Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2022
'B^{++}' Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

(As per New Education Policy 2020)

Subject:- Electronics & Telecommunication Engineering

Name of the Course: Second Year B. Tech (Sem.– III & IV)

(Syllabus to be implemented from-2024-25)

PUNYASHLOK AHILYADE VI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE& TECHNOLOGY

Electronics & Telecommunication Engineering

Programme Educational Objectives and Outcomes

A. Program Educational Objectives

1. To make students competent for professional career in Electronics & allied fields.
2. To build strong fundamental knowledge amongst student to pursue higher education and continue professional development in Electronics & other fields
3. To imbibe professional ethics, develop team spirit and effective communication skills to be successful leaders and managers with a holistic approach.
4. To nurture students to be sensitive to ethical, societal & environmental issues while conducting their professional work.

B. Program Outcomes

Electronics & Telecommunication Engineering Graduate will be able to –

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader indiverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

C. Program Specific Outcomes

1. **Solid foundation** : Graduates will be able to attain a **solid foundation** in Electronics and Tele-Communication Engineering with an ability to function in multidisciplinary environment.
2. **Techniques and Skills**: Graduates will be able to use **techniques and skills** to design, analyze, synthesize, and simulate Electronics and Communication Engineering components and systems.
3. **Developing Programs:** Graduate will be capable of **developing programs** in Assembly, Highlevel and HDL languages using contemporary tools for software development.

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

S. Y. B. Tech (Electronics & Telecommunication Engineering)

NEP 2020 Compliant Curriculum With effect from 2024-2025

Semester –III

Distribution	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*			*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	*OE/ POE*	
PCC	ENTPCC-01	Network Theory Analysis	3			03	70	30			100
PCC	ENTPCC-02	Electronics Circuit Analysis and Design	3			03	70	30			100
PCC	ENTPCC-03	Analog and Digital Communication	3		2	04	70	30	25	25	150
CEP/FP	ENTFP-01	Electronics Circuit Analysis & Design Lab			2	01			25	25	50
CEP/FP	ENTFP-02	PCB Design Lab			2	01			25	25	50
Entrepreneurship	EM-01	Product Development and Entrepreneurship	1	1		02		50	25		75
OE	OE-01	Open Elective-I	2		2	03	70	30	25		**125**
MD M	ENTMDM-01	MD Minor-I	2		2	03	70	30	25		**125**
VEC	VEC-01	Universal Human Values	1		2	02	50*		25		**75**
		Total	**15**	**1**	**12**	**22**	**400**	**200**	**175**	**75**	**850**
		Environmental Science	**1**								

***For UHV MCQ-based examination to be conducted.**

BSC- Basic Science Course, ESC- Engineering Science Course, PCC- Programme Core Course,

AEC- Ability Enhancement Course IKS- Indian Knowledge System, CC- Co-curricular Courses,

VSEC-Vocational and Skill Enhancement Course

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FACULTY OF SCIENCE & TECHNOLOGY

S. Y. B. Tech (Electronics & Telecommunication Engineering)

NEP 2020 Compliant Curriculum With effect from 2024-2025

Semester –IV

Distribution	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*			*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	*OE/ POE*	
PCC	ENTPCC-04	Signals and Systems	3			03	70	30			100
PCC	ENTPCC-05	Control System	2	1		03	70	30	25		125
PCC	ENTPCC-06	Analog Integrated Circuits	3		2	04	70	30	25	25	150
SEC	ENTSEC-01	Data Structure	1		2	02			25	25	50
Economic/ Management	EM-02	Project Management and Economics	2		0	02		25	25		50
OE	OE-02	Open Elective-II	2		2	03	70	30	25		125
MDM	ENTMDM-02	MD Minor-II	2		2	03	70	30	25		125
VEC	VEC-01	Professional Ethics	1		2	02	50*		25		75
		Total	**16**	**1**	**10**	**22**	**400**	**175**	**175**	**50**	**800**
		Environmental Science	**1**				**40**	**10**			**50**

***VEC-01 Examination will be MCQ based**

BSC- Basic Science Course ESC- Engineering Science Course, PCC- Programme Core Course , AEC- Ability Enhancement Course, IKS- Indian Knowledge System, CC- Co-curricular Courses,

VSEC-Vocational and Skill Enhancement Course

Basket of Multidisciplinary Minor (MDM)

A) Multidisciplinary Minor in "Controllers and Applications"

Semester	Course Code	Course Title
III	ENTMDM-01A	Digital Techniques
IV	ENTMDM-02A	8051 Microcontroller
V	ENTMDM-03A	PIC Microcontroller
VI	ENTMDM-04A	Advanced Microcontrollers
VII	ENTMDM-05A	Programmable Logic Controller

B) Multidisciplinary Minor in "Internet of Things"

Semester	Course Code	Course Title
III	ENTMDM-01B	Sensor Technology
IV	ENTMDM-02B	Fundamentals of IoT
V	ENTMDM-03B	IoT Networks and Security
VI	ENTMDM-04B	Industrial IoT
VII	ENTMDM-05B	IoT Cloud Platform

Multidisciplinary Minors are for the students of Other Program

List of Open Electives 01 (Semester –III)

1. OE-01A: Advanced Mathematics and Statistics
2. OE-01B Digital Marketing and E-Commerce
3. OE-01C Humanities and Social Sciences
4. OE-01D Industrial and Quality Management
5. OE-01E Mathematics for Software and Hardware
6. OE-01F Soft Skills and Personality Development

List of Open Electives 02 (Semester –IV)

1. OE-02A Entrepreneurship and Innovation
2. OE-02B Environmental Sustainability
3. OE-02C Renewable Energy
4. OE-02D Measurement, Instrumentation and Sensors
5. OE-02E Operation Research
6. OE-02F Computational Mathematics
7. OE-02G Professional Business Communication

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NEP 2020 Compliant

Honors Degree Curriculum With effect from 2024-2025

Honors Degree Structure: Artificial Intelligence and Machine Learning

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ENTHON-01A	Computational Statistics	3	1		4	70	30	25	125
IV	ENTHON-02A	Artificial Intelligence	3		2	4	70	30	25	125
V	ENTHON-03A	Machine Learning	3		2	4	70	30	25	125
VI	ENTHON-04A	AI Applications	3		2	4	70	30	25	125
VII	ENTHON-05A	Mini Project			4*	2			50	50
		Total	**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

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NEP 2020 Compliant

Honors Degree Curriculum With effect from 2024-2025

Honors Degree Structure: Data Science

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ENTHON-01B	Database Management System	3	1		4	70	30	25	125
IV	ENTHON-02B	Machine Learning	3		2	4	70	30	25	125
V	ENTHON-03B	Data Analytics	3		2	4	70	30	25	125
VI	ENTHON-04B	Business Intelligence	3		2	4	70	30	25	125
VII	ENTHON-05B	Mini Project			4*	2			50	50
Total			**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

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FACULTY OF SCIENCE & TECHNOLOGY

NEP 2020 Compliant

Honors Degree Curriculum With effect from 2024-2025

Honors Degree Structure: Internet of Things

Semester	***Course Code***	***Name of the Course***	***Engagement Hours***			***Credits***	***FA***	***SA***		***Total***
			L	***T***	***P***		***ESE***	***ISE***	***ICA***	
III	ENTHON-01C	Fundamentals of IoT	3	1		4	70	30	25	125
IV	ENTHON-02C	Industrial IoT	3		2	4	70	30	25	125
V	ENTHON-03C	IoT Cloud Platform	3		2	4	70	30	25	125
VI	ENTHON-04C	Architecting IoT Solutions	3		2	4	70	30	25	125
VII	ENTHON-05C	Mini Project			4*	2			50	50
		Total	**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

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FACULTY OF SCIENCE & TECHNOLOGY

NEP 2020 Compliant

Honors Degree Curriculum With effect from 2024-2025

Honors Degree Structure: Railway Engineering

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ENTHON-01D	Railway Engineering: A Beginner's Perspective	3	1		4	70	30	25	125
IV	ENTHON-02D	Data Communication and Signaling in Railway	3		2	4	70	30	25	125
V	ENTHON-03D	Applications of IT and Control Engineering in Railway	3		2	4	70	30	25	125
VI	ENTHON-04D	Advanced Communication and Modern Signaling in Railway	3		2	4	70	30	25	125
VII	ENTHON-05D	Mini Project			4	2			50	50
		Total	**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

Semester III

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech (Electronics & Telecommunication Engineering)

Semester-III (as per NEP) w.e.f. 2024-25

ENTPCC- 01 Network Theory Analysis

Teaching Scheme:
Lectures – 3 Hours/week, 3 credits

Examination Scheme:
ESE – 70 Marks
ISE – 30 Marks

Course Objectives:

1. To develop skills for analysis of linear circuits with dependent and independent DC excitations.
2. To understand concept of resonance in electric circuits and its applications.
3. To analyze transient and steady state response for linear circuits.
4. To know fundamentals of two port network, passive filters, Attenuators.

Course Outcomes: At the end of this course, student will be able to –

1.Analyze linear circuit with use of different network theorems and analysis methods.

2.Compute two port network parameters and draw equivalent network.

3.Determine transient and steady state response of linear circuits.

4.Design passive filter and attenuator circuits.

Course Prerequisite:

KVL, KCL, star-delta transformation.

SECTION I

Unit 1: Circuit Analysis and Network Theorems: [08Hrs]

Types of Network Elements, Types of Sources and Source transformation, Mesh and Nodal Analysis, Concept of Supermesh & Supernode, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems. Numerical problems based on DC analysis.

Unit 2: Resonance: [05Hrs]

Series resonance: Series resonance, impedance and phase angle of series resonant circuit, voltage and current in series resonant circuit. Effect of resistance on frequency response curve, Bandwidth,
Selectivity, Magnification factor, and Quality factor.

Parallel resonance: Parallel resonant circuit (Tank circuit), resonant frequency, and variation of Impedance with frequency, reactance curves. Comparison and applications of series and parallel resonant circuits, Numerical problems based on above.

Unit 3: Two Port Networks: **[07Hrs]**

Two port Network: Open circuit impedance parameters (Z), Short circuit admittance parameters (Y), Transmission parameters (ABCD), Hybrid parameters (H), and reciprocity and symmetry conditions. Interconnection of two port networks: Parallel, Series and Cascade connection of two port networks, T and π representation.

SECTION II

Unit 4: Transient Response: **[08Hrs]**

Review of Laplace Transform Basics
Evaluation and analysis of transient and steady state response of following:
RL circuit: DC voltage and current response.
RC circuit: DC voltage and current response
RLC circuit: DC voltage and current response.

Unit 5: Network Function: **[05Hrs]**

Complex frequency: Concept of complex frequency
Network function**:** Driving point and transfer functions for one and two port networks, Poles and Zeros of network function. Time domain behavior from poles and zero plot.

