Kavayitri Bahinabai Chaudhari

NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Second Year Bachelor of Engineering

in

Electronics & Telecommunication

(As per NEP 2020 Guidelines)

Faculty of Science and Technology

कवयित्री बहिणाबाई चौधरी उत्तर महाराष्ट्र विद्यापीठ
अंतरी पेटवू ज्ञानज्योत
1990
'A' Grade
NAAC Re-Accredited
(4th Cycle)

SYLLABUS STRUCTURE

For Affiliated Colleges

Semester – III & IV

W.E.F. 2025 – 26

Syllabus Structure for Second Year Engineering (Semester – III, Level – 5.0) (Electronics & Telecommunication) (w.e.f. 2025 – 26)

(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC-301	Solid State Devices and Circuits	PCC	3			3	40	60			100	3
EC-302	Solid State Devices and Circuits Lab	PCC			2	2			25	25 (OR)	50	1
EC-303	Digital System Design	PCC	3			3	40	60			100	3
EC-304	Digital System Design Lab	PCC			2	2			25	25 (OR)	50	1
EC-305	Electronics Workshop Lab	PCC	1		2	3			25	25 (PR)	50	2
EC-306	Computer Networks	MD M	2			2	40	60	25		125	2
OE-307	Open Elective Course – I	OE	3			3	40	60			100	3
EC-308	Industrial Organization & Management	HSSM	2			2						2
EC-309	Universal Human Values	HSSM	1		2	3			25		25	2
EC-310	Community Engagement Project / Field Project	ELC			4	4			50		50	2
			15		**12**	**27**	**160**	**240**	**175**	**75**	**650**	**21**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

CA: College Assessment UA: University Assessment

Syllabus Structure for Second Year Engineering (Semester – IV, Level – 5.0) (Electronics & Telecommunication) (w.e.f. 2025 – 26)

(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC-401	Analog Circuits	PCC	3			3	40	60			100	3
EC-402	Analog Circuits Lab	PCC			2	2			25	25 (OR)	50	1
EC-403	Analog and Digital Communication	PCC	3			3	40	60			100	3
EC-404	Analog and Digital Communication Lab	PCC			2	2			25	25 (OR)	50	1
EC-405	Electronics Design Lab	PCC	1		2	3			25	25 (PR)	50	2
EC-406	Biology for Engineers	MD M	2			2	40	60	25		125	2
OE-407	Open Elective Course – II	OE	3			3	40	60			100	3
EC-408	PCB Artwork Layout & Etching	VSEC			2	2			25		25	1
EC-409	Ability Enhancement Course	AEC			2	2			25		25	1
EC-410	Entrepreneurship Development Program	HSSM	2			2						2
EC-411	Environmental Sciences	HSSM	2			2		25			25	2
			16		**10**	**26**	**160**	**265**	**150**	**75**	**650**	**21**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

CA: College Assessment UA: University Assessment

EXIT COURSE FOR U. G. DIPLOMA in Electronics & Telecommunication (DURATION 8 WEEKS)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC-412	Internship / Apprenticeship	OJT							125			4
EC-413	Mini Project	Project							25			4
									150			8

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UNIVERSITY, JALGAON (M.S.)

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Electronics & Telecommunication

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Faculty of Science and Technology



COURSE OUTLINE

For Affiliated Colleges

Semester – III

W.E.F. 2025 – 26

SOLID STATE DEVICES AND CIRCUITS(PCC)					
COURSE OUTLINE					
Course Title:	**Solid State Devices and Circuits**	**Short Title:**	**SSDC**	**Course Code:**	**EC -301**

Course description:
This course provides comprehensive study of transistor analysis with AC & DC.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	03	15	45	03

Prerequisite course(s):
Basic knowledge of electrical networks & semiconductor devices.

Course objectives:

1. Analyze BJT single stage amplifier configurations.
2. Analyze FET single stage amplifier configurations.
3. Analyze cascade amplifier configurations using BJT-FET.
4. Analyze transistor & IC regulators.
5. Familiarize with different power devices.

Course outcomes:
After successful completion of this course the student will be able to:

1. To analyze different BJT amplifier configurations.
2. To analyze different FET amplifier configurations
3. To analyze different cascade amplifier configurations
4. To analyze different discrete & IC regulators.
5. To be familiar with power devices.

COURSE CONTENT

SOLID STATE DEVICES AND CIRCUITS		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

BJT Amplifiers :
General amplifier analysis using h parameters (small signal analysis). CE-CB-CC amplifiers with biasing circuits. Determination of Avs, Ais, Ri, Ro. Conversion of CE-CC h parameters. Comparison of CE-CB-CC, Miller theorem & its dual. (Numericals essential).

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

FET Amplifier :
JFET, D & E type MOSFET operating point, determination of I_{DQ}, V_{DSQ}, V_{GSQ}. Small signal analysis of CS-CG-CD configurations with biasing circuits for JFET only. (Numericals essential)

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Frequency response & Cascade amplifiers:
Frequency response of single stage & cascade amplifier using BJT**.** Cascade configurations: CE-CE, CE-CB, CE-CC & Darlington configuration. (Numericals on these combinations with

biasing circuits only.)		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Regulators:- BJT series regulator with analysis of circuit elements & derivation for Sv & Ro (Fixed Vi, Vo & I_L). LM 317, LM 337, LM 340 & dual tracking regulator. Buck & Boost regulators. (Numericals essential).		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Thyristor Devices: Silicon controlled rectifier (SCR), TRIAC, Power MOSFET, IGBT, Uni-junction transistor, UJT relaxation oscillator. (Working & I-V characteristics).		
Text Books:		
1. R. S. Sedha: “Applied Electronics”, S. Chand Publication. 2. V.K. Mehta: “Principles of Electronics”, S. Chand Publications.		
Reference Books: 1. R. L. Boylestad, L. Nashelsky: “Electronic Devices and Circuits Theory", 11th Edition, Prentice Hall of India, 2017 2. A.P. Malvino : “Electronics Principles” TMH Publications. 3. Millman & Halkias : “Integrated Electronics” TMH Publication.		
NPTEL Links: 1. Basic Electrical Technology,Prof.L Umanand,IIsc Banglore. https://nptel.ac.in/courses/108108076. 2. Introduction to Basic Electronics ,Prof.T.S.Natarajan,IIT,Madras. https://nptel.ac.in/courses/122106025.		

<table>
<tr><th colspan="6">SOLID STATE DEVICES AND CIRCUIT LAB (PCC)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">Solid State Devices and Circuit Lab</td><td>Semester:</td><td>III</td><td>Course Code:</td><td>EC -302</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester credits :</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">Practical (PR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory Experiments/assignments from the following list.
1. Determination of operating point of BJT.
2. Frequency response of single stage CE amplifier.
3. Determination of operating point of JFET.
4. Frequency response of single stage CS amplifier.
5. Frequency response of CE-CC Configuration.
6. Frequency response of CE-CB Configuration.
7. Voltage regulation (Load) of series regulator.
8. To observe output of LM317 regulator.
9. Plot V/I characteristics of SCR.
10. Observe output of UJT relaxation Oscillator.</td></tr>
<tr><td colspan="6">Guide lines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.</td></tr>
<tr><td colspan="6">Guidelines for ESE:</td></tr>
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</table>

DIGITAL SYSTEM DESIGN(PCC)				
COURSE OUT LINE				
Course Title:	**Digital System Design**	**Short Title: DSD**	**Course Code:**	**EC -303**

Course description:

This course is aimed at introducing the fundamentals of digital systems to undergraduate students. This course helps to understand the importance of digital logic verification and design for test ability. The goals of the course are to understand the basic principle of digital systems and application in different area .The major focus of this course is to design and analyze.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Knowledge of number system, logic gates, simplification and implementation of logic system and also knowledge about semiconductor devices of Electronics Engineering

Course objectives:

1. To give the brief idea about basics of Boolean algebra and K-Map.
2. To learn Combinational logic design using MSI circuits.
3. To learn Sequential logic design using flip-flop.
4. To analyze and design asynchronous and synchronous machine.
5. Introduce students with logic family like TTL, CMOS.

Course outcomes:

After successful completion of this course the student will be able to:

1. Apply knowledge of k-map to obtain minimized expressions.
2. Demonstrate the combinational logic design using MSI circuits.
3. Analyze and design sequential logic design using flip-flop.
4. Analyze and design sequential circuit for realize counters and shift registers
5. Understand the design concept of logic family.

COURSE CONTENT

DIGITAL SYSTEM DESIGN(PCC)		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Logic Simplification and code convertors:
Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, canonical forms Karnaugh maps up to 5 variables, Don't care conditions, Binary Codes, BCD Codes, ASCII code, Hamming code ,Code Conversion- Binary to gray, Gray to Binary, BCD to Excess3 And BCD to seven segment decoder.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Combinational Logic Circuits:
Half and Full Adders using basic gates, Half and Full Substractors using basic gates, BCD adder, IC 7483, 1 bit and 2 bit Comparators, Multiplexers, Demultiplexer, Decoder.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Sequential Logic Circuits:

Basic difference between Combinational Logic Circuits and Sequential Logic circuit, Building blocks like S-R, JK and Master-Slave JK FF, T flip flop, D Flip flop.

Shift registers- Types of Shift registers and operation of SISO, SIPO, PIPO, PISO, Bidirectional Shift Register, Universal Shift Register, Ring Counter.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Counters and sequential circuits:

Asynchronous (Ripple) counters-Design of ripple counters and Mod –N ripple counter using Flip- flop, Synchronous counter - Design of Synchronous counters and Mod –N Synchronous counter, Up Down Counter.

Synchronous sequential Circuit model - Mealy Model and Moore Model, Block Diagram, State Diagram, State table, State Assignment.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Logic Families:

Classifications of Logic family, Specifications, Propagation delay, Noise margin, fan-in, fan-out, Simple TTL and standard TTL gate, Specifications of TTL family, ECL family, CMOS families -CMOS Invertor, CMOS NOR gate, CMOS NAND gate Interfacing- TTL to CMOS and CMOS to TTL, Introduction to programmable Logic devices.

Text Books:

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.

Reference Books:

1. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition 2012.
2. John M Yarbrough “Digital Logic Application and Design, Brooks, Thomson LearningVikas Publishing House.
3. Douglas Perry, “VHDL”, Tata McGraw Hill, 4th edition, 2002.
4. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989.

NPTEL Links:

1. Digital System Design,Neeraj Goal,IIT ROPAR. https://onlinecourses.nptel.ac.in/noc21_ee39/preview.
2. Switching circuit & Design ,Indrdranil sen gupta,IIT Kharagpur. https://archive.nptel.ac.in/courses/106/105/106105185/

<table>
<tr><th colspan="6">DIGITAL SYSTEM DESIGN LAB (PCC)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">Digital System Design Lab</td><td>Semester:</td><td>III</td><td>Course Code:</td><td>EC-304</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA :</td><td>25 marks</td></tr>
<tr><td>Semester credits :</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">Practical (PR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory Experiments/assignments from the following list.
1. Realization of logic gates OR, AND, NOT, NOR, NAND gates using discrete components and verify their truth tables.
2. Design and implement 4-bit binary to Gray code converter
3. Implement 4-bit binary adder using IC 7483
4. Implement BCD to 7-segment decoder using IC 7447
5. Verify the truth table of multiplexer and Demultiplexer using IC
6. Study of Decade Counter
7. Study of JK, D type and T-Type flip-flop using IC 7476
8. Study of Shift Register
9. Study of Synchronous counter using IC 74191
10. Realization of half and full Adder using gates.</td></tr>
<tr><td colspan="6">Guidelines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or Mark each assignment on completion date declared for each assignments.</td></tr>
<tr><td colspan="6">Guidelines for ESE:</td></tr>
<tr><td colspan="6">ESE will be based on the laboratory assignments submitted by the students in the form of journal. Evaluation will be based on the understanding and execution.</td></tr>
</table>

ELECTRONICS WORKSHOP LAB (PCC)				
LAB COURSE CONTENT				
Electronics Workshop Lab	**Semester:**	**III**	**Course Code:**	**EC-305**

Course description:

Provides hands-on practical experience in building and troubleshooting electronic circuits, by teaching students how to use various electronic components, tools, and techniques to assemble, test, and repair basic electronic devices. Often applying theoretical knowledge gained in an accompanying electronics class to real-world applications; it typically includes soldering, wiring, circuit design, component identification, and basic troubleshooting procedures.

Teaching Scheme:		**Examination scheme**	
Theory	**1 hours/week**	**End semester exam (ESE) UA:**	**25 marks**
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**	**25 marks**
Semester Credits	**02**		

End Semester Exam (ESE) Pattern:	**ORAL (OR)**

Course objectives:

1. To make students familiar with the components
2. To make students familiar with devices.
3. To make students familiar with various electronics measurement.
4. To make students familiar with electronics instruments.
5. To make students familiar with PCB Designing

Course outcomes:

After successful completion of this course the student will be able to:

1. Know the different types of components.
2. Understand fabrication and characteristics of integrated circuits.
3. Understand basics of measurement.
4. Know electronics instruments and Devices.
5. Design and manufacturing of printed circuit board.

Concerned faculty member should suitably frame SIX laboratory Experiments/assignments from the following list.

1. Introduction of active & passive component.
2. Study of CRO.
3. Study of Digital Multi-meter.
4. Study of Power supply.
5. Study of function generator.
6. Study of Semiconductor devices.
7. Study of various types of PCB's.
8. Study of Etching Process of PCB.
9. Study of drilling process of PCB.
10. Study of Soldering process of PCB.

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignment.

Guidelines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

COMPUTER NETWORK (MD M)					
COURSE OUT LINE					
Course Title:	**Computer Network**	**Short Title:**	**CN**	**Course Code:**	**EC- 306**

Course description:

This course describes the basics concept of Computer Network, architecture, protocol and its Applications.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	02	15	30	02

Prerequisite course(s):

Analog & Digital Communication, Signal and System

Course objectives:

1. To study the basics concept of Computer Network.
2. To understand the principle of various types of Computer Network.
3. To familiarize the concept of Various Protocols.
4. To provide strong foundation for understanding of Congestion and Quality of Service.
5. To Learn the Network Security & Authentication Protocols.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand concept of Computer Network.
2. Explain the principle of various types of Computer Network.
3. Explain the concept of Various Protocols.
4. Apply strong foundation for understanding of Congestion and Quality of Service.
5. Apply the Network Security & Authentication Protocols

COURSE CONTENT

Computer Network		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**2 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**
		Internal Continuous Assessment (ICA) CA:	**25 marks**

Unit–I:	**No. of Lectures: 06 Hours**	**Marks: 12**

Introduction to Computer Network –Network Topologies, Network components: Hubs & switches, LAN, MAN, WAN, ISO/OSI Reference Model, TCP/IP Reference Model, Guided and unguided media: Transmission media: Twisted pair, coaxial cable, Fiber optics. Wireless Transmission: Radio transmission, Microwave transmission, Infrared Transmission.

Unit–II:	**No. of Lectures: 06 Hours**	**Marks: 12**

Design issues, Framing, Error and Flow Control Flow control, Data Link Protocols: Unrestricted Simplex Protocol, stop and wait protocol, Simplex Protocol for a Noisy Channel. Sliding Window Protocols: Using Go-Back n, Protocol using Selective Repeat.

Unit–III:	**No. of Lectures: 06 Hours**	**Marks: 12**

Network Layer -Design Issue of Network Layer, Comparison of Virtual circuit and Datagram subnets, Routing Algorithms, Shortest Path Routing Congestion Control Algorithms, Congestion Prevention Policies.

Unit–IV:	**No. of Lectures: 06 Hours**	**Marks: 12**

Transport Layer -ARP,RARP, Transmission Control Protocol(TCP), User Datagram Protocol(UDP) , Congestion Control of Transport Layer, Quality of Service(QoS).

Unit–V:	**No. of Lectures: 06 Hours**	**Marks: 12**

Application Layer- Domain Name System(DNS), SNMP, Network Security, Cryptography, Public key algorithms, Digital Signature, Firewalls.

Text Books:

1. Andrew S Tanebaum - Computer Networks, 4th Ed. PHI/ Pearson education.
2. Behrouz A Forouzan - Data Communication and Networks, 3rd Ed. TMH.

Reference Books:

1. Irvine Olifer - Computer Networks: Principles, Technology and Protocols, Wiley India.
2. William Stalling – Data and Computer communications, 7th Ed. PHI
3. S.Keshav,"An Engineering Approach to Computer Networking", Pearson Education.

NPTEL Links:

1. Computer network & Internet protocol.Soumya Kanti Ghosh & Sandip Chakraborty,IIT Khragpur. https://onlinecourses.nptel.ac.in/noc22_cs19/preview.
2. Advanced Computer Network.Dr.Neminath Hubballi,IIT Indore, Prof. Sameer G Kulkarni,IIT Gndhinagar.https://onlinecourses.nptel.ac.in/noc24_cs11/preview

Concerned faculty member should suitably frame SIX assignments from the following list.

1. Introduction to Network Topologies,
2. Introduction to Computer network.
3. Various design issue of data link layer.
4. Various design issue of network layer.
5. Comparison of virtual circuit & data gram sub net.
6. Various types of routing algorithms.
7. Congestion prevention policies.
8. Working of SNMP.
9. Working of DNS.
10. Network Security.

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in Charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignment.

INDUSTRIAL ORGANIZATION AND MANAGEMENT (Humanities Social Science and Management)					
COURSE OUTLINE					
Course Title:	**Industrial Organization Management**	**Short Title:**	**IOM**	**Course Code:**	**EC-308**

Course description:

This course provides an introduction to the basics of management their organizational structures with human resources development, financial management, quality management & industrial acts.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	02	15	30	02

Prerequisite course(s):

Course objectives:

The objective of this course is to:
1. Students will understand fundamental principle of Organization and Management.
2. Student will learn the concept of organization Structure.
3. Student will get the knowledge of financial resource for enterprise.
4. Student will gain knowledge about man power planning in industry for proper utilization of available resources.
5. Students will become aware about importance of quality standards and industrial safety.

Course outcomes:

After successful completion of this course the student will be able to:
1. Demonstrate knowledge about management science and get motivation for Entrepreneurship.
2. Able to know about various organizational structures and their application in industry.
3. Able get information about financial sources for setting the capital for startup.
4. Understand the utilization of available resources like men, material and machines etc.
5. Apply the knowledge of ISO standards, Industrial acts and accident avoidance.

COURSE CONTENT

INDUSTRIAL ORGANIZATION AND MANAGEMENT		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**2 hours/week**		

Unit–I:	**No. of Lectures: 06 Hours**

Management and principles of Management: Introduction to definition of management, Introduction to scientific management by F.W Taylor, Administrative management by Fayol, Functions of management. Principles of management, Relation between Administration Management and Organization.

Unit–II:	**No. of Lectures: 06 Hours**

Organizational structure: Concept, Organization theories and forms of organizational structure. Types of ownership, Partnership, proprietorship, Joint stock company, private limited, public limited, co-operative organization.

Unit–III:	**No. of Lectures: 06 Hours**

Financial Management: Definition and functions of financial management, Capital structure

fixed and working capital. Sources of finance – external and internal sources, Loans from banks, Public deposits, Trade credit.

Unit–IV:	**No. of Lectures: 06 Hours**	

Human Resources Management: Factors affecting on human resource planning concept, Need of human resource planning. Sources of recruitment, Objectives and benefit of training methods to workers, E-business and E-governance.

Unit–V:	**No. of Lectures: 06 Hours**	

Industrial Labour Legislation: Importance and necessity of labour act, Industrial act: factories act Industrial Accidents and safety, ISO 9000 series standards in general.

Text Books:

1. M. Mahajan: Industrial Engineering & Production Management, Dhanpat Rai &company.
2. O.P Khanna: Industrial Engineering & Management, Dhanpat Rai &Company.

Reference Books:

1. . Koontz: Essential of Management, TMH 6 th Edition.
2. M.Y Khan & P.K.Jain :- Financial Management, TMH.

NPTEL Links:

1. Introduction to Organization Management, Prof. Vinayshil Gautam, Organization Management, IIT Delhi, Nature, Scope and Complexity, https://nptel.ac.in/courses/110102016.
2. Management and Science ,IIT Delhi, https://archive.nptel.ac.in/courses/122/102/122102007/

Concerned faculty member should suitably frame SIX assignments from the following list.

1) Significance of standardization in F.W. Taylor's Scientific Management approach.
2) Organization theories and forms of organizational structure.
3) Capital structure & its different types.
4) Objectives and benefit of training methods to workers.
5) Importance of ISO 9000 series standards.
6) Functions of management.
7) Functions of Financial management.
8) Various factors affecting on human resource planning

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in Charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignment.

UNIVERSAL HUMAN VALUES (Humanities Social Science and Management)

COURSE OUTLINE

Course Title:	**UNIVERSAL HUMAN VALUES**	**Short Title:**	**UHV**	**Course Code:**	**EC-309**

Course description:

Today, education has become more and more skill biased, and hence, the basic aspiration of a human being, that is to live with happiness and prosperity, gets defeated, in spite of abundant technological progress. This course is aimed at giving inputs that will help to ensure the right understanding and right feelings in the students in their life and profession, enabling them to lead an ethical life. In this course, the students learn the process of self-exploration, the difference between the Self and the Body, the naturally acceptable feelings in relationships in a family, workplace and society, the comprehensive human goal in the society, the mutual fulfilment in the nature and the co-existence in existence. As a natural outcome of such inputs, they are able to evaluate an ethical life and profession ahead.

Thus, this course is intended to provide a much-needed oriental input in value education to the young enquiring minds.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	01	15	15	02
Practical	02	15	30	

Prerequisite course(s):

Course objectives:

The objective of this course is to:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course outcomes:

After successful completion of this course the student will be able to:

1. Become more aware of themselves, and their surroundings (family, society, nature);
2. Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. Have better critical ability.
4. Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning will be made in this direction.

