Vivekanand Education Society's
Institute of Technology
(Affiliated to University of Mumbai, Approved by AICTE & Recognized by Govt. of Maharashtra)

Department of Electronics and Telecommunication

Syllabus (NEP Scheme)

Sem-III and Sem-IV

w.e.f. A.Y. 2025-26

Semester III Scheme								
Course Type	**Course Name**	**Teaching scheme (Contact Hours)**			**Credits Assigned**			
		Th	**Pr**	**Tut**	**Th**	**Pr**	**Tut**	**Total**
Programme Core Course (PCC)	Electronic Devices and Circuits	3	2	--	3	1	--	4
Programme Core Course (PCC)	Digital System Design	3	2	--	3	1	--	4
Programme Core Course (PCC)	Network Theory	3	--	--	3	--	--	3
Programme Core Course (PCC)	Mathematics for Communication	3	--	--	3	--	--	3
Multidisciplinary Minor (MDM)	Computer Networks & Cryptography	4	--	--	4	--	--	4
Entrepreneurship/Economics/Management Course (EM)	Finance Management	2	--	--	2	--	--	2
Ability Enhancement Course (AEC)	Professional Communication and Ethics-II	1	2+2*	--	1	1	--	2
Total Credits					19	03	--	**22**

** Tutorial for complete class*

Semester III Marks Scheme							
Course Type	**Course Name**	**TH**	**MT**	**CA**	**TW**	**PR/OR**	**Total**
Programme Core Course (PCC)	Electronic Devices and Circuits	60	20	20	25	25	150
Programme Core Course (PCC)	Digital System Design	60	20	20	25	25	150
Programme Core Course (PCC)	Network Theory	60	20	20	--	--	100
Programme Core Course (PCC)	Mathematics for Communication	60	20	20	--	--	100
Multidisciplinary Minor (MD M)	Computer Networks & Cryptography	60	20	20	--	--	100
Entrepreneurship/ Economics/Management Course (EM)	Finance Management	30	20	--	--	--	50
Ability Enhancement Course (AEC)	Professional Communication and Ethics-II	--	--	--	25	25	50
Total Marks							**700**

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Semester III
Syllabus

Department of Electronics and Telecommunication

COURSE NAME: ELECTRONICS DEVICES AND CIRCUITS

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETPC31	Electronics Devices and Circuits (Theory)	03	---	---	03	---	---	03
NETPCL31	Electronics Devices and Circuits (Lab)	---	02	---	---	01	---	01

Electronics Devices and Circuits (Theory)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NETPC31	Electronics Devices and Circuits (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPC31	Electronics Devices and Circuits (Theory)	20	20	60	---	---	100

Course Prerequisite: Engineering Physics, Basic Electrical Engineering	
Course Objectives:	
1	Know functionality and applications of various electronic devices.
2	Explain working of various electronics devices with the help of V-I characteristics.
3	Derive expressions for performance parameters of BJT and MOSFET circuits.
4	Evaluate performance of electronic circuits (BJT and MOSFET based).
5	Select the appropriate circuit for the given application.
6	Design electronic circuit (BJT, MOSFET based) circuits for given specifications.
Course Outcomes: After successful completion of the course students will be able to:	
1	To explain functionality of different electronic devices.
2	To perform DC and AC analysis of small signal amplifier circuits.
3	To analyze small signal amplifiers & Multistage amplifiers.
4	To analyze frequency response of small signal amplifiers.
5	To analyze large signal amplifiers.

Electronics Devices and Circuits (Theory)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NETPCL31	Electronics Devices & Circuits (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPCL31	Electronics Devices and Circuits (Lab)	---	---	---	25	25	50

Lab Prerequisite: Engineering Physics, Basic Electrical Engineering	
Lab Objectives:	
1	To make students familiar with equipment and measuring instruments used to perform Electronics Devices and Circuits laboratory work.
2	To provide hands on experience to develop laboratory setup for performing given experiments using various equipment, electronic devices and measuring instruments.
3	To develop ability among students to gather appropriate data and analyse the same to relate theory with practical.
4	To develop troubleshooting abilities among students.
Lab Outcomes: After successful completion of the course students will be able to:	
1	Know various equipment, electronics devices and components, and measuring instruments used to perform laboratory work.
2	Students will be able to explain functionality of various equipment, electronics devices and components and neasu6 instruments used to perform laboratory work.
3	Students will be able connect various equipment, devices, components and measuring devices using bread board as per the circuit diagram for experiment to be performed.
4	Students will able to perform experiment to gather appropriate data.
5	Students will be able to analyze data obtained from experiment to relate theory with experiment results.
6	Students will be able to prepare laboratory report (Journal) to summarise the outcome of each experiment.

Electronics Devices and Circuits (Theory)

Module		Content	Hrs
1		**Introduction of Electronic Devices**	**5**
	1.1	Study of PN junction diode characteristics & diode current equation. Application of Zener diode as a voltage regulator.	
	1.2	Construction, working and characteristics of BJT, JFET, and E-MOSFET	
2		**Biasing Circuits of BJTs and MOSFETs**	**8**
	2.1	Concept of DC load line, Q point and regions of operations, Analysis and design of biasing circuits for BJT (Fixed bias & Voltage divider Bias)	
	2.2	DC load line and region of operation for MOSFETs. Analysis and Design of biasing circuits for JFET (self-bias and voltage divider bias), E-MOSFET (Drain to Gate bias & voltage divider bias).	
3		**Small Signal Amplifiers**	**7**
	3.1	Concept of AC load line and Amplification, Small signal analysis (Zi, Zo, Av and Ai) of CE amplifiers using hybrid pi model.	
	3.2	Small signal analysis (Zi, Zo, Av) of CS (for E-MOSFET) amplifiers.	
4		**Multistage amplifiers**	**6**
	4.1	Introduction to multistage amplifiers. RC Coupling, Transformer coupling, Direct Coupling (Concept, advantages & disadvantages)	
	4.2	Effects of coupling, bypass capacitors and parasitic capacitors on frequency response of single stage amplifier, Miller effect and Miller capacitance	
5		**Frequency response of small signal Amplifiers**	**7**
	5.1	High and low frequency analysis of CE amplifiers.	
	5.2	High and low frequency analysis of CS (E-MOSFET) amplifiers.	
6		**Large Signal Amplifiers:**	**6**
	6.1	Difference between small signal & large signal amplifiers. Classification and working of Power amplifier	
	6.2	Analysis of Class A power amplifier (Series fed and transformer coupled).	
	6.3	Class B power amplifier and Class AB power amplifier.	
		Total	**39**

Textbooks:	
1	D. A. Neamen, "Electronic Circuit Analysis and Design," Tata McGraw Hill, 3nd Edition, 2013.
2	A. S. Sedra, K. C. Smith, and A. N. Chandorkar, "Microelectronic Circuits Theory and Applications," International Version, OXFORD International Students, 7th Edition, 2017
3	Boylestad and Nashelesky, "Electronic Devices and Circuits Theory," Pearson Education, 11th Edition, 2013

Reference Books:	
1	Varsha Agrawal, Anil K. Maini, "Electronic Devices and Circuits," Wiley, 2009
2	T. L. Floyd, "Electronic Devices," Prentice Hall, 9th Edition, 2012.
3	S. Salivahanan, N. Suresh Kumar, "Electronic Devices and Circuits", Tata Mc-Graw Hill, 3rd Edition, 2012
4	Bell, David A. Electronic devices and circuits. Prentice-Hall of India, 5th edition, 2008
Access to software and virtual labs:	
1	https://www.analog.com/en/resources/design-tools-and-calculators/ltspice-simulator.html
2	https://be-iitkgp.vlabs.ac.in/List%20of%20experiments.html

Internal Assessment:

1) Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2) Mid Term test is to be conducted when approx. 50% syllabus is completed.
3) Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Rubrics	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk/competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8.	Multiple Choice Questions (Quiz)	05 marks
9.	Peer Review and participation the marks can be left blank (with discretion of faculty)	05 Marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five need to be solved.

Electronics Devices & Circuits (Lab)

Suggested Experiments: Students are required to complete at least 10 experiments.	
Star (*) marked experiments are compulsory.	
Sr. No.	**Name of the Experiment**
1*	To study PN junction diode characteristics.
2*	To study Zener as a voltage regulator.
3*	To study characteristics of CE configuration.
4	To study BJT biasing circuits
5*	To study FET biasing circuits
6*	To study BJT as a CE amplifier.
7	To study frequency response of CE amplifier.
8*	To study EMOSFET biasing circuits.
9*	Simulation experiment on study of CS amplifier.
10	Simulation experiment on study frequency response of CS amplifier.
11*	Simulation experiment on study of differential amplifier.
12*	Simulation experiment on multistage amplifier.

Note: Suggested List of Experiments is indicative. However, flexibility lies with individual course instructors to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term Work:	
1	Term work should consist of 8 experiments.
2	Journal must include at least 2 assignments.
3	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
4	Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks)

COURSE NAME: DIGITAL SYSTEM DESIGN

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETPC32	Digital System Design (Theory)	03	---	---	03	---	---	03
NETPCL32	Digital System Design (Lab)	---	02	---	---	01	---	01

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Digital system Design (Theory)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW /PR	Tut	Total
NETPC32	Digital System Design (Theory)	03	--	-	03	--	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPC2	Digital System Design (Theory)	20	20	60	---	---	100

Prerequisite: PCC- Digital System	
Course Objectives:	
1	To analyze, design and implement logical operations using various sequential logic circuits
2	To study the finite state machines of sequential circuits
3	To learn basic concepts in Verilog and implement combinational and sequential circuits using Verilog
4	To understand timing requirements of sequential circuits
5	To study clocked synchronous state machine analysis
Course Outcomes:	
1	To analyze, design and implement sequential logic circuits.
2	To develop a digital logic and apply it to solve real life problems.
3	To analyze clocked synchronous State Machines.
4	To design clocked synchronous state machine
5	To simulate and implement basic sequential circuits using Verilog.

Digital system Design (Lab)

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPCL32	Digital System Design (Lab)	---	---	---	25	25	50

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NETPCL32	Digital System Design (Lab)	---	02	---	---	01	---	01

Lab Prerequisite: PCC (Digital system design)	
Lab Objectives:	
1	To get familiarize with basic building blocks of Digital System Design and verify the operation of various digital ICs.
2	To train students to design and implementation of combinational circuits.
3	To instruct students on how to design and implement sequential circuits.
4	To introduce simulation software like Verilog to design basic digital circuits.
Lab Outcomes: After successful completion of the course students will be able to:	
1	Students will be able to identify various Digital ICs and basic building blocks of digital system design.
2	Students will be able to design and implement combinational circuits like adder, subtractor, multiplexer, code converters etc.
3	Students will be able to identify and understand the working of various types of flip flops and their interconversions.
4	Students will be able to design and implement basic sequential circuits such as counters, registers etc.
5	Students will be able to acquire basic knowledge of Verilog basic programming.