Unit 6: Filters and attenuators: **[07Hrs]**

Filters: Classification & characteristics of filters, Constant K type Filters, m-derived filter, section m derived LPF, HPF, BPF and BSF.
Attenuators: Relationship between Neper and Decibels, Design of T, π and Lattice attenuators.

Text books:

1. Circuit and network analysis and synthesis by A Sudhakar and Sham Mohan S Palli. TMH publication. 3rd Edition
2. Electric circuit analysis by Ramesh Babu, Scientech Publication
3. Electrical network by Ravish Singh, TATA McGraw-Hill
4. Circuit Theory (Analysis and Synthesis) A. Chakrabarti DhanpatRai and Co. 6th Edition.
5. Network Analysis & Synthesis- Franklin Kuo, Wiley Publication.
6. Network Fundamentals & Analysis- Kaduskar, Wiley Publication.

Reference Books:

1. Network Analysis M.E. Van Valkenburg, PHI publication. 3rd Edition
2. Network and System - D. Roy Choudhary, Wiley Eastern (2nd Edition).
3. Theory and problems of Electric Circuits Joseph Administer, Shaum's Series

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Semester-III (as per NEP) w.e.f. 2024-25

ENTPCC- 02 Electronics Circuit Analysis and Design

Teaching Scheme:
Lectures – 3 Hours/week, 3 credits

Examination Scheme:
ESE – 70 Marks
ISE – 30 Marks

Course Prerequisite: This course requires knowledge of PN junction diode & basic components R, L & C. Analysis of circuits using Kirchhoff's laws is required.

Course Objectives:

1. To make students analyze wave shaping circuits & voltage multipliers.
2. To make student analyze filter circuits.
3. To make students design and analyze unregulated power supply.
4. To make students comprehend the working of BJT with basic configurations and its hybrid model.
5. To make students design and analyze single-stage feedback amplifiers using BJT amplifiers.
6. Describe and verify the characteristics of JFET, MOSFET, and their applications.

Course Outcomes: At the end of this course, student will be able to –

1. Analyze wave-shaping circuits & voltage multipliers.
2. Analyze filter circuits and its comparison.
3. Analyze unregulated power supply designed using rectifier and filter.
4. Elaborate working, characteristics, and hybrid model of BJT.
5. Analyze negative feedback amplifiers designed using BJT.
6. Describe the construction, working & drain characteristics of JFET and MOSFET.

Section-I

Unit No. 1 Diode and its Special applications: [07 hrs]

Half wave rectifier, Full wave rectifier and Bridge Rectifier (Detailed analysis of all circuits include calculations of various parameters such as Io (rms), Vo (rms), Io (avg), Vo (avg), Ripple Factor, Efficiency, TUF, PIV)
Special Applications: **Clipping Circuits–**Classification of clipper circuits - Series, Shunt, Positive, Negative and Combinational clippers. Design problems on clipper circuit, **Clamper Circuits-**Positive and Negative clamper circuits. Design problems on clamper circuit. **Voltage multipliers:** Voltage Doubler and Tripler.

Unit No. 2 Filter Circuits: [06 hrs]

Filter definition, Classifications of filter circuits- Capacitor Filter, Inductor filter, LC and π Filter (Analysis of all filter circuits and their comparison), design problems on filter circuits.

Unit No. 3 Design of unregulated power supply: [07 hrs]

Design of unregulated power supply using Rectifier and Filter (design includes selection of Transformer, Diode and Filter Components), Zener diode as a voltage regulator.

Section-II

Unit No. 4 Bipolar Junction Transistor: [07 hrs]

BJT characteristics– common base, common emitter & common collector configuration- early effect, punch through effect. BJT biasing DC load line and Q point, analysis of voltage divider biasing circuit expression for stability factor, h-model of BJT, applications of BJT as an amplifier. **Multistage transistor amplifiers:** Need of cascading, different coupling schemes, Design of single stage RC coupled CE amplifier.

Unit No. 5 Feedback Amplifier: [06 hrs]

Classification of amplifiers, feedback concept, General characteristics of negative feedback amplifiers, Feedback Topologies and analysis (with numerical examples), Effect of negative feedback on stability, Bandwidth, noise, distortion, i/p resistance and o/p resistance.

Unit No.6 Field Effect Transistor: [07hrs]

Introduction, Construction and working, JFET characteristics (Transfer and Drain), Schockley's equation, JFET biasing and DC analysis, JFET as CS amplifier, MOSFET-Construction, working & V-I characteristics, application as a switch and as a CS amplifier, CMOS introduction.

List of Experiments: - (Minimum eight experiments from the following list)

1. Analysis & verification of clipper & clamper circuit
2. Analysis & verification of voltage multiplier circuit
3. Performance, parameters of filter circuit
4. Design of unregulated power supply using bridge rectifier & capacitor filter
5. I/O characteristics of CE configuration
6. I/O characteristics of CB configuration
8. Design and analysis of single-stage CE amplifier.
9. V-I characteristics of JFET.
10. V-I Characteristics of MOSFET
11. Application of MOSFET as a switch.
12. Application of MOSFET as an amplifier

Textbooks:

1. Electronic Devices and Circuits Allen Mottershed PHI Publication.
2. Electronic Devices and Circuits- J.B. Gupta 3rd Edition KATSON Books.
3. A Practical Approach to Electronic Circuit Design -D S Mantri & G P Jain, Nikita Publication
4. Electronics Devices and Circuits-S. Shalivahanan, N. Suresh Kumar, TMH Publication.

Reference Books:

1. Electronic Devices Floyd Pearson Education
2. Microelectronics: Digital and Analog Circuits and Systems- Jacob Millman
3. Electronic Devices and Circuit Theory Boylestad Pearson Education
4. “Microelectronics Circuit” by Sedra Smith, Oxford University Press, 4thEdition.

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Semester-III (as per NEP) w.e.f. 2024-25

ENTPCC- 03 Analog and Digital Communication

Teaching Scheme:	**Examination Scheme:**
Lectures – 3 Hrs/week, 3 credits	**ESE – 70 Marks**
Practicals - 2 Hrs/week, 1 credits	**ISE – 30 Marks**
	ICA - 25 Marks
	POE – 25 Marks

Course Objectives:

1. To learn about theoretical aspects of analog and digital communication system and compute spectra of modulated signals.
2. To introduce to student sampling theorem & pulse modulation techniques.
3. To make student understand different carrier modulation and detection techniques along with their performance analysis.
4. To learn about error detection and correction to produce optimum receiver.
5. To make student simulate some of above systems using suitable simulation tool.

Course Outcomes:

After completing this course, student shall be able to –

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth.
2. Use data and pulse communication techniques.
3. Analyze Source and Error control coding.
4. Students are able to perform mathematical

SECTION – I

Unit 1: Introduction to Analog Communication [07 Hrs]

Introduction of Communication, Element of a communication systems, Base band & Carrier communication Modulation and Demodulation, Need of Modulation, Type of modulation, Introduction to noise, Types of Noise, Bandwidth, Application of communication.

Unit 2: AM Transmission and Reception [08 Hrs]

Block Diagram of AM Transmitter, Modulation Index, Generation of AM (DSBFC) and its spectrum. DSBSC – multiplier modulator, Nonlinear generation, switching modulator, Ring modulator & its spectrum, SSBSC, ISB & VSB, their generation methods & Comparison, Block diagram of TRF AM Receivers, Super Heterodyne Receiver, Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection and IFRR. AM Detection: Rectifier detection, Envelope detection; Demodulation of DSBSC: Synchronous detection; Demodulation of SSBSC: Envelope detection

Unit 3: FM Transmission and Reception [06Hrs]

Mathematical analysis of FM and PM, Frequency spectrum analysis of FM, Modulation Index, Narrow Band and wide band FM, Comparison of AM, FM and PM, Direct and indirect methods of FM generation, Need for Pre-emphasis, De-emphasis. FM detection Techniques - Slope Detector, Foster Seeley Discriminator

SECTION- II

Unit 4: Introduction to Digital Communication System [0**7 Hrs]**

Introduction to information theory, average and mutual information, Entropy, Joint Entropy and conditional entropy, Rate of information, redundancy, channel capacity, Shannon Fano coding, Basic block diagram of digital communication system, comparison of analog & digital system, Introduction to pulse modulation.

Unit 5: Digital Modulations Techniques [0**8 Hrs]**

Quantization – Uniform & Non uniform, Types of digital modulation system- PCM System, Differential PCM, Delta Modulation – Noise in DM, ADM, Line Coding Techniques, Binary ASK, FSK, PSK, Coherent and non-coherent Detection. DPSK, QPSK, QAM, Comparison of digital modulation schemes

Unit 6: Error Control Codes [0**6 Hrs]**

Introduction to linear block code, linear block code examples, generator matrix, systematic linear block codes, Parity-check matrix, Syndrome testing, Error correction.

Internal Continuous Assessment:

ICA consists of Minimum 8 experiments performed on above syllabus out of which at least 2 experiments must be using MATLAB / Scilab)

Suggestive List of Practicals on

1. AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal.

2. AM detection using Envelope Detector - Practical diode detector, Observe effect of change in RC time constant which leads to diagonal and negative clipping

3. Frequency modulator & demodulator, calculation of modulation index & BW ofFM into time domain & frequency domain.

4. Generate AM signal using suitable software.

5. Generate FM signal using suitable software.

6. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), reconstruction of original signal, Observe Aliasing Effect in frequency domain.

7. PWM Technique & reconstruction of original signal.

8. PPM Technique & reconstruction of original signal.

9.To study PCM technique.

10. To analyze different Data Formats

11. ASK

12. FSK

13. PSK

Text Books:

1. George Kennedy, “Electronic Communication Systems” 5th Edition, McGraw-Hill.

2. Dennis Roddy & Coolen, “Electronic Communication”,4th Edition, Prentice Hall.

3. Communication System Analog & Digital – Singh & Sapre.-TMH.

4. Communication Systems (Analog and Digital) – Sanjay Sharma –Katsons

Reference Books:

1. Principles of Communication System – Taub & Schling-TMH

2. Digital & Analog Communication systems – K. Sam Shanmugan-Wiley

3. Contemporary Communication system using MATLAB by John G. Proakis, M Asonid Salehi, Genhard Bauch

4. B. P. Lathi, “Modern Digital and Analog. Communication Systems”, 3rd Edition, Oxford University Press.

5. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley &Sons.

6. Taub & Schilling, “Principles of Communication Systems”, Tata McGraw-Hill.

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Semester-III (as per NEP) w.e.f. 2024-25

ENTFP- 01 Electronics Circuit Analysis and Design Lab

Teaching Scheme:
Practicals- 2 Hours/week, 1 credits

Examination Scheme:
ICA – 25 Marks
POE – 25 Marks

Course Prerequisite: This course requires knowledge of PN junction diode & basic components R, L & C. Analysis of circuits using Kirchhoff's laws is required.