COURSE CONTENT

UNIVERSAL HUMAN VALUES	**Semester**	**III**

		:	
Teaching Scheme:		**Examination scheme:**	
Lectures:	**1 hours/week**	**Internal Continuous Assessment (ICA) CA:**	**25 marks**
Practical:	**2 hours/week**		

Unit–I:	**No. of Lectures: 03 Hours**	
Introduction to Value Education		
Understanding Value Education Self-exploration as the Process for Value Education Basic Human Aspirations and their Fulfillment Right Understanding, Relationship and Physical Facility Happiness and Prosperity – Current Scenario Method to Fulfill the Basic Human Aspirations		
Unit–II:	**No. of Lectures: 03 Hours**	
Harmony in the Human Being		
Understanding the Human Being as Co-existence of the Self and the Body Distinguishing between the Needs of the Self and the Body The Body as an Instrument of the Self Understanding Harmony in the Self Harmony of the Self with the Body Programme to Ensure Self-regulation and Health		
Unit–III:	**No. of Lectures: 03 Hours**	
Harmony in the Family and Society		
Understanding Harmony in the Family – The Basic Unit of Human Interaction 'Trust' – The Foundational Value in Relationship Respect – As the Right Evaluation Other Values in Human-to-Human Relationship Understanding Harmony in the Society Vision for the Universal Human Order		
Unit–IV:	**No. of Lectures: 03 Hours**	
Harmony in the Nature (Existence)		
Understanding Harmony in Nature Interconnectedness, Self-regulation and Mutual Fulfillment among the Four Orders of Nature Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence		
Unit–V:	**No. of Lectures: 03 Hours**	
Implications of the Holistic Understanding – A Look at Professional Ethics		
Basis for Universal Human Values Definitiveness of (Ethical) Human Conduct Professional Ethics in the Light of Right Understanding A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession		
Text Books:		
1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 3rd Revised Edition, UHV Publications, 2023. 2. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics – Teachers Manual, 3rd Revised Edition, UHV Publications, 2023		

3. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.
4. UHV-II: Universal Human Values: Understanding Harmony and Ethical Human Conduct https://fdp-si.aicte-india.org/UHVII.php
5. https://uhv.org.in/uhve

Reference Books:

1. JeevanVidya: Ek Parichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karam chand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Reports, Papers and Impact Studies on UHV Implementation,
    a. https://drive.google.com/drive/folders/1N_1Z1tIm8-iDfy9nQRcHbs_Bjtrk_d24
    b. https://fdp-si.aicte-india.org/Activity_and_Impact.php

Video Links:

1. About UHV Refresher for UHV-II – English, https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1So
2. https://www.youtube.com/playlist?list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz

Guide lines for ICA:

Students must submit ICA in the form of journal with **FIVE** assignments / activities based on the practice sessions outlined in the Teacher's Manual (Text Book No. 2, https://uhv.org.in/frontend/download/Teachers%20Manual%20Foundation%20Course%20in%20Human%20Values%20and%20Professional%20Ethics%20(eBook).pdf), encompassing a process of self-investigation and self-exploration, suitably framed by concerned teacher / faculty mentor.

The assessment, in this course, is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. shall be used in evaluation. The evaluation criteria for assessment are as follows.

Assessment by Teacher / faculty mentor: 05 marks
Self-assessment: 05 marks
Assessment by peers: 05 marks
Socially relevant project/Group Activities/Assignments: 10 marks

Faculty in charge will assess the assignments continuously and grade or mark each assignment / activity on completion date declared for each assignment / activity.

COMMUNITY ENGAGEMENT PROJECT / FIELD PROJECT (ELC)					
COURSE OUTLINE					
Course Title:	**COMMUNITY ENGAGEMENT PROJECT / FIELD PROJECT**	**Short Title:**	**CEP**	**Course Code:**	**EC - 310**

Course description:
The subject Community Engagement Project / Field Project involves activities that will expose students to the socio-economic issues in society so that the theoretical learning's can be supplemented by actual life experiences to generate solutions to real-life problems.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Practical	04	15	60	02

Prerequisite course(s):

Course objectives:

The objective of this course is to:
1. To develop an appreciation of rural culture, life-style and wisdom amongst students
2. To learn about the status of various agricultural and development programmes
3. To understand causes for distress and poverty faced by vulnerable households and explore solutions for the same
4. To apply classroom knowledge of courses to field realities and thereby improve quality of learning

Course outcomes:

After successful completion of this course the student will be able to:
1. Gain an understanding of rural life, Indian culture & ethos and social realities
2. Develop a sense of empathy and bonds of mutuality with local community
3. Appreciate significant contributions of local communities to Indian society and economy
4. Learn to value the local knowledge and wisdom of the community
5. Identify opportunities for contributing to community's socio-economic improvements

COURSE CONTENT

COMMUNITY ENGAGEMENT PROJECT / FIELD PROJECT		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Practical:	**4 hours/week**	**Internal Continuous Assessment (ICA) CA:**	**50 marks**

The course requires students to participate in any **TWO** field-based learning/projects as listed below under the supervision of faculty. This will help educate local communities about new technological innovations as well as aware students about ways to harness local technology and knowledge. In this approach, students apply their knowledge and skills in a chosen community to improve the lives of people in that community. The activities may also be conducted other than working hours.

Recommended field-based activities (Tentative):

1. Interaction with Self Help Groups (SHGs) women members, and study of their functions and challenges; planning for their skill building and livelihood activities

2. Visit Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MGNREGS) project sites, interact with beneficiaries and interview functionaries at the work site
3. Field visit to Swatch Bharat project sites, conduct analysis and initiate problem solving measures
4. Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan (GPDP)
5. Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization
6. Visit Rural Schools / mid-day meal centres, study academic and infrastructural resources and gaps
7. Participate in Gram Sabha meetings, and study community participation
8. Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries
9. Visit to local Nagarpalika office and review schemes for urban informal workers and migrants
10. Attend Parent Teacher Association meetings, and interview school drop outs
11. Visit local Anganwadi Centre and observe the services being provided
12. Visit local NGOs, civil society organisations and interact with their staff and beneficiaries,
13. Organize awareness programmes, health camps, Disability camps and cleanliness camps
14. Aware / conduct soil health test, drinking water analysis, energy use and fuel efficiency surveys and guiding solar powered village
15. Raise understanding of people's impacts of climate change, building up community's disaster preparedness
16. Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers and promotion of traditional species of crops and plants
17. Formation of committees for common property resource management, village pond maintenance and fishing
18. Identifying the small business ideas for rural areas to make the people self-reliant.
19. Undertaking research projects in partnership with local community through community-based research methods
20. Social innovation projects with a social impact
21. Financial Literacy Awareness Programme
22. Digital Literacy Awareness Programme
23. Education Loan Awareness Programme
24. Entrepreneurship Awareness Programme
25. Awareness Programmes on Government Schemes
26. Products Market Awareness
27. Services Market Awareness
28. Consumer Awareness Programme
29. Accounting Awareness Programme for Farmers
30. Accounting Awareness Programme for Street Vendors etc.
31. Nutrition survey for mothers and children, and educate them about hygiene and nutrition.

32. Study / Survey / Field based Project on contributions / implications / influence / impact of Indian Knowledge System on Indian Society / Community / life / values / practices / principles / technology / development etc.

Students must conduct comprehensive studies on various challenges that they face in their chosen field. Every work relevant to the subject matter should be compiled and documented.

Students should keep separate fieldwork diary or maintain journal in order to record their fieldwork experiences i.e. reading, e- contents, tasks, planning and work hours have to be recorded in the diary. Detailed work records report on students' fieldwork experiences and activities to be submitted and should be presented.

Every student shall submit a report in the form of journal that may include, but not limited to, the following.

1. A map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village / community.
2. Videos and/or Geo-tagged photographs of events / activities conducted
3. Describe your analysis of rural household economy, its challenges and possible pathways to address them
4. How effectively are institutions functioning? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual).
5. Describe the benefits received and challenges faced in the delivery of one of these programs in the local community; give suggestions about improving implementation of the program for the community.

Guide lines for ICA:

Students must submit ICA in the form of journal. Faculty in charge will monitor and assess continuously with grade or mark each project on completion date declared for each of them.

Assessments of students shall include review of their involvement and contributions to community engagement. It shall also include presentation of project findings as documented in the journal.

Kavayitri Bahinabai Chaudhari NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Second Year Bachelor of Engineering

in

(Common for all)

(As per NEP 2020 Guidelines)

Faculty of Science and Technology



COURSE OUTLINE FOR OPEN ELECTIVE - I

For Affiliated Colleges

Semester – III

W.E.F. 2025 – 26

Open Elective - I

A Student can opt for any one subject out of available institute wide subjects defined in the following list as Open Elective provided, he/she has not taken that particular subject in his/her Programme core, Programme elective, Multidisciplinary Minor, other Open elective and Vocational and Skill Enhancement courses etc. throughout his / her four years of UG Engineering Programme. The student must opt a subject that is compulsorily from faculty other than that of the Major discipline.

Course Code	**Name of the Subject / Course**	**Faculty Offered by**	**Department Offered by**
Open Elective - I (w. e. f. 2025 - 26 at Semester - III, Second Year Engineering)			
OE – 307 A	Quantitative Reasoning and Problem Solving	Sci. & Tech.	Mathematics
OE – 307 B	Management Science	Comm. & Mgmt.	Management
OE – 307 C	Business Ethics & Professional Values	Comm. & Mgmt.	Management
OE – 307 D	Plant Nursery and Management	Sci. & Tech.	Botany
OE – 307 E	General Clinical Pathology	Sci. & Tech.	Biochemistry
OE – 307 F	Herbal Home Remedies	Sci. & Tech.	Botany
OE – 307 G	Psychology of Well-being	Humanities	Psychology
OE – 307 H	Fundamentals of Banking	Humanities	Economics

QUANTITATIVE REASONING AND PROBLEM SOLVING (Open Elective – I)

COURSE OUTLINE

Course Title:	**QUANTITATIVE REASONING & PROBLEM SOLVING**	**Short Title:**	**QRPS**	**Course Code:**	**OE - 307 A**

Course description:

The Quantitative Reasoning course is designed to develop a student's ability to understand, analyze, and apply mathematical concepts and reasoning techniques to solve real-world problems. The course emphasizes critical thinking and logical analysis, focusing on the interpretation and manipulation of quantitative data.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	**15**	**45**	**03**

Prerequisite course(s):

Course objectives:

1. Use appropriate mathematical and statistical language in oral, written, and graphical forms.
2. Think critically about mathematical models for relationships between different quantities and use those models effectively and accurately to solve problems and reach sound conclusions about them.
3. Interpret and analyze various representations of data.

Course outcomes:

After successful completion of this course the student will be able to:

1. Perform arithmetic calculations on number system, HCF and LCM and age
2. Solve application problems involving Time, Distance, Speed.
3. Calculate the time required to do the work and fill the cistern.
4. Calculate problems based on percentage, average and simple interest.
5. Analyze and interpret data using statistical techniques

COURSE CONTENT

QUANTITATIVE REASONING AND PROBLEM SOLVING		**Semester:**	**III**
Teaching Scheme:		**Examination Scheme:**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Number System: Fundamental Concepts, Tests of Divisibility, Factorial of number, Modulus of a number, Greatest integral Value, Multiplication by Short cut method, Division algorithm.
Highest Common Factor and Least Common Factor: Factors and Multiples, Factorization method, Division Method, HCF and LCM of fractions, HCF and LCM of decimal Fractions. **Problems on Ages** : Ratio Based Age Problems, Equation Solving Type Age Problems, Finding Ratio Between Ages.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Time and Distance: Unit Conversion Time and Distance Problems, Average Speed When Travelling To A Place And Returning, Problems Based On Changing Time And Changing Speed.

Problem on Trains: Important facts and Formulae, Time taken by train to pass pole/standing man / Signal post, relative Speed of trains/ bodies moving in same direction, cross time of trains/bodies moving in opposite direction, Cross time trains/ bodies moving in same direction with different speed, reaching time of two trains/ bodies start at the same time from point A and B towards each other destination.

Problem on Boat: Speed of downstream, Speed of upstream, Speed in still water, Rate of stream, Speed of the man in still water.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Time and Work: Calculate Time to Complete Work by 2 or More People, Equations Based Time and Work Problems, Efficiency Based Time and Work Problems, Calculate Time When Efficiency is Given in Percentage, Calculate Time When Workers Leave in Between, Share of Salary Based on Work**.**

Pipes and Cisterns: Important Facts and Formulae, Calculate Time Taken to Fill a Tank By 2 or More Pipes, Calculate Time Taken to Fill a Tank with Leakage, Equations Based Pipes and Cistern Problems, Calculate Time Taken When Pipes Are Opened for Different Periods, Calculate Number of Pipes.

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Percentage: Concepts of percentage, Results on population, Result on depreciation, Salary Comparison percentage problems, Appreciation and depreciation based Percentage problems, Price and consumption based percentage problems

Average: Number Series Summation based Averages, Consecutive Even/Odd Type Problems, Distance and Speed based Averages.

Simple Interest: Important Fact and Formulae, Simple Interest Formula based Direct Problems, **Compound Interest** Formula based Direct Problems

Ratio and Proportion : Combined Ratio Based on Individual Ratios, Distributing any Quantity Based on Ratios, Coins Based Ratio Problems, Mixtures & Replacement Based Ratio Problems

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Clocks: Finding angle between Minute and Hour Hands, Finding Time if angle is given, Correct Time on incorrect (Fast or Slow) Clocks.

Calendar: Odd day, Leap year, Ordinary Year, Counting of Odd days, Day of the week related to odd days.

Data Interpretation: Tabulation, Bar Graph, Pie Chart, Line graph, Problem on data Interpretation: Sum and Difference based, Average based questions, percentage-based questions.

Text Books:

1. Dr. R.S. Aggarwal “Quantitative Aptitude” S. Chand Publication, Revised Edition 2017

MANAGEMENT SCIENCE (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**MANAGEMENT SCIENCE**	**Short Title:**	**MS**	**Course Code:**	**OE – 307 B**

Course description:

This course provides students with a fundamental understanding of Management Science, covering key concepts such as decision-making, organizational structure, operations and process management, project management, and modern management practices. The course focuses on essential management functions, managerial skills, quality control techniques, inventory management, and project planning tools like PERT and CPM. It aims to develop students' analytical and problem-solving skills, preparing them for effective decision-making and managerial roles in various industries.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	15	45	03

Prerequisite course(s):

Principles of Management, Quantitative Techniques for Management, Operations Management, Project Planning and Control and Business Analytics

Course objectives:

The objective of this course is to impart knowledge so that the student will:

1. To understand the fundamental principles and functions of management and their historical evolution.
2. To analyse organizational structures and evaluate their impact on business efficiency.
3. To apply quality management techniques and inventory control methods for process optimization.
4. To utilize network analysis techniques like PERT and CPM for project planning and management.
5. To implement modern management practices such as ERP, JIT, TQM, and Six Sigma for continuous improvement.

Course outcomes:

After successful completion of this course the student will be able to:

1. Explain core management concepts and their relevance in organizational success.
2. Evaluate and implement appropriate organizational structures based on business needs.
3. Apply inventory and quality management techniques to optimize business processes.
4. Demonstrate the use of project management tools for effective planning and execution.
5. Implement modern management methodologies such as Kaizen, Kanban, and Lean Manufacturing to improve organizational performance.

COURSE CONTENT

MANAGEMENT SCIENCE		Semester:	III
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Fundamentals of Management

Definitions, Nature, Importance, and Functions of Management
Historical Perspectives: Evolution of Management Thought
Levels of Management and their Functions
Decision-Making Types & Process
Managerial Skills and Roles (Mintzberg's)

Unit–II:	No. of Lectures: 09 Hours	Marks: 12
Organization and Structure		
Concepts and Principles of Organization Formal and Informal Organization, Authority, Responsibility, Delegation Types of Organizational Structures: Line, Line and Staff, Matrix, and Team Structures Departmentation: Need, Importance, and Bases of Departmentation		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
Operations and Process Management		
Fundamentals of Work Study: Time and Motion Study Techniques Quality Management: Tools and Techniques (P-Chart, R-Chart, C-Chart) Inventory and Material Management: Importance of Inventory Control Economic Order Quantity (EOQ) Calculation ABC Analysis and its Variants (HML, SDE, VED, FSN)		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Project Management		
Introduction to Project Management: Objectives and Importance Network Analysis: Concepts and Applications PERT (Program Evaluation and Review Technique) and CPM (Critical Path Method): Comparison and Implementation Project Optimization: Cost-Time Trade-Off and Crashing Techniques		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Modern Management Practices		
Materials Requirement Planning (MRP) and Enterprise Resource Planning (ERP) Just-In-Time (JIT) and Lean Manufacturing Total Quality Management (TQM): Principles and Implementation Six Sigma: Concepts and DMAIC Process Japanese Management Practices: Kaizen, Kanban, and 5S		
Text Books:		
1. Essentials of Management by Harold Koontz & Heinz Weihrich, 6th Edition, Tata McGraw-Hill (2005)		
Reference Books:		
1. Koontz & Weihrich: Essentials of Management, 6/e, TMII, 2005 2. Kanishka Bedi: Production and Operations Management, Oxford University Press, 2004 3. Samuel C. Certo: Modern Management, Pearson Education, 2005 4. Mahajan, M. (2015). Industrial engineering and production management. Dhanpat Rai & Co. (P) Limited.		
NPTEL Links: 1. Principles of Management by Prof. Usha Linka https://archive.nptel.ac.in/courses/110/107/110107150/ 2. Production and Operation Management by Prof. Rajat Agrawal https://archive.nptel.ac.in/courses/110/107/110107141/ 3. Economic Order Quantity by Prof. Puran Singh https://www.youtube.com/watch?v=_h4i9C47rT8 4. Total Quality Management by Prof. Raghunandan Sengupta https://archive.nptel.ac.in/courses/110/104/110104080/		

BUSINESS ETHICS & PROFESSIONAL VALUES (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**BUSINESS ETHICS & PROFESSIONAL VALUES**	**Short Title:**	**BE & PV**	**Course Code:**	**OE – 307 C**

Course description:

This course provides students with a fundamental understanding of business ethics and professional values, focusing on ethical decision-making, corporate governance, workplace ethics, and corporate social responsibility (CSR). It explores ethical leadership, environmental sustainability, and the ethical challenges posed by emerging technologies.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	15	45	03

Prerequisite course(s):

Course objectives:

The objective of this course is to impart knowledge so that the student will:

1. Understand the principles and significance of business ethics in organizational success.
2. Analyse ethical theories and decision-making models in corporate environments.
3. Evaluate corporate governance, ethical leadership, and workplace ethics.
4. Explore ethical challenges in technology, globalization, and sustainability.
5. Develop a strong foundation in professional values and responsible business conduct.

Course outcomes:

After successful completion of this course the student will be able to:

1. Apply ethical principles and decision-making frameworks in business scenarios.
2. Assess the role of corporate governance and ethical leadership in business success.
3. Analyse workplace ethics and strategies for ethical corporate culture.
4. Evaluate ethical considerations in technology, cyber security, and sustainability.
5. Demonstrate professional values such as integrity, accountability, and transparency in decision-making.

COURSE CONTENT

BUSINESS ETHICS & PROFESSIONAL VALUES		Semester:	III
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Fundamentals of Business Ethics

Definition, significance, and principles of business ethics
Ethical theories: Utilitarianism, Deontology, Virtue Ethics
Ethical decision-making models: Consequentialist, Non-consequentialist and Hybrid Approaches
Role and importance of ethics in achieving organizational goals
Corporate Governance and Ethical Business Practices
Ethical dimensions of corporate social responsibility (CSR)

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Ethical Leadership and Workplace Practices

Key aspects: Workplace ethics, confidentiality, and transparency

Ethical leadership: Traits, decision-making, and influence on organizational culture
Technology ethics: Privacy, cyber security, and AI-related challenges
Addressing dilemmas: Whistleblowing, conflicts of interest, and ethical challenges
Diversity, equity, and inclusion (DEI) in ethical decision-making
Corporate fraud and unethical business practices: Causes, consequences and Preventive measures

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Emerging Ethical Challenges and Trends

Ethical considerations in disruptive technologies: AI, block chain, IoT, and robotics
Intellectual property rights (IPR): Significance and ethical dimensions of innovation
Ethical challenges in globalization: Cultural relativism and navigating cross-border practices
Future trends: Sustainable leadership, stakeholder capitalism, and Industry 4.0
Environmental ethics in business: Carbon footprint reduction, sustainable resource management and corporate environmental responsibility
Cyber security and ethical hacking: Digital ethics, protection against cybercrimes, ethical dilemmas in surveillance, and hacking ethics

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Environmental and Sustainability Ethics

Organizational responsibilities for health, safety, and the environment
Green engineering: Sustainable designs and renewable technologies
Case studies: Lessons from environmental disasters (e.g. Bhopal Gas Tragedy, Exxon Valdez oil spill)
Regulatory frameworks: Environmental laws, compliance, and ethical practices
Climate change and corporate responsibility: Strategies for sustainable business operations
Role of businesses in achieving Sustainable Development Goals (SDGs)

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Professional Values

Definition and relevance of professional values, Core values: Honesty, integrity, accountability, transparency, and respect,
Workplace ethics: Building an ethical culture and promoting positive work environments,
Professional codes of conduct: ASME, ASCE, IEEE, IETE, Business etiquette and ethical decision-making in professional interactions,Role of mentorship & leadership in cultivating professional values

Text Books:

1. "Business ethics: Concepts and cases (9th ed.)" by Velasquez, M. G. (2020) Pearson.

Reference Books:

1. Crane, A., Matten, D., Glozer, S., & Spence, L. J. (2019). Business ethics: Managing corporate citizenship and sustainability in the age of globalization (5th ed.). Oxford University Press.
2. Fernando, A. C. (2019). Business ethics: An Indian perspective (4th ed.). Pearson Education India.
3. Saha, B. (2010). Environmental ethics: A practical approach. Aadi Publications.
4. Johnson, D. G., & Wetmore, J. M. (2008). Technology and society: Building our sociotechnical future. MIT Press.

NPTEL Links:

1. Business Ethics by Prof Susmita Mukhopadhyay
   https://archive.nptel.ac.in/courses/110/105/110105079/
2. Intellectual property rights By Dr. K. D. Raju
   https://archive.nptel.ac.in/courses/110/105/110105139/
3. Ethics in Engineering Practice by Prof Susmita Mukhopadhyay
   https://archive.nptel.ac.in/courses/110/105/110105097/
4. Introduction to Industry 4 0 and Industrial Internet of Things by a Prof. Sudip Misra
   https://archive.nptel.ac.in/courses/106/105/106105195/

PLANT NURSERY AND MANAGEMENT (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**PLANT NURSERY AND MANAGEMENT**	**Short Title:**	**PNM**	**Course Code:**	**OE – 307 D**

Course description:

This course is designed to provide students with an in-depth understanding of the processes, practices, and techniques involved in the establishment and management of plant nurseries. It covers various aspects of plant production, from seedling propagation to the management of nursery operations. Students will gain practical knowledge in selecting plant species, propagating plants, maintaining nursery health, and understanding the financial and operational considerations in managing a nursery.

	Hours/week	No. of weeks	Total hours	Semester credits
Lecture	**03**	**15**	**45**	**03**

Prerequisite course(s):

Course objectives:

1. To provide knowledge about basic concepts and principles of nursery techniques.
2. To impart basic and technical knowledge on nursery management for strengthening of horticulture sector.
3. To study the disease and pest controlling nursery with practical experience.
4. To help students to study marketing and management relating to nursery.
5. To help students to manage nurseries and propagate healthy plants on a commercial scale.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the importance of a plant nursery and basic infrastructure to establish it.
2. Explain the basic material, tools and techniques required for nursery.
3. Demonstrate expertise related to various practices in a nursery.
4. Comprehensive knowledge and skills to get an employment or to become an entrepreneur in plant nursery sector.
5. To know green house and playhouse technology.