Digital System Design (Theory)

Module		Content	Hrs
1		**Sequential Logic Circuit**	**6**
	1.1	Sequential Design Latches, FFs, Shift registers, Counters design techniques, Deadlock condition, Bushing	
2		**Clocked Synchronous State Machine Analysis**	**7**
	2.1	Clocked Synchronous State Machine Analysis: State Machine Structure, Output logic, Characteristics equation	
	2.2	Analysis State Machine with DFF, Analysis State Machine with JK-FF	
3		**Clocked Synchronous State Machine Design**	**8**
	3.1	State Table design Example, State assignment	
	3.2	State Minimization, Synthesis using D-FF and JK-FF Design state machine using state diagrams, The Guessing game	
4		**Timing requirements of sequential circuits**	**6**
	4.1	Setup time, Hold time, Clock skew, gating the clock, Synchronizer failure and metastability	
	4.2	Static timing analysis, Static and dynamic hazards, stuck in 0 Fault, Stuck In-1 fault.	
5		**Introduction to VERILOG Programming**	**6**
	5.1	Structure of Verilog code, gate level modelling Data types, blocking, non-blocking assignments, Dataflow, Behavioural and Structural programming style, Test bench	
6		**HDL Programming using VERILOG**	**6**
	6.1	Always block, initial block, finite state machine design, parameter and generic coding, tasks and functions	
		Total	**39**

Textbooks:

1	John F. Warkerly, "Digital Design Principles and Practices", Pearson Education, Fifth Edition (2018).
2	Morris Mano, Michael D. Ciletti, "Digital Design", Pearson Education, Fifth Edition (2013).
3	Donald P. Leach, Albert Paul Malvino, Gautam Saha, "Digital Principles and Applications", The McGraw Hill, Eight Edition (2015).
4	Samir Palnitkar, "Verilog HDL A guide to Digital Design and Synthesis" , 2nd Edition, Pearson Education, (2009)
5	Stephen Brown & Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", Third Edition, MGH (2014).

Reference Books:	
1	Thomas L. Floyd, *"Digital Fundamentals"*, Pearson Prentice Hall, Eleventh Global Edition (2015).
2	Mandal, *"Digital Electronics Principles and Applications"*, McGraw Hill Education, First Edition (2010).
3	Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, *"Digital Systems Principles and Applications"*, Ninth Edition, PHI (2009).
4	Donald P. Leach, Albert Paul Malvino, Gautam Saha, *"Digital Principles and Applications"*, The McGraw Hill, Eight Edition (2015).
5	Stephen Brown & Zvonko Vranesic, *"Fundamentals of Digital Logic Design with VHDL"*, Second Edition, TMH (2009).
6	J. Bhasker, *"A Verilog HDL Primer"*, Star Galaxy Press, Third Edition (1997).
7	Samir Palnitkar, *"Verilog HDL A guide to Digital Design and Synthesis"* , 2nd Edition, Pearson Education, (2009)
	Access to software and virtual labs:
1	https://cse15-iiith.vlabs.ac.in/List%20of%20experiments.html
2	https://da-iitb.vlabs.ac.in/List%20of%20experiments.html
	Industry articles and case studies:
1	https://ocw.snu.ac.kr/sites/default/files/NOTE/8867.pdf
2	https://courses.cs.washington.edu/courses/cse370/03au/lectures/05-CombEx.pdf
	Any other (Access to AI tools / Data driven insights (if applicable) or any other):
1	https://www.cadence.com/en_US/home/solutions/cadence-jedai-solution.html

Internal Assessment:

1) Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2) Mid Term test is to be conducted when approx. 50% syllabus is completed.
3) Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Rubrics	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks

3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk/competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8.	Multiple Choice Questions (Quiz)	05 marks
9.	Peer Review and participation the marks can be left blank (with discretion of faculty)	05 Marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five needs to be solved.

Digital System Design (Lab)

Suggested Experiments: Students are required to complete at least 8 experiments.	
Star (*) marked experiments are compulsory.	
Sr. No.	**Name of the Experiment**
1*	Flip flop conversions JK to D, JK to T and D to T Flip Flop
2*	Design asynchronous/synchronous MOD N counter
3*	Verify different counter operations
4*	Verify shift register operations/modes
5	Implement and verify using test bench Data Flow code for different logic gates and adders using VERILOG
6*	Implement and verify using test bench Behavioural code for mux and encoder using VERILOG
7	Implement FF's, Counter using VERILOG
8*	Implement traffic signal FSM and simulate using VERILOG
9*	State machine for one's counter using VERILOG
10*	Implement and verify Generic adder using VERILOG
11*	Implement Multiplier using VERILOG
12	Implement RAM using VERILOG

Term Work:	
1	Term work should consist of 8 experiments.
2	Journal must include at least 2 assignments.
3	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
4	Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks)

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COURSE NAME: NETWORK THEORY

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NETPC33	Network Theory (Theory)	03	---	---	03	---	---	03

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Network Theory

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETPC33	Network Theory (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPC33	Network Theory (Theory)	20	20	60	---	---	100

Course Prerequisite: Engineering Physics, Basic Electrical Engineering	
Course Objectives:	
1	To evaluate the Circuits using network theorems.
2	To analyze the Circuits in time and frequency domain.
3	To study network Topology, network Functions and two port networks.
4	To synthesize passive networks by various methods.
Course Outcomes: After successful completion of the course students will be able to:	
1	Apply their knowledge in analyzing Circuits by using network theorems.
2	Apply the time and frequency method of analysis.
3	Evaluate circuit using graph theory.
4	Find the various parameters of two port networks.
5	Apply network topology for analysing the circuit.
6	Synthesize the network using passive elements.
7	Students will able to prepare laboratory report (Journal) to summarise the outcome each experiment.

Module		Content	Hrs
1		**Electrical circuit analysis**	**7**
	1.1	Circuit Analysis: Analysis of Circuits with dependent sources using generalized loop and node analysis, super mesh and super node analysis techniques. Circuit Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems (Use only DC source)	
	1.2	Magnetic circuits: Concept of Self and mutual inductances, coefficient of coupling, Dot convention, equivalent circuit, solution using mesh analysis (for Two Loops only).	
2		**Graph Theory**	**5**
	2.1	Objectives of graph theory, Linear Oriented Graphs, graph terminologies Matrix representation of a graph: Incidence matrix, Circuit matrix, Cut-set matrix, reduced Incident matrix, Tie set matrix, f-cutset matrix.	
	2.2	Relationship between sub matrices A, B & Q. KVL & KCL using matrix.	
3		**Time and frequency domain analysis**	**8**
	3.1	Time domain analysis of R-L and R-C Circuits: Forced and natural response, initial and final values. Solution using first order and second order differential equations with step signals.	
	3.2	Frequency domain analysis of R-L-C Circuits: Forced and natural response, effect of damping factor. Solution using second order equation for step signal.	
4		**Network Functions**	**6**
	4.1	Network functions for the one port and two port networks, driving point and transfer functions, Poles and Zeros of Network functions, necessary conditions for driving point functions, necessary conditions for transfer functions.	
	4.2	Analysis of ladder & symmetrical lattice network (Up to two nodes or loops)	

5		**Two Port Networks**	**6**
	5.1	Parameters: Open Circuits, short Circuit, Transmission and Hybrid parameters, relationship among parameters, conditions for reciprocity and symmetry.	
	5.2	Interconnections of Two-Port networks T & π representation.	
6		**Synthesis of RLC circuits**	**7**
	6.1	Hurwitz Polynomial, Positive Real Functions: Concept of positive real function, necessary and sufficient conditions for Positive real Functions.	
	6.2	Synthesis of LC, RC & RL Circuits for one and Two port Networks: properties of LC, RC & RL driving point functions, LC, RC & RL network Synthesis in Cauer-I & Cauer-II , Foster-I & Foster-II forms (Up to Two Loops only).	
		Total	**39**

Textbooks:	
1	Franklin F Kuo, "Network Analysis and Synthesis", Wiley Toppan, 2nd ed. 2005.
2	M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi,3rd Edition ,2019
Reference Books:	
1	A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co., Delhi, 6th Edition, 2012
2	A. Sudhakar, Shyammohan S. Palli "Circuits and Networks", Tata McGraw-Hill education, 5th Edition, 2017
3	K.S. Suresh Kumar, "Electric Circuit Analysis" Pearson, 2013.
4	D. Roy Choudhury, "Networks and Systems", New Age International, Reprint, 2005.
Access to software and virtual labs:	
	http://vlabs.iitkgp.ernet.in/asnm/
Any other (Access to AI tools / Data driven insights (if applicable) or any other):	
	https://www.circuitlab.com/
	https://www.multisim.com/content/97zVnTcq7aTxJQUEubAEYX/circuit-theory-simulation/

Internal Assessment:

1) Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2) Mid Term test is to be conducted when approx. 50% syllabus is completed.
3) Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Rubrics	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8.	Multiple Choice Questions (Quiz)	05 marks
9.	Peer Review and participation the marks can be left blank (with discretion of faculty)	05 Marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five needs to be solved.

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COURSE NAME: MATHEMATICS FOR COMMUNICATION

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tut	Theory	TW /PR	Tut	Total
NETPC34	Mathematics for Communication (Theory)	03	---	---	03	---	---	03

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Mathematics for Communication

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETPC34	Mathematics for Communication (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPC34	Mathematics for Communication (Theory)	20	20	60	---	---	100

Course Prerequisite: Matrices and Differential Calculus, Integral Calculus and Complex Numbers **Course Objectives:**	
1	To build a strong foundation in mathematics, provide students with mathematics fundamentals necessary to formulate, solve and analyse complex engineering problems.
2	To prepare students to apply reasoning informed by the contextual knowledge to engineering practice, to work as part of teams on multi-disciplinary projects.
Course Outcomes: After successful completion of the course students will be able to:	
1	Understand and apply the fundamental concepts of linear algebra with applications to quantum mechanics and related fields.
2	Analyze the different Signals used in communication, control using Fourier Series.
3	Analyze the different systems like communication, control using Fourier transform.
4	Apply Z- transform and its properties to find the transform of a given function and analyse the digital systems.

5	Compute probability using probability distribution of discrete and continuous Random variable, Poisson and Normal distribution

Module		Content	Hrs
1		**Basics Of Linear Algebra**	8
	1.1	Vectors, Matrices, and Complex Vector Spaces: Scalars, vectors, and matrices over $\mathbb{C}$, Basic operations: addition, scalar multiplication, matrix multiplication, Complex numbers and complex vector spaces, Linear independence, span, basis, and dimension	
	1.2	**Dirac Notation and Hilbert Spaces** Introduction to Dirac notation: bra $\langle\cdot\vert$, ket $\vert\cdot\rangle$, Hilbert space as a complex inner product space, Orthonormal basis, completeness, and applications	
	1.3	**Inner Products and Linear Operators** Inner product, norm, orthogonality,Linear operators as matrix representations of linear transformations ,Projection operators and change of basis	
	1.4	**Eigenvalues, Eigenvectors, and the Spectral Theorem** Eigenvalue problem: definitions and properties, Diagonalization of linear operators, Spectral theorem for Hermitian and unitary operators, Physical interpretation	
	1.5	**Tensor Products and Composite Systems** Tensor product of vectors and matrices, Properties: dimensionality, associativity, distributivity, non-commutativity	
2		**Fourier Series**	6
	2.1	Definition Of Fourier Series, Types-Trigonometric Form of Fourier Series,-Definition,Conditions for Existence of FourierSeries, Exponential Form of FourierSeries -Definition,NegativeFrequency,FrequencySpectrum(or Line Spectrum) of Periodic Continuous Time Signals.	
	2.2	Fourier series of even and odd functions, Properties of Fourier Series, Gibbs Phenomenon, Relation Between Fourier Coefficients of Trigonometric and Exponential Form,	
3		**Fourier transform**	8
	3.1	Definition Fourier Transform, Fourier Transform of Standard Signals, Frequency Spectrum using Fourier Transform, Properties of Fourier Transform	
	3.2	Fourier Transform of aPeriodic Signal, Relation Between Fourier & Laplace Transform	