Course Objectives:

1. To make students analyze wave shaping circuits & voltage multipliers.
2. To make student analyze filter circuits.
3. To make students design and analyze unregulated power supply.
4. To make students comprehend the working of BJT with basic configurations and its hybrid model.
5. To make students design and analyze single-stage feedback amplifiers using BJT amplifiers.
6. Describe and verify the characteristics of JFET, MOSFET, and their applications.

Course Outcomes: At the end of this course, student will be able to –

1. Analyze wave-shaping circuits & voltage multipliers.
2. Analyze filter circuits and its comparison.
3. Analyze unregulated power supply designed using rectifier and filter.
4. Elaborate working, characteristics, and hybrid model of BJT.
5. Analyze negative feedback amplifiers designed using BJT.
6. Describe the construction, working & drain characteristics of JFET and MOSFET.

List of Experiments: - (Minimum eight experiments from the following list)

1. Analysis & verification of clipper & clamper circuit
2. Analysis & verification of voltage multiplier circuit
3. Performance, parameters of filter circuit
4. Design of unregulated power supply using bridge rectifier & capacitor filter
5. I/O characteristics of CE configuration
6. I/O characteristics of CB configuration
8. Design and analysis of single-stage CE amplifier.
9. V-I characteristics of JFET.
10. V-I Characteristics of MOSFET
11. Application of MOSFET as a switch.
12. Application of MOSFET as an amplifier

Textbooks:

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2. Electronic Devices and Circuits- J.B. Gupta 3rd Edition KATSON Books.
3. A Practical Approach to Electronic Circuit Design -D S Mantri & G P Jain, Nikita Publication
4. Electronics Devices and Circuits-S. Shalivahanan, N. Suresh Kumar, TMH Publication.

Reference Books:

1. Electronic Devices Floyd Pearson Education
2. Microelectronics: Digital and Analog Circuits and Systems- Jacob Millman
3. Electronic Devices and Circuit Theory Boylestad Pearson Education
4. “Microelectronics Circuit” by Sedra Smith, Oxford University Press, 4thEdition.

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Semester-III (as per NEP) w.e.f. 2024-25

ENTFP- 02: PCB Design Lab

Teaching Scheme:
Practical - 2 Hrs/week, 1 credits

Examination Scheme:
ICA - 25 Marks
POE – 25 Marks

Prerequisites: Knowledge of analog and digital circuits, Chemistry.

Course Objectives:

1. The need for PCB design and steps involved in PCB design and fabrication process.
2. To familiarize schematic and layout design flow using Electronic Design Automation (EDA) Tools.

Course Outcomes:

At the end of this course, the student will be able to -

COs	Course Outcomes
CO1	Understand the steps involved in schematic, layout, fabrication, and assembly process of PCB design.
CO2	Design (schematic and layout) PCB for analog circuits, and digital circuits.
CO3	Design (schematic and layout) and fabricate PCB for simple circuits.
CO4	Evaluate an electronic printed circuit board for a specific applications.

Course Structure

Sr No.	List of Experiments	No. of Practical Hours
1	Introduction to PCB design steps of Schematic design, layout design, create new schematic components and component footprint.	2
2	Fabrication of DC regulated power supply	2
3	Amplifier design using transistor	2
4	Astable/ Monostable multivibrator using IC555	2
5	Inverting/non-inverting amplifier circuit using op amp.	2
6	Full-Adder using half-adders.	2
7	Design an 8051-development board having serial communication section consisting of Max232 capacitor, DB9 connector, jumper, Reset circuit, Crystal Oscillator, Input /output sections, LEDs. Design an 8051 Development board having Reset & Input /output sections consisting of 89C51 Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crstal Oscillator, Capacitors.	2
8	Fabricate single-sided PCB, mount the components, and assemble in a cabinet for any one of the circuits mentioned above. 2	2
9	Fabricate single-sided PCB, mount the components, and assemble in a cabinet for any one of the circuits mentioned above. – 3 or 4 or 5	2
10	Fabricate single-sided PCB, mount the components, and assemble in a cabinet for any one of the circuits mentioned above. – 6 or 7	2
11	Identification of various types of PCB and soldering techniques	2

PCB Lab: (a) Artwork & printing of a simple PCB. (b) Etching & drilling of PCB.

Tools: Eagle /OrCAD/ Proteus/ Any others PCB design software

Internal Continuous Assessment (ICA):

▪ ICA shall consist of minimum eight practicals based on mentioned list of experiments.
(Minimum two experiments based on fabrication of PCB)

Text books:

1. Printed Circuit Board by RS Khandpur, Tata McGraw Hill Education Pvt Ltd., New Delhi
2. Electronic Product Design Volume-I by S D Mehta, S Chand Publications
3. Designing Circuit board with Eagle, Matthew Scarpino-Prentice Hall.
4. EAGLE Tutorial Version 4.1 , CadSoft Computer Inc.
5. Open source EDA Tool KiCad Tutorial: http://kicad-pcb.org/help/tutorials/
6. PCB Fabrication user guide page: http://www.wikihow.com/Create-Printed-Circuit- Boards
7. PCB Fabrication at home(video): https://www.youtube.com/watch?v=mv7Y0A9YeUc,
8. https://www.youtube.com/watch?v=SkxbnIypGwY
9. https://www.youtube.com/watch?v=imQTCW1yWkg

Reference Books:

1. Printed circuit Board Design and technology, Walter C. Bosshart
2. Printed Circuits Handbook, Sixth Edition,by Clyde F. Coombs, Jr, Happy T. Holden, Publisher: McGraw-Hill Education Year: 2016

3. Complete PCB Design Using OrCAD Capture and PCB Editor, Kraig Mitzner Bob Doe Alexander Akulin Anton Suponin Dirk Müller, 2nd Edition 2009

Multidisciplinary Minors

A) Multidisciplinary Minor in "Controllers and Applications"

Semester	Course Code	Course Title
III	ENTMDM-01A	Digital Techniques

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech (Electronics & Telecommunication Engineering)

Semester-III (as per NEP) w.e.f. 2024-25

ENTMDM- 01A: Digital Techniques

Teaching Scheme:
Lecture - 2 Hrs/week, 2 credits
Practical - 2 Hrs/week, 1 credits

Examination Scheme:
ESE- 70 Marks
ISE - 30 Marks
ICA – 25 Marks

Course Objectives:

1. To demonstrate the use of codes and k-map minimization techniques in digital circuits.
2. To design combinational logic circuits using logic gates.
3. To illustrate the use of flip-flops in digital circuits.
4. To design asynchronous and synchronous sequential logic circuits.

Course Outcomes: At the end of this course, students will be able to –

1. Demonstrate the use of codes and k-map minimization techniques in digital circuits.
2. Design combinational logic circuits using logic gates.
3. Illustrate the use of flip-flops in digital circuits.
4. Design asynchronous and synchronous sequential logic circuits.

SECTION– I

Unit 1: Codes and Simplification technique: [07 Hrs]

Principles of combinational logic: Standard representation for Logical Function, don't care conditions, minimization techniques using Karnaugh map up to 4 variables only.

Unit 2: Combinational Circuit Design: [06 Hrs]

Half and Full Adder, Half and Full Subtractor, Code converters (binary to gray and gray to binary), Multiplexer and Demultiplexer , encoder, decoder, magnitude comparator.

SECTION-II

Unit 3: Flip flop: **[06 Hrs]**

Flip flop NAND Latch, Flip-Flop: D, SR, JK and T (Characteristic table, excitation table and characteristic equation), Race around condition, Flip flop conversion.

Unit 4: Registers and Counters: **[07 Hrs]**

Asynchronous and synchronous sequential circuits, Shift register (modes of operation), Design of ripple counter using flip-flop, 4 bit up/down counter, mod –N counter, Design of Synchronous counter using Flip-Flop, 4 bit up/down counter, mod –N counter.

Internal Continuous Assessment (ICA):

Experiments: -

Minimum Ten experiments from the following.

1. Implementation of SOP and POS logical functions using universal gates.
2. Implementation of full adder, and full subtractor using logic gates.
3. Code conversion using logic gates or logic ICs: BCD to Binary, Binary to Gray, Gray to Binary.
4. Design and implementation of 2 – bit digital comparator using logic gates and functional
5. Verification of 4 bit digital comparator using IC 7485.
6. Design and implementation of 1 decimal digit BCD adder using IC 7483.
7. (i) Verification of functionality of multiplexer.
   (ii) Design and implement combinational logic function using multiplexer ICs.
8. (i) Verification of functionality of decoder.
   (ii) Design and implement combinational logic function using decoder IC.
9. Verification of the functionality of BCD to Seven segment decoder/driver.
10. Implement S-R, D, J-K, T flip flops using logic gates.
11. Functional verification of universal shift registers using IC 7495.
12. Design and implementation of Ring counter using shift register.
13. Design and implementation of Johnson counter using shift register.
14. Design and implementation of Pulse train generator using IC 7495.
15. Functional verification of ripple counter using IC 7490.

Text books:

1. Digital Design - M. Morris Mano - Pearson Education (3rd Edition)
2. Digital Principles – Leach, Malvino, TMH (6th Edition).
3. Fundamental of Digital Circuits- Anand Kumar- Prentice Hall of India Pvt. Ltd.
4. Digital Electronics – Dr. R. S. Sedha – S. Chand Publications (3rd Revised Edition).
5. Digital System, Principles and Applications, Ronald J. Tocci, PHI

6. Digital Electronics- Anil K Maini, Wiley Publication.

Reference Books:

1. Digital Design Principles and Application - Wakerly – Pearson Education
2. Digital Electronics - Gothman - (PHI)
3. Digital Logic and Computer Design - Morris Mano - Pearson Education
4. The Principles of Computer hardware- Alan Clements (3rd Edition), Oxford Press.

B) Multidisciplinary Minor in "Internet of Things"

Semester	Course Code	Course Title
III	ENTMDM-01B	Sensor Technology

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech (Electronics & Telecommunication Engineering)

Semester-III (as per NEP) w.e.f. 2024-25

ENTMDM- 01B: Sensor Technology

Teaching Scheme:
Lecture - 2 Hrs/week, 2 credits
Practical - 2 Hrs/week, 1 credits

Examination Scheme:
ESE- 70 Marks
ISE - 30 Marks
ICA – 25 Marks

Course Objective-

1. To understand classifications of sensors.
2. To understand principle & operation of Industrial Sensors
3. To understand principle & operation of Medical Sensors

Course Outcomes-

After completion of this course, the students are able to –

1. Analyze the classification depends on application
2. Obtain the applications of Industrial Sensors
3. Obtain the applications of Medical Sensors

Section-I

Unit 1- Introduction to Sensors ***(06 Hrs.)***

Definition of Sensor and transducers, Terminologies - Measurand and Measurement, Sensor and Transducer, Analog and Digital Sensor, Sensor Signal Conditioning, Pure, Passive, and Active Devices. Sensor Types and Selection- Sensor Classification Based on the Measurand, Sensor Classification Based on Sensor Technology, Sensor Selection.