COURSE CONTENT

PLANT NURSERY AND MANAGEMENT		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Plant nursery:

Introduction, definition and importance. Types of nurseries, Temporary (Features, Advantages and disadvantages).Permanent (Features, Advantages and disadvantages.) Ornamental, Vegetable, Fruit plant, Forest plant, Open field and High-tech nurseries. Selection of place, lay out and components of a good nursery. Important role of nursery in horticulture development.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Nursery Basic requirement and setup:

Nursery beds–types and precautions to be taken during preparation. Growing media, nursery tools and implements, and containers in brief. Soil and seed treatments sowing of seeds and planting material used for nursery.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Plant Propagation Technique:

Introduction, Sexual propagation (Advantages and dis-advantages) Cutting (Root, Stem and leaf cutting) Layering (Simple and Air layering) (Gootee) Budding (T and Patch budding) Grafting (Whip and tongue grafting). Green house and Polyhouse Types and importance.

Unit-IV:	No. of Lectures: 09 Hours	Marks: 12

Nursery Management practices:

Potting and repotting, application of manures and fertilizers. Plant bio-regulators and growth retardants, Water quality and management. Common diseases, pests, care and management of nursery plants. Seasonal activities and routine operations in a nursery. Common possible errors in nursery activity. Bureau of Indian Standards (BIS-2008) related to nursery. Economics of nursery development, pricing and record maintenance. Packing, transport, Branding and marketing of nursery plants. Entrepreneurship development through nursery.

Unit-V:	No. of Lectures: 09 Hours	Marks: 12

Vertical farming and Hydroponics:

Vertical Farming: Introduction, scope and importance. Plants suitable for vertical farming. Advantages of vertical farming. Hydroponics: Introduction, scope and importance. Basic concepts and designs, Importance of light, temperature and humidity. Nutrient film technique (NFT) Advantages and Plants suitable for hydroponics.

Text Books:

1. "Plant Nursery Management: Principles and Practices, Central Arid Zone Research Institute" by Ratha Krishnan, P. Kalia Rajwant K.Tewari, J.C., Roy M.M., (2014).

Reference Books:

1. Bose, T.K. Sanyal, Dand Sandhu, M.L. (1998) Propagation of Horticultural crops. Naya Prakash Publishers, Kolkatta.
2. K.K. Nanda and V.K. Kochhar (1985). Vegetative propagation of plants. Kalyani Publisher-NewDelhi-Ludhiana.
3. Kunte, Y.N.,Kawthalkar, M.P.andYawalkar,K.S.(2005).Principles of Horticulture and Fruit Growing. Agri-Horticultural Publishing House, Nagpur.
4. Rahudkar W.B., Bhujbal B.G.,Madhuri Sonawane, Hemraj Rajput ,(2010), CMOU, Text book Publication No. AGR 227Horticulture Nursery Management.
5. Randhawa G.S., A. Mukhopadhyay (2001). Floriculture in India. Book published by Allied Publishers Limited, New Delhi

NPTEL Links:

1. Basics of Crop Breeding and Plant Biotechnology (https://onlinecourses.nptel.ac.in/noc25_ag01/preview)
2. Plant Developmental Biology By Prof. Shri Ram Yadav | IIT Roorkee (Plant Developmental Biology - Course (nptel.ac.in))

GENERAL CLINICAL PATHOLOGY (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**GENERAL CLINICAL PATHOLOGY**	**Short Title:**	**GCP**	**Course Code:**	**OE - 307 E**
Clinical pathology is the second major subdivision of the discipline of pathology after anatomic pathology. It is concerned with laboratory investigations for screening, diagnosis, and overall management of diseases by analysis of blood, urine, body fluids, and other specimens. The specialties included under the discipline of clinical pathology are clinical chemistry, hematology, blood banking, medical microbiology, cytogenetic and molecular genetics.					

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s):

Course objectives:

The objective of this course is to:

1. To study the basic principles of laboratory medicine.
2. Laboratory examination of various body fluids for screening and diagnosis of diseases.
3. To study the tests required for assessing various organ functions.
4. Laboratory examination of formed elements of blood and to study different tests involved in the diagnosis of disorders of blood.
5. To study blood group systems, blood transfusion, screening tests for infections transmissible by transfusion and its adverse effects.

Course outcomes:

After successful completion of this course the student will be able to:

1. Explain the significance of clinical pathology in screening and diagnosis of diseases.
2. Describe the role of laboratory in examination of various body fluids, metabolic disorders, gastric anatomy, pregnancy and reproductive system disorders.
3. Explain the structure and function of different organs present in clinical pathology setting and enlist the classification of tests required for evaluating those respective organ functions.
4. Enlist the components of blood and describe the role of several formed elements of blood in clinical pathology.
5. Describe the blood group systems, types of blood donors, screening and identification of antibody.

COURSE CONTENT

GENRAL CLINICAL PATHOLOGY		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Laboratory tests for organ function and examination of body fluids:

Basic principles of laboratory medicine, Examination of Urine, Kidney Function Tests, Laboratory test in Diabetes Mellitus, Liver Function test, Laboratory test in disorders of lipids, Biochemical Cardiac Markers, Examination of Cerebrospinal fluid, Examination of Synovial Fluid, Examination of Sputum.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Gastric system and reproductive system analysis:

Examination of Feces, Gastric Analysis, est for Malabsorption and Pancreatic function test, Thyroid

function test, Laboratory tests in pregnancy, Infertility, Semen Analysis, Pyrexia of unknown origin.		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
Methods for estimation of Blood cell count:		
Haematopoiesis, Collection of blood, Automated complete blood cell count, Estimation of Haemoglobin, Packed cell volume, Total leucocyte count, Reticulocyte count, Platelet count, Blood smear, Red cell indices, Erythrocyte sedimentation rate, Examination of bone marrow.		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Laboratory test for disorders of Blood:		
Malignancy, Laboratory test in bleeding disorders, Laboratory test in Thrombophilia, Laboratory Hematology of infectious disease, Laboratory tests in anaemia, Laboratory test in Hematological test in porphyrias.		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Blood group systems and Transfusion of blood:		
Blood Group systems, Blood grouping, Collection of donor blood, processing and storage, Screening tests for infections transmissible by transfusion, Antibody Screening and Identification, Compatibility Test, Whole blood, blood components and blood derivatives, Adverse effects of Transfusion.		
Text Books:		
1. "Essentials of Clinical Pathology" by Shirish M. Kawthalkar, JP Medical Ltd, 2018.		
Reference Books: 1. Clinical Pathology, Hematology & Blood banking, 3rd Edition, Nanda Maheshwari. 2. Clinical Pathology Interpretations, A.H.Nagi, Fourth Edition. 3. Essential textbook of Clinical Pathology with Practicals, Tapeshwar yadav & Asheshwar Yadav. 4. Concise text in Clinical pathology, Hematology & Blood banking, Surabhi Bansal, AITBS Publisher. 5. Laboratory Manual of clinical pathology and hematology, Santosh Kumar Mondal. 6. A concise textbook of Clinical Pathology, Hematology & Blood banking, Rakesh Joshi.		

HERBAL HOME REMEDIES (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**HERBAL HOME REMEDIES**	**Short Title:**	**HHR**	**Course Code:**	**OE – 307 F**

The herbal home remedies course is designed to introduce individuals to the power of natural, plant-based remedies that can be used for common ailments and overall health maintenance. Participants will learn the principles of herbal medicine, understand the therapeutic properties of different herbs, and explore how to incorporate them into daily life through simple, safe, and effective home remedies. The course will cover a wide range of herbs and their uses in treating various conditions, including digestive issues, skin problems, stress, sleep disturbances, and immune system support. By the end of the course, students will have the knowledge to prepare herbal teas, tinctures, salves, and other remedies.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	03	15	45	03

Prerequisite course(s):

Course objectives:

The objective of this course is to:

1. Understand the basics of herbal medicine and its history in various cultures.
2. Familiarize yourself with common medicinal herbs and their healing properties.
3. Gain hands-on experience in making teas, tinctures, syrups, salves, and poultices.
4. Discover herbal solutions for everyday health concerns like colds, headaches, digestive problems, and skin issues.
5. Learn how to incorporate herbs into your diet, beauty routines, and wellness practices.

Course outcomes:

After successful completion of this course the student will be able to:

1. Identify and classify common herbs and their medicinal uses.
2. Create their own herbal remedies such as teas, tinctures, and oils tailored to specific health needs.
3. Apply natural remedies to improve personal health and wellness in a safe and sustainable way.
4. Understand how to work with herbs to support emotional and physical balance in the body.
5. Integrate herbs into daily routines to enhance lifestyle, nutrition, and overall well-being.

COURSE CONTENT

HERBAL HOME REMEDIES		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to Herbal Medicine:

Definition of herb, herbal medicine, Source of Herbs, Basic introduction of Ayurveda, Siddha, Unani and Homeopathy, Introduction of in cultivation of medicinal plants, Leaf, bark, root, seed, flowers, fruits & gums.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Herbal Identification and Properties:

Basic home remedies for general problem: Cold and Cough, Fever, Acidity, Itching, Constipation, Headache, Toothache, Vomiting.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12
Preparing Herbal Remedies:		
Source of minerals, vitamins, protein, Source of home spices & plant: honey, ashwagandha tulsi, shilagit, bhel, adulsa, pipal, black pepper , caraway seeds , cardamom seed powder , cayenne , celery seed , chives , chile peppers , Korintje cinnamon , Vietnamese cinnamon , cloves , cumin , dill seed , dill weed , garlic , gumbo filé , lemon , mace , marjoram , nutmeg , onion , oregano (Mediterranean).		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Herbal Remedies for Common Ailments:		
Herbal compound for oral care, skin care, sun care, hair care, decorative cosmetics, body care and perfumes.		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Integrating Herbal Remedies into Daily Life:		
Preparation of Ayurvedic formulations viz powder, Ghutika, Churna and Bhasma.		
Text Books:		
1. "Textbook of Pharmacognosy" by Trease & Evans. 2. "Pharmacognosy" by Kokate, Purohit and Gokhale.		
Reference Books: 1. Pharmacognosy & Phytochemistry by V. D. Rangari. 2. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy).		

PSYCHOLOGY OF WELL-BEING (Open Elective – I)

COURSE OUTLINE

Course Title:	**PSYCHOLOGY OF WELL-BEING**	**Short Title:**	**POWB**	**Course Code:**	**OE – 307 G**

The Psychology of Well-Being course explores the psychological factors that contribute to human flourishing, happiness, and life satisfaction. This course delves into the scientific study of well-being, examining how positive emotions, healthy relationships, resilience, and personal growth influence mental and physical health. Students will explore theories and research from positive psychology, focusing on practical strategies to enhance personal well-being and cultivate a meaningful life. By understanding the psychological principles behind well-being, students will be better equipped to foster positive mental health both in them selves and in others.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	03	15	45	03

Prerequisite course(s):

Course objectives:

The objective of this course is to:

1. The psychological and physiological benefits associated with experiencing positive emotions, such as improved resilience, mental health, and social connections.
2. The mindfulness and its components, including present-moment awareness, non- judgmental acceptance, and compassion.
3. The different strategies for developing and enhancing emotional intelligence skills, including mindfulness practices, self-reflection exercises, and social skill-building activities.
4. The important concepts of well-being like conflict resolution, reconciliation, and stress management
5. Include mindfulness practices, self-reflection exercises, and social skill-building activities.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the positive emotion and well-being, including the ability to define and differentiate these concepts from other affective states and mental health constructs.
2. Demonstrate an understanding of mindfulness principles and techniques, including the ability to define mindfulness and its components such as present-moment awareness, non-judgmental acceptance, and compassion.
3. Develop strategies for enhancing emotional intelligence competencies, including mindfulness practices, self-reflection exercises, and social skill-building activities.
4. Collaborate with peers to explore the application of gratitude and forgiveness principles in real-world scenarios, such as conflict resolution, reconciliation, and stress management, demonstrating the ability to work effectively with others and apply learned concepts in practical settings.
5. Developing personal tools and strategies for enhancing individual well-being.

COURSE CONTENT

PSYCHOLOGY OF WELL-BEING	**Semester:**	**III**
Teaching Scheme:	**Examination scheme**	

Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Positive emotion and well-being :

Positive Emotions: Meaning of Positive Emotions, Identifying Positive Emotions, Benefits of Positive Emotions Barbara Fredrickson's Broaden and Build Theory of Positive Emotions Positive Emotions and Health Resources: Physical, Psychological and Social Resources. Positive Emotions and Well-being: Happiness and Positive Behaviour, Positive Emotion and Success, Positive Emotion and Flourishing (PERMA Model)Cultivating Positive Emotions: Flow Experiences, savoring.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Mindfulness and well-being :

Mindfulness: Meaning, Mindfulness as an Antidote for Mindlessness, Mindfulness as Present-centered, Awareness and Attention Mindfulness Meditation, Attributes of Mindful Awareness- Non-Judging, Patience, Beginner Mind, Trust, Non-Striving, Acceptance, Letting go. Benefits of Mindfulness, Mindfulness and Mental Health, Living with Mindfulness: Being Mindfulness of Emotion, Being Mindfulness of Eating, Being Mindfulness of Exercise, Mindfulness Breathing and sitting as a Meditation Mindfulness and Happiness.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Emotional intelligence:

Emotional Intelligence, Meaning, Nature and Definition Theories of EI, Peter Salovey and John D Mayre, Danial Golman, Bar-On Emotional Intelligence and Happiness Ways That Emotionally Intelligent People Choose for Happiness Factors - Emotional Intelligence Be Increased, Manage another Person's Emotions.

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Gratitude and forgiveness :

Gratitude: Meaning and Concept, Characteristics of Gratitude People, Gratitude Physical and Mental Health, Gratitude and Happiness ,Ways to Practice Gratitude Forgiveness Meaning, Definition, Importance and Types ,Benefits of Forgiveness, Forgiveness is the key of Happiness.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Happiness and the Facts of Life :

Happiness Across the Life-Span - Focus on Research: Happiness and Where we Live - Stability in Well-Being Despite Life Changes - Temperament and Subjective Well-Being - Frequency, Intensity and Balance of Positive and - Negative Emotions - Measurement and Definitional Issues -The Shifting Basis of Life Satisfaction - Gender and Happiness - Gender differences in Emotional Experience - Negative Emotions - Positive Moods and Behaviors - Explaining the Paradox of Gender Other Facts of Life - Physical and Mental Health ,Work and Unemployment , Intelligence and Education - Religion - Race, Ethnicity and Stigma.

Text Books:

1. "The Role of Positive Emotions in Positive Psychology: The Broadenand-Build Theory of Positive Emotions" by Fredrickson, B. L. (2001) American Psychologist, 56, 218-226.

Reference Books:

1. Steve B. & Marie, C. (2015). Positive Psychology. Pearson Education.
2. Snyder C.R., Lopez S.J., Pedrotti J.T. (2011) Positive Psychology. Sage Publication.

NPTEL Links:

1. Introduction to Psychology By Prof. Braj Bhushan, IIT Kanpur
   https://onlinecourses.nptel.ac.in/noc21_hs49/preview

FUNDAMENTALS OF BANKING (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**FUNDAMENTALS OF BANKING**	**Short Title:**	**FOB**	**Course Code:**	**OE – 307 H**

This course provides a fundamental understanding of banking concepts, types of banks, negotiable instruments, banking operations, and remittance methods. It covers essential topics like account management, banking regulations, and digital banking services, equipping students with foundational knowledge for careers in banking and finance.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s):

Course objectives:

The objective of this course is to:

1. Explain the basic concepts, evolution, and significance of banking.
2. Provide knowledge of different types of bank accounts and their operations.
3. Introduce negotiable instruments and their role in banking transactions.
4. Familiarize students with endorsements, remittances, and digital banking methods.
5. Develop an understanding of banking regulations, customer protection, and ethical banking practices.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the fundamental concepts and functions of banking.
2. Identify different types of bank accounts, cooperative banking structures, and their significance.
3. Analyze the characteristics and legal aspects of negotiable instruments and endorsements.
4. Evaluate different means of remittances and their role in modern banking.
5. Apply knowledge of banking regulations, digital banking, and financial security measures.

COURSE CONTENT

FUNDAMENTALS OF BANKING		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fundamentals of Banking

Meaning and definition of banking
Evolution of banking in the world and in India
Importance of banking in the Indian economy
Types of banks – Commercial Banks, Cooperative Banks, Development Banks, and Central Bank

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Banking Operations and Account Management

Types of bank accounts – Savings, Current, Fixed Deposit, Recurring Deposit, Non-Resident Accounts
Procedure for opening, operating, and closing accounts
KYC norms and customer due diligence
Role of banks in financial inclusion

Unit–III:	No. of Lectures: 09 Hours	Marks: 12
Negotiable Instruments and Endorsements		
Meaning, characteristics, and types of negotiable instruments – Promissory Notes, Bills of Exchange, Cheques Types of cheques – Bearer, Order, Crossed (General & Special) Endorsements – Definition, characteristics, types (Blank, Special, Partial, Restrictive, Conditional, Facultative) Rights and liabilities of parties to negotiable instruments		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Remittance Services and Digital Banking		
Different means of remittances – Demand Drafts, Letters of Credit Credit Cards, Debit Cards, ATMs – Advantages and Disadvantages MICR cheques and their significance Introduction to digital banking – NEFT, RTGS, UPI, Mobile Banking		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Banking Regulations and Ethical Practices		
Role of regulatory authorities – RBI, SEBI, and their functions in banking Consumer protection in banking – Banking Ombudsman Scheme Common banking frauds and security measures Ethical banking practices and financial literacy		
Text Books:		
1. "Basics of Banking and Finance" by K.M. Bhattacharya & O.P. Agrawal, Himalaya Publishing House. 2. "Fundamentals of Banking Theory and Practice" by A.K. Basu.		
Reference Books: 1. Elements Banking and Insurance – B. S. Shah Publication, Ahmadabad 2. Elements of Banking and Insurance – New Popular Publication, Surat 3. Banking Theory and Practice, Prem Kumar Srivastava, Himalaya Publishing House.		
NPTEL Links: 1.Management of Commercial Banking by Prof. Jitendra Mahakud, IIT Kharagpur https://nptel.ac.in/courses/110105143		

Kavayitri Bahinabai Chaudhari
NORTH MAHARASHTRA
UNIVERSITY, JALGAON (M.S.)

Second Year Bachelor of Engineering
in
Electronics & Telecommunication
(As per NEP 2020 Guidelines)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(4th Cycle)

COURSE OUTLINE
For Affiliated Colleges
Semester – IV
W.E.F. 2025 – 26

ANALOG CIRCUITS (PCC)					
COURSE OUTLINE					
Course Title:	**ANALOG CIRCUITS**	**Short Title:**	**AC**	**Course Code:**	**EC -401**

Course description:
This course provides comprehensive study of transistor analysis with Feedback, Power amplification & Tuning.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	03	15	45	03

Prerequisite course(s):

Basic knowledge electrical networks & solid state devices analysis.

Course objectives:

1. Analyze BJT amplifier configurations using negative feedback concept.
2. Analyze BJT amplifier configurations using positive feedback concept.
3. Analyze BJT single stage tuned amplifier & power amplifier configurations.
4. Analyze IC 741 op-amp configurations.
5. Analyze active filter configurations.

Course outcomes:

After successful completion of this course the student will be able to:
1. Analyze different BJT negative feedback amplifier configurations.
2. Analyze different positive feedback amplifier configurations.
3. Analyze tuned & power amplifier configurations.
4. Analyze different op-amp applications.
5. Familiar with design of filter circuits.

COURSE CONTENT

ANALOG CIRCUITS		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Feedback Amplifiers :
General feedback concept. Relation between A_F & A. Method of analysis of negative feedback amplifiers. Analysis of 4 feedback amplifier topologies.(Numericals essential).

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Oscillators & Multivibrators (BJT) :
Barkhausen criterion. RC phase shift oscillator, Hartley, Colpitt, Clapp Oscillator (derivation for frequency of oscillation only). Astable & Monostable Multivibratos. (Numericals essential)

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Tuned amplifier & Power amplifiers:
BJT tuned amplifier (working, equations & numericals). Class AB power amplifier with COD &

its elimination, equations for powers & efficiency. (Numericals essential).Hybrid π model of BJT & significance of parameters. Short circuit current gain. (numericals expected).		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Operational Amplifiers:- Basic difference amplifier, Ad, Ac & CMRR. Emitter coupled differential amplifier with analysis for Ad, Ac & CMRR (numerical essential). Different op-amp applications- Inverting amplifier, Non-inverting amplifier, Adder, Substractor, Instrumentation amplifier, Schmitt trigger.		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Filters: Introduction to passive filters, active filters using op-amp- first order & second order butter-worth low pass & high pass filters, design & numericals.		
Text Books:		
1. R. S. Sedha: "Applied Electronics", S. Chand Publication. 2. V.K. Mehta: "Principles of Electronics", S. Chand Publications.		
Reference Books: 1. R.L.Boylestad, L.Nashelsky:"Electronic Devices and Circuits Theory", 11th Edition, Prentice Hall of India, 2017 2. A.P. Malvino : "Electronics Principles" TMH Publications. 3. Millman & Halkias : "Integrated Electronics" TMH Publication.		
NPTEL Links: 1. Basic Electrical Technology Basic Electrical Technology, Prof. L. Umanand IISc Bangalore, https://nptel.ac.in/courses/108108076 2. Introduction to Basic Electronics Basic Electronics and Lab, Prof. T.S. Natarajan, IIT Madras, https://nptel.ac.in/courses/122106025		

<table>
<tr><th colspan="6">ANALOG CIRCUITS LAB (PCC)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">ANALOG CIRCUITS LAB</td><td>Semester:</td><td>IV</td><td>Course Code:</td><td>EC -402</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">Practical (PR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory Experiments/assignments from the following list.
1. Plot the frequency response & observe effect of feedback in current series feedback amplifier.
2. Plot the frequency response & observe effect of feedback in voltage shunt feedback amplifier.
3. Observe & measure output voltage & frequency of RC Phase shift oscillator.
4. Observe & measure output voltage & frequency of Astable multi vibrator.
5. Plot the frequency response of single tuned amplifier.
6. Observe cross over distortion & its elimination for class AB amplifier.
7. Measure Ad, Ac,CMRR for emitter coupled differential amplifier.
8. Obtain & measure output of OPAMP non inverting amplifier.
9. Plot the frequency response of second order Low Pass Filter.
10. Plot the frequency response of second order High Pass Filter.</td></tr>
<tr><td colspan="6">Guide lines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.</td></tr>
<tr><td colspan="6">Guidelines for ESE:</td></tr>
<tr><td colspan="6">ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.</td></tr>
</table>

ANALOG AND DIGITAL COMMUNICATION (PCC)					
COURSE OUT LINE					
Course Title:	**ANALOG & DIGITAL COMMUNICATION**	**Short Title:**	**ADC**	**Course Code:**	**EC -403**

Course description:

This course is aimed at introducing the fundamentals of Analog and digital communication to undergraduate students. This course explores the concept of basic modulation as well as digital modulation technique. The goals of the course are to understand the basic principle of communication and application in transmission and reception of signals. The major focus of this course is to build the fundamental concept related to different generation of frequency spectrum for communication system.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Knowledge of analog & digital signal & fundamentals

Course objectives:

1. To understand fundamentals, principles along with noise of communication system.
2. To learn about Amplitude, frequency & phase modulation in communication system.
3. To learn knowledge of waveform coding techniques.
4. To understand fundamentals of coding & decoding of information.
5. To study & understand different digital modulation technique.