4		**Z-Transform**	**8**
	4.1	Definition of Z-transform, Region of Convergence, Properties of Z-Transform, Poles and Zeros of Rational Function of z, Representation of Poles and Zeros in z-plane, ROC of Rational Function of z	
	4.2	Inverse Z-Transform- Residue Method, Inverse Z-Transform by Partial Fraction Expansion Method, Inverse Z-Transform by Power Series Expansion Method, Relation Between Laplace Transform and Z-Transform	
5		**Probability And Distribution Function**	**5**
	5.1	Discrete & continuous random variable with probability distribution Function & probability density function, probability mass function, properties of PDF and CDF	
	5.2	Standard Probability Distribution: Binomial, Poisson and Normal Distribution	
6		**Random Variable**	**4**
	6.1	Function of random variables and their distribution and density functions.	
	6.2	Expectation,Variance,Moment Generating Function,RawandcentralMoments, Covariance, Correlation coefficient and their properties	
		Total	**39**

Textbooks:	
1	Nagoor Kani, Signals and Systems, Tata McGraw Hill, Third Edition, 2011.
2	R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publication, Fifth Edition, 2016
3	T. Veerarajan, "Probability, Statistics and Random Processes", McGraw-Hill. Third Edition, 2016
Reference Books:	

1	Hwei. P Hsu, Signals and Systems, Tata McGraw Hill, Fourth edition, 2020
2	Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication, 42th Edition, 2020
3	Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Limited, 10th Edition, 2021
4	Taub, Schilling and Saha, "Taub's Principles of Communication systems", Tata McGraw Hill, Fourth edition, 2013.
Access to software and virtual labs:	
	https://virtuallabs.merlot.org/vl_math.html
Any other (Access to AI tools / Data driven insights (if applicable) or any other):	
	https://www.mathworks.com/products/matlab.html
	https://www.scilab.org/

Internal Assessment:

1) Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2) Mid Term test is to be conducted when approx. 50% syllabus is completed.
3) Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Rubrics	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks

4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8.	Multiple Choice Questions (Quiz)	05 marks
9.	Peer Review and participation the marks can be left blank (with discretion of faculty)	05 Marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five needs to be solved.

Vivekanand Education Society's
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COURSE NAME: COMPUTER NETWORKS & CRYPTOGRAPHY

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETMM31	Computer Networks & Cryptography (Theory)	04	---	---	04	---	---	04

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Computer Networks & Cryptography (Theory)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETMM31	Computer Networks & Cryptography (Theory)	04	---	---	04	---	---	04

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETMM31	Computer Networks & Cryptography (Theory)	20	20	60	---	---	100

Prerequisite: Digital Electronics, Integral Calculus and Complex Numbers	
Course Objectives: Students will be learning,	
1	To introduce networking architecture and protocols.
2	To understand and recognize the layer-wise functions, services, data formats, protocols, hardware devices and addresses in the TCP/IP architecture.
3	To apply different addressing and routing schemes.
4	To understand and apply Data encryption techniques.
5	To learn various system security techniques.
Course Outcomes: Students should be able to,	
1	Analyze network topologies, hardware devices, addressing schemes and the protocol stacks.
2	Elaborate the services and functions of different layers of TCP/IP protocol stack.
3	Apply network layer addressing and routing schemes.

4	Demonstrate the core concepts of Cryptography
5	Compare Symmetric & Asymmetric Key Cryptography schemes and able to apply different cryptography techniques.
6	Understand various security techniques

Module		Content	Hrs
1		**Fundamentals of Computer Networks**	**8**
	1.1	Introduction to computer networks, Network topologies, OSI reference model, TCP/IP architecture: protocol suite, comparison of OSI and TCP/IP	
	1.2	Layer wise network hardware devices (NIC, Repeaters, Hubs, Bridges, Switches, Routers, Gateway and their comparison), Physical layer: Guided transmission media- comparison among coaxial, optical fiber and twisted pair cables, Unguided transmission media	
	1.3	Data Link Layer: Data link services- Framing, Flow control, Error control, Error detection using block codes & CRC, High Level Data Link Control (HDLC): HDLC configurations, Frame formats; Medium Access Control Protocols- ALOHA, Slotted ALOHA, CSMA, CSMA/CD	
2		**Network Layer**	**12**
	2.1	Difference between circuit switching and Packet switching networks	
	2.2	Internet Protocol: Principles of Internetworking, requirements, IPv4 packet, IPv4 addressing (classful and classless (CIDR))	
	2.3	Routing in Packet Switching Networks: Characteristics, Routing strategies, Routing algorithms: Link state Routing, Distance vector Routing and Path vector routing, Routing protocols: RIP, OSPF, BGP and EIGRP	
	2.4	Subnetting, supernetting, VLSM, and NAT	
	2.5	Functions of ICMP, ARP, RARP. IPv6 (IPv6 Datagram format, comparison with IPv4, and transition from IPv4 to IPv6)	

3		**Transport and Application layer**	**9**
	3.1	Connectionless and Connection–oriented services at transport layer, Transmission Control Protocol (TCP): TCP Services, TCP Segment, TCP three way handshake, TCP Checksum Calculation	
	3.2	User datagram Protocol (UDP), UDP Services, UDP Datagram, UDP Checksum Calculation	
	3.3	Flow control, error control and congestion control	
	3.4	Introduction to Application layer Protocols: HTTP, FTP, DNS, SMTP, TELNET, DHCP	
4		**Data security**	**8**
	4.1	Security Goals, Cryptographic Attacks, Techniques	
	4.2	Symmetric Key cryptography: Substitution Cipher, Transposition Cipher , Stream and Block Cipher, DES- Methodology, Double DES, AES-Methodology	
5		**Public Key Cryptography**	**9**
	5.1	Fermat's and Euler's Theorem, Chinese Remainder Theorem	
	5.2	Public key cryptography: Principles of Public Key Crypto System, RSA algorithm	
	5.3	Key management, KDC, Deffie-Hellman key exchange	
	5.4	Message Integrity, Message Authentication and Hash Functions, SHA, H MAC, Digital Signature Standards	
6		**System Security**	**6**
	6.1	Intrusion Detection System, Secure Electronic Transactions,	
	6.2	Case studies - Firewall- introduction, need and types of firewall	
	6.3	Case studies -Digital Immune systems, Biometric Authentication	
		Total	**52**

Textbooks:	
1	Data Communications and Networking with TCPIP Protocol Suite– Behrouz A. Forouzan, Sixth Edition TMH, 2022
2	Computer Networks -- Andrew S Tanenbaum, Nick Feamster, 6th Edition, Pearson Education, 2022
3	J J. F. Kurose and K. W. Ross," Computer Networking: A Top-Down Approach", Addison Wesley, 7th Edition, 2017.
4	Khalid Sayood , "Introduction to Data Compression", 4th Edition, Morgan Kauffman, 2012
5	Mark Nelson, Jean-Loup Gailly, "The Data Compression Book", 2nd edition, BPB Publications, 1995
6	William Stallings, "Cryptography and Network Security Principles and Practices", 4th Edition, Pearson Education, 2017
7	Marcẹlo Sampaio, "Cryptography and Network Security", River Publishers in Security and Digital Forensics, 2022
Reference Books:	
1	Alberto Leon Garcia, "Communication Networks", McGraw Hill Education, Second Edition, Fourth Edition, 2017.
2	An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education, 2015
3	Data and Computer Communications, William Stallings, 10th Edition, Pearson Education, 2014.
4	Bernard Menesez, "Network Security and Cryptography", 7th Edition, Delmar Cengage Learning, 2018.
5	Matt Bishop, "Computer Security Art and Science", Addison-Wesley, 2018.
Access to software and virtual labs:	
1	Cisco Packet Tracer/ Wireshark/NetSim/OpenSSL/GnuPG/Cryptoo
2	Cisco Learning Labs: https://learningnetworkstore.cisco.com/cisco-learning-labs
3	NDG NetLab: https://www.netdevgroup.com/products/features/
4	Cryptography basic virtual lab: https://www.cybrary.it/practice-lab/cryptography-basics

Industry articles and case studies:	
1	Case Study: Enterprise Network Architecture for a Global Retailer (Source: Cisco Case Studies)
2	Case Study: Implementing Software-Defined Networking (SDN) in a University Network (Source: ACM SIGCOMM)
3	Article: Quantum-Resistant Cryptography – Preparing for the Future (Source: ACM Computing Surveys)
Any other (Access to AI tools / Data driven insights (if applicable) or any other):	
1	Cisco AI Network Analytics
2	Juniper Networks' Mist AI

Internal Assessment:

1) Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2) Mid Term test is to be conducted when approx. 50% syllabus is completed.
3) Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Rubrics	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8.	Multiple Choice Questions (Quiz)	05 marks
9.	Peer Review and participation the marks can be left blank (with discretion of faculty)	05 Marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
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COURSE NAME: FINANCE MANAGEMENT

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETEM31	Finance Management (Theory)	02	---	---	02	---	---	02

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Finance Management (Theory)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETEM31	Finance Management (Theory)	02	---	---	02	---	---	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETEM31	Finance Management (Theory)	20	---	30	---	---	50

Course Objectives:	
1	To know about the Indian financial system, instruments and market.
2	To understand the relationship between risk, return and time value of Money.
3	To understand the financial statements and ratio analysis.
4	To understand personal taxation.
Course Outcomes: Student will be able	
1	To explain Indian financial system, instrument and market.
2	To determine risk, return and time value of Money with respect to financial decisions.
3	To decide investment decisions for projects with the help of financial ratios.
4	To determine components involved in taxation

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Finance Management (Theory)

Module		Content	Hrs.
1		**Indian Financial System**	8
	1.1	Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, Treasury Bills, Trade credit.	
	1.2	Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market	
	1.3	Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions: Commercial Banks, Investment-Merchant Banks and Stock Exchanges	
2		**Financial Risk and Returns**	6
	2.1	Concepts of Returns and Risks: Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio	
	2.2	Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.	
	2.3	Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	
3		**Corporate Finance**	6
	3.1	Overview of Financial Statements: Balance Sheet, Profit and Loss Account, and Cash Flow Statement.	
	3.2	Financial Ratio Analysis: Purpose of Financial Ratio Analysis. Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	
4		**Introduction to Taxation**	6
	4.1	Introduction and Objectives, Assessment Year, Previous Year, Person	
	4.2	Assessee, Assessment, Income	
	4.3	Gross Total Income, Total Income, Scheme of charging income tax	
		Total	**26**

Reference Books:	
1	Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2	Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3	Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4	Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.
Industry articles and case studies:	
1	Case Studies for five industry data using Front page Mobile app.
Any other (Access to AI tools / Data driven insights (if applicable) or any other):	
1	Analysis of the market for various industries using Mobile apps. Front Page

Internal Assessment:

1) Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2) Mid Term test is to be conducted when approx. 50% syllabus is completed.
3) Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

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4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8.	Multiple Choice Questions (Quiz)	05 marks
9.	Peer Review and participation the marks can be left blank (with discretion of faculty)	05 Marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
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COURSE NAME: PROFESSIONAL COMMUNICATION AND ETHICS-II

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
AEC:BE02	Professional Communication and Ethics-II (Theory)	02	---	---	02	---	---	02