Unit 2- Classification of Sensors ***(07 Hrs.)***

Basic Sensors- Temperature Sensing, Light Intensity, Strain Gauges, Magnetic Field Sensors. Motion Transducers- Multipurpose Sensing Elements, Motion Transducer Selection. Effort Sensors- Force Sensors for Motion Measurement, Force Sensor Location, [in this chapter no equations and no problems required]

Section -II

Unit 03- Industrial Sensors ***(07 Hrs.)***

Linear-Variable Differential Transformer/Transducer, Rotatory-Variable Differential Transformer/Transducer, Mutual-Induction Proximity Sensor, Resolver, DC Tachometer, AC Tachometer, Eddy Current Transducers, Capacitive Liquid Level Sensor, Capacitive Rotation and Angular Velocity Sensors. [in this chapter no equations and problems required]

Unit 04- Medical Sensors ***(06 Hrs.)***

Ultrasonic sensor, Thermocouple, Thermistor, RTD. Principle of (only Block diagram and working expected)-- Pulse Oximetry (SpO2) sensor, Humidity Sensor, pH sensor, Vibration sensor, Chemical and Gas sensor, Heart-beat sensor, [examples are not required]

Internal Continuous Assessment (ICA):

Minimum 08 experiments based on the above topics.

Text Books-

1. SENSORS AND ACTUATORS-Control System Instrumentation by CLARENCE W. de SILVA, publisher- CRC press
2. SENSORS and ACTUATORS ENGINEERING SYSTEM INSTRUMENTATION by Clarence W. de Silva, publisher- CRC press, second edition.

Reference books-

1. Introduction to Instrumentation, Sensors, and Process Control by William C. Dunn, publisher- Artech House.

Semester IV

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech (Electronics & Telecommunication Engineering)

Semester-IV (as per NEP) w.e.f. 2024-25

ENTPCC- 04: Signals and Systems

Teaching Scheme:
Lecture - 3 Hrs/week, 3 credits

Examination Scheme:
ESE- 70 Marks
ISE - 30 Marks

Course Objective:

1. To understand the fundamental characteristics of signals and systems
2. To develop mathematical skills and to solve problems involving convolution.
3. To represent and to realize LTI System by differential and difference Equations.
4. To understand the concept of Fourier Transform and its applications.
5. To understand the concept of Z transform with ROC

Course Outcome:

At the end of the course, students will be able to:

1. Understand the fundamental concepts of signals and systems, including their types and characteristics.
2. Develop analytical and problem-solving skills by applying the concepts of convolution integral and Convolution sum to represent the LTI system.
3. Realize LTI system equations by using different forms.
4. Use Fourier series for analysis of complex exponential signals.
5. Enumerate Fourier transform of the signals.
6. Enumerate ZT of a function and plot its ROC.

Section - I

Unit 1: Signals and Systems: **(08Hrs)**

Introduction to signal and systems, Types of Signals, Elementary Continuous time and discrete time Signals, Transformations of independent Variable, Classification of Signals, Properties of System (Static and Dynamic, Linear and Nonlinear, Time variant and Time Invariant, Causal and Non Causal)

Unit 2 Continuous Time (CT)systems: **(06Hrs)**

Introduction, The Representation of Signals in Terms of Impulses, Convolution integral, Block Diagram representation of LTI Systems described by Differential Equations.

Unit 3 - Discrete Time (DT) systems: **(06Hrs)**

The Representation of Signals in Terms of Impulses, Convolution Sum, and Block diagram Representation of LTI Systems described by Difference Equations, Interconnections of systems.

Section - II

Unit 4- Fourier Representation of Periodic Signals: **(06Hrs)**

Introduction, The Response of LTI Systems to Complex Exponentials, Fourier series, and Representation of Continuous-Time Periodic signals, Convergence of Fourier Series and basic problems.

Properties of Continuous time Fourier series (statement and proof of theorems).

Unit 5- Fourier Representation of aperiodic Signals: **(08Hrs)**

Introduction to Fourier Transform & DTFT, Definition and basic problems.

Properties of Fourier Transform:

Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier Transform (statement and proof of theorems).

Unit 6 - Z-Transform **(06Hrs)**

Introduction, The Z-Transform, The Region of Convergence for the Z-Transform, Properties of Z Transform, The Inverse Z-Transform (IZT)(Power Series method and Partial Fraction Expansion Method), Application and Characteristics of LTI System Using Z Transform.

Text books:

1. Signals and Systems A.V. Oppenheim and A. S. Wilsky, 2nd edition [PearsonEducation]

2. Signals and Systems Simon Haykin and Barry Van Veen, 2nd edition [Wiley andSons]

3. Signals and Systems, I. Ravi Kumar, PHI

Reference Books:

1. Signals and Systems Dr. S. Palani [Ane Books Pvt Ltd, NewDelhi]

2. Signals and Systems by V. Krishnaveni and A. Rajeswari [WileyIndia]

3. Signals and Systems by P. Ramesh Babu and R. Anand Natarajan[Scitech]

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S. Y. B. Tech (Electronics & Telecommunication Engineering)

Semester-IV (as per NEP) w.e.f. 2024-25

ENTPCC- 05: Control System

Teaching Scheme:
Lecture - 2 Hrs/week, 2 credits
Tutorial - 1 Hrs/week, 1 credits

Examination Scheme:
ESE- 70 Marks
ISE - 30 Marks
ICA – 25 Marks

Course Objective-

1. To understand concepts of various control systems and mathematical Modelling.
2. To represent control system using block diagram and signal flow graph and obtain transfer function of system
3. To obtain stability of control systems.
4. To obtain Gain Margin and Phase Margin using Bode Plot

Course Outcomes-

After completion of this course, the students are able to –

1. Analyze various control systems and represents mathematical models for control systems
2. Obtain block diagram reduction of control system and transfer function of systems using signal flow graph.
3. Determine stability of systems.
4. Obtain Gain Margin and Phase Margin using Bode Plot

Section-I

Unit 01- Introduction and Mathematical modeling [07Hrs]

Open loop and Closed loop control systems, examples of control systems: Liquid Level Control System, Missile Launching and Guidance System.

Mathematical modeling of Electrical systems using R, L and C, Transfer function of RLC circuits, Transfer function of closed loop system,

Unit 02 -: System representation and components [06Hrs]

Block diagram representation and reduction techniques with problems, Signal Flow Graph- Construction with examples, Mason's Gain formula with problems.

Section –II

Unit 03- Stability and Error Coefficients [07Hrs]

Stability -Concept of stability, absolute and conditional stability, relative stability, Routh – Hurwitz criterion for stability with problems.

Errors- Steady state errors and error constants of type 0, type 1 and type 2 systems.

Unit 04- Stability Analysis [06Hrs]

Bode plot: asymptotic bode plot, stability analysis using bode plot. Need of compensators, types of compensations- Lead, Lag & Lead Lag

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Internal Continuous Assessment (ICA):

Minimum 06 assignments on the above topics.

Text Books-

1. Control Systems Engineering by I. J. Nagrath & M Gopal, New Age Publication. –pp 92

2. Feedback & Control Systems. By Schaum's Outline Series McGraw Hill.

3. Control Systems Engineering, by R. Anandanatrajan, P.RameshBabu - Scitech Publication.

Reference Books:

1. Modern Control Engineering by K.Ogata, Pearson Education.

2. Principles of Control Systems by S.C. Goyal & U. A. Bakshi Technical Publication, Pune.

3. Control systems by Dr. Sanjay Sharma, Katson publication.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech (Electronics & Telecommunication Engineering)

Semester-IV (as per NEP) w.e.f. 2024-25

ENTPCC- 06: Analog Integrated Circuits

Teaching Scheme:	**Examination Scheme:**
Lecture - 3 Hrs/week, 3 credits	**ESE- 70 Marks**
Practical - 2 Hrs/week, 1 credits	**ISE - 30 Marks**
	ICA – 25 Marks
	POE – 25 Marks

Course Objectives:

1. To make student understand principles, configurations and specification of ideal and practical op amp
2. To make student understand frequency response of op amp
3. To make student understand linear and nonlinear applications of op amp
4. To enable student design active filters using op amp and analyze waveform generators
5. To introduce to student working of special Linear ICs and its applications

Course Outcomes: At the end of the course, students will be able to-

1. Describe fundamentals of op amp and compare characteristics of ideal and practical op amp
2. Understand and analyze frequency response of op amp
3. Develop various Linear and Nonlinear applications of op amp
4. Design first order and second order filters
5. Understand and describe the concept of special ICs and its applications

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SECTION– I

Unit 1: Fundamentals of Operational Amplifier: **[08Hrs]**

Concept of Differential amplifier- DIBO, AC & DC analysis, op amp fundamentals- block Diagram, equivalent circuit, Transfer curve, Electrical Parameters- practical & Ideal, Open loop configurations, closed loop configurations with negative feedback- Inverting, non-inverting& Differential Amplifier.

Unit 2: Practical op amp & frequency response: [06Hrs]

Input offset voltage, Input bias current, Input offset current, total output offset voltage, Thermal drift, PSRR,CMRR,SR &its importance, IC 741 characteristics. High frequency equivalent circuit and compensation techniques.

Unit 3: General Linear applications of Op amp: [07Hrs]

Summing, scaling and averaging amplifier, adder-subtractor , Instrumentation Amplifier: Block diagram output voltage , IC of Instrumentation amplifier, V to I and I to V convertors, Op-Amp as differentiator and Integrator including study of frequency response.

SECTION-II

Unit 4: Non linear applications*:* [07Hrs]

Comparator-Basic, ZCD, Schmitt trigger, window detector, sample & hold circuit, peak detector, precision rectifiers, log-antilog amplifier, clipper & clamper.

Unit5: Active filters & Waveform Generators: [07Hrs]

Basic filter definitions, Advantages of active filters, First and second order low pass and high pass Butterworth filters.

Waveform Generators- Square Wave Generator Triangular saw tooth wave generators using Op-Amp, Oscillators- principle, Phase shift, Wien Bridge, Quadrature oscillators.

Unit6: Special ICS and its applications: *[07Hrs]*

Phased Locked Loops (PLL), 565, Application of PLL, LM317, LM337, IC 555Timer-basic, astable, monostable modes of operation and applications.

Internal Continuous Assessment (ICA): ICA should be based on minimum eight experiments from the following list of experiments.