Course outcomes:

After successful completion of this course the student will be able to:

1. Demonstrate knowledge about fundamentals, principles of communication system as well as effect of noise on communication system.
2. Use & explain different methods of analog communication.
3. Analyze the behavior of a communication system in presence of noise
4. Understand different digital modulation technique.
5. Explain and analyses performance of signal with coding and decoding.

COURSE CONTENT

ANALOG AND DIGITAL COMMUNICATION		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to communication system

Basic Communication System, Segments of RF Band spectrum, Modulation Technique, Need of modulation, Types of modulation, Introduction to amplitude, frequency and phase modulation. Pulse modulation, Review of PAM, PWM, PPM.

Noise Classification of noise, Types of noise, Gaussian and white noise characteristics, signal to noise ratio, Noise figure, pre-emphasis and de-emphasis

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Amplitude and Frequency Modulation

Amplitude Modulation Systems-Mathematical representation of AM wave, frequency domain

representation of AM signal, AM transmitter & receiver, DSB, SSB modulations. Angle Modulation. Frequency and Phase modulation
Mathematical representation of FM wave, Modulation Index, Comparison of AM, FM and PM.AM and FM Receivers- Performance characteristics –Sensitivity, Selectivity, Fidelity.
AM Receivers- TRF Receiver, Superhetrodyne Receiver.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Waveform Coding and Baseband Shaping for Data Transmission.
Pulse Code Modulation, Quantization noise in PCM, Delta Modulation, Adaptive Delta modulation, Time Division multiplexing, T1 Multiplexers.
Discrete PAM Signals and Power Spectra of Discrete PAM Signals, ISI & Nyquist's Criterion for Distortion less Baseband, Binary Transmission, Eye Pattern.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Information and Detection Theory
Uncertainty, Information and Entropy, Source coding theory, Huffman coding and Discrete memory less channels, Numerical on Information and Entropy, Numerical on Huffman coding. Mutual information, channel capacity and channel coding theory, Numerical on Channel capacity.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Digital Modulation Techniques
Digital Modulation schemes- Phase Shift Keying (PSK), Frequency Shift Keying (FSK), Quadrature phase shift keying (QPSK), Differential Phase shift Keying (DPSK), Minimum Shift Keying (MSK), comparison of FSK, PSK, QPSK, MSK.

Text Books:

1. G. Kennedy, B. Davis, "Electronic Communication Systems", Tata McGraw Hill Edition, 4th Edition, 1999.
2. P. Chakrabarti "Analog Communication Systems" Second Edition, Dhanpat Rai and Company.

Reference Books:

1. H. Taub, D. L. Schilling and G. Saha, "Principles of Communication Systems", TataMcGraw-Hill Edition, 3rd Edition, 2011.
2. D. Roddy, J. Coolen, "Electronic Communications", Pearson, 4th Edition, 2011

NPTEL Links:

1. Analog Communication Prof Goutam Das, IIT Kharagpur, https://archive.nptel.ac.in/courses/117/105/117105143/
2. Digital Communication, Prof. Bikash Kumar Dey, IIT Bombay https://nptel.ac.in/courses/117101051

<table>
<tr><th colspan="6">ANALOG AND DIGITAL COMMUNICATION LAB (PCC)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">ANALOG AND DIGITAL COMMUNICATION</td><td>Semester:</td><td>IV</td><td>Course Code:</td><td>EC -404</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">Practical (PR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory experiments/assignments from the following list.
1. Study of AM transmitter and calculate of modulation index of AM wave by envelope method.
2. Analyze and generate A.M. Demodulation signal by diode detector
3. Study of FM and calculate of modulation index of FM wave
4. F.M. Demodulation (Phase discriminator/Ratio detector method.)
5. To Construct and Verify Pre-emphasis and De-emphasis and Plot the Waveforms.
6. DSB-SC signal generation using balanced modulator
7. To understand waveform of Delta Modulation and Demodulation
8. To understand waveform of Adaptive Delta Modulation and Demodulation.
9. Generation and detection of FSK I/P and O/P waveform.
10. Generation and detection of PSK I/P and O/P waveform</td></tr>
<tr><td colspan="6">Guidelines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.</td></tr>
<tr><td colspan="6">Guidelines for ESE:</td></tr>
<tr><td colspan="6">ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.</td></tr>
</table>

ELECTRONICS DESIGN LAB (PCC)					
LAB COURSE CONTENT					
ELECTRONICS DESIGN LAB		**Semester:**	**IV**	**Course Code:**	**EC -405**
Course description:					
The subject covers basic concepts of circuit design using transistors & IC's					
Teaching Scheme:		**Examination scheme**			
Theory	**1 hours/week**	**End semester exam (ESE) UA :**			**25 marks**
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**25 marks**
Semester Credits	**02**				
End Semester Exam (ESE) Pattern:		**ORAL (OR)**			

Course objectives:

1. Design of IC regulators.
2. Design of voltage amplifier using BJT.
3. Design of tuned amplifier using BJT.
4. Design of multivibrators.
5. Design of active filters.

Course outcomes:

After successful completion of this course the student will be able to:

1. To design a buck-boost regulator.
2. To design inverting & non-inverting voltage amplifiers.
3. To design tuned amplifier.
4. To design Astable & Monostable multivibrator.
5. To design 2 nd order active filters.

Concerned faculty member should suitably frame SIX laboratory experiments/ assignments from the following list.

1. Identification & testing of the components.
2. Design of LM 317 regulator.
3. Design of inverting amplifier.
4. Design of non-inverting amplifier.
5. Design of single tuned amplifier.
6. Design of Astable multivibrator.
7. Design of 2nd order LPF.
8. Design of 2nd order HPF.

Guide lines for ICA:

Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in charge will assess the experiments / assignments continuously and grade or mark each experiment / assignment on completion date declared for each experiment / assignment.

Guidelines for ESE:

ESE will be based on practical experiment / assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

BIOLOGY FOR ENGINEERS (Multidisciplinary Minor)					
COURSE OUTLINE					
Course Title:	**BIOLOGY FOR ENGINEERS**	**Short Title:**	**BFE**	**Course Code:**	**EC - 406**

Course description:

This course describes basics and introduction of Biology for various engineering disciplines. It enables students to identify different cell types, functions and biomolecules with their roles. The students were acquainted with the concept of Biomimicry in engineering. After studying the course, student is able to demonstrate the human organ systems and bio-designs.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	02	15	30	02

Prerequisite course(s):

Course objectives:

Objectives of the course are:
1. To get introduced to different cell types and functions.
2. To understand the biomolecules and their roles.
3. To identify the concept of Biomimicry in engineering.
4. To demonstrate the knowledge of human organ system and bio-designs.
5. To analyze Bioengineering concepts.

Course outcomes:

After successful completion of this course the student will be able to:
1. Identify cell types and their functions and chemistry of cells.
2. Understand Biomolecules with their applications.
3. Identification & applications of Biomimicry in engineering.
4. Correlate the human organ system and bio-designs.
5. Analyze Bioengineering concepts and their applications across different engineering disciplines.

COURSE CONTENT

BIOLOGY FOR ENGINEERS		**Semester:**	**III**
Teaching Scheme:		**Examination scheme:**	
Lectures:	**2 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**
		Internal Continuous Assessment (ICA) CA:	**25 marks**

Unit–I:	**No. of Lectures: 06 Hours**	**Marks: 12**

Introduction to Biology: The cell: the basics of a cell. Prokaryotic and Eukaryotic cell, The Plant Cell and animal cell, Chemistry of cells. Cell Division: Cell cycle, mitosis, meiosis, cell division, cell cycle check points, cell death.

Unit–II:	**No. of Lectures: 06 Hours**	**Marks: 12**

Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Application of Biomolecules in water filters production, Proteins in food production, lipids in biodiesel and detergents production, Enzymes in biosensors fabrication, food processing

Unit–III:	**No. of Lectures: 06 Hours**	**Marks: 12**

Biomimicry: Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).

Unit–IV:	No. of Lectures: 06 Hours	Marks: 12

Human Organ Systems and Bio Designs: Brain as a CPU system (signal transmission, BCI, EEG). Eye as a Camera system (rod and cone cells, optical corrections, lens materials, bionic eye). Heart as a pump system (electrical signaling - ECG monitoring, design of stents, pacemakers, defibrillators). Lungs as purification system (spirometry, Ventilators, Heart-lung machine, artificial lungs). Kidney as a filtration system.

Unit–V:	No. of Lectures: 06 Hours	Marks: 12

Bioengineering: Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis.

Text Books:

1. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
2. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
3. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023

Reference Books:

1. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
2. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008
3. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
4. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016
5. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000). Lehninger principles of biochemistry. New York: Worth Publishers.

NPTEL Links:

NPTEL Course on Biology for engineers and other non-biologists (4 weeks UG Course) By Prof. G.K. Suraish kumar & Prof. Madhulika Dixit (IIT. Madras)

Guidelines for ICA:

Students must submit ICA in the form of journal. Concerned faculty member should suitably frame **FIVE** assignments based on the above syllabus. Faculty in charge will assess the assignments continuously, and grade or mark each assignment on completion date declared for each assignment.

<table>
<tr><th colspan="6">PCB ARTWORK LAYOUT & ETCHING (VSEC)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">PCB ARTWORK LAYOUT & ETCHING</td><td>Semester:</td><td>IV</td><td>Course Code:</td><td>EC - 408</td></tr>
<tr><td colspan="6">Course description:</td></tr>
<tr><td colspan="6">The students can use this knowledge to design PCB by preparing lay-out, etching etc.</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4" rowspan="2">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="6">Course objectives:</td></tr>
<tr><td colspan="6">1. To make students familiar with the components
2. To make students familiar with devices.
3. To make students familiar with etching process.
4. To make students familiar with PCB artwork.
5. To make students familiar with PCB Designing.</td></tr>
<tr><td colspan="6">Course outcomes:</td></tr>
<tr><td colspan="6">After successful completion of this course the student will be able to:
1.Know the different types of components.
2.To understand the process of drilling & soldering.
3. To understand basics of etching process.
4. Know procedure of PCB artwork designing.
5.Design and manufacturing of printed circuit board.</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory assignments from the Following list.
1. Introduction of PCB.
2. Study various types of PCB.
3. Study of Circuit Diagram & Art work Preparation.
4. Study Etching Process on PCB.
5. Study Drilling process on PCB.
6. Study Component mounting on PCB.
7. Study Soldering of Components on PCB.
8. Testing of PCB& continuity testing.</td></tr>
<tr><td colspan="6">Guide lines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in charge will assess the experiments / assignments continuously and grade or mark each experiment / assignment on completion date declared for each experiment / assignment.</td></tr>
</table>

ABILITY ENHANCEMENT COURSE (AEC)

COURSE OUTLINE

Course Title:	**ABILITY ENHANCEMENT COURSE**	**Short Title:**	**AEC**	**Course Code:**	**EC - 409**

Course description:

The Course Provides students English proficiency across four key skills: **Listening, Reading, Writing, and Speaking**. It is used for study, work, and migration purposes in English-speaking countries.

Practical	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	02	**15**	**30**	**01**

Course Objectives:

The objective of this course is:

1. Evaluate English proficiency for academic, professional, and migration purposes.
2. Provide an internationally recognized standard for English language assessment.
3. Develop language skills necessary for effective communication in diverse environments.
4. Prepare candidates for real-life language use in academic and work-related.
5. To equip students with test-taking strategies to maximize their scores.

Course Outcomes:

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

1. Demonstrate a high level of English proficiency for academic, professional, or migration purposes.
2. Develop leadership and teamwork skills in collaborative environments.
3. Apply effective strategies for all Ability Enhancement modules.
4. Develop confidence in using English in real-life and test situations.
5. Achieve the required Ability Enhancement score for university admissions, work, or immigration.

COURSE CONTENT

ABILITY ENHANCEMENT COURSE		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Practical	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**	**25 Marks**

Concerned faculty member should suitably frame **FOUR** assignments in the form of interactive Practice Sessions based on the following modules.

Listening:

1. **Activity 1:** Podcasts, news, speeches, conversations, storytelling, News websites, BBC CNN, NBC
2. **Practice 1:** Practice with audio materials (podcasts, TED Talks, movies)
3. **Practice 2:** Cornell Method, Mind Mapping, Key Points and Summarization
4. **Practice 3:** Listening tests and quizzes, Practical exercises

Reading:

1. **Activity 3:** Fiction, short stories, novels: News articles, essays, reports, Research papers, textbooks, Blogs, social media posts, online articles
2. **Practice 1:** Self-assessment and comprehension quizzes
3. **Practice 2:** Note-taking strategies for effective retention
4. **Practice 3:** Understanding idioms and figurative language

5. **Practice 4:** Context clues and word recognition
Writing: 1. **Activity 4:** Write a daily journal, Letters to an English speaker, Make lists of the things you see every day, Write descriptions of your family and friends. 2. **Practice 1:** Common writing mistakes and how to fix them. 3. **Practice 2:** Unity in writing (sticking to one main idea) 4. **Practice 3:** Poetry, short stories, scripts 5. **Practice 4:** Storytelling techniques, point of view, dialogue
Text Books:
1. Barron's, IELTS Practice Exam, New Age International Private Limited, 2nd Edition.
Reference Books:
1. IELTS 19 Academic, Authentic Practice Tests, Cambridge University Press,2024 2. Pauline Cullen, IELTS Academic and General Training, Cambridge University Press,2014
NPTEL Links:
1. Skills by Prof. Binod Mishra, IIT Roorkee, https://nptel.ac.in/courses/109107121 2. Skills Development by Prof. P. Patnaik, Prof. V.N. Giri, Prof. D. Suar, IIT Kharagpur, https://nptel.ac.in/courses/109105110
Links: (for online practice)
1. A noticeboard message | Learn English (britishcouncil.org) 2. Free IELTS on Computer familiarisation test (ieltsidpindia.com)
Guide lines for ICA:
Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on the completion date declared for each assignment.

ENTREPRENEURSHIP DEVELOPMENT PROGRAM (HSSM)					
COURSE OUTLINE					
Course Title:	**ENTREPRENEURSHIP DEVELOPMENT PROGRAM**	**Short Title:**	**EDP**	**Course Code:**	**EC - 410**

Course description:

Entrepreneurship has emerged quite recently. The syllabus explore the concept of entrepreneurship, financial requirements of a new enterprise, Expansion strategies of an enterprise, challenges for small enterprises and large scale enterprises

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	02	15	30	02

Prerequisite course(s):

Course objectives:

The objective of this course is to:

1. Understand Entrepreneurial quality.
2. Understand the role of small scale enterprises and large scale enterprises.
3. Develop advanced knowledge to assess business opportunities to overcome failures.
4. Understand technology and entrepreneurship in a cross- disciplinary fashion
5. Understand the concept of human resource management, Marketing management, financial management, Production and Operation management in a new enterprise.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the concept of entrepreneurship and learn the procedure of setting up an enterprise.
2. Develop advanced knowledge about key processes necessary to bring new products and services to market and key challenges facing the entrepreneur at different stages of the entrepreneurial**.**
3. Understand the importance of theories, models and management of the entrepreneurship to become successful entrepreneur. .
4. Demonstrate ability to work in multidisciplinary teams and understand the impact of engineering solutions in a global, economic, environmental, and societal context.
5. Develop effective management and policy towards successful entrepreneur.

COURSE CONTENT

PROJECT MANAGEMENTAND ENTREPRENEURSHIP		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**2 hours/week**		

Unit–I:	**No. of Lectures: 06 Hours**

Introduction, Concept of entrepreneurship: Theories of entrepreneurship, Definition of entrepreneur: Traits and characteristics of successful entrepreneur, Functions of an entrepreneur, Professional vs. family entrepreneurs, Entrepreneurial leaders vs. managers, Women as entrepreneur, Role of woman entrepreneurs in society, Barriers to women entrepreneurs.

Unit–II:	**No. of Lectures: 06 Hours**

Financial requirements of a new Enterprise: Estimation of fix capital requirements, Estimation of working capital requirements Identifying the sources of finance–sources of long-term

financing: Sources of medium term financing, Sources of short-term financing.		
Unit–III:	**No. of Lectures: 06 Hours**	
Expansion strategies of an Enterprise: Expanding and enterprise: Expansion through concentration, Expansion through integration, Expansion through diversification, Expansion through cooperation, Expansion through digitalization.		
Unit–IV:	**No. of Lectures: 06 Hours**	
Challenges for small Enterprises: Problem faced by small enterprises: Managerial problems, Marketing management, Human resource, Production management, Technological problems.		
Unit–V:	**No. of Lectures: 06 Hours**	
Institutional Support for small enterprises and decision support system: Institutions supporting small scale enterprises: Small scale industries (SSI) board, Khadi and village industries commission (KVIC), Micro, small and medium enterprises development organization (MSME-DO), National small industries corporation limited (NSIC),National institute for entrepreneurship and small business development (NIESBUD),Indian institute of entrepreneurship (IIE).		
Text Books:		
1. Alpana Trehan, "Entrepreneurship" Published –Dream tech Press. 2. Poornima M. Charantimath, Entrepreneurship Development–Small Business Enterprises, Pearson Publication.		
Reference Books:		
1. Jack M. Kaplan, Patterns of Entrepreneurship, Wiley. 2. K. Nagarajan, Project Management, New Age International Pvt. Ltd.		
NPTEL Links: **1.** ENTREPRENEURSHIP DEVELOPMENT Dr. Nilam Panchal B.K. School of Business Management, Gujarat University https://onlinecourses.swayam2.ac.in/ntr21_ed41/preview. **2.** Entrepreneurship, By Prof. C Bhaktavatsala Rao IIT Madras, https://onlinecourses.nptel.ac.in/noc21_mg70/preview.		
Concerned faculty member should suitably frame SIX assignments from the following list. 1) Types of Entrepreneur & Traits and characteristics of successful Entrepreneur. 2) Role of woman entrepreneurs in society &Barriers to women entrepreneurs. 3) Different sources of finance. 4) Expansion through cooperation. 5)Expansion through concentration 6) Various challenges of small enterprise. 7) Khadi & Village Industry Commission. 8) Indian institute of entrepreneurship (IIE).		
Guide lines for ICA:		
Students must submit SIX Assignments in the form of journal. Each assignment should be well documented. Faculty in Charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignment.		

ENVIRONMENTAL SCIENCES					
COURSE OUTLINE					
Course Title:	**ENVIRONMENTAL SCIENCES**	**Short Title:**	**EVS**	**Course Code:**	**EC - 411**

Course description:
The course aims to percolate the importance of environmental science and environmental studies.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	02	15	30	02

Prerequisite course(s):

Course objectives:

The objective of this course is to impart knowledge so that the student will:

1. Integrate the knowledge on human interactions with the environment and problems associated with it
2. Analyze the importance of renewable and non-renewable natural resources
3. Learn the fundamentals of ecosystem
4. Learn and conserve the biodiversity and its conservation
5. Analyze the relation between social issues and the environment

Course outcomes:

After successful completion of this course the student will be able to:

1. Evaluate the effectiveness of various environmental policies and practice them as life-long learning
2. Develop the strategies for effective waste management and resource conservation
3. Articulate the interconnected, and interdisciplinary nature of environmental studies
4. Evaluate the local and global scale of environmental problems
5. Communicate complex environmental information to both technical and non-technical audiences.

COURSE CONTENT

ENVIRONMENTAL SCIENCES		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**2 hours/week**	**End Semester Examination (ESE) UA:**	**25 marks**

Unit I	**No. of Lectures: 08 Hours**	**5 Marks**

Multidisciplinary Nature of Environmental Studies and Social Issues

Definition, scope and importance multidisciplinary nature of environmental studies and need for public awareness, From Un sustainable to Sustainable development, Water conservation, rain water harvesting, water shed management, Resettlement and rehabilitation of people; its problems and concerns. Case Studies, Environmental ethics: Issues and possible solutions.
Climate change, global warming, acid rain, ozone layer depletion, nuclear
Accidents and holocaust. Case Studies. Waste land reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act Wild life Protection Act Forest Conservation Act Issues involved in enforcement of environmental legislation. Public awareness.

Unit II	**No. of Lectures: 05 Hours**	**5 Marks**

Natural Resources

Renewable and non-renewable resources

Natural resources and associated problems.

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people
Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
Role of an individual in conservation of natural resources.
Equitable use of resources for sustainable lifestyles

Unit III	**No. of Lectures: 08 Hours**	**5 Marks**

Ecosystems, Biodiversity and their Conservations

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the ecosystem like Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries), Introduction–Definition: genetic, species and ecosystem diversity, Bio geographic classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-sports of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Unit IV	**No. of Lectures: 05 Hours**	**5 Marks**

Environmental Pollution

Definition, Cause, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Unit V	**No. of Lectures: 04 Hours**	**5 Marks**

Human, Population and the Environment

Population growth, variation among nations. Population explosion–Family Welfare Program, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.

Reference Books:

1. Agarwal, K. C.2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad – 380 013, India, Email: mapin@icenet.net (R)
3. BrunnerR.C.,1989, Hazardous Waste Incineration, McGrawHillInc.480p
4. Clark R. S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. De A. K. Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment

& Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M. L. & School, R. M.1996.EnvironmentalSciencesystems&Solutions, Web Enhanced edition.639p.
13. Mhaskar A. K. Matter Hazardous, Techno-Science Publication (TB)
14. Miller T. G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E. P.1971. Fundamentals of Ecology.W.B.SaundersCo.USA,574p
16. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
17. SharmaB.K.,2 001.Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)

EXIT COURSE

Internship / Apprenticeship:

Internship / Apprenticeship / OJT shall be corresponding to the programme (Major) subject. Internship / Apprenticeship / OJT shall be monitored jointly by faculty and Industry / organization mentor.

The role of a Mentor, nominated by institute, shall be to provide professional/research guidance to the student during the internship. They shall also facilitate networking with other subject matter experts/professionals, which will enhance the internship experience and learning of the students.

Internship / Apprenticeship / OJT corresponding to the programme (Major) subject in Exit course with an external organization / entity is desirable. External organization may be industries, research institutions, University research centers or CSIR laboratories. Internship / Apprenticeship / OJT shall be preferably in offline mode, however online mode may also be permitted.

Preferably the Mini Project in Exit course shall be based on Internship / Apprenticeship / OJT.