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Professional Communication and Ethics-II

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tut	Theory	TW/ PR	Tut	Total
AEC:BE02	Professional Communication and Ethics-II (Theory)	01	01 (2 hours)*	---	01	01	---	02

* Students to be divided into Batches

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
AEC:BE02	Professional Communication and Ethics-II (Theory)	---	---	---	50	---	50

Course Objectives:	
1	To know about the Indian financial system, instruments and market.
2	To understand the relationship between risk, return and time value of Money.
3	To understand the financial statements and ratio analysis.
4	To understand personal taxation.
Course Outcomes: Student will be able	
1	To explain Indian financial system, instrument and market.
2	To determine risk, return and time value of Money with respect to financial decisions.
3	To decide investment decisions for projects with the help of financial ratios.
4	To determine components involved in taxation

Module	Topics		Hours
1	**ADVANCED TECHNICAL WRITING :PROJECT/PROBLEMBASED LEARNING (PBL)**		6
	1.1	**Definition, Purpose & Types of Proposals** • Solicited & Unsolicited Proposals • Types (Short and Long proposals)	
	1.2	**Parts of a Proposal** • Elements • Scope and Limitations • Conclusion	
	1.3	**Objectives of Report Writing** • Information • Decision Making • Analysis • Recommendation	
	1.4	**Parts of a Long Formal Report:** • Prefatory Parts (Front Matter) • Report Proper (Main Body) • Appended Parts (Back Matter)	
	1.5	**Language and Style of Reports** • Tense, Person & Voice of Reports • Numbering Style of Chapters, Sections, Figures, Tables • Referencing Styles in APA & MLA Format • Proofreading through Plagiarism Checkers	
	1.6	**Technical Paper Writing:** • Parts of a Technical Paper • Language and Formatting • Writing an abstract • Referencing in IEEE Format	
	1.7	**Presenting data-figures, diagrams and labeling** • Graphic Organizers for Summaries • Radial Diagrams like Mind Maps • Flow Charts • Cyclic Diagrams • Linear Diagrams like Timelines • Pyramids • Venn Diagrams	

2	**EMPLOYMENT SKILLS**		
	2.1	**Cover Letter & Resume** • Parts and Content of a Cover Letter • Difference between Bio-data, Resume & CV • Essential Parts of a Resume • Types of Resume (Chronological, Functional &Combination)	**6**

Reference Books:	
1	Lesiker and Petit (1997), "Report Writing for Business", McGraw-Hill Education10th edition
2	Butterfield, J. (2017). Verbal communication: Soft skills for a digital workplace. Boston, MA: Cengage Learning.
3	Bovée, C. L., & Thill, J. V. (2017). *Business communication today*, 14th Edition, NJ: Pearson.
4	Robbins, S. P., Judge, T. A., & Campbell, T. T. (2017). *Organizational Behaviour*. Harlow, England: Pearson.
5	Fred Luthans. (2010). *Organizational Behavior* , McGraw Hill Education, 12th edition
6	B N Ghosh(2017), *Managing Soft Skills for Personality Development*, Tata McGraw Hill Education.
7	R. C. Sharma, Krishna Mohan, Virendra Singh Nirban (2020). *Business Correspondence and Report Writing* , 6th Edition, McGraw Hill
8.	Julie-Ann Amos (2004). *Handling Tough Job Interviews* Jaico Publishing House
References: Web Links	
	http://networketiquette.net/ https://public.wsu.edu/~brians/errors/ http://users3.ev1.net/~pamthompson/body_language.htm http://www.albion.com/netiquette/corerules.html http://www.bbc.co.uk/worldservice/learningenglish/radio/specials/1535_questionanswer/page15.shtml http://www.colostate.edu/Depts/Speech/rccs/theory44.html http://www.dailywritingtips.com

Term Work

Term Work will be for 50 - Marks as given below

Sr No	Headings	Marks
A	Assignments	10 Marks
B	Mini Project with Presentation	10 Marks
C	Media Studies	10 Marks
D	Book Report andPresentation	10 Marks
E	Group Discussion	10 Marks
	Total	**50 Marks**

A) Assignments: List of assignments are as given below. The assignments have to be discussed in the group and approved by faculty. Each student in the group will have to write the assignments individually (10 Marks):

Sr No	List of Assignments
1.	Resume, Cover Letter and SOP
2.	Summarizing data figures into paragraphs (Module 1.7)
3.	Notice, Agenda and Minutes of Meeting
4.	Two case studies on Business Ethics
5.	Assignment on (Teamwork, Leadership, Decision Makingand Problem Solving)

B) Report on presentation: A detail typed report has to be prepared of minimum 25 pagesand maximum 30 pages. The format of the report has to be discussed and approved by faculty.

C) A final Group Discussion Round will be conducted and every student must participate in the group discussion.

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Semester IV

Syllabus

VIVEKANAND EDUCATION SOCIETY'S
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Department of Electronics and Telecommunication

Semester IV Scheme									
Course Type	**Course Code**	**Course Name**	**Teaching scheme (Contact Hours)**			**Credits Assigned**			
			Th	**Pr**	**Tut**	**Th**	**Pr**	**Tut**	**Total**
Programme Core Course (PCC)	NETPC41/ NETPCL41	Linear Integrated Circuits	2	2	-	2	1	-	3
Programme Core Course (PCC)	NETPC42/ NETPCL42	Communication Engineering	2	2	-	2	1	-	3
Programme Core Course (PCC)	NETPC43	Electromagnetics and Transmission Lines	2	-	-	2	-	-	2
Multidisciplinary Minor (MDM)	NETMM41	Ethical Hacking & Digital Forensic	4	-	-	4	-	-	4
Open Elective(OE)	NETOE4X	Open Elective Course - I **(NPTEL MOOC Courses)**	-	-	-	-	-	-	4
Vocational andSkill Enhancement Course (VSEC)	NETVS41	Skill Lab-1:Python Programming	-	2+2*	-	-	2	-	2
Field Project (FP)	NETFP41	Field Project	-	4	-	-	2	-	2
Entrepreneurship /Economics/Management Course (EM)	NETEM41	Innovation and Entrepreneurship	2	-	-	2	-	-	2
Total Credits									**22**

** Students to be divided into batch*

Semester IV Marks Scheme									
Course Type	**Course Code**	**Course Name**	**Internal Assessment**		**End Sem Exam**	**Exam Duration in Hrs.**	**TW**	**PR/OR**	**Total**
			MT	**CA**					
Programme Core Course (PCC)	NETPC41/NETPCL41	Linear Integrated Circuits	20	20	60	2	25	25	150
Programme Core Course (PCC)	NETPC42/NETPCL42	Communication Engineering	20	20	60	2	25	25	150
Programme Core Course (PCC)	NETPC43	Electromagnetics and Transmission Lines	20	20	60	2	-	-	100
Multidisciplinary Minor (MDM)	NETMM41	Ethical Hacking & Digital Forensic	20	20	60	2	-	-	100
Open Elective (OE)	NETOE4X	Open Elective Course - I**(NPTEL MOOC Courses)**	-	-	-	-	-	-	100
Vocational and Skill Enhancement Course (VSEC)	NETVS41	Skill Lab-1:Python Programming	-	-	-	-	25	25	50
Field Project (FP)	NETFP41	Field Project	-	-	-	-	50	-	50
Entrepreneurship /Economics/Management Course (EM)	NETEM41	Innovation and Entrepreneurship	-	-	-	-	25	-	25
					Total Marks				**725**

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Department of Electronics and Telecommunication

Open Elective Course -I(NPTEL Mooc Courses)

Sr. No.	Course Code	Name Of The Subject
1	NETOE41	German-I
2	NETOE42	Energy and the Climate Crisis: The Path to Net-Zero Emissions
3	NETOE43	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems
4	NETOE44	Energy Resources, Economics and Environment

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COURSE NAME: LINEAR INTEGRATED CIRCUITS

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETPC41	Linear Integrated Circuits (Theory)	02	---	---	02	---	---	02
NETPCL41	Linear Integrated Circuits (Lab)	---	02	---	---	01	---	01

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Linear Integrated Circuits (Theory)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETPC41	Linear Integrated Circuits (Theory)	02	---	---	02	---	---	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPC41	Linear Integrated Circuits (Theory)	20	20	60	---	---	100

Prerequisite: Network Theory, Electronics Devices & Circuits	
Course Objectives	
1	To understand the concepts, working principles and key applications of linear integrated circuits.
2	To perform analysis of circuits based on linear integrated circuits.
3	To design circuits and systems for particular applications using linear integrated circuits.
Course Outcomes	
1	Outline and classify all types of integrated circuits.
2	Understand the fundamentals and areas of applications for the integrated circuits.
3	Develop the ability to design practical circuits that perform the desired operations.
4	Understand the IC 555 timer and its applications.
5	Design voltage regulators for different applications.
6	Identify the appropriate integrated circuit modules for designing engineering applications.

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Linear Integrated Circuits (Lab)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NETPCL41	Linear Integrated Circuits (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPCL41	Linear Integrated Circuits (Lab)	---	---	---	25	25	50

Prerequisite: Basic Electrical Engineering, Electronic Devices & Circuits	
Lab Objectives:	
1	To understand the concepts, working principles and key applications of linear integrated circuits.
2	To perform analysis of circuits based on linear integrated circuits.
3	To design circuits and systems for particular applications using linear integrated circuits.
Lab Outcomes:	
1	Understand the differences between theoretical, practical and simulated results in integrated circuits.
2	Apply the knowledge to do simple mathematical operations.
3	Apply knowledge of op-amp, timer and voltage regulator ICs to design simple applications.

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Linear Integrated Circuits (Theory)

Module		Content	Hrs
1		**Introduction to Operational Amplifier**	5
	1.1	Block diagram of Op-Amp. Ideal and practical characteristics of op-amp.	
	1.2	Configurations of Op-Amp: Open loop and closed loop Configurations of Op-amp, Inverting and Non-inverting configuration of Op-amp and buffer.	
	1.3	Summing amplifier, difference amplifiers and Instrumentation amplifier using Op-amp.	
2		**Linear Applications of Operational Amplifier**	6
	2.1	Voltage to current and current to voltage converter.	
	2.2	Integrator & differentiator (ideal & practical), Active Filters: First and Second order active low pass, high pass, band pass, band reject and Notch filters.	
	2.3	Positive feedback, Burkhouse's criteria, Sine Wave Oscillators: RC phase shift oscillator, Wein bridge oscillator.	
3		**Non-Linear Applications of Operational Amplifier**	5
	3.1	Comparators: Inverting comparator, non-inverting comparator zero crossing detectors, Inverting Schmitt trigger	
	3.2	Waveform Generators: Square wave generator and triangular wave generator, Half wave and full wave precision rectifiers.	
4		**Timer IC 555 and it's applications**	4
	4.1	Functional block diagram and working of IC 555	
	4.2	Design of Astable and Monostable multivibrator using IC 555	
	4.3	Applications of Astable and Monostable multivibrator as Pulse width modulation and Pulse Position Modulation.	