Internal Continuous Assessment (ICA):

Minimum 08 experiments from given list

Experiments List:-

1. Measurement of parameters –V_{io}, I_{io}, I_B etc
2. Op-Amp as Inverting and Non-inverting amplifier, Voltage follower.
3. Frequency response of Inverting and Non-inverting amplifiers.
4. Implementation of Op-Amp as adder and subtractor.
5. Op-Amp as Integrator and Differentiator.
6. Op-Amp as Schmitt trigger.
7. Op-Amp as window detector.
8. Op-Amp as peak detector.
9. Op-Amp as waveform generators(Square, Triangular, Sawtooth)
10. RC oscillator.
11. Op-Amp as Precision rectifier.
12. Op-Amp as Clippers and Clampers.
13. V to I convertor with grounded load.
14. Implementation of first and second order low pass Butterworth filter.
15. Implementation of first and second order high passes Butterworth filer.

Note: Simulate results using simulation software for at least two experiments.

Textbooks:

1. Op-Amps and Linear Integrated Circuits, Ramakant A. Gaikwad, PHI Learning Pvt. Ltd.,Third and Fourth edition
2. LinearIntegratedCircuits,D.RoyChoudhary,ShailB.Jain,NewageInternational Publishers, Thirdedition

Reference Books:

1. OperationalAmplifiers, G.B.Clayton, English Language Book Society, Second edition
2. Operational amplifiers and Linear ICS by David Bell,oxford university press,3rd edition
3. Linear Integrated circuits by S Salivahanan, TataMc Grawhill
4. Integrated Circuits by K R Botkar, Khanna Publication

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S. Y. B. Tech (Electronics & Telecommunication Engineering)

Semester-IV (as per NEP) w.e.f. 2024-25

ENTSEC- 01: Data Structure

Teaching Scheme:
Lecture - 1 Hrs/week, 1 credit
Practical - 2 Hrs/week, 1 credits

Examination Scheme:
ICA – 25 Marks
POE – 25 Marks

Course Objectives:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

Course Outcomes: At the end of the course, students will be able to-

1. Understand data organizations and data structure operations, with the ability to evaluate their efficiency in terms of time and space complexity..
2. Develop solutions using stacks and queues, and critically evaluate their performance in terms of time and space complexity.
3. Construct various types of linked lists and conduct performance analysis based on time and space complexity.
4. Implement search and traversal algorithms for trees and graphs, and analyze their computational complexity.
5. Design, implement, and compare the performance of selection sort, bubble sort, insertion sort, quick sort, merge sort, and heap sort algorithms in terms of time and space complexity.

SECTION– I

Unit 1: Introduction: **[02Hrs]**

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; complexity analysis.

Unit 2: Stacks: **[03Hrs]**

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation (converting infix to postfix expression using algorithm, evaluating postfix expression using algorithm), programs using recursive functions (factorial, Fibonacci sequence) and complexity analysis.

Unit 3: Queues: **[02Hrs]**

ADT queue, Types of Queue: Simple Queue and its operations, Circular Queue, and their analysis.

SECTION-II

Unit 4: Linked Lists: **[02Hrs]**

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; doubly linked list , Circular Singly Linked Lists

Unit 5: Trees and Graph: **[02Hrs]**

Tress: Basic Tree Terminologies, Different types of Trees: Binary Tree, Binary Search Tree its operations and complexity analysis, Applications of Binary Trees: B Tree, B+ Tree: definitions

Graph: Basic Terminologies and Representations.

Unit 6: Searching and Sorting: **[03Hrs]**

Searching: Linear Search and Binary Search Techniques, complexity analysis of searching techniques.

Sorting: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort

Hashing: basics of hashing, Different Hashing techniques.

Internal Continuous Assessment (ICA):

Students should perform minimum twelve practical's based on the following:

Practicals: -

Minimum twelve practicals from the following.

1. Implementation of stack using array.
2. Implementation of stack for converting infix to postfix expression.
3. Find Factorial of a given no, by defining recursive function.
4. Fibonacci sequence implementation using recursive function.
5. Implementation of Queue using array.
6. Implementation of circular Queue using array.
7. Implementation of singly Linked list.
8. Implementation of stack using Linked list.
9. Implementation of Queue using Linked list.
10. Write the program for Tree traversal.
11. Write the program for Adjacency Matrix representation of Graph.
12. Search element from list using linear search and Binary search method.
13. Write the program to Sort the given list using Selection sort and Bubble sort method.
14. Write the program to Sort the given list using Insertion sort and Quick sort method.

Text books:

1. Data Structures Using C and C++, Y.Langsam, M.J. Augenstein, A.M Tanenbaum Pearson Education Second Edition
2. Data structures using C, Rajani Jindal Umesh Publication
3. Data structures through C in Depth, S.K.Srivastava, Deepali Srivastava, BPB Publication.
4. Data Structures using C, ISRD Group, TMH
5. Data Structures- Venkatesan, Wiley Publication.

Reference Books:

1. Fundamentals of Data Structures, Ellis Horowitz, Sartaj Sahni (Galgotia Book Source).
2. Data Structures and Program design, Robert L. Kruse (PHI).
3. Data structure and algorithm, mark Allen Weiss (Pearson Publication, Second edition).
4. Data Structures using C and C++, Rajesh K. Shukla, Wiley

Multidisciplinary Minors

A) Multidisciplinary Minor in "Controllers and Applications"

Semester	Course Code	Course Title
IV	ENTMDM-02A	8051 Microcontroller

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech (Electronics & Telecommunication Engineering)

Semester-IV (as per NEP) w.e.f. 2024-25

ENTMDM- 02A: 8051 Microcontroller

Teaching Scheme:
Lecture - 2 Hrs/week, 2 credits
Practical - 2 Hrs/week, 1 credits

Examination Scheme:
ESE- 70 Marks
ISE - 30 Marks
ICA – 25 Marks

Course Objectives:

1. To provide an introduction to microcontroller families and details of RISC and CISC microcontrollers.
2. To describe core features and Peripheral features of Microcontrollers
3. To explain and practice assembly language and Embedded C programming techniques
4. To demonstrate and perform hardware interfacing and design for various applications.

Course Outcomes: At the end of this course, students will be able to –

1. To understand the fundamentals of CISC and RISC Microcontroller architectures
2. To study the architecture of 8051
3. To develop a program for different peripherals.
4. To demonstrate and perform hardware interfacing.

SECTION – I

Unit 1: Introduction of Microcontroller (05Hrs)

Introduction, Microprocessor and Microcontrollers, CISC & RISC Microcontroller, Harvard and von Neumann architecture, Development platforms and tools for programming for Microcontroller.

Unit 2: The 8051 Architecture and Instructions (08Hrs)

8051 Microcontroller Hardware, addressing modes, Instruction set, Assembly Language Programming/ C Programming.

SECTION – II

Unit 3: 8051 Peripherals (05Hrs)

Input / Output Pins, ports and Circuits, External Memory, Counters and Timers, Serial Data Input/ output, interrupts. Fundamentals of C programming.

Unit 4: 8051 Interfacing (08Hrs)

Programming in assembly and C for Input/ Output Ports, Serial Port Programming, Timer Programming and Interrupt Programming. Interfacing Switches, LED, Relay, Buzzer, LCD display, Matrix keyboard, Stepper Motor.

Internal Continuous Assessment (ICA):

Minimum 08 practical's from given list

Suggested List of Practicals:

1. Arithmetic and Logic operations
2. Interfacing of Switches, LEDs and Buzzer.
3. Interfacing of Matrix Keyboard
4. Interfacing of LCD Display.
5. Use of Timer for generation of time delays
6. Use of Timer as counter.
7. Interfacing of Stepper motor.
8. Speed control of DC Motor using PWM.
9. Interfacing of ADC
10. Use of Interrupts for any Application.
11. Interfacing of DAC
12. Serial communication.

Text Books:

1. The 8051 Microcontroller Architecture, programming and Applications by Kenneth Ayala Penram International (Third Edition)
2. The 8051 Microcontroller and Embedded systems by Muhammad Ali Mazidi Pearson Education Asia LPE (Second Edition)

Reference Books:

1. 8051 Microcontrollers programming and practice by Mike Predcko.
2. Data sheets of MCS51 family microcontrollers, PIC 16F877A Flash microcontrollers,
3. 8051 Microcontroller by I Stott, Mackenzie, Rathel & Phan – Fourth Edition - Pearson

A) Multidisciplinary Minor in “Internet of Things”

Semester	Course Code	Course Title
IV	ENTMDM-02B	Fundamentals of IoT

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech (Electronics & Telecommunication Engineering)

Semester-IV (as per NEP) w.e.f. 2024-25

MDM- 02B: Fundamentals of IOT

Teaching Scheme:
Lecture - 2 Hrs/week, 2 credits
Practical - 2 Hrs/week, 1 credits

Examination Scheme:
ESE- 70 Marks
ISE - 30 Marks
ICA – 25 Marks

Course Objective:

1. Describe the evolution of the IoT concept.
2. Explain the basic characteristics of IoT.
3. Distinguish the IoT from other related technologies.
4. Explain the IoT architectures.
5. Articulate the pros and cons of IoT.
6. Apply the IoT architecture concepts for specific IoT applications.
7. Understand the implementation aspect of IoT architecture.

Course Outcome:

After completion of the Course, Students will be able to:

1. Understand the basics of IoT, things, smart connecting devices, IP & network layers, application protocols
2. Implement of blocks of IoT system – things, smart devices, IP & network layers, application protocols
3. Apply the various Things, smart devices IoT Protocols and Application Protoco (Datalink, Network, Transport, Session, Service) for real-time applications
4. Analyse of various existing IoT Systems
5. Evaluate various IoT architecture, IoT protocols with relevant hardware/software

Prerequisite:

- Basic knowledge of microprocessor, C programming

UNIT-I: Introduction: **(03 Hrs)**

The genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and OT, IoT Challenges

Internal Continuous Assessment (ICA):

At Least 08 practical's based on topics of the syllabus to be performed either in software tools and/or

UNIT-II: IoT Network Architecture: (05Hrs)
Drivers behind new network architectures, Comparing IoT architectures, A simplified IoT Architecture, The core IoT functional stack, IoT Data management and compute stack

UNIT-III: The "Things" in IoT: (05 Hrs)
Introduction to IoT enabled devices, Sensors, Actuators, Micro-electro-mechanical systems (MEMS), Introduction to Arduino,/R

SECTION – II

UNIT-IV: Connecting Smart Objects: (04 Hrs)
Communication criteria, IoT Access Technologies – IEEE 802.15.4, IEEE 802.15.4g & 802.15.4e, IEEE 1901.2a, IEEE 802.11ah, LoRaWAN, NB-IoT
and other LTE variations

UNIT-V: IP as the IoT Network Layer: (04 Hrs)
The business case for IP, The need for optimization, optimizing IP for IoT, Profiles and Compliances

UNIT-VI: Application Protocols for IoT: (05 Hrs)
The transport layer, IoT Application Transport Methods, SCADA, Generic web-based protocols, IoT application layer protocols: CoAP, MQTT.

hardware kits.