Activities under Internship / Apprenticeship / OJT include Project work, Seminar, Industrial Training (excluding credits for Advanced Courses). This can be Industrial / Govt. / NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship / academic / industry research project.

After completion of Internship, students shall prepare a comprehensive report highlighting their learning's and takeaways during the internship period. The students are mandated to give a seminar based on the internship undertaken before an expert committee constituted by the concerned department and the assessment of internship shall be based on the following criteria:

1) Quality and effectiveness of presentation
2) Depth of knowledge and demonstrated skills
3) Variety and relevance of learning experience
4) Practical applications and relationships with concepts taught in the course
5) Internship Report
6) Attendance record, student diary (log), supervisor evaluation

Attendance record shall include daily attendance with IN and OUT time. It shall be signed by Industry supervisor.

Student Diary (log) shall include daily activities carried out by the student during Internship with Task assigned, Activities performed, key learning's etc. It shall be signed by Industry supervisor.

Supervisor evaluation form shall include the following with ratings in FIVE-point scale.

1) Behaviours
2) Performs in a dependable manner
3) Cooperates with co-workers and supervisors
4) Shows interest in work
5) Learns quickly
6) Shows initiative
7) Produces high quality work
8) Accepts responsibility
9) Accepts criticism
10) Demonstrates organizational skills
11) Uses technical knowledge and expertise
12) Shows good judgment
13) Demonstrates creativity/originality
14) Analyses problems effectively
15) Is self-reliant
16) Communicates well
17) Writes effectively
18) Has a professional attitude
19) Gives a professional appearance
20) Is punctual
21) Uses time effectively

Supervisor evaluation form shall be signed by Industry supervisor.

Mini project:

The student shall carry out a Mini project based on the knowledge acquired during the degree course and/or Internship. The project may be either fully theoretical/practical or involving both theoretical and practical work to be assigned by the guide / mentor / department. The work may also be Study/Survey/Design or R&D work. The work may also be on specified task or project assigned to the students during Internship. The project may also be a sponsored project. The project shall be corresponding to the programme (Major) subject.

Upon completion of the Mini project, the student shall submit project report in the form of hard bound. Assessment for the Mini project shall also include presentation by the student. Assessment of Mini project shall be based on the following criteria:

1) Problem Identification / Project Objectives
2) Methodology / Design
3) Implementation
4) Results and Discussion
5) Conclusion
6) Report
7) Depth of Understanding
8) Presentation
9) Demonstration of the project

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Kavayitri Bahinabai Chaudhari NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Second Year Bachelor of Engineering

in

(Common for all)

(As per NEP 2020 Guidelines)

Faculty of Science and Technology



COURSE OUTLINE FOR OPEN ELECTIVE - II

For Affiliated Colleges

Semester – IV

W.E.F. 2025 – 26

Open Elective - II

A Student can opt for any one subject out of available institute wide subjects defined in the following list as Open Elective provided, he/she has not taken that particular subject in his/her Programme core, Programme elective, Multidisciplinary Minor, other Open elective and Vocational and Skill Enhancement courses etc. throughout his / her four years of UG Engineering Programme. The student must opt a subject that is compulsorily from faculty other than that of the Major discipline.

Course Code	Name of the Subject / Course	Faculty Offered by	Department Offered by
Open Elective - II (w.e.f. 2025 - 26 at Semester - IV, Second Year Engineering)			
OE – 407 A	Human Resource Management	Comm. & Mgmt.	Management
OE – 407 B	Logical Reasoning and Problem Solving	Sci. & Tech.	Mathematics
OE – 407 C	Retail Management	Comm. & Mgmt.	Commerce
OE – 407 D	Public Health and Hygiene	Sci. & Tech.	Zoology
OE – 407 E	Agricultural Pest Management	Sci. & Tech.	Zoology
OE – 407 F	Basics of Stock Markets	Comm. & Mgmt.	Commerce
OE – 407 G	Problems of Philosophy	Humanities	Philosophy
OE – 407 H	Social and Preventive Pharmacy	Sci. & Tech.	Pharmacy

HUMAN RESOURCE MANAGEMENT (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**HUMAN RESOURCE MANAGEMENT**	**Short Title:**	**HRM**	**Course Code:**	**OE – 407 A**

Course description:

This course provides a comprehensive understanding of Human Resource Management (HRM), including key functions such as talent acquisition, performance management, training and development, and compensation management. It also covers emerging trends like AI in HR, digital HR, people analytics and sustainable HRM practices.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	15	45	03

Prerequisite course(s):

Course objectives:

The objective of this course is to impart knowledge so that the student will:

1. To understand the fundamental principles and functions of HRM.
2. To analyse workforce planning, recruitment, selection, and retention strategies.
3. To evaluate performance management systems, appraisal techniques, and key HR metrics.
4. To assess training and development programs to enhance employee skills and productivity.
5. To explore digital HR, work-life balance, compensation strategies, and sustainable HRM practices.

Course outcomes:

After successful completion of this course the student will be able to:

1. Explain HRM concepts and their significance in business operations.
2. Apply talent acquisition and retention strategies in an organizational context.
3. Implement performance appraisal and feedback systems effectively.
4. Develop employee training and development programs for career growth.
5. Utilize modern HR tools and technologies to enhance organizational efficiency.

COURSE CONTENT

HUMAN RESOURCE MANAGEMENT		Semester:	IV
Teaching Scheme:		**Examination scheme**	
Lectures:	**4 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Basics of Human Resource Management

Introduction to HRM: Meaning, Definitions, Nature and Objectives,
Functions of HRM: Managerial and Operative Functions
Differences between HRM, Personnel Management, and HRD
Role of HR Managers: Skills, Qualities, and Future Challenges
Emerging Trends: AI in HR, Digital HR, and People Analytics

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Talent Acquisition and Management

Human Resource Planning (HRP): Concept, Need, Characteristics, Benefits, Process.
Recruitment: Concept, Purpose, Sources, and Process

Selection: Concept, Process, Selection Tests, and Barriers
Placement: Concept and Problems
Induction/Orientation: Concept, Objectives, Steps, Problems
Promotion, Demotion, Transfer, Layoff, Downsizing, Rightsizing, and Voluntary Retirement Scheme (VRS)

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Performance Management and Appraisal

Performance Management: Concept, Objectives, and Modern Approaches
Performance Appraisal: Concept, Need, and Importance
Performance Appraisal: Traditional Methods and Modern Methods
Key Performance Indicators (KPIs) and Balanced Scorecard Approach
Bias in Performance Appraisal: Types and Ways to Mitigate
Legal and Ethical Issues in Performance Appraisal

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Training and Development

Definitions, Need, and Objectives of Training & Development
Concept and Importance of Executive Development
Training Methods: On-the-Job and Off-the-Job Methods, Virtual Learning and E-Learning Platforms
Evaluating Training Effectiveness: Tools and Models
Difference between Training, Development, and Education
Career Development and Succession Planning

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Advanced HRM Practices

HRM in the Digital Age: HRIS (Human Resource Information System) and Digital Transformation
Work-Life Balance: Flexible Work Models, Hybrid Work, and Employee Wellbeing
Compensation Management: Wage and Salary Administration, Incentives, and Benefits
Sustainable HRM: Green HRM, Corporate Social Responsibility (CSR) in HR, and Ethical HRM

Text Books:

1. "Human Resource Management: Text and Cases" by Dr. V.S.P. Rao (Excel Books)

Reference Books:

1. Human Resource Management By Dr. Shikha Kapoor - Taxmann
2. Human Resource Management By Dr K. Ashwathappa – Tata McGraw Hill
3. Essentials of Human Resource Management By P. SubbaRao – Himalaya Publishing House
4. HR From the Outside In: Six Competencies for the Future of Human Resources –
5. Boudreau & Cascio - McGraw-Hill Education- ISBN: 978-0071790351

NPTEL Links:

1. Principles of HRM by Prof. Aradhna Malik
   https://archive.nptel.ac.in/courses/110/105/110105069/
2. Talent Acquisition and Management by Prof. Santosh Rangnekar
   http://kcl.digimat.in/nptel/courses/video/110107152/L19.html
3. Performance & Reward Management by Prof Susmita Mukhopadhyay
   https://archive.nptel.ac.in/courses/110/105/110105137/
4. Training and Development by Prof. Susmita Mukhopadhyay and Prof. S. Srinivasan
   https://onlinecourses.nptel.ac.in/noc22_hs63/preview

LOGICAL REASONING AND PROBLEM SOLVING (Open Elective – II)

COURSE OUTLINE

Course Title:	LOGICAL REASONING AND PROBLEM SOLVING	Short Title:	LRPS	Course Code:	OE – 407 B

Course description:

The Logical Reasoning course is designed to enhance a student's ability to think critically and make reasoned judgments through structured and logical thought processes. This course focuses on developing key skills required to analyze patterns, relationships, and arguments, which are essential for solving complex problems. Throughout the course, students will be exposed to various types of logical reasoning problems, including deductive and inductive reasoning, analogies, sequences, and puzzles.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	15	45	03

Prerequisite course(s):

Course objectives:

1. Course will provide an introduction to logical and philosophical reasoning.
2. To enhance the analytical skill and problem solving skill of the students.
3. To improve verbal and non-verbal reasoning ability skill of the students

Course outcomes:

After successful completion of this course the student will be able to:

1. Choose analogy and classification, and perform coding and decoding on data
2. Evaluate arguments, identify assumptions, and recognize logical fallacies, strengthening their ability to think critically and make informed decisions.
3. Recognize logical reasoning applicable to real-life situations and solve real-life problems
4. Apply critical thinking in analyzing number patterns, ranks, and time sequences, fostering decision-making skills that are crucial for problem-solving.
5. Develop the ability to identify and interpret visual patterns and sequences.

COURSE CONTENT

LOGICAL REASONING AND PROBLEM SOLVING		Semester:	IV
Teaching Scheme:		**Examination Scheme:**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Analogy : Completing the analogous pair, Direct/ Simple Analogy, Choosing the analogous pair, Double Analogy Choosing a similar word, Detecting Analogies, Multiple word analogy, Number analogy, Alphabet Analogy

Classification : Choosing the odd word, Choosing the odd pair of word, Choosing the odd numeral, Choosing the odd numeral pair/ group

Coding and Decoding : Letter coding, Direst letter coding, Number/ Symbol Coding, Matrix

Coding , Substitution, Deciphering message word codes, Deciphering number and symbol codes for messages.
Blood relations: Deciphering jumbled up descriptions, Relation puzzle, Coded relations

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Direction sense Test : Directions and Cardinal Directions , Direction puzzle
Logical Sequence of words : Sequence in process , Sequence in object formation
Data Sufficiency : Yes/No Questions, Value Questions
Verification of Truth of the Statement: Relationship with the thing mentioned.
Sequential Output Tracing

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Logic : Logical Reasoning, Logical Deduction , Two- Premise Arguments, Three-Premise Arguments
Statement – Arguments : Strong arguments and weak Arguments
Statement –assumption : Type 1- implicit statement, Type2-Implicit in Context
Statement –Conclusions : Direct / indirect implications of conclusions
Cause and Effect Reasoning

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Logical Venn Diagrams: Type 1, Type 2
Number, Ranking and Time Sequence Test: Type 1: Number Test, Type 2: Ranking Test, Type 3: Time Sequence Test
Mathematical Operations
Type 1: Problem-Solving by Substitution, Type 2: Interchange of Signs and Numbers, Type 3: Deriving the Appropriate Conclusions
Arithmetical Reasoning: Type 1: Calculation-Based Problems, Type 2: Data-Based Questions, Type 3: Problems on Ages, Type 4: Venn-Diagram Based Questions

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

NON-VERBAL REASONING:
Classification: Choosing the Odd Figure, Choosing a Similar Figure, Finding Figures with the Same Characteristics,
Analytical Reasoning
Mirror-Images : Mirror-Images of Capital letters, Small letters, Numbers and figures
Water-Images : Water-Images of Capital letters, Small letters, Numbers and figures
Cubes and Dice : 2D and 3D cubes, Number opened dice and Letter opened dice

Text Books:

1. Dr. R.S. Aggarwal "A Modern Approach to Verbal & Non-Verbal Reasoning" by S. Chand Publication.

RETAIL MANAGEMENT (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**RETAIL MANAGEMENT**	**Short Title:**	**RM**	**Course Code:**	**OE – 407 C**

Course description:

This course provides an in-depth understanding of retail management, covering key concepts such as retail formats, consumer behavior, supply chain management, and e-retailing. It explores the role of technology in retail, sustainable business practices, and emerging retail trends. The course equips students with the knowledge and skills required to manage retail operations efficiently and explore entrepreneurial opportunities in the retail sector.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s):

Course objectives:

The objective of this course is to:

1. Understand the fundamentals of retailing, consumer behavior, and key retail formats.
2. Analyze retail operations, supply chain management, and technology integration in retail.
3. Apply e-retailing strategies and digital innovations to enhance customer experience.
4. Evaluate sustainable and ethical retail practices and their impact on business.
5. Develop entrepreneurial skills by exploring emerging trends and business opportunities in retail.

Course outcomes:

After successful completion of this course the student will be able to:

1. Explain the core concepts, significance, and evolution of retailing.
2. Analyze retail supply chain, store operations, and digital retail transformations.
3. Apply technology-driven solutions like AI, IOT, and block chain in retail management.
4. Evaluate sustainable retail models and ethical business practices.
5. Develop innovative retail business strategies and entrepreneurial ventures.

COURSE CONTENT

RETAIL MANAGEMENT		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fundamentals of Retailing

Retailing: Definition, significance, and evolution
Retail formats, business models, and ownership structures
Consumer behavior and purchase decision-making
Key drivers of retail growth in India and globally

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Retail Organization and Supply Chain Management		
Store location, layout, and visual merchandising Inventory control, logistics, and warehouse management POS systems, cash handling, Role of automation in retail operations		
Unit-III	**No. of Lectures: 09 Hours**	**Marks: 12**
E-Retailing and Digital Transformation		
Growth of e-commerce and omnichannel retailing AI, IoT, and blockchain applications in retail Customer data management and personalized marketing strategies Role of AR/VR in enhancing customer experience Cybersecurity and data privacy in online retailing		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Sustainable and Ethical Retailing		
Sustainability and green retailing practices Ethical sourcing and fair trade in retail Waste management and circular economy in retail Impact of government policies and regulations on retailing		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Future Trends and Entrepreneurship in Retail		
Retail analytics and business intelligence for decision-making Startups and innovation in retail entrepreneurship Franchising and global retail expansion Emerging trends: Quick commerce, Direct-to-Consumer (DTC) models Case studies on innovative retail success stories		
Text Books:		
1. "Retailing Management – Text and Case" (7th Edition) by Swapna Pradhan, Tata McGraw Hill		
Reference Books:		
1. Suja Nair, Retail Management, 2011 Edition, Generic, 2015. 2. R. S. Tiwari, Retail Management, Himalaya Publishing House. 3. Francois Chaubard, AI for Retail: A Practical Guide to Modernize Your Retail Business with AI and Automation, Wiley, 2023 4. Michael Levy, Barton A. Weitz and, Dhruv Grewal Professor Retailing Management, McGraw Hill; 10th edition (4 January 2018) 5. Gibson G. Vedamani, "Retail Management- Functional Principles and Practices", Jaico Publishing House, Mumbai.		
NPTEL Links: 1. Retail Management by By Prof. Swagato Chatterjee, IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc25_mg56/preview		

PUBLIC HEALTH AND HYGIENE (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**PUBLIC HEALTH AND HYGIENE**	**Short Title:**	**PH H**	**Course Code:**	**OE – 407 D**

Course description:

This course provides a comprehensive understanding of public health and hygiene practices, exploring their significance in preventing disease, promoting well-being, and improving the quality of life for individuals and communities. Students will learn about the principles and strategies involved in maintaining public health, the role of hygiene in disease prevention, and the impact of environmental and behavioral factors on health.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Lecture	**03**	**15**	**45**	**03**

Prerequisite course(s):

Course objectives:

1. Gain knowledge of common food-borne and water-borne diseases (causes, symptoms, transmission), and apply strategies for prevention and control.
2. To impart basic and technical knowledge on nursery management for strengthening of horticulture sector.
3. To study the disease and pest controlling nursery with practical experience.

Course outcomes:

1. Demonstrate the ability to design balanced meal plans considering calorie needs and dietary requirements for different individuals and life stages.
2. Effectively communicate the causes, symptoms, and prevention strategies for common food-borne and water-borne diseases.
3. Competently demonstrate essential personal hygiene practices and advocate for social hygiene initiatives in the community.
4. Articulate the negative health consequences of unhealthy habits and positively promote physical activities like cycling and walking, stress management techniques (yoga), and responsible family planning methods.
5. Develop an understanding of nutrition principles, balanced diets, and dietary needs for different life stages (infants, children, adults, pregnancy, lactation), promoting healthy eating practices for disease prevention.

COURSE CONTENT

PUBLIC HEALTH AND HYGIENE		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Nutrition and health:

Introduction: Scope and importance of Public health and hygiene. Balanced diet, diet control for diabetics and cholesterol, etc. Concept of energy, calories, daily food intake as per occupation, pregnancy and lactation. Dietary requirements of infants, pre-school children, schoolchildren, adults.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Health Hazards:

Health dynamicity – definition, factors influencing health, health as a medium of socio-economic development. Diseases – Common food borne and water borne diseases (jaundice, cholera, diarrhea and typhoid) – causative agents, symptoms, mode of transmission, prevention and control.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Health hygiene:

Personal hygiene, body odour, oral hygiene and sexual hygiene, grooming, feminine hygiene, sleep hygiene, hand washing, toiletry. Social hygiene – clean living movements, occupational hygiene, food and cooking hygiene, medical hygiene, excessive hygiene.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Health Education:

Definition, objectives, principles ,effects of smoking, alcoholism and drug abuse (hashish, opium, brown sugar).Population control and family welfare- use of contraceptives Importance of Body fitness Importance of cycling and walking exercise. Stress reduction management – Importance of yoga Sickle Cell Disorder.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Healthy Lifestyle:

Lifestyle habits ,Balanced Diet , Stress Management**,** Benefits of a Healthy Lifestyle,
Excessive usage of T.V., computer, mobile phones, two wheelers, and their impacts on health.

Text Books:

1. “Essentials of Public Health and Sanitation – Part I- IV” by Jatin V. Modi and Renjith S. Chawan.

Reference Books:

1. Murray, C. J. L. and A.D. Lopez. (1996), The Global Burden Of Disease. World Health Organization.
2. Park, J.E. and Park, K. Textbook of Community Health for Nurses.
3. Swaminathan S. Principles of Nutrition and Dietetics.

NPTEL Links:

1. **One Health-**By One Health InstructorsICMR - Regional Medical Research Centre, Bhubanesw (One Health - Course (nptel.ac.in)
2. **Basics of Health Promotion and Education Intervention**
   By Dr. Arista Lahiri, Dr. Sweety Suman Jha, Dr. Madhumita Dobe, Dr. Chandrashekhar Taklikar | IIT Kharagpur, IIT Kharagpur, AIIH&PH, Kolkata, AIIH&PH, Kolkata
   (Basics of Health Promotion and Education Intervention - Course (nptel.ac.in))

AGRICULTURAL PEST MANAGEMENT (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**AGRICULTURAL PEST MANAGEMENT**	**Short Title:**	APM	**Course Code:**	**OE – 407 E**

Course description:

This course provides a comprehensive understanding of the tactics and practices of managing pests in agricultural systems. It covers the identification, biology, and ecology of common agricultural pests. Students will learn integrated pest management (IPM) strategies that combine biological, cultural, physical, and chemical control methods to minimize pest damage while promoting environmental sustainability and economic viability**.**

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s):

Course objectives:

The objective of this course is to:

1. To understand agricultural pest management.
2. To learn economic impacts of integrated pest management and decision making.
3. To improve the biological precepts and sampling for detection convey.
4. To learn management of insect pests of cotton and rice.
5. To understand management of insect pests of vegetable crops and oilseeds.

Course outcomes:

After successful completion of this course the student will be able to:

1. Apply the concept of agricultural pest management.
2. Co-relate the economic impacts of integrated pest management and decision making.
3. Acquire skill of the biological precepts and sampling for detection.
4. Illustrate the management of insect pests of Cotton and rice.
5. Demonstrate and analyse the management of insect pests of vegetable crops and oilseeds.

COURSE CONTENT

AGRICULTURAL PEST MANAGEMENT		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

The IPM paradigm: concepts, strategies and tactics and Economic impacts of IPM

Historical perspectives, Early conceptual efforts in Integrated Pest Management (IPM} development, Kinds of pests, Pest management strategies and tactics, Funding IPM research and implementation, Measuring IPM implementation. Economic impacts of IPM: Measuring IPM adoption, Individual economic impacts to the IPM user, Analyzing typical adoption cases using budgets, Analyzing optimal IPM decisions, Aggregate or market-level economic impacts of IPM, 1 Capturing price effects when IPM impacts are large, Aggregating economic impacts over time, Valuing health and environmental impacts.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Economic decision rules for IPM and Decision making and economic risk in IPM

Economic decision rules for IPM: Economic decision levels, The EIL, The ET, Development of EILs and ETs, Current approaches, Limitations to EILs and ETs. Decision making and economic risk in IPM: Defining IPM within a management context, Economic injury level (EIL) and economic threshold (ET), Risk and IPM, Representing risky situations, Decision making criteria and tools, Risk preferences defined.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

IPM as applied ecology-the biological precepts and Sampling for detection, estimation and IPM decision making

IPM as applied ecology-the biological precepts: Life systems, Pest population dynamics, Stochastic models and meta populations, Population structure and life tables, Population stability and species diversity, Open and closed ecosystems, Scale and ecologically based pest management Sampling for detection, estimation and IPM decision making: Basics of sampling, Necessary sample size, Detection sampling, Estimation sampling, Decision sampling.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Management of Insect Pest of Cotton and Rice

Management of Insect Pests of Cotton: Introduction Changing Insect Pest Scenario, Cultural, Mechanical, and Physical Control, Microbial Control, Biological Control, Botanical Control, Chemical Control, Integrated Pest Management. Management of Insect Pests of Rice: Introduction, Component of Integrated Pest Management, Cultural Methods, Biological Control, Behavior modifying chemicals, Botanical Bio pesticides.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Management of Insect Pests of Vegetable Crops and Oilseeds

Management of Insect Pests of Vegetable Crops in Net House: Introduction, Physical Control, Cultural Control, Mechanical Control, Biological Control, Botanical Control. Management of Insect Pests of Oilseeds Crops: Rapeseed-Mustard, Sunflower, Groundnut, Sesamum, Linseed.

Textbooks:

1. "Integrated Pest Management, Concepts, Tactics, Strategies and Case Studies" by Edward B. Radcliffe, William D. Hutchison, Rafael E. Cancelado, Cambridge Publishing.
2. “Theory and Practice of Integrated Pest Management” by Ramesh Arora, Balwinder Singh, A.K. Dhawan, Scientific Publisher.