5		**Voltage Regulators**	**4**
	5.1	Functional block diagram, working and design of three terminal fixed voltage regulators (78XX, 79XX series).	
	5.2	Functional block diagram, working and design of general-purpose IC 723 (HVLC and HVHC), Introduction of LM 317	
6		**Special Purpose Integrated Circuits**	**2**
	6.1	Functional block diagram and working of VCO IC 566 and application as frequency modulator.	
	6.2	Functional block diagram and working of PLL IC 565 and application as FSK Demodulator.	
		Total	**26**

Textbooks	
1	Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson Prentice Hall, 4th Edition.(2015)
2	D. Roy Choudhury and S. B. Jain, "Linear Integrated Circuits", New Age International Publishers, 4th Edition.(2009)
Reference Books	
1	K. R. Botkar, "Integrated Circuits", Khanna Publishers (2004) Tata McGraw Hill, 3rd Edition. University Press, Indian Edition.
2	Sergio Franco, "Design with operational amplifiers and analog integrated circuits", 4th Edition.(2014)
3	David A. Bell, "Operational Amplifiers and Linear Integrated Circuits", Oxford University Press,3rd Edition (2009)
4	R. F. Coughlin and F. F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, 6th Edition.(2001)
5	J. Millman, Christos C. Halkias, and Satyabratatajit, Millman's, "Electronic Devices and Circuits," McGraw-Hill, 3rdEdition.(1967)
Access to software and virtual labs:	
1	https://be-iitkgp.vlabs.ac.in/exp/non-inverting-amplifiers/
2	https://be-iitkgp.vlabs.ac.in/exp/operational-amplifier/
3	https://ltspice.en.softonic.com/

Internal Assessment:

1) Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2) Mid Term test is to be conducted when approx. 50% syllabus is completed.
3) Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

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Sr. No	Rubrics	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8.	Multiple Choice Questions (Quiz)	05 marks
9.	Peer Review and participation the marks can be left blank (with discretion of faculty)	05 Marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five needs to be solved.

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Linear Integrated Circuits (Lab)

Suggested Experiments: Students are required to complete at least 08 experiments.	
Minimum 6 hardware practical (compulsorily based on IC 741, IC 555, IC 723 and remaining on VCO 566 or PLL 565) and 2 simulations should be conducted. At least one experiment from each Module of the syllabus.	
Sr. No.	**Name of the Experiment**
1*	Design inverting, non-inverting amplifier and buffer using IC 741.
2	Design summing and difference amplifiers using op-amp.
3	Design voltage to current converter with grounded load.
4*	Design and analyze Integrator.
5*	Design and analyze Differentiator.
6*	Design Schmitt trigger using Op-amp.
7	Design Wein bridge and RC phase shift Oscillator.
8*	Design and analyze first or second order High pass and Low pass filter.
9	Design and analyze Band pass and Band reject filter.
10*	Design Astable multivibrator using IC 555 for fixed frequency and variable duty cycle.
11*	Design Monostable Multivibrator using IC 555.
12	Design voltage regulator using IC 723.
13	Design Frequency Modulator using IC 566.
14.	Design FSK Demodulator using IC 565.
15.	Design Precision rectifier.
16.	Design Square & Triangular wave generator.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently Star (*) marked experiments are compulsory.

Term Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

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COURSE NAME: COMMUNICATION ENGINEERING

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETPC42	Communication Engineering (Theory)	02	---	---	02	---	---	02
NETPCL42	Communication Engineering (Lab)	---	02	---	---	01	---	01

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Communication Engineering (Theory)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETPC42	Communication Engineering (Theory)	02	---	---	02	---	---	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPC42	Communication Engineering (Theory)	20	20	60	---	---	100

Prerequisite: Mathematics for Communication, Electronic Devices and Circuits, Network Theory	
Course Objectives: Students will be learning,	
1	To understand various analog modulation and demodulation techniques.
2	To understand various angle modulation and demodulation techniques.
3	To understand various digital pulse modulation and demodulation techniques.
4	To understand baseband transmission methods for digital signals
5	To understand comparison of various digital modulation Techniques
6	To illustrate various error correction codes.
Course Outcomes: Students should be able to,	
1	Analyze the concepts of amplitude modulation and demodulation.
2	Analyze the concepts of angle modulation and demodulation.
3	Analyze and compare various digital pulse modulation and demodulation techniques.
4	Compare various baseband transmission methods for digital signals
5	Compare the performances of different digital modulation techniques
6	Analyze different error correction codes.

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Communication Engineering (Lab)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tut	Theory	Practical	Tut	Total
NETPCL42	Communication Engineering (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPCL42	Communication Engineering (Lab)	---	---	---	25	25	50

Lab Prerequisite: Matlab/ Scilab, Python programming	
Lab Objectives:	
1	To illustrate the fundamentals of basic communication system
2	To understand various analog modulation and demodulation techniques.
3	To understand various angle modulation and demodulation techniques.
4	To understand various digital pulse modulation and demodulation techniques.
5	To understand baseband transmission methods for digital signals
6	To understand comparison of various digital modulation Techniques
Lab Outcomes: After successful completion of the course students will be able to:	
1	Understand the basic components and types of noises in communication systems.
2	Analyze the concepts of amplitude modulation and demodulation.
3	Analyze the concepts of angle modulation and demodulation.
4	Analyze and compare various digital pulse modulation and demodulation techniques.
5	Compare various baseband transmission methods for digital signals
6	Compare the performances of different digital modulation techniques

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Communication Engineering (Theory)

Module		Content	Hrs
Pre-requisites		Block diagram, electromagnetic spectrum, signal bandwidth and power, types of communication channels, Introduction to time and frequency domain. Basic concepts of wave propagation, Types of noise, signal to noise ratio, noise figure, noise temperature and Friss formula.	
1		**Amplitude and Angle Modulation and Demodulation**	8
	1.1	Basic concepts, need for modulation, modulation index, bandwidth, power calculations.	
	1.2	DSBFC: Principles, low-level and high-level modulators, DSB suppressed carrier, Balanced modulators with diode and SSB systems.	
	1.3	Amplitude demodulation: Diode detector, practical diode detector.	
	1.4	Frequency and Phase modulation (FM and PM): Basic concepts, mathematical analysis, FM wave (time and frequency domain), phase and frequency deviation, modulation index, deviation ratio, bandwidth requirement of angle modulated waves, narrowband FM and wideband FM.	
	1.5	Varactor diode modulator, Direct FM transmitter, indirect FM Transmitter	
	1.6	FM demodulation: Balanced slope detector, Foster-Seely discriminator.	
2		**Radio Receivers**	**3**
	2.1	AM receiver: Radio characteristics, TRF receiver, superheterodyne receiver, tracking & choice of IF	
	2.2	FM receiver block diagram, comparison with AM receiver.	
3		**Sampling and Digital Pulse modulation**	4
	3.1	Pulse amplitude modulation (PAM), sampling theorem, Type of sampling instantaneous, Natural and flat top.	

	3.2	Introduction to pulse position and pulse duration modulations, Digital signal, Quantization, Quantization error.	
	3.3	Pulse code modulation, signal to noise ratio, Delta Modulation (DM) and Adaptive Delta Modulation (ADM)	
4		**Baseband transmission**	**2**
	4.1	Block diagram of baseband transmitter-receiver system, Line codes (RZ and NRZ Unipolar formats, RZ and NRZ Polar formats, NRZ Bipolar format (AMI format), NRZ Manchester format, and Quaternary Polar format), Introduction to ISI.	
5		**Bandpass Modulations**	**6**
	5.1	Classification of Digital Modulation techniques, concept of coherent and non-coherent detection.	
	5.2	Generation, Detection, Bandwidth and applications of the following modulations: Binary ASK, Binary PSK, Quadrature PSK, Off-Set QPSK, M-ary PSK, Binary FSK, M-ary FSK, 16-ary QASK and MSK.	
6		**Error detection and Correction codes**	3
	6.1	Introduction of error control system, Comparison between FEC and ARQ.	
	6.2	Introduction to Linear block code, Cyclic code and Convolutional code	
		Total	**26**

Textbooks:	
1	H. Taub, D. Schlling, and G. Saha- "Principles of Communication Systems", Tata Mc-Graw Hill, New Delhi, Third Edition, 2012.
2	Lathi B P, and Ding Z- "Modern Digital and Analog Communication Systems", Oxford University Press, Fourth Edition, 2017.
3	Haykin Simon- "Digital Communications", John Wiley and Sons, New Delhi, Fourth Edition, 2014.
4	Wayne Tomasi, "Electronics Communication Systems", Pearson education, Fifth Edition, 2008.
5	Kennedy and Davis, "Electronics Communication System", Tata McGraw Hill, Fourth edition, 2017.
Reference Books:	
1	P. Singh and S.D. Sapre, "Communication Systems: Analog and Digital", Tata McGraw Hill, Third edition, 2012.
2	Dennis Roddy and John Coolen, Electronic Communication, Pearson, 4/e, 2011.
3	Louis Frenzel, "Communication Electronics", Tata McGraw Hill, Third Edition, 2012.
4	Sklar B, and Ray P. K.-"Digital Communication: Fundamentals and applications", Pearson, Dorling Kindersley (India), Delhi, Second Edition, 2009.
5	T L Singal-"Analog and Digital Communication", Tata Mc-Graw Hill, New Delhi, First Edition, 2012.
6	P Ramakrishna Rao "Digital Communication", Tata Mc-Graw Hill, New Delhi, First Edition,2011
Access to software and virtual labs:	
1	virtual lab on amplitude modulation and demodulation : https://kcgcollege.ac.in/Virtual-Lab/Electronics-and-Communication-Engineering/
2	Am, FM, BPSK (simulation and real-time), Qpsk: https://vlab.amrita.edu/index.php?sub=59&brch=163

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Internal Assessment:

1) Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2) Mid Term test is to be conducted when approx. 50% syllabus is completed.
3) Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Rubrics	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8.	Multiple Choice Questions (Quiz)	05 marks
9.	Peer Review and participation the marks can be left blank (with discretion of faculty)	05 Marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five needs to be solved.

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Communication Engineering (Lab)

Suggested Experiments: Students are required to complete at least 08 experiments.	
Sr. No.	**Name of the Experiment**
1	Generation and detection of amplitude modulation for m=1, m>1 and m<1.
2	Generation and detection frequency modulation.
3	Study characteristics of superhetrodyne receiver.
4	Generation and detection of Sampling theorem.
5	Generation and detection of Pulse code modulation.
6	Generation and detection of Delta modulation.
7	Line Codes generation and performance comparison.
8	Spectrum of line codes (NRZ unipolar and polar).
9	Impulse responses of ideal (Nyquist filter) and practical (Raised cosine filter) solution for zero ISI.
10	Generation (and detection) of Binary ASK.
11	Generation (and detection) of Binary PSK.
12	Generation (and detection) of Binary FSK.
13	Generation (and detection) of QPSK.
14.	Generation (and detection) of M-ary PSK.
15.	Generation (and detection) of M-ary FSK.
16.	Generation (and detection) of 16-ary QASK.
17.	Generation (and detection) of MSK.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

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COURSE NAME: ELECTROMAGNETICS & TRANSMISSION LINES

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tut	Theory	TW /PR	Tut	Total
NETPC43	Electromagnetics & Transmission Lines (Theory)	02	---	---	02	---	---	02

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Electromagnetics & Transmission Lines (Theory)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETPC43	Electromagnetics & Transmission Lines (Theory)	02	---	---	02	---	---	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETPC43	Electromagnetics & Transmission Lines (Theory)	20	20	60	---	---	100

Pre-requisites: 1. Vector Calculus 2. Fundamental concepts of electricity and magnetism **Course Objectives:** Students will be learning,	
1	To introduce fundamental concepts of electromagnetics and transmission lines.
2	To develop a strong theoretical foundation for understanding electromagnetic field theory.
3	To enable students to analyze and solve problems related to electromagnetic fields and transmission lines.
4	To provide practical knowledge applicable to engineering fields such as telecommunications, power systems, and electronics.
5	To encourage critical thinking and problem-solving skills in the context of electromagnetics and Transmission lines.
Course Outcomes: Students should be able to	
1	Understand the basic principles of electromagnetism and its relevance in engineering applications.

