecommunication Engineering (2024 Course)		
CEP-260-ETC: : Community Engagement Project		
Teaching /scheme	**Credits**	**Examination Scheme**
Practical : 04 Hours/Week	02	**Term Work :** 25 Marks

Companion Course :

1. CEP is an experiential learning approach that combines education, learning, community development, and meaningful community service.
2. Project involves students in community development and service activities and applies the experience to personal and academic development.
3. The targeted contribution of college students to the village/local development will benefit the community.
4. The college has an opportunity to help students become more socially conscious and responsible while simultaneously becoming a socially conscious organization.

Course Objectives: The course aims to:

1. Establish a mutually beneficial relationship between the college and the community
2. Opportunities to engage with their local community, fostering empathy, teamwork, and problem-solving skills while contributing positively to their surroundings.
3. An understanding of the challenges faced by the local community and the role of engineering in addressing those challenges.
4. The ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
5. The skills to evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact

Course Outcomes: Upon successful completion of this course, students will be able to:

1. CO1 - **Identify** and **Analyze** local community needs and challenges by engaging with stakeholders and evaluating real-world problems.
2. CO2- **Design** and **Implement** practical, creative, and context-specific solutions using engineering principles to address community issues.
3. CO3 - **Reflect** and **Evaluate** the effectiveness of their interventions and articulate lessons learned through reports and presentations.

Course Contents
Implementation

- A group of 3 to 4 students or a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise.
- Each group is allotted to a faculty member of the department as a mentor.
- The group of students will be associated with a government official / village authorities /NGOs etc. concerned, allotted by the district administration, during the duration of the project.
- The Community Engagement Project should be different from the regular programmes of NSS/NC-C/Green Club/Hobby Clubs, Special Interests Groups etc
- An activity book has to be maintained by each of the students to record the activities undertaken/involved and will be countersigned by the concerned mentor/HoD.
- Project report shall be submitted by each student/group of students.
- An internal evaluation shall also be conducted by a committee constituted by the HoD. Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor/HoD.
- Students groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries or in advocating prohibition of liquor or about renewable energy, e-waste management or any other activity in an area of their studies and as per his/her aptitude.

Suggestive list of topics under Community Engagement Project

The below lists are not exhaustive and open for HoD's or mentors to add, delete or modify. It is expected that the focus should be on specific local issues in their nearby areas.

The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a student/group of students shall

- Use and/or miss-use of cell phones
- Career orientation of youth
- Water facilities and drinking water availability
- Health and hygiene of the school going students, home makers and old personals
- Health intervention and awareness programmes
- Horticulture
- Herbal and Nutrition
- Traditional and Modern health care methods
- Food habits
- Air /Sound /Water pollution

- Plantation and Soil protection
- Renewable energy and Solar Systems
- Yoga awareness and practice
- Health care awareness programmes and their impact
- Organic farming
- Food adulteration
- Incidence of Diabetes and other chronic diseases
- Blood groups and blood levels
- Chemicals in daily life
- Music and dance
- Women education and empowerment

Project Scope

- Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.
- Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.
- Promote health through awareness programs on hygiene, nutrition, and exercise.
- Teach basic computer or technical skills to students, staff, or the community

Proposal Submission

CEP Group should Submit a two-page project proposal, preferably prior to the term commencement outlining the following:-

- Title of the project
- Aim, Objective and expected outcome
- Plan of execution (timeline and activities).
- Place of the CEP and involvement of any local authority, NGP
- Required resources (if any).

- Get approval from the designated faculty mentor.

Learning Resources

Text Books:

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.
2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.
3. Design Thinking for Social Innovation. IDEO Press, 2015.
4. Dostilio, L. D., et al. The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education. Stylus Publishing, 2017

- **MOOC / NPTEL/YouTube Links:**

1. NPTEL course: Ecology and Society https://onlinecourses.nptel.ac.in/noc20_hs77/preview

Web Links: -

1. UNESCO: Education for Sustainable Development https://www.unesco.org
2. EPICS (Engineering Projects in Community Service) https://engineering.purdue.edu/EPICS
3. Ashoka: Innovators for the Public https://www.ashoka.org
4. Design for Change https://www.dfcworld.com