Reference Books:

1. “Integrated Pest Management for Crops and Pastures” by Paul Horne, Jessica Page, Land Links Publishing
2. “Encyclopedia of Pest Management” Volume II, by Devid Pimentel, CRC Press Taylor and Francis Group Publishing.

NPTEL Links:

1. Integrated Pest Management (IPM) by IIT Kanpur.
   https://archive.nptel.ac.in/courses/126/104/126104003/

BASICS OF STOCK MARKETS (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**BASICS OF STOCK MARKETS**	**Short Title:**	**BSM**	**Course Code:**	**OE – 407 F**

Course description:

This course introduces students to the fundamental concepts of stock markets, investment avenues, and trading mechanisms. It covers the structure and functioning of Indian financial markets, types of securities, stock trading strategies, mutual funds, and regulatory frameworks. The course also emphasizes investor protection measures, risk management, and financial literacy to enable informed decision-making in stock market investments.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s):

Course objectives:

The objective of this course is to:

1. Remember and define the fundamental concepts of stock markets and various investment instruments.
2. Understand the structure, organization, and functioning of financial markets in India.
3. Apply knowledge of primary and secondary market operations, trading mechanisms, and investment avenues.
4. Analyze stock trading strategies, risk-return factors, and investor protection measures.
5. Evaluate the role of regulatory bodies and ethical investment practices in the stock market.

Course outcomes:

1. After successful completion of this course the student will be able to:
2. Describe the functioning and significance of stock markets in the Indian financial system.
3. Classify different types of investment instruments and explain their characteristics.
4. Examine stock trading mechanisms, market indices, and risk-return factors.
5. Develop basic investment strategies and assess stock market operations.

COURSE CONTENT

BASICS OF STOCK MARKETS		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction

Saving vs Investment – Understanding the Need for Investment
Types of Investment Instruments – Equity Shares, Preference Shares, Bonds, Debentures, Government Securities, Sovereign Gold Bonds
Overview of Stock Exchanges – BSE, NSE & Their Indices
Difference Between Trading & Investment in Stock Market

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Types of Market and Derivatives

Types of Markets – Primary & Secondary Markets
Primary Market – IPO, Credit Rating Agencies, Underwriting, Grey Market
Secondary Market – Stock Brokers, Sub Brokers, Listing of Shares, Depositories
Basics of Derivatives – Futures, Options, Call & Put, Commodity & Financial Derivatives

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Mutual Funds and Investment Avenues

Concept and Advantages of Mutual Funds
Types of Mutual Funds – Equity, Debt, Liquid, Hybrid, Growth, Income, Tax-Saving, Pension Funds
Role of Asset Management Companies (AMCs) and Fund Managers
Factors to Consider Before Investing in Mutual Funds

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Stock Trading and Investment Strategies

Basics of Stock Trading – How to Open a Demat & Trading Account
Stock Order Types – Market Order, Limit Order, Stop Loss, Intraday Trading
Understanding Stock Market Indices and Their Importance
Risk & Return Analysis – Concept of Diversification, Systematic vs. Unsystematic Risk

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Regulatory Framework & Investor Protection

Role of SEBI (Securities and Exchange Board of India) in Stock Market Regulation
Investor Protection Mechanisms – Grievance Redressal, Investor Rights & Duties
Common Stock Market Frauds & Scams – Insider Trading, Pump & Dump Schemes
Overview of Taxation on Stock Market Investments – Capital Gains Tax, Securities Transaction Tax

Text Books:

1. Prasanna Chandra, “Investment Analysis and Portfolio management”, Tata McGraw Hill,3rd Edn., 2008
2. Julian Walmsley, “New Financial Instruments”, John Wiley & Sons, 2nd edition, Inc 1998
3. PunithavathyPandian, Security Analysis and Portfolio Management, 2nd edition, Vikas Publishing House Pvt. Ltd., 2013
4. Dhanesh Khatri, Security Analysis and Portfolio Management, 1st edition, MacMillan Publishers, 2010

Reference Books:

1. Bharati V. Pathak, “ The Indian Financial System: Markets, Institutions and Services”, Pearson education, 3rd edn.
2. Bhole I. M.: “Financial Markets and Institutionals”: Tata McGraw Hill, New Delhi.
3. Chandler M. V. and Goldfeld S. M: Economics of Money and Banking: Harper and Row, New York.
4. Edwin J. Elton, Martin J. Gruber, Modern Portfolio Theory and Investment Analysis, 8 th edition, John Wiley & Sons, 2010
5. SEBI Manual, 33rd edition, Taxmann Publications, 2019
6. Shashi K Gupta, Security Analysis Portfolio Management, 1st edition, Kalyani Publishers, 2010

NPTEL Links:

1. **Financial Institution and Market**
   https://archive.nptel.ac.in/courses/110/105/110105121/

PROBLEMS OF PHILOSOPHY (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**PROBLEMS OF PHILOSOPHY**	**Short Title:**	**POP**	**Course Code:**	**OE – 407 G**

Course description:

This course explores some of the central questions and issues in philosophy, designed to introduce students to fundamental philosophical problems and to develop their critical thinking skills. The course covers a broad range of topics, including metaphysics, epistemology, ethics, philosophy of mind, philosophy of language, and political philosophy. Students will examine classic and contemporary texts by influential philosophers, critically analyze their arguments, and engage with different philosophical traditions.

	Hours/week	No. of weeks	Total hours	Semester credits
Lecture	**03**	**15**	**45**	**03**

Prerequisite course(s):

Course objectives:

1. To provide knowledge of philosophical Theories
2. To create awareness about Indian and western Philosophy .
3. To understand Theory's Problem of Change, Problem of Self,Problem of Values
4. To understanding various Self of Philosophy
5. Help students understand key ethical dilemmas and encourage thinking about how philosophy informs moral decisions, ethical theory, and the application of ethical principles in real-world situations.

Course outcomes:

1. Students will understand knowledge of philosophical Theories
2. Students will understand about Problem of Change, Problem of Self.
3. Students will to understand Values
4. Students will to understand theory of causation
5. Developing the ability to critically analyze and evaluate philosophical arguments, identifying strengths and weaknesses in reasoning.

COURSE CONTENT

PROBLEMS OF PHILOSOPHY		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Nature of Philosophy:

Concept and definition of Philosophy according to Empiricism, Rationalism, Advait Vedanta, Buddhism. Scope of Philosophy in relation to Natural Sciences, Social Sciences, Political Science, Economics and Sociology, Religion.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Problem of Knowledge:

Western approach of Empiricism and Rationalism (Locke and Leinbnitz) , Indian approach of Empiricism and Rationalism (Charvaka and Nyaya) ,Sources of knowledge, Perception , Inference , Intuition , Testimony.

Unit–III	No. of Lectures: 09 Hours	Marks: 12
Problem of Change:		
Concept of change and permanence , Theories of change and causation Satkaryavad (Samkhya) Arambhavada (Nyaya), Aristotle's four fold theory of causation, Hume's theory of causation, and Mill's concept of causation.		
Unit–IV	**No. of Lectures: 09 Hours**	**Marks: 12**
Problem of Self		
Nature of Self, Concept of self-according to Plato ,Descartes ,Samkhya ,Buddhism		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Problem of Values		
Nature of values and their role in human life, Kinds of values ,Moral ,Aesthetic Problem of Truth, Correspondence Theory of Truth ,Coherence Theory of Truth ,Pragmatic Theory of Truth.		

Text Books:

1. "The problems of philosophy" by Russell, B. (1959) New York, Oxford University Press.

Reference Books:

1. Moore G. E.-Some Main Problemsof Philosophy
2. Durant Will-The Pleasures of Philosophy
3. Hawking W. E- Types of Philosophy
4. Ewing A. C.-The Fundamental Questions of Philosophy
5. Ayer A. J.-The Central Questions of Philosophy

NPTEL Links:

1. **Philosophy and Critical Thinking-**By Prof. Gyan Prakash | Indian Institute of Technology (Indian School of Mines), Dhanbad, India
   Philosophy and Critical Thinking - Course (nptel.ac.in)
2. **Indian Philosophy-Prof. Satya Sundar Sethy** is a Professor in the Department of Humanities and Social Sciences, IIT Madras.
   Indian Philosophy - Course (nptel.ac.in)

SOCIAL & PREVENTIVE PHARMACY (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**SOCIAL & PREVENTIVE PHARMACY**	**Short Title:**	**SPP**	**Course Code:**	**OE – 407 H**

Course description:

This course is designed to impart basic knowledge on public health, epidemiology, preventive care and other social health related concepts. Also, to emphasize the roles of students in the public health programs.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s):

Course objectives:

1. The objective of this course is to:
2. Preventive healthcare.
3. Public health and national health programs.
4. Food and nutrition related health issues.
5. Health education & social promotion of maintenance of health.

Course outcomes:

1. After successful completion of this course the student will be able to:
2. Describe various sources of health hazards and disease preventive measures.
3. Discuss the health care issues associated with food and nutritional substances.
4. Describe the general roles and responsibilities of students in public health.
5. Create awareness so that health status of society can be raised.

COURSE CONTENT

SOCIAL & PREVENTIVE PHARMACY		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to social Pharmacy

Definition & Scope: Social Pharmacy as a discipline & its scope in improving public health. Concept of health: WHO definition, various dimensions, determinants and health indicators. Public and private health system in India, national health mission.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Environment and Health

Water pollution, importance of safe drinking water, waterborne diseases, air pollution, noise pollution, sewage and solid waste disposal, occupational illness. Psychosocial Pharmacy: Drugs of misuse and abuse- psychotropic, narcotics, alcohol, tobacco products. Social impact of these habits on social health and productivity and suicidal behaviors.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

First Aid

Need for emergency treatment, emergency treatment in shock, snake bite, burns, poisoning,

fractures, resuscitation methods.		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Nutrition and Health		
Basics of nutrition: Macronutrients and Micronutrients, Importance of water & fiber in diet, Balanced diet, Malnutrition, nutrition deficiency diseases, ill effects of junk foods, caloric & nutrients values of various foods, fortification of food, Introduction to food safety, adulteration of foods, effects of artificial ripening, use of pesticides, genetically modified foods, Dietary supplements, nutraceuticals, food supplements, indications, benefits, Drug –Food interactions.		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Epidemiology		
Introduction to epidemiology, and its applications. Understanding the terms epidemic, pandemic, endemic, mode of transmission, outbreak, quarantine, isolation, incubation period, contact tracing, morbidity, mortality, Causative agents, mode of transmission and prevention of following communicable diseases, Respiratory infections- Mumps, Influenza(including Avian-Flu, H1N1, SARA,COVID-19), whooping cough, tuberculosis., Intestinal infections- Viral hepatitis, acute diarrheal disease, typhoid, food poisoning, Arthropod-borne disease- dengue, malaria, chikungunya, STDs, HIV/AIDS.		
Text Books:		
1. New approach to Social Pharmacy, S.P.S. Khurana Pee Vee publications. 2. A text book of Health Education & Community Pharmacy, Dr. Anees Siddique, Birla publications		
Reference Books: 1. Social Pharmacy: Tayler, Geoffrey. Pharmaceutical Press. London. 2. Social Pharmacy: Innovation and Development. Geoff Harding, Sarah Nettleton and Kevin Taylor. The Pharmaceutical Press. 3. Community Pharmacy Handbook- Jonathan Waterfield. 4. Essentials of Community Medicine- Apracical approach, Hiremath Lalita D, Hiremath Dhananjaya A 2nd Edition, 2012,ISBN: 9789350250440, JAYPEE Publications.		

Kavayitri Bahinabai Chaudhari
NORTH MAHARASHTRA UNIVERSITY,
JALGAON (M.S.)

Bachelor of Engineering – Honors
in
5G & Advanced Technology
for Second Year Bachelor of Engineering
in
Electronics & Telecommunication
(As per NEP 2020 Guidelines)

Faculty of Science and Technology



SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Syllabus Structure for Honors in 5G and Advance Technology: Additional Credit (Semester – III) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC -311A	Analog and Digital Communication	PCC	3			3	40	60			100	3
EC -312A	Analog and Digital Communication Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Honors in 5G and Advance Technology: Additional Credit (Semester – IV) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC -414A	Fiber Optics Communication	PCC	3			3	40	60			100	3
EC -415A	Fiber Optics Communication Lab	PCC			2	2			25	25 (OR)	50	1

ANALOG AND DIGITAL COMMUNICATION (Honors) (PCC)					
COURSE OUT LINE					
Course Title:	**ANALOG AND DIGITAL COMMUNICATION**	**Short Title:**	**ADC**	**Course Code:**	**EC -311 A**

Course description:

This course is aimed at introducing the fundamentals of Analog and digital communication to undergraduate students. This course explores the concept of basic modulation as well as digital modulation technique. The goals of the course are to understand the basic principle of communication and application in transmission and reception of signals. The major focus of this course is to build the fundamental concept related to different generation of frequency spectrum for communication system.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	03	15	45	03

Prerequisite course(s):

Knowledge of analog & digital signal & fundamentals

Course objectives:

1. To understand fundamentals, principles along with noise of communication system.
2. To learn about Amplitude, frequency & phase modulation systems in communication system.
3. To learn knowledge of waveform coding techniques.
4. To understand fundamentals of coding & decoding of information.
5. To study & understand different digital modulation technique.

Course outcomes:

After successful completion of this course the student will be able to:

1. Demonstrate knowledge about fundamentals, principles of communication system as well as effect of noise on communication system.
2. Use & explain different methods of analog communication.
3. Analyze the behavior of a communication system in presence of noise
4. Understand different digital modulation technique.
5. Explain and analyses performance of signal with coding and decoding.

COURSE CONTENT

ANALOG AND DIGITAL COMMUNICATION		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to communication system:

Basic Communication System, Segments of RF Band spectrum, Modulation Technique, Need of modulation, Types of modulation, Introduction to amplitude, frequency and phase modulation. Pulse modulation, Review of PAM, PWM, PPM.

Noise Classification of noise, Types of noise, Gaussian and white noise characteristics, signal to noise ratio, Noise figure, pre-emphasis and de-emphasis

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Amplitude and Frequency Modulation:

Amplitude Modulation Systems-Mathematical representation of AM wave, frequency domain representation of AM signal, AM transmitter & receiver, DSB, SSB modulations. Angle Modulation. Frequency and Phase modulation
Mathematical representation of FM wave, Modulation Index, Comparison of AM, FM and PM.AM and FM Receivers- Performance characteristics –Sensitivity, Selectivity, Fidelity.
AM Receivers- TRF Receiver, Superhetrodyne Receiver.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Waveform Coding and Baseband Shaping for Data Transmission: Pulse Code Modulation, Quantization noise in PCM, Delta Modulation, Adaptive Delta modulation, Time Division multiplexing, T1 Multiplexers.
Discrete PAM Signals and Power Spectra of Discrete PAM Signals, ISI & Nyquist's Criterion for Distortion less Baseband, Binary Transmission, Eye Pattern.

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Information and Detection Theory:
Uncertainty, Information and Entropy, Source coding theory, Huffman coding and Discrete memory less channels, Numerical on Information and Entropy, Numerical on Huffman coding. Mutual information, channel capacity and channel coding theory, Numerical on Channel capacity.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Digital Modulation Techniques:
Digital Modulation schemes- Phase Shift Keying (PSK), Frequency Shift Keying (FSK), Quadrature phase shift keying (QPSK), Differential Phase shift Keying (DPSK), Minimum Shift Keying (MSK), and comparison of FSK, PSK, QPSK, and MSK.

Text Books:

1. G. Kennedy, B. Davis, "Electronic Communication Systems", Tata McGraw Hill Edition, 4th Edition, 1999.
2. S. Kundu, "Analog and Digital Communication", Pearson, ISBN 978-81-317- 3187-1

Reference Books:

1. H. Taub, D. L. Schilling and G. Saha, "Principles of Communication Systems", TataMcGraw-Hill Edition, 3 rd Edition, 2011.
2. S. Haykin, "Digital Communications", Wiley Student Edition, ISBN 9971-51-205

NPTEL Links:

1. Analog Communication Prof Goutam Das, IIT Kharagpur, https://archive.nptel.ac.in/courses/117/105/117105143/
2. Digital Communication, Prof. Bikash Kumar Dey, IIT Bombay https://nptel.ac.in/courses/117101051

<table>
<tr><th colspan="6">ANALOG AND DIGITAL COMMUNICATION LAB (Honors) (PCC)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">ANALOG AND DIGITAL COMMUNICATION LAB</td><td>Semester:</td><td>III</td><td>Course Code:</td><td>EC -312A</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">ORAL (OR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory Experiments/assignments from the following list.
1. Study of AM transmitter and calculate of modulation index of AM wave by envelopemethod
2. Analyze and generate A.M. Demodulation signal by diode detector
3. Study of FM and calculate of modulation index of FM wave
4. F.M. Demodulation (Phase discriminator/Ratio detector method.)
5. To Construct and Verify Pre-emphasis and De-emphasis and Plot the Waveforms.
6. DSB-SC signal generation using balanced modulator
7. To understand waveform of Delta Modulation and Demodulation
8. To understand waveform of Adaptive Delta Modulation and Demodulation.
9. To generation and detection of FSK I/P and O/P waveform.
10. To generation and detection of PSK I/P and O/P waveform</td></tr>
<tr><td colspan="6">Guidelines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.</td></tr>
<tr><td colspan="6">Guidelines for ESE:</td></tr>
<tr><td colspan="6">ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.</td></tr>
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FIBRE OPTIC COMMUNICATION (Honors) (PCC)

COURSE OUT LINE

Course Title:	FIBRE OPTIC COMMUNICATION	Short Title:	FOC	Course Code:	EC-414 A

Course description:

This course provides knowledge about optical fiber technology that emerged as major innovation in telecommunication.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Knowledge of Light wave theory, Basic concept of analog and digital Communication

Course objectives:

The main objective of this course is

1. To introduce student with light ray theory of transmission and its application in optical communication.
2. To understand the construction of fiber and signal degradation in fiber.
3. To study various optical sources and optical detectors.
4. To understand Optical link design for fiber optics.
5. To study Optical Switching and networking technology concepts.

Course outcomes:

After successful completion of this course the student will be able to:

1. Know the fundamentals of Light theory and its application in optical communication.
2. Know the construction of various optical fiber and causes of signal degradation in fiber
3. Experience with the Knowledge of working of various optical sources and optical detectors.
4. Know about Optical link design for fiber optics.
5. Develop the knowledge on Optical Switching and networking technology.

COURSE CONTENT

FIBRE OPTIC COMMUNICATION		Semester:	IV
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Optical Fibers-Structures Wave guiding and Fabrication

Block diagram of Optical communication system, Light system components, Optical transmitters, optical Receivers Advantage and Disadvantage of OFCS over other communication systems.

Ray theory of transmission and concept of acceptance angle and Numerical Aperture (Numerical based on Ray theory), Propagation of light.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Optical Fibers and Signal Degradation

Different types of optical fibers-Fiber profiles-Step index fibers, Graded index fibers

Fiber modes –Optical modes Normalized frequency Single mode step index, Multimode step index, Multimode Graded index (Numerical on mode theory).

Signal degradation on optical fiber due to dispersion and attenuation.

Attenuation, Absorption, Absorption due to atomic defects, Extrinsic Absorption ,Intrinsic , Absorption ,scattering loss- Linear and Nonlinear loss, bending losses.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Optical Sources and Detectors Sources : Factors or Characteristics for their selection in OFCS,

Light Emitting diodes: Surface emitter, LEDS, Edge emitter LEDS, LED operating Characteristics, Radiation patterns of surface and Edge emitters,

Laser diode: Laser principles, semiconductor laser diode, Hetero junction Laser, stripgromentry lasers, laser diode.

Detectors: Characteristics or factors for their Selection, P-N photo diode, P-I-N Photo diode, Avalanche photodiode. (No Numerical on Detectors)

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Optical Receivers.

Optical link design- Power budget, Rise time budget.(No Numerical)

Sources of power penalties, Modal Noise, Dispersion Broadening, and Mode partition noise, Frequency Chipring. BER calculation, Fiber Splicing-Fusion Splicing, V-groove Splicing.

Optical Fiber Measurements: Measurement of Attenuation, refractive index. Optical time domain reflectometry (OTDR).

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Advanced Optical Systems

Advanced Techniques: Wavelength Division Multiplexing (WDM), Dense Wavelength Division Multiplexing (DWDM).

WDM components-2*2 Fiber Coupler, Star Coupler, Optical Isolator.

Optical amplifiers- Semiconductor Amplifier, Raman Amplifier, EDFA.

Optical Networks- SONET (Synchronous Optical Network)

Text Books:

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. Govind Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997

Reference Books:

1. John M. Senior , “Optical Fiber Communication (Principles & Practice)”,Pearson Education.
2. Govind Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
3. F.C.Allard, Fiber Optics Handbook for engineers & scientists,TMH,NewYork (1990) .

NPTEL Links:

1. Introduction to Fiber Optics Communication, Deepa, IIT Madras.
   https://archive.nptel.ac.in/courses/108/106/108106167/.
2. Fiber Optics Communication and Technique, Pradeep Kumar ,IIT Kharagpur
   https://archive.nptel.ac.in/courses/108/104/108104113/.

<table>
<tr><th colspan="6">FIBRE OPTIC COMMUNICATION LAB (Honors) (PCC)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">FIBRE OPTIC COMMUNICATION LAB</td><td>Semester:</td><td>IV</td><td>Course Code:</td><td>EC -415 A</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">ORAL (OR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory Experiments/assignments from the following list.
1. Electrical Characteristics of different type LED.
2. To study Laser Diode.
3. NA Measurement for Single/Multi mode, Graded Index/Single Index optical Fiber
4. Attenuation Measurement and bending losses measurement of optical fiber
5. Spectral characteristics of LED.
6. Analog Signal transmission using LED source.
7. Digital Signal transmission using LED source.
8. Study of OTDR
9. Study of optical connectors.</td></tr>
<tr><td colspan="6">Guidelines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.</td></tr>
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Kavayitri Bahinabai Chaudhari
NORTH MAHARASHTRA UNIVERSITY,
JALGAON (M.S.)

Bachelor of Engineering – Honors
in
VLSI Design & Technology
for Second Year Bachelor of Engineering
in
Electronics & Telecommunication
(As per NEP 2020 Guidelines)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(4th Cycle)

SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Syllabus Structure for Honors in VLSI Design and Technology: Additional Credit (Semester – III) (w .e .f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC -311B	Digital System Design	PCC	3			3	40	60			100	3
EC -312B	Digital System Design Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Honors in VLSI Design and Technology: Additional Credit (Semester – IV) (w .e. f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC -414B	Signal and System	PCC	3			3	40	60			100	3
EC -415B	Signal and System Lab	PCC			2	2			25	25 (OR)	50	1

DIGITAL SYSTEM DESIGN (Honors) (PCC)

COURSE OUT LINE

Course Title:	DIGITAL SYSTEM DESIGN	Short Title:	DSD	Course Code:	EC -311 B

Course description:

This course is aimed at introducing the fundamentals of digital systems to undergraduate students. This course helps to understand the importance of digital logic verification and design for test ability. The goals of the course are to understand the basic principle of digital systems and application in different area .The major focus of this course is to design and analyze combinational and sequential logic circuits.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Knowledge of number system, logic gates, simplification and implementation of logic system and also knowledge about semiconductor devices of Electronics Engineering

Course objectives:

1. To give the brief idea about basics of Boolean algebra and K-Map.
2. To learn Combinational logic design using MSI circuits.
3. To learn Sequential logic design using flip-flop.
4. To analyze and design asynchronous and synchronous machine.
5. Introduce students with logic family like TTL, CMOS.