2	Analyze and apply Maxwell's equations to describe electromagnetic phenomena.
3	Explain the behaviour of electromagnetic waves in different media and understand the concept of wave propagation.
4	Solve problems related to the transmission of electromagnetic waves through different mediums and structures.
5	Analyze and design transmission lines for efficient signal transmission and power distribution.
6	Utilize simulation tools for analyzing electromagnetic fields and transmission line behaviour.

Module		Course Module / Contents	Hours
1		**Introduction to Electromagnetic Theory**	2
	1.1	Review of vector calculus and coordinate systems	
2		**Electrostatics and Magneto statics**	13
	2.1	**Electrostatics** Coulomb's Law, Electric Field Intensity - Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V.	
	2.2	**Electrostatic Fields** Energy Density, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance - Parallel plate, Illustrative Problems	
	2.3	**Magnetostatics** Biot - Savart's Law , Ampere's Circuital Law and Applications, Magnetic Flux Density, Faraday's Law	
3		**Time-Varying Fields and Maxwell's Equations**	4
	3.1	Maxwell's Equations, Displacement Current Density, Conditions at a Boundary Surface: Dielectric - Dielectric, Magnetic Vector Potentials,	
	3.2	Reflection and Refraction of Plane Waves - Normal for both perfect, Poynting Vector and Poynting Theorem	
4	4.1	**Transmission Lines I**	4
		Overview of transmission lines and their types, Parameters, Transmission line equations and their solutions, Primary & Secondary Constants, Expressions for Characteristics Impedance,	

		Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless transmission line, Distortion - Condition for Distortionlessness and Minimum Attenuation.	
5	5.1	**Transmission Lines – II**	3
		SC and OC Lines, Input Impedance, Reflection and transmission of signals on transmission lines, Relations, Reflection Coefficient, VSWR, λ/4, λ 2, λ /8 Lines – Smith chart and impedance matching techniques, Smith Chart - Configuration and Applications, Single Stub Matching,	
		Total	**26**

Textbooks:	
1	R K Shevgaonkar ,"Electromagnetic Waves" McGraw-Hill Education (India) Pvt Limited (2006)
2	Bhag Singh Guru, Kettering University, Michigan, Hüseyin R. Hiziroglu, Kettering University, Michigan, "Electromagnetic Field Theory Fundamentals" Cambridge University Press, July 2009 2nd edition
3	William H. Hayt, Jr. John A. Buck "Engineering Electromagnetics" The McGraw-Hill Companies 9th Edition (2020)
Reference Books:	
1	Matthew N.O. Sadiku "Principles of Electromagnetics" Oxford University Press, 6th Edition (2015)
2	Reinhold Ludwig Worcester "RF Circuit Design. Theory and Applications", 2nd Ed, Pearson International.(2008)
3	J. D. Kraus, "Electromagnetics", McGraw-Hill Book Company 5th Edition (1999).
Access to software and virtual labs:	
1	Vlab Electromagnetics: https://www.ee.iitb.ac.in/course/~vel/
2	Vlab Transmission Lines: https://vlab.amrita.edu/?sub=3&brch=180&sim=300&cnt=1
3	NPTEL course: https://onlinecourses.nptel.ac.in/noc21_ee83/preview

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Internal Assessment:

1) Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2) Mid Term test is to be conducted when approx. 50% syllabus is completed.
3) Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Rubrics	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8.	Multiple Choice Questions (Quiz)	05 marks
9.	Peer Review and participation the marks can be left blank (with discretion of faculty)	05 Marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five need to be solved.

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COURSE NAME: ETHICAL HACKING & DIGITAL FORENSIC

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETMM41	Ethical Hacking & Digital Forensic (Theory)	04	---	---	04	---	---	04

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Ethical Hacking & Digital Forensic (Theory)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETMM41	Ethical Hacking & Digital Forensic (Theory)	04	---	---	04	---	---	04

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETMM41	Ethical Hacking & Digital Forensic (Theory)	20	20	60	---	---	100

Prerequisite: Computer Networks and Cryptography	
Course Objectives: Students will be learning,	
1	To describe fundamentals of Ethical hacking
2	To understand the methodologies and techniques of Sniffing technique and web security
3	To understand the methodologies and techniques of hardware security.
4	To understand cyber-attacks and the digital forensic process.
5	To discuss the need and process of digital forensics and Incident Response Methodology, to explore the procedures for identification, preservation, and extraction of digital evidence
6	To discuss the investigation process of network and host based system intrusions.

Course Outcomes: Students should be able to,	
1	Interpret the knowledge of networking and ethical hacking.
2	Apply the knowledge of network reconnaissance to perform Network and web application-based attacks.
3	Apply the concepts of hardware elements and endpoint security to provide security to physical devices.
4	Discuss various cybercrimes and its prevention methods, the phases of Digital Forensics and methodology to handle the computer security incident.
5	Understand the process of collection, analysis and recovery of the digital evidence.
6	Investigate the process of monitoring and analysis of computer network traffic for network investigation.

Module		**Content**	**Hrs**
1		**Introduction to network security**	**7**
	1.1	Protocol vulnerabilities, Steps for ethical hacking, Types of attacks on network, Information gathering, reconnaissance, scanning, vulnerability assessment, Open VAS, Nessus	
	1.2	System hacking: Password cracking, penetration testing, Social engineering attacks, Malware threats	
2		**Hardware Security**	**8**
	2.1	Side channel attacks, physical unclonable functions, Firewalls, Backdoors and trapdoors, Demonstration of Side Channel Attacks on RSA, IDS and Honeypots.	
	2.2	Various attack scenarios and their remedies, Session hijacking and man-in-middle attacks	
3		**Wireless and Web Security**	**10**
	3.1	Wireless Network security: hacking wireless networks (WEP, WPA, WPA- 2), Proxy network, VPN security, Ransomware (Wannacry), Botnets, Rootkits, Mobile device security	
	3.2	Web Security Considerations, OWASP, User Authentication, Cookies, SSL, HTTPS	

	3.3	Privacy on Web, Account Harvesting, Web Bugs, Sniffing, ARP poisoning, Denial of service attacks, Hacking Web Applications, Clickjacking, Cross-Site scripting and Request Forgery, Session Hijacking and Management, Phishing and Pharming Techniques, SSO, Web Service Security, OAuth 2.0	
4		**Cybercrime and Hacking**	**8**
	4.1	Cybercrime, Categories of Cybercrime (Cybercrime against people, Cybercrime Against property, Cybercrime Against Government), Types of cybercrime (Violent- Cyber terrorism, Assault by Threat, Cyberstalking, Child Pornography, Non-violent - Cybertrespass, Cyber Theft, Cyber Fraud), Computers' role in crimes	
	4.2	Hacking, Life cycle of Hacking, Types of Hackers (White Hat hackers, Black Hat hackers, Grey Hat hackers), Hacking techniques	
5		**Digital Forensics**	**10**
	5.1	Objectives of digital forensics, Process of digital forensics, Types of digital forensics, Challenges faced by digital forensics	
	5.2	Digital evidence, Admissibility of evidence, Challenges in evidence handling, collecting digital evidence, Preserving digital evidence, Documenting evidence, Necessity of forensic duplication, Forensic duplicates as admissible evidence	
	5.3	Introduction to Incident - Computer Security Incident, Goals of Incident Response, CSIRT, Incident Response Methodology, Phase after detection of an incident	
6		**System Investigation ,Network and Mobile Forensics**	**9**
	6.1	Investigating Windows systems, Investigating UNIX systems, Investigating applications, Web browsers, Email tracing, Recovering digital evidence, Acquiring, Analyzing and duplicating data: dd, dcfldd, foremost, scalpel	
	6.2	Analyzing network traffic, collecting network based evidence, Evidence handling. Investigating routers	
	6.3	Mobile Forensic: Introduction, definition, process	
		Total	**52**

Textbooks:	
1	Security in Computing -- Charles P. Pfleeger, Sixth Edition, Pearson Education, 2023
2	Network Security and Cryptography -- Bernard Menezes, Cengage Learning, 2014
3	Network Security Bible -- Eric Cole, Second Edition, Wiley, 2011
4	Mark Stamp's "Information Security: Principles and Practice" --Deven Shah, Wiley, 2009
5	Nilakshi Jain & Kalbande, "Digital Forensics", Wiley Publication, 1st edn,Kindle Edition, 2017
6	"Scene of the Cybercrime: Computer Forensics" Handbook 1st Edition, Kindle Edition,2008
7	Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGraw-Hill, 2006
8	Nina Godbole, Sunit Belapure, "Cyber Security", Wiley Publication, 2011
Reference Books:	
1	UNIX Network Programming –Richard Steven, Addison Wesley, 2003
2	Cryptography and Network Security -- Atul Kahate, 3rd edition, Tata Mc Graw Hill, 2013
3	Applied Cryptography, Protocols Algorithms and Source Code in C Bruce Schneier, 2nd Edition 20th Anniversary Edition, Wiley, 2015
4	Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", Cengage Learning, 2014
5	Debra Littlejohn Shinder Michael Cross "Scene of the Cybercrime: Computer Forensics Handbook", 2nd Edition Syngress Publishing, Inc.2008.
Access to software and virtual labs:	
	Kali Linux/ Metasploit Framework/Nmap/ Wireshark/ Autopsy/ FTK Imager
	Hack The Box (HTB) Virtual Lab: https://www.hackthebox.com/hacker/hacking-labs
	TryHackMe Online Penetration Testing Lab: https://tryhackme.com/
	Virtual Hacking Labs: https://www.virtualhackinglabs.com/

Industry articles and case studies:	
1	Case Study: Ethical Hacking to Secure a Financial Institution (Source: SANS Reading Room)
2	Article: The Role of Ethical Hacking in Cybersecurity (Source: IEEE Security & Privacy)
3	Article: The Evolution of Ethical Hacking: Techniques and Tools (Source: IEEE Transactions on Information Forensics and Security)
4	Article: Advancements in Digital Forensics Techniques (Source: IEEE Transactions on Information Forensics and Security)
5	Article: Digital Forensics in Cloud Computing Environments (Source: IEEE Cloud Computing)
6	Case Study: Mobile Device Forensics in Criminal Investigations (Source: Forensic Focus)
Any other (Access to AI tools / Data driven insights (if applicable) or any other):	
1	IBM Watson for Cyber Security
2	Splunk

Internal Assessment:

1) Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2) Mid Term test is to be conducted when approx. 50% syllabus is completed.
3) Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Rubrics	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks

5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	05 marks
8.	Multiple Choice Questions (Quiz)	05 marks
9.	Peer Review and participation the marks can be left blank (with discretion of faculty)	05 Marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five needs to be solved.