Exp. NO.	List of Experiments
Exp:1	Study the fundamental of IOT software's and components.
Exp:2	Familiarization with Arduino/Raspberry Pi and perform necessary software
Exp:3	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
Exp:4	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
Exp:5	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
Exp:6	To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
Exp:7	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
Exp:8	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when _1'/'0' is received from smartphone using Bluetooth

Exp:9	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
Exp:10	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.

Text Books-

Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on- Approach)", 1st Edition, VPT, 2014.

Reference books-

1. David Hanes, Gonzelo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Hentry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Pres, 2017.
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
3. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM –MUMBAI
4. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156- 5 e-ISBN 978-3-642-19157-2, Springer
5. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publ

Honors Degree Curriculum

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

NEP 2020 Compliant

Honors Degree Curriculum With effect from 2024-2025

Honors Degree Structure: Artificial Intelligence and Machine Learning

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ENTHON-01A	Computational Statistics	3	1		4	70	30	25	125
IV	ENTHON-02A	Artificial Intelligence	3		2	4	70	30	25	125
V	ENTHON-03A	Machine Learning	3		2	4	70	30	25	125
VI	ENTHON-04A	AI Applications	3		2	4	70	30	25	125
VII	ENTHON-05A	Mini Project			4*	2			50	50
		Total	**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering
Honors in Artificial Intelligence and Machine Learning
S.Y. B.Tech (Electronics & Telecommunication Engineering)- Sem-III
ENTHON01A: Computational Statistics

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ESE:70 Marks
Tutorial: 1Hr/Week, 1 credit	ISE:30 Marks
	ICA: 25 Marks

The goal of this course is to provide students an introduction to a variety of modern computational statistical techniques and the role of computation as a tool of discovery.

Course Prerequisite:

Student shall have knowledge of programming language python, also some background in probability and statistical inference.

Course Objectives:

1. To make students learn efficient numerical methods for solving problems in statisticalanalysis.
2. To make students use computational statistics in applications like statistical machinelearning.
3. To describe the Dimensionality reduction method.
4. To introduce basics of Learning theory.

Course Outcomes:

At the end of the course, students will be able to-

1. Describe fundamental aspects of efficient numerical methods for statistical analysis
2. Explore modern computational statistical techniques
3. Describe the role of computation as a tool of discovery.
4. Apply statistical methods for Machine learning applications

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SECTION I

Unit 1: Probability Distributions **(07)**

Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, ProductRule, and Bayes' Theorem, Statistics and Independence, Gaussian distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform

Unit 2: Regression - linear and nonlinear **(07)**

Problem Formulation, Parameter Estimation, Bayesian Linear Regression, Maximum Likelihoodas Orthogonal Projection

Unity 3 : Matrix fundamentals **(08)**

Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear

Independence, Basis and Rank, Linear Mappings, Affine Spaces, Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation

SECTION II

Unit 4 : Dimensionality reduction **(07)**

Problem Setting, Maximum Variance Perspective, Projection Perspective, Eigenvector Computation and Low-Rank Approximations, PCA in High Dimensions, Key Steps of PCA in Practice, Latent Variable Perspective

Unit 5 : Basic learning theory **(07)**

- types, feasibility, training, testing, generalization, bias- variance, underfitting, overfitting etc

Unit 6: Introduction to Machine Learning

(08)

Well posed learning problem, designing a learning system, perspectives and issues in machine learning, applications of machine learning, probability theory, model selection, the curse of dimensionality, decision theory, information theory

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Internal Continuous Assessment:

ICA consists of minimum 8 tutorials based upon above curriculum.

Text books:

1. Peter Givens, G. H. and Hoeting, J. A. (2005) Computational Statistics, 2nd Edition, Wiley-Interscience
2. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and ChengSoon Ong .

Reference Books:

1. Liu, J. (2001). Monte Carlo Strategies in Scienti_c Computing, Springer-Verlag.
2. Lange, K. (2002). Numerical Analysis for Statisticians, Springer-Verlag, 2nd Edition.
3. Hastie, T., Tibshirani, R. and Friedman, J. (2009). The Elements of Statistical Learning, 2ndEdition, Springer.
4. Goodfellow, I., Bengio, Y. and Courville, A. (2016). Deep Learning, MIT Press.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering
Honors in Artificial Intelligence and Machine Learning
S.Y. B.Tech (Electronics & Telecommunication Engineering)- Sem-IV
ENTHON02A: Artificial Intelligence

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ESE:70 Marks
Practical: 2Hr/Week, 1 credit	ISE:30 Marks
	ICA: 25 Marks

Course Objectives:

1. To present to student general overview of AI with its future prospects
2. To make student understand various problem-solving methods through search techniques
3. To make student understand the various methods for knowledge representation and reasoning
4. To make student understand the various methods for decision making
5. To make student comprehend learning and knowledge acquisition concepts

Course Outcomes:

At the end of this course, student will be able to -

1. Formulate and solve sequence of actions for an agent as a search problem.
2. Infer from represented knowledge using logical and probabilistic reasoning methods
3. Solve agent decision problems using probability theory
4. Explain forms of learning and demonstrate their working.

Course Prerequisite:

Student shall have fundamental knowledge of algorithms

SECTION-I

Unit 1: Overview **(06)**

Foundations, scope, problems, and approaches of AI, intelligent agents: reactive, deliberative,goal-driven, utility-driven, and learning agents

Unit 2: Problem-Solving through Search **(07)**

Forward and backward, state-space, blind, heuristic, problem-reduction, A, A, AO, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications

Unit 3: Knowledge Representation and Reasoning (07)

Ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; first order logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications

SECTION II

Unit 4: Representing and Reasoning with Uncertain Knowledge (07)

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, and sample applications

Unit 5: Decision-Making (06)

Basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications

Unit 6: Learning and Knowledge Acquisition (07)

A bird's eye view, scalability issues and the streaming scenario, a stroll through some application scenarios

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Internal Continuous Assessment (ICA)

ICA shall consist of minimum 08 experiments based on above Syllabus.

Text Books:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall
2. A First Course in Artificial Intelligence, Deepak Khemani, McGraw Hill Education (India)
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.

Reference Book:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw Hill

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

NEP 2020 Compliant

Honors Degree Curriculum With effect from 2024-2025

Honors Degree Structure: Data Science

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ENTHON-01B	Database Management System	3	1		4	70	30	25	125
IV	ENTHON-02B	Machine Learning	3		2	4	70	30	25	125
V	ENTHON-03B	Data Analytics	3		2	4	70	30	25	125
VI	ENTHON-04B	Business Intelligence	3		2	4	70	30	25	125
VII	ENTHON-05B	Mini Project			4*	2			50	50
Total			**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering
Honors in Data Science
S.Y. B.Tech (Electronics & Telecommunication Engineering)- Sem-III
ENTHON01B: Database Management System

Teaching Scheme:
Lecture : 3Hrs/Week, 3 credits
Tutorial: 1Hr/Week, 1 credit

Examination Scheme:
ESE:70 Marks
ISE:30 Marks
ICA: 25 Marks

This course introduces a Data Base Management System, which is the system software for easy, efficient and reliable data processing and management. It covers ER Model, Relational Model, Structured Query Language, Relational Database Design and Concurrency Control techniques.

Course Objectives:

1. To understand the basics of database design, structure, implementation and applications.
2. To develop the logical design of the database using data modeling concepts such as entity relationship diagrams.
3. To understand and use Structured Query Language to query, update, and manage a database.
4. To apply normalization techniques to normalize the database.
5. To familiarize the students with the fundamentals of database transaction processing, learn techniques for concurrency control and recovery methods**.**

Course Outcomes:

At the end of this course, the student will be able to,

1. Apply the basic concepts of database system to design relational model and schemas.
2. Design schema using E-R model and normalization.
3. Extract data using relational algebra and SQL.
4. Access data using Indexing and Hashing techniques.
5. Apply ACID properties for transaction processing.
6. Explain concurrency control and recovery methods.

SECTION– I

Unit 1: Introduction to DBMS (03)

Database- System Applications, Purpose of Database Systems, View of data, Database Languages, Database Architectures, Database users and administrators, history of databases system.

Unit 2: E-R model **(05)**

Overview of design process, E-R Model, Constraints, E-R diagrams, E-R design issues, Weak Entity Sets, Extended E-R features, Reduction to relational schema.

Unit 3: Relational Model **(05)**

Relational Model: Basic structure of relational databases, Database schema, keys, Schema diagrams, Relational Query languages, Relational algebra-Fundamental, Additional and Extended Relational Algebra Operations.

Unit 4: Introduction to SQL **(08)**

Overview, SQL data definition, SQL data types, Integrity constraints, Basic structure of SQL Queries, Types of SQL Commands: DDL, DML, DCL and TCL statements, Basic SQL clauses [select, from, where, group by, having, order by etc.].

SECTION-II

Unit 5: Intermediate SQL **(06)**

Additional basic operations, Set operations, NULL values, Aggregate functions, Nested sub queries, Modification of the databases. Join operations, Views, Integrity constraints, Authorization.

Unit 6: Normalization **(05)**

Features of good Relational Designs, Atomic Domains, First Normal Form, Keys and Functional dependencies, Second Normal Form, Boyce-Codd Normal Form, Third Normal Form, Functional dependency theory.

Unit 7: Indexing and Hashing **(05)**

Basic Concepts, Ordered Indices, B+ Tree Index Files, B Tree Index Files, Multiple Key Access, Introduction to Indexing, Comparison of Indexing and Hashing, Index definition in SQL.

Unit 8: Transactions and Concurrency Control **(05)**

Transaction concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions. Concurrency Control - Lock based protocol: Locks, Granting of Locks, Two-Phase Locking Protocol. Time Stamp-based protocols, Deadlock handling.

Internal Continuous Assessment (ICA):

ICA shall consist of minimum 8 assignments/tutorials based on above syllabus.

Suggestive List of Assignments/tutorials:

- Write queries in SQL using DDL and DML commands.
- Write queries in SQL to demonstrate integrity constraints.
- Write nested sub queries in SQL using Joins and Set operations.
- Write queries in SQL to create Views and demonstrate Authorization.

- Identify set of functional dependencies, find canonical cover and closure of functional dependency.
- Convert the created database into 1NF, 2NF, 3NF and BCNF

Text books:

1. Database system concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan (McGraw Hill International Edition) sixth edition.
2. Database system concepts by Peter Rob, Carlos Coronel (Cengage Learning) ninth edition.