Course outcomes:

After successful completion of this course the student will be able to:

1. Apply knowledge of k-map to obtain minimized expressions.
2. Demonstrate the combinational logic design using MSI circuits.
3. Analyze and design sequential logic design using flip-flop.
4. Analyze and design sequential circuit for realize counters and shift registers
5. Understand the design concept of logic family.

COURSE CONTENT

DIGITAL SYSTEM DESIGN		Semester:	III
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Logic Simplification and code convertors

Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, canonical forms Karnaugh maps up to 5 variables, Don't care conditions, Binary Codes, BCD Codes, ASCII code, Hamming code ,Code Conversion- Binary to gray, Gray to Binary, BCD to Excess3 And BCD to seven segment decoder..

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Combinational Logic Circuits

Half and Full Adders using basic gates, Half and Full Substractors using basic gates, BCD adder, IC 7483, 1 bit and 2 bit Comparators, Multiplexers, Demultiplexer, Decoder.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Sequential Logic Circuits

Basic difference between Combinational Logic Circuits and Sequential Logic circuit, Building blocks like S-R, JK and Master-Slave JK FF, T flip flop, D Flip flop.

Shift registers- Types of Shift registers and operation of SISO, SIPO, PIPO, PISO, Bidirectional Shift Register, Universal Shift Register, Ring Counter.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Counters and sequential circuits

Asynchronous (Ripple) counters-Design of ripple counters and Mod –N ripple counter using Flip- flop, Synchronous counter - Design of Synchronous counters and Mod –N Synchronous counter, Up Down Counter.

Synchronous sequential Circuit model - Mealy Model and Moore Model, Block Diagram, State Diagram, State table, State Assignment.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Logic Families

Classifications of Logic family, Specifications, Propagation delay, Noise margin, fan-in, fan-out, Simple TTL and standard TTL gate, Specifications of TTL family, ECL family, CMOS families -CMOS Invertor, CMOS NOR gate, CMOS NAND gate Interfacing- TTL to CMOS and CMOS to TTL, Introduction to programmable Logic devices.

Text Books:

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
2. G.K. Kharate, “Digital Electronics” Oxford university press, 1st edition,2010.

Reference Books:

1. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition 2012.
2. John M Yarbrough “Digital Logic Application and Design, Brooks/cole, Thomson Learning Vikas Publishing House.
3. Douglas Perry, “VHDL”, Tata McGraw Hill, 4th edition, 2002.

NPTEL Links:

1. Digital System Design,Neeraj Goal,IIT ROPAR.
   https://onlinecourses.nptel.ac.in/noc21_ee39/preview.
2. Switching circuit & Design ,Indrdranil sen gupta,IIT Kharagpur.
   https://archive.nptel.ac.in/courses/106/105/106105185/

DIGITAL SYSTEM DESIGN LAB (Honors) (PCC)					
LAB COURSE CONTENT					
DIGITAL SYSTEM DESIGN LAB		**Semester:**	**III**	**Course Code:**	**EC -312 B**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**End semester exam (ESE) UA:**			**25 marks**
Semester Credits	**01**	**Internal Continuous Assessment (ICA) CA:**			**25 marks**
End Semester Exam (ESE) Pattern:		**ORAL (OR)**			

Concerned faculty member should suitably frame SIX laboratory Experiments/ assignments from the following list.

1. Realization of logic gates OR, AND, NOT, NOR, NAND gates using
2. Discretecomponents and verify their truth tables.
3. Design and implement 4-bit binary to Gray code converter
4. Implement 4-bit binary adder using IC 7483
5. Implement BCD to 7-segment decoder using IC 7447
6. Verify the truth table of multiplexer and Demultiplexer using IC
7. Study of Decade Counter
8. Study of JK, D type and T-Type flip-flop using IC 7476
9. Study of Shift Register
10. Study of Synchronous counter using IC 74191
11. Realization of half and full Adder using gates.

Guidelines for ICA:

Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.

Guidelines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

SIGNAL & SYSTEM (Honors) (PCC)					
COURSE OUT LINE					
Course Title:	**SIGNAL & SYSTEM**	**Short Title:**	**SS**	**Course Code:**	**EC -414 B**

Course description:

Signals play a major role in our life and it can be represented in a number of ways. Signal processing is a method of extracting information from the signal which in turn depends on type of signal and the nature of information it carries.

This course describes the various signals with the help of mathematical tools such as Fourier Transform, Laplace Transform and Z-Transform. It also introduces the state space approach of system.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	03	15	45	03

Prerequisite course(s):

Mathematics - II

Course objectives:

1. To introduce the students to the various signals.
2. Study and understanding of representation of signals and systems.
3. To learn and understand different Transforms for Digital Signal Processing
4. Analysis of Discrete Time signals and systems

Course outcomes:

After successful completion of this course the student will be able to:

1. Demonstrate the ability to represent signals mathematically in continuous time and discrete time, and in frequency domain.
2. Understand the use of numerical method to analyze digital signal processing.
3. Understand Discrete Fourier Transform (DFT) and properties.
4. Analyze discrete time systems using Laplace and Z – transform.
5. Basic Understanding of state space analysis of system.

COURSE CONTENT

SIGNAL & SYSTEM		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Classifications of Signals and Systems (only Introduction):

Classifications of Signals-Deterministic and non-deterministic signals, periodic and aperiodic signals, even and odd signals, energy and power signals.

Singularity functions-unit impulse function, unit step function, unit ramp function, unit pulse function, representation of signals**.**

Classifications of Systems-Static and dynamic systems, linear and non-linear systems, time variant and time invariant systems, stable and unstable systems.

Simple manipulations of discrete time signals-shifting, folding, time scaling. Representations of systems, Linear differential equations, Impulse response of a system. Analog to digital conversion of signals-sampling of continuous time signals, signal reconstruction.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fourier Transform:

Introduction - Trigonometric Fourier series, complex or exponential form of Fourier series, Parseval's identity for Fourier series.

Fourier Transform- energy spectrum for non-periodic function, properties of Fourier Transform.
Discrete Fourier Transforms (DT)- discrete convolution, properties of convolution, circular convolution (numerical), Discrete -Time Fourier Transform (DTFT),properties of DFT (numerical)

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Laplace Transforms:
Definition, Region of Convergence (ROC), LT of some important function and numerical. Initial value theorem, Final value theorem. Convolution integral numerical. Application of LT only in series R-L circuit and series R-C circuit.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Z- Transforms:
Introduction, definition, Region of Convergence (ROC), properties of the ROC for the z-transform and numerical. Properties of z-transform such as Linearity, Time Reversal, Time Shifting, Scaling, Differentiation, Convolution and numerical based on these properties.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

State space analysis: Concept of state (State variable and state model). State model of linear system. Eigen Values of Matrix A. Solution of state equation. Properties of State Transition Matrix and numerical.

Text Books:

1. S. Salivahanan, C. Gnanpriya, Digital Signal processing, McGraw Hill, 4th Edition
2. J. Nagrath and M. Gopal , Control system Engineering- New Age 5thEdition

Reference Books:

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing Principles, algorithms and applications, Pearson Prentice Hall, Fourth edition
2. I.J. Nagrath, S.N. Sharan, R. Ranjan, S.Kumar, Signals and Systems, TMH, 2nd Edition
3. Katsuhiko Ogata, Modern Control Engineering, Pearson, 4th edition.

NPTEL Links:

1. Introduction to Signal and System, By Prof. Kushal K. Shah, IISER Bhopal.
   https://onlinecourses.nptel.ac.in/noc21_ee28/preview
2. Digital Signal Processing , By K Singh ,IIT, Madras
   https://archive.nptel.ac.in/courses/108/106/108106151/

SIGNAL & SYSTEM LAB (Honors) (PCC)					
LAB COURSE CONTENT					
SIGNAL & SYSTEM LAB		**Semester:**	**IV**	**Course Code:**	**EC -415 B**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**End semester exam (ESE) UA:**			**25 marks**
Semester Credits	**01**	**Internal Continuous Assessment (ICA) CA:**			**25 marks**
End Semester Exam (ESE) Pattern:		**ORAL (OR)**			

Concerned faculty member should suitably frame SIX laboratory assignments from the Following list.

1. Introduction to MATLAB/ Scilab.
2. To create user defined functions for generating sinusoidal signal, delta function, unit step function and periodic signal.
3. To create user defined functions for signal operation: signal addition, time shifting, time scaling and time inversion.
4. To compute convolution of two signals and verify its properties.
5. To synthesize the periodic signal using Fourier series.
6. To analyze the spectrum of the signal using Fourier transform and verify its properties.
7. To compute and plot the impulse response and pole-zero diagram of transfer function using Laplace transform.
8. To find Z-transform of a signal.

Guidelines for ICA:

Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.

Guidelines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

Kavayitri Bahinabai Chaudhari
NORTH MAHARASHTRA UNIVERSITY,
JALGAON (M.S.)

Bachelor of Engineering – Honors
in
Data Science in Telecom
for Second Year Bachelor of Engineering
in
Electronics & Telecommunication
(As per NEP 2020 Guidelines)

Faculty of Science and Technology

कवयित्री बहिणाबाई चौधरी उत्तर महाराष्ट्र विद्यापीठ
अंतरी पेटवू ज्ञानज्योत
1990
'A' Grade
NAAC Re-Accredited
(4th Cycle)

SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Syllabus Structure for Honors in Data Science in Telecom: Additional Credit (Semester – III) (w. e. f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC -311C	Real Time Analytics	PCC	3			3	40	60			100	3
EC -312C	Real Time Analytics Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Honors in Honors in Data Science in Telecom: Additional Credit (Semester – IV) (w. e. f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC -414C	Telecom Network Security	PCC	3			3	40	60			100	3
EC -415C	Telecom Network Security Lab	PCC			2	2			25	25 (OR)	50	1

REAL TIME ANALYTICS (Honors) (PCC)					
COURSE OUT LINE					
Course Title:	**REAL TIME ANALYTICS**	**Short Title:**	**RTA**	**Course Code:**	**EC -311 C**

Course description:

Data Analysis is an ever-evolving discipline with lots of focus on new predictive modeling techniques coupled with rich analytical tools that keep increasing our capacity to handle big data.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Course objectives:

1. To understand the concepts of big data
2. To understand the concepts of Data science
3. To do the data analysis
4. To apply the concepts of data visualization
5. To apply data analytics tools

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the concepts of big data
2. Understand the concepts of Data science
3. Do the data analysis
4. Apply the concepts of data visualization
5. Apply data analytics tools

COURSE CONTENT

REAL TIME ANALYTICS		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to Big Data: Big data, 3V's, 4 V's of big data, Types of Big data, Analytics, Industry examples of Big data, Data risk, Big data technologies, Big data architecture, operational and analytical big data technologies, big data and e Governance, Benefits of Big data, analytics and cloud computing, Crowd sourcing analytics.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to Data Science: Data Science, Terminology Related with Data Science, Methods of Data Repository, Personnel Involved with Data Science, Types of Data, The Data Science Process (DSP), Popular Data Science Toolkits, Familiarity with Example Applications

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Data Analysis: Introduction to Applied Statistical Techniques, Types of Statistical Data, Types of Big Data Analytics, Collecting Data for Sampling and Distribution, Probability, Frequency Distribution, Population and Parameters, Central Tendency or Central Value, Measures of Central Tendency, Different Types of Statistical Means, Problems of Estimation : Population or Sample, Normal Distribution Curve

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Data Visualization: Data Visualization, Importance of Data Visualization, Conventional Data Visualization Methods, Retinal Variables, Mapping Variables to Encodings, Case Study, Recent trends in various data collection and analysis techniques, Various Big Data

Visualization Tools, Visualizing Big Data, Preattentive Attributes, Challenges of Big Data Visualization, Potential Solutions, Future Progress of Big Data Visualization. Nuclear Energy: Nuclear Reactors for Power Generation.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Advanced Analytics: Technology and Tools: Hadoop: Architecture, components of Hadoop framework, Analyzing big data with Hadoop. Map Reduce: Overview, Map Operations, HIVE: features, architecture, working, data models. PIG: Introduction, components, pig vs Map Reduce, Pig vs. HIVE,

Text Books:

1. V.K.Jain, "Data Science and Analytics", Khanna Book Publishing Co.(P) LTD. Edition 2018
2. V.K.Jain, "Big Data and Hadoop", Khanna Book Publishing Co.(P) LTD

Reference Books:

1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.
2. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication,ISBN: 978-1-118-16430-3

NPTEL Links:

1. Big Data Computing, By Rajiv Mishra, IIT Patna.
   https://archive.nptel.ac.in/courses/106/104/106104189/

<table>
<tr><th colspan="6">REAL TIME ANALYTICS LAB. (Honors) (PCC)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">REAL TIME ANALYTICS LAB.</td><td>Semester:</td><td>III</td><td>Course Code:</td><td>EC -312 C</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="3">End Semester Exam (ESE) Pattern:</td><td colspan="3">ORAL (OR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory experiments/assignments from the following list.
1. Installation of Hadoop Framework, it‘s components and study the HADOOP ecosystem.
2. Write a program to implement word count program using Map Reduce
3. Experiment on Hadoop Map-Reduce / PySpark: -Implementing simple algorithms in Map-Reduce: Matrix multiplication.
4. Install and configure Mongo DB/ Cassandra/ HBase/ Hyper table to execute NoSQL Commands.
5. Implementing DGIM algorithm using any Programming Language/ Implement Bloom Filter using any programming language
6. Implement and Perform Streaming Data Analysis using flume for data capture, PYSpark / HIVE for data analysis of twitter data, chat data, weblog analysis etc.
7. Implement any one Clustering algorithm (K-Means/CURE) using Map-Reduce.
8. Implement Page Rank Algorithm using Map-Reduce</td></tr>
<tr><td colspan="6">Guidelines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.</td></tr>
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<tr><td colspan="6">ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.</td></tr>
</table>

TELECOM NETWORK SECURITY (Honors) (PCC))					
COURSE OUT LINE					
Course Title:	**TELECOM NETWORK SECURITY**	**Short Title:**	**TNS**	**Course Code:**	**EC -414 C**

Course description:

This skill oriented course equips the system Administrators with the skills require to protect & recover the computer systems & networks from various security threats.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Various Security Threats

Course objectives:

1. To understand the concepts of Security issues.
2. To understand the concepts of Wireless Network Security.
3. To understand the concept of attacks.
4. To understand security attacks in MANET.
5. To understand the characteristics of Cloud Computing.

Course outcomes:

After successful completion of this course the student will be able to:

1. Familiarize with the issues and technologies involved in designing a wireless and mobile system that is robust against various attacks.
2. Gain knowledge and understanding of the various ways in which wireless networks can be attacked.
3. Have a broad knowledge of the state-of-the-art and open problems in wireless and mobile security.
4. Learn various security issues involved in cloud computing and MANET.
5. Learn various security issues related to GPRS and 5G.

COURSE CONTENT

TELECOM NETWORK SECURITY		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Security Issues in Mobile Communication: Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Security of various Device: Network and Server Levels, Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Application Level Security in Cellular Networks: Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications,3G to 5G security for applications, Some of Security and authentication Solutions.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12
Application Level Security in MANETs: MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions.		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Data Center Operations: Security challenge, implement "Five Principal Characteristics of Cloud Computing, Data center Security Recommendations Encryption for Confidentiality and Integrity, Encrypting data at rest, Key Management Lifecycle, Cloud Encryption		
Text Books:		
1. Pallapa Venkataram, Satish Babu: "Wireless and Mobile Network Security", 1st Edition, Tata McGraw Hill,2010. 2. Frank Adelstein, K.S.Gupta :"Fundamentals of Mobile and Pervasive Computing", 1st Edition, Tata McGraw Hill 2005.		
Reference Books:		
1. Randall k. Nichols, Panos C. Lekkas : "Wireless Security Models, Threats and Solutions", 1st Edition, Tata McGraw Hill, 2006. 2. Bruce Potter and Bob Fleck : "802.11 Security" , 1st Edition, SPD O'REILLY 2005. 3. James Kempf:"Guide to Wireless Network Security, Springer. Wireless Internet Security – Architecture and Protocols", 1st Edition, Cambridge University Pre		
NPTEL Links: 1. Introduction to Adhoc Wireless Network, Sudip Misra IIT Kharagpur. https://archive.nptel.ac.in/courses/106/105/106105160/. 2. Evolution Of Air Interface Towards 5G, By Prof. Suvra Sekhar Das , IIT Kharagpur https://onlinecourses.nptel.ac.in/noc22_ee56/preview.		

TELECOM NETWORK SECURITY LAB (Honors) (PCC)					
LAB COURSE CONTENT					
TELECOM NETWORK SECURITY LAB		**Semester:**	**IV**	**Course Code:**	**EC -415 C**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**End semester exam (ESE) UA:**			**25 marks**
Semester Credits	**01**	**Internal Continuous Assessment (ICA) CA:**			**25 marks**
End Semester Exam (ESE) Pattern:		**ORAL (OR)**			

1. Concerned faculty member should suitably frame SIX laboratory assignments from the following list.
2. Study of various network components.
3. Study of LAN.
4. Study of CLOUD Computing
5. Study of various types of attacks.
6. Study of MANET.
7. Study of GSM.
8. Study of GPRS
9. Study of 5G.

Guidelines for ICA:

Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.

Guidelines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

Kavayitri Bahinabai Chaudhari
NORTH MAHARASHTRA UNIVERSITY,
JALGAON (M.S.)

Bachelor of Engineering – Minor
in
5G & Advanced Technology
for Second Year Bachelor of Engineering
offered by
Electronics & Telecommunication
(As per NEP 2020 Guidelines)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(4th Cycle)

SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Syllabus Structure for Specialization Minor in 5G & Advanced Technology: Additional Credit (Semester – III) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC - 313A	Principles of Analog & Digital Communication	PCC	3			3	40	60			100	3
EC - 314A	Principles of Analog & Digital Communication Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Specialization Minor in 5G & Advanced Technology: Additional Credit (Semester – IV) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC-416A	Light Wave Communication	PCC	3			3	40	60			100	3
EC - 417A	Light Wave Communication Lab	PCC			2	2			25	25 (OR)	50	1

PRINCIPLES OF ANALOG & DIGITAL COMMUNICATION
(Specialization Minor)

COURSE OUT LINE

Course Title:	PRINCIPLES OF ANALOG & DIGITAL COMMUNICATION	Short Title:	PA DC	Course Code:	EC -313 A

Course description:

This course is aimed at introducing the fundamentals of analog & digital communication to Undergraduate students. The goals of the course are to understand the basic principle of analog & digital communication and application in different era.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Knowledge of Analog Signal Transmission & fundamentals

Course objectives:

1. To understand fundamentals, principles & theory of communication system.
2. To learn about Amplitude & phase modulation systems along with noise in communication system.
3. To learn about Frequency Modulation.
4. To study & understand AM & FM Receiver.
5. To understand fundamentals of Different types of Noise.

Course outcomes:

After successful completion of this course the student will be able to:

1. Demonstrate knowledge about fundamental principles, theories and concept of communication system.
2. Understood Amplitude Modulation.
3. Understood Frequency Modulation.
4. Understood AM & FM Receiver.
5. Analyze the behavior of a communication system in presence of noise.

COURSE CONTENT

PRINCIPLES OF ANALOG & DIGITAL COMMUNICATION		Semester:	III
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Introduction of Electronics Communication System: Element of communication system, Communication channel, types of transmission media (co-axial & Fiber optic cable), Need of modulation, Basic types of Analog modulation (AM,FM,PM),Multiplexing techniques(TDM,FDM),Mechanism of propagation of waves.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Amplitude Modulation: Definition of AM, Mathematical representation of AM wave, Modulation index, frequency spectrum of AM wave, AM transmitter, High level & low level modulation, SSB communication, SSB generation method(Filter method, phase-shift method & Third method),Numericals on AM

Unit–III:	No. of Lectures: 09	Marks: 12

	Hours	
Frequency Modulation: Definition of FM, Mathematical representation of FM signal, Frequency deviation, Phase modulation, Comparison between AM,FM,PM, Preemphasis & Deemphasis, Numarical based on FM		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
. **AM & FM Receiver:** Definition of receiver, performance characteristic of receiver, TRF receiver, super heterodyne receiver, AGC, FM receiver, types of FM receiver slope detector, balanced slope detector, Phase detector		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Introduction to Noise in Communication system: Definition of noise, Classification of noise, External noise, Internal noise, signal to noise ratio, Noise figure, Numerical Based on noise, noise calculation, addition of noise due to several sources, white noise.		

Text Books:

1. G. Kennedy, B. Davis, “Electronic Communication Systems”, Tata McGraw Hill Edition, 4th Edition, 1999.
2. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

Reference Books:

1. D. Roddy, J. Coolen, “Electronic Communications”, Pearson, 4th Edition, 2011
2. S. Haykin, “Digital Communications”, Wiley Student Edition, ISBN 9971-51-205-X.

NPTEL Links:

1. Analog Communication Prof Goutam Das, IIT Kharagpur, https://archive.nptel.ac.in/courses/117/105/117105143/
2. Digital Communication, Prof. Bikash Kumar Dey, IIT Bombay https://nptel.ac.in/courses/117101051

<table>
<tr><th colspan="6">PRINCIPLES OF ANALOG & DIGITAL COMMUNICATION LAB
(Specialization Minor)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">PRINCIPLES OF ANALOG & DIGITAL COMMUNICATION</td><td>Semester:</td><td>III</td><td>Course Code:</td><td>EC -314 A</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">ORAL (OR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory experiments / assignments from the following list.
1. Study of AM Modulation.
2. Study of AM Demodulation.
3. Study of FM Modulation.
4. Study of FM Demodulation.
5. Study of AM receiver.
6. Study of FM receiver.
7. Study of SSB transmitter.
8. DSB-SC signal generation using balanced modulator</td></tr>
<tr><td colspan="6">Guidelines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.</td></tr>
<tr><td colspan="6">Guidelines for ESE:</td></tr>
<tr><td colspan="6">ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.</td></tr>
</table>

LIGHT WAVE COMMUNICATION (Specialization Minor)

COURSE OUT LINE

Course Title:	**LIGHT WAVE COMMUNICATION**	**Short Title:**	**LWC**	**Course Code:**	**EC -416 A**

Course description:

This course provides knowledge about optical fiber technology that emerged as major innovation in telecommunication.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Knowledge of Light wave theory, Basic concept of analog and digital Communication

Course objectives:

1. To introduce student with light ray theory of transmission and its application in optical communication.
2. To understand the construction of fiber and signal degradation in fiber.
3. To study various optical sources and optical detectors.
4. To understand Optical link design for fiber optics.
5. To study Optical Switching and networking technology concepts

Course outcomes:

After successful completion of this course the student will be able to:

1. Know the fundamentals of Light theory and its application in optical communication.
2. Know the construction of various optical fiber and causes of signal degradation in fiber
3. Experience with the Knowledge of working of various optical sources and optical detectors.
4. Know about Optical link design for fiber optics.
5. Develop the knowledge on Optical Switching and networking technology.