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COURSE NAME: SKILL LAB -I: Python Programming

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETVS41	Skill Lab -I : Python Programming	---	2+2*	---	---	02	---	02

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Skill Lab -I: Python Programming

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETVS41	Skill Lab -I : Python Programming	--	2+2*	---	--	02	---	02

*2 Hours Tutorial + Project work [Not necessarily classroom teaching]

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	CA				
NETVS41	Skill Lab -I : Python Programming	--	--	--	25	25	50

Course Prerequisite: C and Java Programming	
Course Objectives:	
1	To describe the core syntax and semantics of Python programming language
2	To explore functions and decision flow control statements in Python
3	To infer the Object-oriented Programming concepts in Python
4	To formulate GUI Programming and Databases operations in Python
5	To develop applications using variety of libraries and functions
6	**To automate the procedures with python programming**
Course Outcomes: After successful completion of the course students will be able :	
1	Describe syntax and semantics in Python
2	Construct single valued and multi-valued functions along with control statements.
3	Interpret object oriented programming in Python.
4	Design GUI Applications in Python
5	Express proficiency in the handling Python libraries for data science
6	Implement automation to create, delete, rename, organize and manage various types of files using python.

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Skill Lab -I: Python Programming

Module		Content	Hrs
1		**Introduction to Python**	**6**
	1.1	Introduction to Python, Installation and resources, Identifiers and Keywords, Comments, Indentation and Multi-lining, Variables (Local and Global), data types, Arithmetic, Comparative, Logical and Identity Operators, Bitwise Operators, Expressions, Print statement and Formats, Input Statements in python	
	1.2	Strings, Lists, Tuples, Dictionaries, Sets, Accessing Elements, Properties, Operations and methods on these data structures	
2		**Functions and Decision flow control statement**	**8**
	2.1	Functions: Built-in-functions, library functions, Defining and calling the functions, Return statements, Passing the arguments, Lambda Functions, Recursive functions, Modules and importing packages in python code.	
	2.2	Decision Flow Control Statement: if and else statement, Nested If statement, Loop Statement: While Loop, do and while loop, for loop statement, Continue, Break and pass Statement, Conditional Statements	
3		**Object Oriented Programming**	**9**
	3.1	Classes and Objects, Public and Private Members, Class Declaration and Object Creation, Object Initialization, Class Variables and methods, Accessing Object and Class Attributes	
	3.2	Intricacies of Classes and Objects, Inheritance, Constructor in Inheritance, Exception Handling	
4		**Graphical User Interface and Image processing**	**9**
	4.1	Graphical User Interface using Tkinter Library module, creating simple GUI; Buttons, Labels, entry fields, widget attributes.	

	4.2	Basic Image Processing using OpenCV library, simple image manipulation and enhancement	
5		**Numpy, Pandas, Matplotlib, Seaborn, Scipy**	**10**
	5.1	Introduction to Numpy, Creating and Printing Ndarray, Class and Attributes of Ndarray, Basic operation, Copy and view, Mathematical Functions of Numpy.	
	5.2	Introduction to Pandas, Understanding Dataframe, View and Select Data, Missing Values, Data Operations, File read and write operation	
	5.3	Introduction to Matplotlib library, Line properties, Plots and subplots, Types of Plots, Introduction to Seaborn.	
	5.3	Introduction to Scipy, Scipy Sub packages – Integration and Optimization, Eigen values and Eigen Vectors, Statistic, Weave and IO.	
6		**Automation with Python**	**10**
	6.1	File handling: Reading and writing files, Organizing files, working with excel, word, pdf, text, sending email, OS and SYS modules	
	6.2	Case study in Python (On topics like Automation project, data structure algorithms, Network establishment, web scraping etc.)	
		Total	**52**

Textbooks:	
1	Yashavant Kanetkar, "Let us Python: Python is Future, Embrace it fast", 1st edition, BPB Publications (8 July 2019)
2	Dusty Phillips, "Python 3 object-oriented Programming", Second Edition PACKT Publisher August 2015.
3	John Grayson, "Python and Tkinter Programming", Manning Publications (1 March 1999).
4	Dr. R. Nageswara Rao, Dreamtech Press, "Core Python Programming", 1st edition
5	James Payne, "Beginning Python: Using Python 2.6 and Python 3.1", Wrox publication

6	E Balagurusamy, "Introduction to computing and problem solving using python" , McGraw Hill Education.
7	Zed A. Shaw, "Learn Python the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code", Addison Wesley; 3rd edition (1 October 2013).
8	AL Sweigart, "Automate The Boring Stuff with Python"-Practical Programming for beginners
9	Bassem Aly, "Hands-on Enterprise Automation with Python", Packt publisher
10	Jamie Buelta, "Python Automation Cookbook", Packt publisher
Reference Books:	
1	M. L. Liu, "Distributed Computing Principles and Applications", Pearson Addison Wesley, 2004
2	George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education, 2005
3	Andreas C. Mueller, "Introduction to Machine Learning with Python", O'Reilly; 1 edition (7 October 2016)
4	David Beazley, Brian K. Jones, "Python Cookbook: Recipes for Mastering Python 3", O'Reilly Media; 3rd edition (10 May 2013).
5	Bhaskar Chaudhary, "Tkinter GUI Application Development Blueprints: Master GUI programming in Tkinter as you design, implement, and deliver 10 real world application", Packt Publishing (November 30, 2015)

Software Tools:
1. Python IDE: https://www.python.org/downloads/
2. Anaconda Environment: https://www.anaconda.com/distribution/

Online Repository:
1. Github
2. Python 3 Documentation: https://docs.python.org/3/
3. "The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/
4. http://spoken-tutorial.org

5. Python 3 Tkinter library Documentation: https://docs.python.org/3/library/tk.html
6. Numpy Documentation: https://numpy.org/doc/
7. Pandas Documentation: https://pandas.pydata.org/docs/
8. Matplotlib Documentation: https://matplotlib.org/3.2.1/contents.html
9. Scipy Documentation : https://www.scipy.org/docs.html
10. Machine Learning Algorithm Documentation: https://scikit-learn.org/stable/
11. https://nptel.ac.in/courses/106/106/106106182/
12. NPTEL course: "The Joy of Computing using Python"

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr. No.	**Name of the Experiment**
1	Write python programs to understand expressions, variables, quotes, basic math operations, list, tuples, dictionaries, arrays etc
2	Write a Python program to implement byte array, range, set and different STRING Functions (len, count, lower, sorted etc).
3	Write a Python program to implement control structures.
4	Assume a suitable value for distance between two cities (in km). Write a program to convert and print this distance in meters, feet, inches and centimetre.
5	Write a program to carry out the following operations on the given set s = {10, 2, -3, 4, 5, 88} a. Number of items in sets s b. Maximum element in sets s c. Minimum element in sets s d. Sum of all elements in sets s e. Obtain a new sorted set from s, set s remaining unchanged f. Report whether 100 is an element of sets s g. Report whether -3 is not an element of sets s.
6	Write python program to understand different File handling operations
7	Create 3 lists – a list of names, a list of ages and a list of salaries. Generate and print a list of tuples containing name, age and salary from the 3 lists. From this list generate 3 tuples – one containing all names, another containing all ages and third containing all salaries.
8	Write Python program to implement classes, object, Static method and inner class

9	If any integer is given as in input through the keyboard, write a program to find whether it is odd or even number.
10	If ages of Ram, Shyam, and Ajay are given as an input through the keyboard, write a program to determine the youngest of the three.
11	Write a program that prints square root and cube root of numbers from 1 to 10, up to 4 decimal places. Ensure that the output is displayed in separate lines, with number center-justified and square and cube roots right-justified.
12	Write a program that defines a function count_lower_upper( ) that accepts a string and calculates the number of uppercase and lowercase alphabets in it. It should return these values as a dictionary. Call this function for some sample strings.
13	A 5-digit positive integer is entered through the keyboard, write a recursive function to calculate sum of digits of 5-digit number.
14	Write Python program to create, append, update, delete records from database using GUI.
15	Write Python program to obtain histogram of any image
16	Write a Python Program to split color image in R,G,B and obtain individual histograms.
17	Write Python program for histogram equalization
18	Write Python Program for edge detection
19	Write Python Program for image segmentation
20	Write Python program to implement GUI Canvas application using Tkinter
21	Write Python program to implement GUI Frame application using Tkinter
22	Write Python program to study define, edit arrays and perform arithmetic operations.
23	Write python program to study selection, indexing, merging, joining, concatenation in data frames
24	Evaluate the dataset containing the GDPs of different countries
25	Analyze the Federal Aviation Authority (FAA) dataset using Pandas to do the following: a. View: aircraft make name, state name, aircraft model name,

	text information, flight phase, event description type, b. fatal flag c. Clean the dataset and replace the fatal flag NaN with "No". d. Find the aircraft types and their occurrences in the dataset e. Remove all the observations where aircraft names are not available f. Display the observations where fatal flag is "Yes"
26	Analyze the "auto mpg data" and draw a pair plot using seaborn library for mpg, weight, and origin.
27	Write a python program to use SciPy to solve a linear algebra problem.
28	Implement automation with python by reading, writing and managing excel file
29	Implement automation with python by reading, writing and managing csv file
30	Implement automation with python by reading, writing and managing word file
31	Creating a simple report using python

Term Work:	
1	Term work should consist of 10 experiments.
2	Journal must include at least 2 assignments.
3	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
4	Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks)

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COURSE NAME: FIELD PROJECT

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW /PR	Tut	Total
NETFP41	Field Project	---	04	---	---	02	---	02

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Field Project

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NETFP41	Field Project	---	04	---	---	02	---	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETFP41	Field Project	---	---	---	50	---	50

Prerequisite: Basic Electrical Engineering, Electronic Devices and Circuits, Digital System Design, Linear Integrated Circuits.

Course Objectives:

1.	To engage students in field visits, with an objective of identifying and formulating problem statements based on observations during visits in industry, Government/ Non-governmental organizations as well as the broader societal context. **(with reference to Scheme A).** Students engage in experiential learning through developing industry or organizational case studies, analysing real-world processes, and proposing innovative enhancements based on critical observations and analysis **(with reference to Scheme B).** These approach bridges academic theory with practical application, fostering deeper understanding and actionable insights for students.

2.	To apply theoretical knowledge and foster creativity & innovation in addressing practical real-world problems.
3.	To enhance student's analytical, design & problem-solving skills, increase student's critical thinking ability to engage them in lifelong learning.
4.	To develop teamwork skills to achieve project goals and deadlines.
Course Outcomes:	
1.	To identify and resolve the issues with industry & society at large, to provide practical solutions for real-world challenges.
2.	To implement novel and efficient solutions fostering interdisciplinary collaboration in addressing challenges
3.	To apply appropriate techniques, resources and modern engineering tools, to improve the analytical, design, and problem-solving skills to abreast with the booming Technologies
4.	Cultivation of effective teamwork abilities, facilitating collaboration and synergy among individuals to achieve common goals.