Reference Books:

1. Fundamentals of Database systems by Ramez El Masri, S. B. Navathe (Pearson Education)5thedition.
2. Database Management Systems by Ramkrishnan Gehreke (Tata McGraw Hill) third edition.
3. Principles of Database Systems by J. D. Ullman (Galgotia Publications)
4. Advanced Database Management System by Rini Chakrabarti, Shilbhadra Dasgupta (Dreamtech Press Publication).

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering
Honors in Data Science
S.Y. B.Tech (Electronics & Telecommunication Engineering)- Sem-IV
ENTHON02B: Machine Learning

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ESE:70 Marks
Practical: 2Hr/Week, 1 credit	ISE:30 Marks
	ICA: 25 Marks

Course Objectives:

1. To make student learn necessity and different aspects of Machine Learning.
2. To make student understand Machine Learning Models.
3. To make student understand Classification and Regression.
4. To introduce to student real world applications of Machine Learning.

Course Outcomes:

At the end of this course, student will be able to –

1. Describe fundamental aspects of Machine Learning.
2. Distinguish between various characteristics of ML
3. Explore classification and regression algorithm
4. Design neural network for classification
5. Design and implement different Machine Learning models
6. Apply Machine learning techniques that enable to solve real world problems.

Course Prerequisite:

Student shall have knowledge of programming language like python / R, also fundamentals of probabilityand Statistics.

SECTION I

Unit 1: Introduction to Machine Learning **(08)**

Basics of Statistics, what is Machine learning? Examples of Machine Learning Problems, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, database and data processing for ML.

Unit 2: Theory of Machine Learning **(05)**

Definition of learning systems, Types: Supervised, Unsupervised, Semi Supervised, Reinforcement learning with examples. hypothesis space and inductive bias, evaluation, cross-validation, what is a feature? feature construction, feature extraction.

Unit 3: Supervised Learning **(08)**

Classification: Binary Classification- Assessing Classification performance.

Common classification algorithms: K Nearest Neighbor, Decision Tree, Random Forest model, Support vector machines. Probabilistic Models: Naïve Bayes Classifier.

Regression: Assessing performance of Regression- Error measures, Overfitting, underfitting, linear regression, logistic Regression. Multivariate Linear Regression.

SECTION II

Unit 4: Unsupervised Learning **(08)**

Unsupervised Vs supervised learning, Applications of unsupervised learning, Clustering, clustering as ML task, Different clustering techniques, partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN, Finding pattern using association rule, Association rule, apriori algorithm for association rule learning, Build the apriori principle rules.

Unit 5: Artificial Neural Networks **(08)**

Introduction, Exploring Artificial Neuron, Types of activation functions, Early implementations of ANN, Architectures of Neural Network, Learning process in ANN, Backpropagation, Deep learning

Unit 6: Applications of Machine Learning **(05)**

Email Spam and Malware Filtering, Image recognition, Speech Recognition, Traffic Prediction, Self-driving Cars, Virtual Personal Assistant, Medical Diagnosis.

Internal Continuous Assessment (ICA):

ICA consists of minimum 8 practical based upon above curriculum.

Text books:

1. Tom Mitchell, "Machine Learning", McGraw Hill, 3rdEdition, 1997.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India,3rd Edition2014.
4. Dutt, Chandramouli, Das, "Machine Learning" Pearson publication, Eighth Impression,2022.

Reference Books:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning", MIT Press,2012.

2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.
3. Kevin P. Murphy “Machine Learning: A Probabilistic Perspective”, The MIT Press, 2012
4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015.
5. Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRCPress,2014.
6. Charu C. Aggarwal, “DATA CLUSTERING Algorithms and Applications”, CRC Press,2014.
7. Machine Learning Mastery With Python 2016 by Jason Brownlee.

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

NEP 2020 Compliant

Honors Degree Curriculum With effect from 2024-2025

Honors Degree Structure: Internet of Things

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ENTHON-01C	Fundamentals of IoT	3	1		4	70	30	25	125
IV	ENTHON-02C	Industrial IoT	3		2	4	70	30	25	125
V	ENTHON-03C	IoT Cloud Platform	3		2	4	70	30	25	125
VI	ENTHON-04C	Architecting IoT Solutions	3		2	4	70	30	25	125
VII	ENTHON-05C	Mini Project			4*	2			50	50
		Total	**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering
Honors in Internet of Things
S.Y. B.Tech (Electronics & Telecommunication Engineering)- Sem-III
ENTHON01C: Fundamentals of IoT

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ESE:70 Marks
Tutorial: 1Hr/Week, 1 credit	ISE:30 Marks
	ICA: 25 Marks

The Internet of Things (IoT) refers to the system in which different devices equipped with sensors and signal processing are connected through a network to communicate with each otherand/or with central servers. This course provides a thorough introduction to the different components of an IoT System. The course also introduces different communication protocols. Introduction to Raspberry Pi and its architecture is also a part of this course.

Course Objectives:

1. To make student aware of different components of an IoT System
2. To introduce to student different sensors used in IoT.
3. To make student learn usage of different sensors in IoT.
4. To make student learn different communication technologies used in IoT.
5. To make student build simple IoT applications with Raspberry Pi.

Course Outcomes:

At the end of this course students will be able to,

1. Define what Internet of Things is with suitable example.
2. Comprehend different components of an embedded System w.r.t. IoT.
3. Select appropriate sensor for a given IoT application with suitable justification.
4. Categorize different communication technologies used in IoT.
5. Construct a solution based on Raspberry Pi for the development of simple IoT application.

SECTION I

Unit 1 - Introduction to Internet of Things (06)

Introduction to IoT, different components of an IoT system: embedded system, communication systems, cloud, applications of IoT in various domains.

Unit 2 – Embedded Systems for IoT (07)

Introduction to embedded systems, different components of an embedded system, basics of Linux based embedded systems, various embedded platforms used in IoT, understanding the various IDEs used for embedded development.

Unit 3 – Sensors Fundamentals and Characteristics (08)

Sensors, Sensor Classification, Signals and Systems, Units of Measurements, Sensor Characteristics.

SECTION II

Unit 4 – Sensor Applications (07)

Occupancy and Motion Detectors, Position, Displacement, and Level, Velocity and Acceleration, Humidity and Moisture Sensors, Light Detectors, Temperature Sensors.

Unit 5 – Communication technologies for IoT (06)

Basics of the communication technologies (Bluetooth Low Energy (BLE), Wifi, RFID) their architecture, characteristics, limitation, power consumption parameters and applications.

Unit 6 – Development of IoT solution. (08)

Introduction to Raspberry Pi, Linux- Introduction, File System, Raspbian O.S.- Introduction, Installing Raspbian on Pi, First boot and Basic Configuration of Pi, Popular Linux Commands for shell access, remote access though Putty, features, Python programs for interfacing I/O devices like led's, switch's, LCD, etc with Raspberry Pi.

Internal Continuous Assessment (ICA):

ICA consists of minimum 8 tutorials based on above curriculum

Text Books

1. Internet of Things: Architecture and Design Principles by Raj Kamal, First edition, McGraw Hill Education
2. The Definitive Guide to the ARM Cortex-M3 by Joseph Yiu, Second Edition, Elsevier
3. Internet of Things for Architects by Perry Lea, Packt Publishing Limited
4. Analytics for the Internet of Things (IoT) by Andrew Minteer, First edition, Packt Publishing
5. Getting Started with Python for the Internet of Things by Dr. Steven Lawrence Fernandes, SaiYamanoor, and Tim Cox, First edition, Packt Publishing
6. Internet of Things Programming Projects: Build Modern IoT Solutions with the Raspberry Pi 3 and Python by Colin Dow, Packt Publishing Limited

Reference Books

1. Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies by Dimitrios Serpanos, Marilyn Wolf, 1st ed. 2018 edition, Springer
2. Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3 by Peter Waher. First edition, Packt Publishing
3. Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed by Perry Xiao, 1st edition, Wiley
4. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer

Recommended Online Free Courseware /Learning Resources

1. Udemy.com
2. Introduction to ARM mbed: playlist on Youtube
3. https://www.raspberrypi.org/teach/

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering
Honors in Internet of Things
S.Y. B.Tech (Electronics & Telecommunication Engineering)- Sem-IV
ENTHON02C: Industrial IoT

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ESE:70 Marks
Practical: 2Hrs/Week, 1 credit	ISE: 30 Marks
	ICA: 25 Marks

The Industrial Internet of Things (IoT) has transformed how businesses think about and interact with the world. Sensors can measure the performance of high- volume industrial manufacturing operations or the daily environmental health of a remote island. The IoT makes it possible to study the world at various levels of precision and enable data-driven decision making anywhere. Machine learning (ML) and Elastic cloud computing have accelerated our ability to understand and analyze the huge amount of data generated by the IoT. With edge computing, data analytics and ML models can process information locally at the source where the data is generated. This course introduces an approach to combine the technologies of edge computing and machine learning to deliver next-generation cyber-physical outcomes.

Course Objectives:

1. To make students aware of data driven architecture for edge devices.
2. To introduce students with machine learning at the edge.
3. To make students learn various edge topologies.
4. To make students learn the deployment of edge applications in real time.
5. To make students build edge applications on the cloud.

Course Outcomes:

At the end of this course students will be able to,

1. Define data driven architecture with machine learning for the edge.
2. Define the anatomy of edge machine learning solutions.
3. Build an edge application w.r.t. best edge topology for a given application
4. Orchestrate deployment of streaming from the edge to a data lake on the cloud.
5. Design data flow patterns on the cloud.

SECTION I

Unit 1 - Introduction to the Data-Driven Edge with Machine Learning (06)

Living on the edge, Bringing ML to the edge, Tools to get the job done, Demand for smart home and industrial IoT, Setting the scene: A modern, smart home solution, Hands-on prerequisites.

Unit 2 – Foundations of Edge Workloads (07)

The anatomy of an edge ML solution, IoT Greengrass for the win, Checking compatibility with IoT Device Tester, Installing IoT Greengrass, Your first edge component.

Unit 3 – Building the Edge (08)

Exploring the topology of the edge, Reviewing common standards and protocols, Security at the edge, Connecting your first device – sensing at the edge, Connecting your second device – actuating at the edge.

SECTION II

Unit 4 – Extending the Cloud to the Edge (07)

Creating and deploying remotely, Storing logs in the cloud, Synchronizing the state between the edge and the cloud, Deploying your first ML model.

Unit 5 – Ingesting and Streaming Data from the Edge (07)

Defining data models for IoT workloads, Designing data patterns for the edge, Getting to know Stream Manager, Building your first data orchestration workflow on the edge, Streaming from the edge to a data lake on the cloud.

Unit 6 – Processing and Consuming Data on the Cloud (07)

Defining big data for IoT workloads, Introduction to Domain-Driven Design (DDD) concepts, Design data flow patterns on the cloud, Remembering data flow anti-patterns for edge workloads.