COURSE CONTENT

LIGHT WAVE COMMUNICATION		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Optical Fibers-Structures Wave guiding and Fabrication:

Block diagram of Optical communication system, Light system components, Optical transmitters, optical Receivers Advantage and Disadvantage of OFCS over other communication systems.Ray theory of transmission and concept of acceptance angle and Numerical Aperture (Numerical based on Ray theory),Propagation of light

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Optical Fibers and Signal Degradation

Different types of optical fibers-Fiber profiles-Step index fibers, Graded index fibers Fiber modes –Optical modes Normalized frequency Single mode step index, Multimode step index, Multimode Graded index (Numerical on mode theory).Signal degradation on optical fiber due to dispersion and attenuation. Attenuation, Absorption, Absorption due

to atomic defects, Extrinsic Absorption ,Intrinsic , Absorption ,scattering loss- Linear and Nonlinear loss, bending losses.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Optical Sources and Detectors:

Sources : Factors or Characteristics for their selection in OFCS,

Light Emitting diodes: Surface emitter, LEDS, Edge emitter LEDS, LED operating Characteristics, Radiation patterns of surface and Edge emitters,

Laser diode: Laser principles, semiconductor laser diode, Hetero junction Laser, stripgromentry lasers, laser diode.

Detectors: Characteristics or factors for their Selection, P-N photo diode, P-I-N Photo diode, Avalanche photodiode. (No Numerical on Detectors)

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Optical Receivers.

Optical link design- Power budget, Rise time budget.(No Numerical) Sources of power penalties, Modal Noise, Dispersion Broadening, Mode partition noise, Frequency Chipring. BER calculation, Fiber Splicing-Fusion Splicing, V-groove Splicing.

Optical Fiber Measurements: Measurement of Attenuation, refractive index. Optical time domain reflectometry (OTDR).

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Advanced Optical Systems

Advanced Techniques: Wavelength Division Multiplexing (WDM), Dense Wavelength Division Multiplexing (DWDM).

WDM components-2*2 Fiber Coupler, Star Coupler, Optical Isolator.

Optical amplifiers,- Semiconductor Amplifier, Raman Amplifier, EDFA

Optical Networks- SONET (Synchronous Optical Network)

Text Books:

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.

Reference Books:

1. John M. Senior , “Optical Fiber Communication (Principles & Practice)”,Pearson Education.
2. Govind Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
3. F.C.Allard, Fiber Optics Handbook for engineers & scientists,TMH,NewYork (1990) .

NPTEL Links:

1. Introduction to Fiber Optics Communication, Deepa, IIT Madras. https://archive.nptel.ac.in/courses/108/106/108106167/.
2. Fiber Optics Communication and Technique, Pradeep Kumar ,IIT Kharagpur https://archive.nptel.ac.in/courses/108/104/108104113/.

<table>
<tr><th colspan="6">LIGHT WAVE COMMUNICATION LAB (Specialization Minor)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">LIGHT WAVE COMMUNICATION LAB</td><td>Semester:</td><td>IV</td><td>Course Code:</td><td>EC -417 A</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">ORAL (OR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory experiments/assignments from the following list.
1. Electrical Characteristics of different type LED.
2. To study Laser Diode.
3. NA Measurement for Single/Multi mode, Graded Index/Single Index optical Fiber
4. Attenuation Measurement and bending losses measurement of optical fiber
5. Spectral characteristics of LED.
6. Analog Signal transmission using LED source.
7. Digital Signal transmission using LED source.
8. Study of OTDR
9. Study of optical connectors</td></tr>
<tr><td colspan="6">Guidelines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.</td></tr>
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Kavayitri Bahinabai Chaudhari
NORTH MAHARASHTRA UNIVERSITY,
JALGAON (M.S.)

Bachelor of Engineering – Minor
in
VLSI Design & Technology
for Second Year Bachelor of Engineering
offered by
Electronics & Telecommunication
(As per NEP 2020 Guidelines)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(4th Cycle)

SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Syllabus Structure for Specialization Minor in VLSI Design & Technology : Additional Credit (Semester – III) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC -313B	Digital Electronics	PCC	3			3	40	60			100	3
EC -314B	Digital Electronics Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Specialization Minor in VLSI Design & Technology: Additional Credit (Semester – IV) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC -416B	Basics of Signal & System	PCC	3			3	40	60			100	3
EC -417B	Basics of Signal & System Lab	PCC			2	2			25	25 (OR)	50	1

DIGITAL ELECTRONICS (Specialization Minor)					
COURSE OUT LINE					
Course Title:	**DIGITAL ELECTRONICS**	**Short Title:**	**DE**	**Course Code:**	**EC -313 B**

Course description:

This course is aimed at introducing the fundamentals of digital electronics to undergraduate students. This course helps to understand the importance of digital logic and implementation.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Knowledge of number system, logic gates and Boolean algebra.

Course objectives:

1. To give the brief idea of number system and logic gates.
2. To study about simplification of K map for minimization of Boolean expressions.
3. To learn the concept of combinational logic design.
4. To learn the concept of sequential logic design using flip-flop.
5. To understand the concept of types of counters.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the concept of number system and implementation of logic gates
2. Apply knowledge of k-map to obtain minimized expressions.
3. Demonstrate the combinational logic design using logic gates.
4. Understand and design the concept of memory using flip flop.
5. Understand and design sequential circuit for counters.

COURSE CONTENT

DIGITAL ELECTRONICS		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Basics of digital electronics:

Introduction to number system, conversion of number system, Arithmetic in number system, Boolean Algebra, De Morgan's Theorem, Examples on Boolean Algebra, Basic gate, Universal gates, concept of Coding ,classification of code, BCD code, binary code , Gray code, hamming code and ASCII code

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Simplification of Boolean function:

Standard representation for logic expression SOP (Sum of Product) POS (Product of sum), concept of min term and max term. Introduction to K map and its simplification. 2, 3 and 4 variable kmap. Minimization of SOP and POS expressions. Examples on k map. Don't care condition, example on don't care.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Combinational Logic Circuits:

Half and Full Adders using basic gates, Half and Full Substractors using basic gates,

Multiplexer, Types of multiplexer(2:1,4:1,8:1,16:1), Demultiplexer (1:2,1:4,1:8,1:16), cascading of multiplexer, concept of Encoder and decoder, 1 bit and 2 bit Comparators

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Sequential Logic Circuits (Flip flop and Shift register)

Basic difference between Combinational Logic Circuits and Sequential Logic circuit,
Flip-flops- concept of 1 bit memory cell, S-R flip flop, Types of triggering, JK flip flop, Race around condition in J K Flipflop. Master-Slave JK FF, T flip flop, D Flip flop
Shift registers- Types of Shift registers and operation of SISO, SIPO, PIPO, PISO

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Counters:

Introduction to counter, Asynchronous (Ripple) counter, 3 bit up down counter, 4 bit up down counter, Modulus counter, Decade counter (Mod -10), Difference between asynchronous and synchronous counter.
Synchronous counter-2 bit Synchronous counter, 3 bit Synchronous counter.(only operation)
Counter IC –IC 7490 and IC 74191.

Text Books:

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
2. W.H. Gothmann,“Digital Electronics- An introduction to theory and practice”, PHI, 2nd edition 2006.
3. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989

Reference Books:

1. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition 2012.
2. John M Yarbrough “Digital Logic Application and Design, Brooks/cole, Thomson Learning Vikas Publishing House.
3. G.K.Kharate, “Digital Electronics” Oxford university press, 1st edition,2010.

NPTEL Links:

1. Digital System Design,Neeraj Goal,IIT ROPAR.
https://onlinecourses.nptel.ac.in/noc21_ee39/preview.
2. Switching circuit & Design ,Indrdranil sen gupta,IIT Kharagpur.
https://archive.nptel.ac.in/courses/106/105/106105185/

<table>
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<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">DIGITAL ELECTRONICSC LAB</td><td>Semester:</td><td>III</td><td>Course Code:</td><td>EC -314 B</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">ORAL (OR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory experiments/assignments from the following list.
1. Verify the truth tables of logic gates OR, AND, NOT, NOR, NAND.
2. Design of 4 bit Gray to binary Code Converter.
3. Realization of adders using IC 7483.
4. Realization of 8:1 Mux using IC 74151
5. Realization of 1:16 DeMux using IC 74138
6. Verify the truth table of J-K, T, and D Flip-flops using ICs.
7. Verification of asynchronous decade counter by using IC 7490
8. Verification of synchronous 4 bit counter by using IC 74191.</td></tr>
<tr><td colspan="6">Guidelines for ICA:</td></tr>
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BASICS OF SIGNAL & SYSTEM (Specialization Minor)

COURSE OUT LINE

Course Title:	BASICS OF SIGNAL & SYSTEM	Short Title:	BSS	Course Code:	EC -416 B

Course description:

Signals play a major role in our life and it can be represented in a number of ways. Signal processing is a method of extracting information from the signal which in turn depends on type of signal and the nature of information it carries.
This course describes the various signals with the help of mathematical tools such as Fourier Transform, Laplace Transform and Z-Transform. It also introduces the state space approach of system.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Mathematics - II

Course objectives:

1. To introduce the students to the various signals.
2. Study and understanding of representation of signals and systems.
3. To learn and understand different Transforms for Digital Signal Processing
4. Analysis of Discrete Time signals and systems

Course outcomes:

1. Demonstrate the ability to represent signals mathematically in continuous time and discrete time, and in frequency domain.
2. Understand the use of numerical method to analyze digital signal processing.
3. Understand Discrete Fourier Transform (DFT) and properties.
4. Analyze discrete time systems using Laplace and Z – transform.
5. Basic Understanding of state space analysis of system

COURSE CONTENT

BASICS OF SIGNAL & SYSTEM		Semester:	IV
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Classifications of Signals and Systems (only Introduction):
Classifications of Signals-Deterministic and non-deterministic signals, periodic and aperiodic signals, even and odd signals, energy and power signals.
Singularity functions-unit impulse function, unit step function, unit ramp function, unit pulse function, representation of signals.
Classifications of Systems-Static and dynamic systems, linear and non-linear systems, time Variant and time invariant systems, stable and unstable systems.
Simple manipulations of discrete time signals-shifting, folding, time scaling. Representations of systems, Linear differential equations, Impulse response of a system. Analog to digital conversion of signals-sampling of continuous time signals, signal reconstruction.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Fourier Transform:
Introduction - Trigonometric Fourier series, complex or exponential form of Fourier series, Parseval‟s identity for Fourier series.

Fourier Transform- energy spectrum for non-periodic function, properties of Fourier Transform.

Discrete Fourier Transforms (DT)- discrete convolution, properties of convolution, circular convolution (numerical), Discrete -Time Fourier Transform (DTFT),properties of DFT (numerical)

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Laplace Transforms:

Definition, Region of Convergence (ROC), LT of some important function and numerical. Initial value theorem, Final value theorem. Convolution integral numerical. Application of LT only in series R-L circuit and series R-C circuit

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Z- Transforms:

Introduction, definition, Region of Convergence (ROC), properties of the ROC for the z-transform and numerical. Properties of z-transform such as Linearity, Time Reversal, Time Shifting, Scaling, Differentiation, Convolution and numerical based on these properties.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

State space analysis:

Concept of state (State variable and state model). State model of linear system. Eigen Values of Matrix A. Solution of state equation. Properties of State Transition Matrix and numerical.

Text Books:

1. S. Salivahanan, C. Gnanpriya, Digital Signal processing, McGraw Hill, 4th Edition
2. I.J. Nagrath and M. Gopal , Control system Engineering- New Age 5thEdition

Reference Books:

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing Principles, algorithms and applications, Pearson Prentice Hall, Fourth edition
2. I.J. Nagrath, S.N. Sharan, R. Ranjan, S.Kumar, Signals and Systems, TMH, 2nd Edition
3. Katsuhiko Ogata, Modern Control Engineering, Pearson, 4th edition.
4. A. Anand Kumar, Signals and Systems, PHI
5. RishabhAnand, Signals and Systems, Khanna Book Publishing Co., Delhi
6. TarunRawat, Signals and Systems, Oxford University Press
7. B.P. Lathi, Signal Processing and Linear Systems, Oxford University Press

NPTEL Links:

1. Introduction to Signal and System, By Prof. Kushal K. Shah, IISER Bhopal.
   https://onlinecourses.nptel.ac.in/noc21_ee28/preview
2. Digital Signal Processing , By K Singh ,IIT, Madras
   https://archive.nptel.ac.in/courses/108/106/108106151/

<table>
<tr><th colspan="6">BASICS OF SIGNAL & SYSTEM LAB (Specialization Minor)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">BASICS OF SIGNAL & SYSTEM LAB</td><td>Semester:</td><td>IV</td><td>Course Code:</td><td>EC -417 B</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">ORAL (OR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory experiments / assignments from the following list.
1. Introduction to MATLAB/Scilab.
2. To create user defined functions for generating sinusoidal signal, delta function, unit step function and periodic signal.
3. To create user defined functions for signal operation: signal addition, time shifting, time scaling and time inversion.
4. To compute convolution of two signals and verify its properties.
5. To synthesize the periodic signal using Fourier series.
6. To analyze the spectrum of the signal using Fourier transform and verify its properties.
7. To compute and plot the impulse response and pole-zero diagram of transfer function using Laplace transform
8. To find Z-transform of a signal.</td></tr>
<tr><td colspan="6">Guidelines for ICA:</td></tr>
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Kavayitri Bahinabai Chaudhari

NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Bachelor of Engineering – Minor in Data Science in Telecom

for Second Year Bachelor of Engineering

offered by

Electronics & Telecommunication
(As per NEP 2020 Guidelines)

Faculty of Science and Technology



SYLLABUS STRUCTURE & COURSE OUTLINE

For Affiliated Colleges

Semester – III & IV

W.E.F. 2025 – 26

Syllabus Structure for Specialization Minor in Data Science in Telecom : Additional Credit (Semester – III) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme			Evaluation Scheme						Credits
						Theory			Practical		Total	
			Theory Hrs. /week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC - 313C	Real Time Analytics	PCC	3			3	40	60			100	3
EC - 314C	Real Time Analytics Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Specialization Minor in Data Science in Telecom: Additional Credit (Semester – IV) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs. / week	Tutorial Hrs. / week	Practical Hrs. / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
EC - 416C	Telecom Network Security	PCC	3			3	40	60			100	3
EC - 417C	Telecom Network Security Lab	PCC			2	2			25	25 (OR)	50	1

REAL TIME ANALYTICS (Specialization Minor)					
COURSE OUT LINE					
Course Title:	**REAL TIME ANALYTICS**	**Short Title:**	**RTA**	**Course Code:**	**EC -313 C**

Course description:

Data Analysis is an ever-evolving discipline with lots of focus on new predictive modeling techniques coupled with rich analytical tools that keep increasing our capacity to handle big data.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Data Mining

Course objectives:

1. To understand the concepts of big data
2. To understand the concepts of Data science
3. To do the data analysis
4. To apply the concepts of data visualization
5. To apply data analytics tools

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the concepts of big data
2. Understand the concepts of Data science
3. Do the data analysis
4. Apply the concepts of data visualization
5. Apply data analytics tools

COURSE CONTENT

REAL TIME ANALYTICS		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to Big Data: Big data, 3V's, 4 V's of big data, Types of Big data, Analytics, Industry examples of Big data, Data risk, Big data technologies, Big data architecture, operational and analytical big data technologies, big data and e Governance, Benefits of Big data, analytics and cloud computing, Crowd sourcing analytics

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to Data Science: Data Science, Terminology Related with Data Science, Methods of Data Repository, Personnel Involved with Data Science Process (DSP), Popular Data Science Toolkits, Familiarity with Example Applications

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Data Analysis: Introduction to Applied Statistical Techniques, Types of Statistical Data, Types Of Big Data Analytics, Collecting Data for Sampling and Distribution, Probability, Frequency Distribution, Population and Parameters, Central Tendency or Central Value, Measures of Central Tendency, Different Types of Statistical Means, Problems of Estimation : Population or Sample, Normal Distribution Curve

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Data Visualization: Data Visualization, Importance of Data Visualization, Conventional Data Visualization Methods, Retinal Variables, Mapping Variables to Encodings, Case Study, Recent trends in various data collection and analysis techniques, Various Big Data Visualization Tools, Visualizing Big Data, Pre attentive Attributes, Challenges of Big Data Visualization, Potential Solutions, Future Progress of Big Data Visualization

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Advanced Analytics: Technology and Tools: Hadoop: Architecture, components of Hadoop framework, Analysing big data with Hadoop. MapReduce: Overview, Map Operations, HIVE: features, architecture, working, data models. PIG: Introduction, components, pig vs MapReduce, Pig vs HIVE

Text Books:

1. V.K.Jain, "Data Science and Analytics", Khanna Book Publishing Co.(P) LTD. Edition 2018
2. V.K.Jain, "Big Data and Hadoop", Khanna Book Publishing Co.(P) LTD. Edition 2017

Reference Books:

1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.
2. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication,ISBN: 978-1-118-16430-3
3. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012, ISBN0-07-120413-X
4. Ashutosh Nandeshwar , "Tableau Data Visualization Codebook", Packt Publishing, ISBN 978-1-84968-978-6
5. Luís Torgo, "Data Mining with R, Learning with Case Studies", CRC Press, Talay and Francis Group, ISBN9781482234893
6. Carlo Vercellis, "Business Intelligence - Data Mining and Optimization for Decision Making", Wiley Publications, ISBN: 9780470753866

NPTEL Links:

1. Big Data Computing, By Rajiv Mishra, IIT Patna.
   https://archive.nptel.ac.in/courses/106/104/106104189/

<table>
<tr><th colspan="6">REAL TIME ANALYTICS LAB (Specialization Minor)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">REAL TIME ANALYTICS LAB</td><td>Semester:</td><td>III</td><td>Course Code:</td><td>EC -314 C</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="3">End semester exam (ESE) UA:</td><td>25 marks</td></tr>
<tr><td>Semester Credits</td><td>01</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">ORAL (OR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory experiments/assignments from the following list.
1. Installation of Hadoop Framework, it‘s components and study the HADOOP ecosystem.
2. Write a program to implement word count program using Map Reduce
3. Experiment on Hadoop Map-Reduce / PySpark: -Implementing simple algorithms in Map-Reduce: Matrix multiplication.
4. Install and configure MongoDB/ Cassandra/ HBase/ Hypertable to execute NoSQL Commands.
5. Implementing DGIM algorithm using any Programming Language/ Implement Bloom Filter using any programming language
6. Implement and Perform Streaming Data Analysis using flume for data capture, PYSpark / HIVE for data analysis of twitter data, chat data, weblog analysis etc.
7. Implement any one Clustering algorithm (K-Means/CURE) using Map-Reduce.
8. Implement Page Rank Algorithm using Map-Reduce.</td></tr>
<tr><td colspan="6">Guidelines for ICA:</td></tr>
<tr><td colspan="6">Students must submit ICA in the form of journal. Each experiment / assignment should be well documented. Faculty in Charge will assess the experiments / assignments continuously and grade or mark each experiment assignment on completion date declared for each experiment / assignment.</td></tr>
<tr><td colspan="6">Guidelines for ESE:</td></tr>
<tr><td colspan="6">ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.</td></tr>
</table>

TELECOM NETWORK SECURITY (Specialization Minor)					
COURSE OUT LINE					
Course Title:	**TELECOM NETWORK SECURITY**	**Short Title:**	**TNS**	**Course Code:**	**EC -416 C**

Course description:

This skill oriented course equips the system Administrators with the skills require to protect & recover the computer systems & networks from various security threats.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03

Prerequisite course(s):

Various Security Threats

Course objectives:

1. To understand the concepts of Security issues.
2. To understand the concepts of Wireless Network Security.
3. To understand the concept of attacks.
4. To understand security attacks in MANET.
5. To under stand the characteristics of Cloud Computing

Course outcomes:

After successful completion of this course the student will be able to:

1. Familiarize with the issues and technologies involved in designing a wireless and mobile system that is robust against various attacks.
2. Gain knowledge and understanding of the various ways in which wireless networks can be attacked.
3. Have a broad knowledge of the state-of-the-art and open problems in wireless and mobile security.
4. Learn various security issues involved in cloud computing and MANET.
5. Learn various security issues related to GPRS and 5G.

COURSE CONTENT

TELECOM NETWORK SECURITY		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Security Issues in Mobile Communication: Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Security of various Device: Network and Server Levels,Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Application Level Security in Cellular Networks: Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications,3G to 5G security for applications, Some of Security and authentication Solutions

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Application Level Security in MANETs: MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Data Center Operations - Security challenge, implement "Five Principal Characteristics of Cloud Computing, Data center Security Recommendations Encryption for Confidentiality and Integrity, Encrypting data at rest, Key Management Lifecycle, Cloud Encryption Standards.

Text Books:

1. Pallapa Venkataram, Satish Babu: "Wireless and Mobile Network Security", 1st Edition, Tata McGraw Hill,2010.
2. Frank Adelstein, K.S.Gupta : "Fundamentals of Mobile and Pervasive Computing", 1st Edition, Tata McGraw Hill 2005.

Reference Books:

1. Randall k. Nichols, Panos C. Lekkas : "Wireless Security Models, Threats and Solutions", 1st Edition, Tata McGraw Hill, 2006.
2. Bruce Potter and Bob Fleck : "802.11 Security" , 1st Edition, SPD O'REILLY 2005.
3. James Kempf: "Guide to Wireless Network Security, Springer. Wireless Internet Security – Architecture and Protocols", 1st Edition, Cambridge University

NPTEL Links:

1. Introduction to Adhoc Wireless Network, Sudip Misra IIT Kharagpur. https://archive.nptel.ac.in/courses/106/105/106105160/.
2. Evolution Of Air Interface Towards 5G, By Prof. Suvra Sekhar Das , IIT Kharagpur https://onlinecourses.nptel.ac.in/noc22_ee56/preview.

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<tr><td colspan="6">Concerned faculty member should suitably frame SIX laboratory experiments/assignments from the following list.
1. Study of various network components.
2. Study of LAN.
3. Study of CLOUD Computing
4. Study of various types of attacks.
5. Study of MANET.
6. Study of GSM.
7. Study of GPRS
8. Study of 5G.</td></tr>
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