Internal Continuous Assessment (ICA):

ICA consists of a minimum of 8 practicals based on the above curriculum.

Text Books

1. Intelligent Workloads at the Edge: Deliver cyber-physical outcomes with data and machine learning using AWS IoT Greengrass by Indraneel Mitra, Ryan Burke, Packt Publishing Limited,First Published-2022.
2. Internet of Things for Architects by Perry Lea, Packt Publishing Limited
3. Internet of Things Programming Projects: Build Modern IoT Solutions with the Raspberry Pi 3and Python by Colin Dow, Packt Publishing Limited

Reference Books

1. Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies by DimitriosSerpanos, Marilyn Wolf, 1st ed. 2018 edition, Springer
2. Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi3 by Peter Waher. First edition, Packt Publishing

Recommended Online Free Courseware /Learning Resources

1. Udemy.com
2. https://docs.aws.amazon.com/iot/index.html

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

NEP 2020 Compliant

Honors Degree Curriculum With effect from 2024-2025

Honors Degree Structure: Railway Engineering

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ENTHON-01D	Railway Engineering: A Beginner's Perspective	3	1		4	70	30	25	125
IV	ENTHON-02D	Data Communication and Signaling in Railway	3		2	4	70	30	25	125
V	ENTHON-03D	Applications of IT and Control Engineering in Railway	3		2	4	70	30	25	125
VI	ENTHON-04D	Advanced Communication and Modern Signaling in Railway	3		2	4	70	30	25	125
VII	ENTHON-05D	Mini Project			4	2			50	50
		Total	**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering
Honors in Railway Engineering
S.Y. B.Tech (Electronics & Telecommunication Engineering)- Sem-III

ENTHON01D: **Railway Engineering: A Beginner's Perspective**

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ESE:70 Marks
Tutorial: 1Hr/Week, 1 credit	ISE:30 Marks
	ICA: 25 Marks

Railway engineering is a multi-faceted engineering discipline dealing with the design, construction and operation of all types of rail transport systems. It encompasses a wide range of engineering disciplines, including civil engineering, computer engineering, electrical engineering, mechanical engineering, industrial engineering and production engineering. In this course, there is study of Railway signaling with Electronics part. This course is help for new beginners to understand the operation of railway signaling.

Course prerequisite: Prerequisite for this course is Basic electronics and Basic Electrical Engineering.

Course Objectives:

1. To make student aware of Indian Railways System
2. To summarize Railway Transportation and Its Development
3. To understand role of Electrical, Electronics, Computer, Civil, and Mechanical Engineers in Railways
4. To discuss recent trends in Indian Railways
5. To discriminate the Indian Railways as an International Perspective

Course Outcomes:

At the end of this course students will be able to,

1. Define the Indian Railways System
2. Summarize Railway Transportation and Its Development
3. Understand the role of Electrical, Electronics, Computer, Civil and Mechanical Engineers in Railways
4. Discuss the recent trends in Indian Railways
5. Discriminate the Indian Railways as an International Perspective

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SECTION I

Unit 1-Indian Railways - A Perspective : (05)

General Features of Indian Railways, Important Statistics of Indian Railways, Organization of Indian Railways, Indian Railway Finances and their Control, Commission of Railway Safety, Recruitment Boards of Indian Railways Different Corporations in Indian Railways, Indian Railway Information Systems, Growth of Indian Railways.

Unit 2- Railway Transportation and Its Development : (07)

Terminology- Locomotive, Engine, Bogie, Coach, Freight train, Wheel Arrangement (WA), Driving Cab, Pantograph, Gauge, Transmission, Traction Motors, Coupler, Crossing, Diamond crossing, Junction, Terminal, Fishplate, Permanent way, Rolling stock

Evolution of Different Facets of the Railways

a. Rails Types of rail section: D.H. Rails, B.H. Rails and F.F. Rails, Standard rail sections, Comparison of rail types, Track structure and different gauges.

b. Sleepers , comparison of different types of sleepers and components of track

c. Bridges evolution of iron to steel, arch ,rcc, psc, steel

d. Mode of traction steam, diesel, electric

e. Locomotives evolution of locomotives of each type Various propulsion systems

f. Bogies and coaches

Unit 3- Role of Electrical, Electronics & Computer Engineering in Railways (09)

Introduction to Electrical Engines, Working of Locomotives, Overhead (OHE) Equipment's in Railways, Braking Systems in Railways, Power Supply System & Technology in Railways, Introduction to the Electronic System in Indian Railway, Electrical Switches and Relays used in Indian Railway, Display Control and Mechanism in Railway, Electronics Communication System in Railways, Safety Measures in Indian Railways, Software's in Indian Railways

SECTION II

Unit 4- Role of Civil and Mechanical Engineering in Railways (08)

Fundamentals of Geology, Tracking System, Layers of material on Tracks, Overview of Civil Engineering in Railway Systems, Introduction to Ballast, Rails, Sleepers, Points of Crossings, and Points of Switches, Maintenance of Railway Tracks.

Mechanical System used in Railway Engine & Bogies. Construction of Bogies, Material Used for Railing system, Mechanisms in Railway Locomotive, Study of Railway Engines, Maintenance of Railway Tracks

Unit 5- Recent Trends in Indian Railways **(08)** Introduction, Modernization of traction, Speed trends, modernization of track, Trends in trackvehicles, container transport service, Automation in operation, High powered locomotives,Miscellaneous development. Introduction to the Clean Energy in Indian Railways, Overview ofFaster Trains in India, Overview of Bullet Trains and Metro, Concept of Anubhuti Coaches inIndian Railways, and Introduction to the Bio Toilets in Indian Railway.

Unit 6- Review of Railways - An International Perspective **(05)**

Overview of International Railways, Development of Railway Systems, Recent Trends inInternational Railways, and Overview of Maglev Technology.

Internal Continuous Assessment (ICA):

1. Case Study: Case Studies on Recent Trends in Railways (15 hrs)
2. Industrial Visits on Railway Workshops/Institutes/Industries (15 hrs)

References:

1. Satish Chandra and M.M. Agarwal, Railway Engineering, Oxford University Press, 2007.
2. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia
3. M.A. Chowdhary and A. Sadek, Fundamentals of Intelligent Transportation systems planning. Artech House Inc., US, 2003
4. S.C. Rangawala, Principles of Railway Engineering, Charotar Publication, 2015.
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3. Handbook of Railway Vehicle Dynamics, Taylor & Francis Group
4. J. S. Mundrey, Railway Track Engineering, McGraw Hill Publication, 2009
5. R.. B. Gupte, Text Book Of Engineering Geology, Pune Vidyarthi Griha Prakashan
6. G. Shanmugam and M. S. Palanichamy, Basic Civil and Mechanical Engineering, Tata McGraw Hill Publishing Co., New Delhi, 1996.
7. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, Delhi, 1999.
8. Robert Sneddon, Material Technology, Heinemann Library, 2002 12. James A. Jacobs & Thomas Kilduff, Engineering Materials Technology: Structures, Processing, Properties, and Selection, Pearson; 5th edition, 2004
9. David A. Dornfeld, Green Manufacturing: Fundamentals and Applications, Springer; 2012 edition
10. Nand K. Jha, Green Design and Manufacturing for Sustainability, CRC Press; first edition, 2015
11. John B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Education; 1st edition, 2017
12. V. Ganeshan, Internal Combustion Engine, McGraw Hill Education; 4th edition, 2017
13. S.C. Saxena, S.P. Arora, A Text Book Of Railway Engineering, Dhanpat Rai Publications (p) Ltd.-new Delhi, 2010.

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Electronics & Telecommunication Engineering
Honors in Railway Engineering
S.Y. B.Tech (Electronics & Telecommunication Engineering)- Sem-IV

ENTHON02D: Data Communication and Signaling in Railway

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ESE:70 Marks
Practical:2Hrs/Week, 1 credit	ISE:30 Marks
	ICA: 25 Marks

Course Objectives:

1. To make students aware of Data communication
2. To summarize Railway Transportation and Its Internet Facility
3. To understand the role of Electrical, Electronics in Railways
4. To discuss recent trends in signaling in Indian Railways
5. To discriminate against the Indian Railways from an International Perspective

Course Outcomes:

At the end of this course, students will be able to,

1. Define the Data communication
2. Summarize Railway Transportation and Its Internet Facility
3. Understand the role of Electrical, Electronics in Railways
4. Discuss the recent trends in signaling in Indian Railways
5. Discriminate the Indian Railways as an International Perspective

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SECTION I

Unit 1 - Data Communication **(07)**

Introduction of data communication Fundamentals such as data, signals, etc., types of Transmission Medias, Types of Network cables: Twisted Pair cable, Coaxial Cable, Fiber Optic Cable,

Unit 2 - Internet **(07)**

IP Addressing: Physical, Logical Internet & Intranet, Components of the Internet, World Wide Web, E-Mail, Telnet, FTP, Understanding the World Wide Web, Hypertext: The Motion of the Web, Retrieving Documents on the Web: The URL, Real-Time Communication.

Unit 3 - Basics of Electrical and Electronics **(07)**

Passive Components, Basics of AC and Electrical Cables, Cells & Batteries, Transformers, AC & DC measurements, Soldering & De-soldering and switches, Rectifiers, IC Regulators, Different Batteries, 110 DC Voltage, Electromagnetic theory, Electric Discharge Different types of fuzes

SECTION II

Unit 4 - Basic Signaling in Railway **(07)**

Introduction to Signal, Objects of Signals, Types of Signals, Classification of Signals according to functions, Classification of Signals according to Location, Special Signals. Principles of Signaling, Concepts of points. Location of point and range of operation. Signaling Plan- Control Table, Characteristics OF Electro-Magnetic Relay, Classification Of Signaling Relay

Unit 5 - Computer Network **(06)**

Introduction to Computer Network, Networking Devices, Client-Server Communication, Installation & Configuration of DHCP, DNS, FTP, TELNET, Introduction to Network security & GPS

Unit 6 - Railnet (Railway Intranet) (08)

An Installation, Equipment used in Railnet, Installation of the equipment, Connectivity Diagram, IP Planning, E-Mail addressing, Software based on Railnet, Failure & Troubleshooting

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Internal Continuous Assessment (ICA):

1. ICA shall consist of minimum six to eight assignments based on entire curriculum
2. Industrial Training/Internship

References:

1. Computer Networks (Principles, Technologies and Protocols for network design) - Natalia Olifer, Victor Olifer (Wiley Publications)
2. Internetworking with TCP/IP Vol III. Client-Server Programming & Applications: Douglas E. Comer
3. Data Communication and Networking: Behrouz A. Forouzan
4. Satish Chandra and M.M. Agarwal, Railway Engineering, Oxford University Press, 2007.
5. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia
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