Module	Content	Hrs
1	**Project Planning and Proposal Development:** Defining project objectives and scope, conducting literature review and background research, developing project proposal and timeline, Identifying required resources and constraints.	6
2	**Design and Implementation:** Selecting appropriate methodologies and Simulation tools, designing system architecture and components, Prototyping and testing system functionalities, iterative development and troubleshooting.	6
3	**Documentation and Reporting:** Maintaining detailed project documentation, Recording progress, challenges and solutions, Writing technical reports and documentation, Creating presentations for project updates and final presentation.	6
4	**Project Presentation and Evaluation:** Delivering oral presentations of project progress, demonstrating project outcomes and achievements, responding to questions and feedback from peers and instructors, reflecting on lessons learned and areas for improvement.	6
	Total	**24**

Text Books:	
1.	M. Rishardson and S Wallace, Getting started with Raspberry Pi, O'Reilly Pub, 2014.
2.	Simon Monk, Raspberry Pi Cookbook, O'Reilly Pub, 2014.
3.	Michael Morgolis, Arduino Cookbook, O'Reilly Pub, 2011.
4.	Yashavant Kanetkar and Shrirang Korde, 21 IoT Experiments, BPB Pub.
Access to Softwares: and Virtual Labs	
1.	Tinkercad : https://www.tinkercad.com/
2.	Proteus software
3.	https://www.arduino.cc/
4.	https://www.raspberrypi.com/
5.	http://esp32.net/
6.	https://www.espressif.com/en/products/socs/esp32
Data Driven Insights and repositories:	
1	https://circuitdigest.com
2	www.Github.com
3	https://www.electronicshub.org

Term Work:

1	**Guideline to maintain quality of field project are as follows :** Students can achieve this by making proper selection of projects based on field visit/ study of archives from the library. Encourage the use of open source softwares for simulation, design and documentation of the project. **Project Topic selection and approval :-** 1. The group may be of maximum **FOUR (04)** students. 2. The students are required to visit industry/community/library to identify the problem statement and be able to provide the proof of interaction. 3. Topic selection and approval by **2 Expert** faculty from department at the start of semester. 4. **Log Book** to be prepared for each group to record the work per week by students. Weekly comment, remarks to be put by guiding faculty. Both students and faculty will put signatures in it per week. The log book can be managed **online** with proper authentication method using google sheets/forms or open source project management software. 5. **Suggested steps for project selection and implementation as per scheme A.** a. After identification of a problem statement during field visit, it is mandatory to design (analog+digital) sensor/IC based circuit on PCB in the project. Pure software projects will not be allowed. b. Application is made using PCB + Arduino (IDE)/ ESP32/Basic Raspberry-pi board. (Hardware + software co-design). (Project should be completely hardware based with minimal software use). c. Identification and testing of different components, instruments, simulation software for projects. d. Topic selected should be application based. The chosen topic should not belong to existing experiment list with medium/high difficulty level of implementation. e. Designing and analysing circuits by students using standard material and software. f. Initial project demonstration and testing is expected to be done by soldering on general purpose PCB. Discourage use of breadboards. g. Study of PCB, Simulation on software and making of final PCB layout for given circuit. h. Implementing the final circuits on PCB by mounting required components with application using Arduino. 6. Suggested list of components: Transistors, diodes, regulators, gates, counters, FF, Latches, Decoder, Mux, comparator, Adder, Subtractor, ALU, CPLDs, DC motors, resistor, capacitor, inductor, Op-amp etc.(Students may add more components as per the requirement of project)

2	**Project Report Format:** 1. Project **report** should include the objectives, circuit diagram, operation, application, waveforms (if applicable), simulation results and final prepared PCB image, conclusion and references etc. 2. Report should not exceed **30 pages**.
3	The final certification and acceptance of term work ensures satisfactory performance of project work and minimum passing marks in term work.
4	**Term Work evaluation and marking as per Scheme A:** 1. At the end of semester the above 2 expert faculty who have approved the topic will internally **evaluate the performance**. 2. Students have to give a presentation and demonstration on the Field Project. 3. In the evaluation each individual student should be assessed for his/her contribution, understanding and knowledge gained about the project completed. Based upon it the marks will be awarded to students. 4. **Distribution of 50 Marks for Term Work:** • **Initial Stage** : Field study report and Project Proposal = **10** Marks • **Circuit simulation/** Zero PCB (GPP) implementation + Arduino Interfacing = **05** Marks ○ **(Project review:** Stage 1 and 2 will be evaluated in 3rd or 4th week of the semester). • **Project report**: Circuit Design + Explanation + Analysis Results + Conclusion + References = **10** Marks • **Prototype Demonstration and Testing:** PCB (simulation + Layout) + Final result with Arduino interfacing / ESP32/Basic Raspberry-pi board.+ Working Demo = **15** Marks • **Final Presentation and Report**: PPT (upto **12** slides) + Answers given to Questions = **10** Marks
	Project selection, implementation and report writing with reference to **Course Description B.** The student will mention the objectives of the field visit, description including field visit data collection, processes/ operations, analysis and suggestions for the improvement and innovations if any. **Distribution of 50 Marks for Term Work in scheme B is as follows:** 1. Assessment of case study report with analysis prepared by student groups: **25 marks** 2. Presentation by student groups and Q&A: **15 marks** 3. Suggestions given for improvement in the present Processes/ Systems / Operations, innovation identification: **10 marks.**

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COURSE NAME: Introduction to Innovation and Entrepreneurship for Engineers

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ PR	Tut	Total
NETEM41	Introduction to Innovation and Entrepreneurship for Engineers	—	---	02	--	--	02	02

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Introduction to Innovation and Entrepreneurship for Engineers

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tut	Theory	TW/ PR	Tut	Total
NETEM41	Introduction to Innovation and Entrepreneurship for Engineers	—	---	02	—	--	02	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NETEM41	Introduction to Innovation and Entrepreneurship for Engineers	--	—	--	25	---	25

Course Prerequisite:	
Course Objectives:	
1	Understand the concepts and theories of innovation and entrepreneurship within engineering disciplines.
2	Develop critical thinking and problem-solving skills necessary for identifying and evaluating entrepreneurial opportunities.
3	Gain practical experience in ideation, prototyping, and validation of innovative solutions to engineering challenges.
4	Explore the role of engineering in addressing societal and environmental challenges through innovation and entrepreneurship.
5	Cultivate teamwork, communication, and leadership skills essential for entrepreneurial success in interdisciplinary contexts.

Course Outcomes: At the end of the course the student will gain the capability to:	
1	Understand principles of innovation and entrepreneurship.
2	Identify and evaluate entrepreneurial opportunities.
3	Understand and Apply design thinking and innovation methodologies.
4	Develop and validate viable business models and innovative solutions.
5	Understand and demonstrate ethical practices in innovation and entrepreneurship
6	Demonstrate entrepreneurial mindset and skills.

Module	Contents	Hrs
1	**Introduction to Innovation and Design Thinking**	**06**
1.1	Overview of innovation concepts and importance in engineering.	
1.2	Types of innovation and innovation processes.	
1.3	Introduction to design thinking methodology.	
1.4	Applying design thinking principles to engineering challenges.	
1.5	Empathy mapping and user journey analysis.	
1.6	Iterative design process and user testing.	
2	**Opportunity Identification, Ideation**	**04**
2.1	Techniques for identifying customer needs and pain points.	
2.2	Idea generation exercises and brainstorming sessions.	
2.3	Problem-solving through human-centered design.	
3	**Prototyping and MVP Development**	**04**
3.1	Introduction to prototyping techniques and tools.	
3.2	Minimum viable product (MVP) development and validation.	
3.3	Rapid iteration and feedback gathering.	

4	**Introduction to Entrepreneurship**	**04**
4.1	Overview of entrepreneurship concepts and mindset.	
4.2	Role of entrepreneurs in driving economic and social change.	
4.3	Characteristics of successful entrepreneurs. - Case Studies	
5	**Business Model Innovation and Validation**	**04**
5.1	Introduction to business model canvas and value proposition design.	
5.2	Revenue models, pricing strategies, and cost structure analysis.	
5.3	Techniques for market research and customer validation.	
5.4	Identifying target markets and understanding customer needs.	
6	**Legal and Ethical Considerations**	**04**
6.1	Intellectual property rights and patents in engineering innovation.	
6.2	Ethical considerations in entrepreneurship and engineering practice.	
6.3	Social responsibility and sustainability in innovation and entrepreneurship.	
	Total	**26**

Textbooks:	
1	"Entrepreneurship Development and Small Business Enterprises" by Poornima M. Charantimath
2	"Innovation and Entrepreneurship: Practice and Principles" by Peter F. Drucker
3	"Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" by Alexander Osterwalder and Yves Pigneur
4	"Innovative India: Science and Technology Entrepreneurship" by K. Vijayaraghavan and Rajan Srikanth
5	"Startup Nation: Making India a Startup Ecosystem" by Dr. H.K. Mittal
6	"Entrepreneurship: Theory, Process, and Practice" by Kuratko, Hornsby, and Covin:
7	"Zero to One: Notes on Startups, or How to Build the Future" by Peter Thiel and Blake Masters

Websites :	
1	Startup India (startupindia.gov.in): • Provides resources, guidelines, and support for startups and entrepreneurs in India, including information on funding, policies, and events.
2	National Entrepreneurship Network (NEN) (wadhwanifoundation.org/national-entrepreneurship-network): • Offers resources, workshops, and programs for entrepreneurship education and ecosystem development in India.
3	MIT OpenCourseWare (ocw.mit.edu): • Offers free online courses on entrepreneurship and innovation, including lecture notes, assignments, and case studies from MIT's entrepreneurship curriculum.
4	Stanford eCorner (ecorner.stanford.edu) • Features a rich collection of videos, podcasts, and articles on entrepreneurship and innovation from Stanford University, including talks by successful entrepreneurs and industry experts.
5	Coursera (coursera.org) • Provides online courses on entrepreneurship and innovation from top universities and institutions, allowing students to learn at their own pace and earn certificates.
6	TiE (The Indus Entrepreneurs) (tie.org) • A global nonprofit organization dedicated to fostering entrepreneurship through mentoring, networking, and education, with many chapters in India offering local support and events.
Additional Resources:	
1	Entrepreneurship Development Institute of India (EDII) (ediindia.org) • Provides entrepreneurship education, training, and research programs, as well as workshops and seminars on various aspects of entrepreneurship.
2	Harvard Business Review (hbr.org) • Offers articles, case studies, and insights on innovation, entrepreneurship, and business strategy from industry experts and thought leaders.
3	Khan Academy (khanacademy.org) • Offers free educational resources, including lessons on entrepreneurship, economics, and business fundamentals.

Term Work :	
The Assessment will be based on a set of 5 activities of 5 marks each. The suggested list of activities:	
1	Individual and group assignments (e.g., business model canvas, market research report).
2	Presentations and pitches for venture ideas.
3	Participation in discussions and workshops.
4	Reflection papers or journals documenting personal learning and growth.
5	Presentation of innovation projects by students.
6	Feedback and peer evaluation of prototypes.
7	Reflection on the innovation process and lessons learned.

COURSE NAME: ONLINE OPEN ELECTIVE

Teaching Scheme								
Course Code	Course Name	Course Duration			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NETOE4X	Online Open Elective (Theory)	12 weeks	–	---	04		---	04

Examination Scheme							
Course Code	Course Name	Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Semester Exam			
		Mid-Term Test	Continuous Assessment				
NETOE4X	Online Open Elective (Theory)	---	---	100*	---	---	100

(*marks will be allotted based on the consolidated score awarded by NPTEL)

Mode of Learning: Online (NPTEL / SWAYAM Platform)

Nature of Course: Self-learning (MOOC)

Assessment: NPTEL Certification

There will be no Internal Assessment (CA) and no End Semester Examination (ESE) conducted by the Institute. Credits awarded based on NPTEL certificate

List of Courses:

1. Safety and Risk Analytics
2. Climate Hazards and Disaster Mitigation
3. Strategies for Sustainable Design
4. Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems
5. German-I

Important Note: The syllabus would be as prescribed by NPTEL for the selected list of courses by the Department.

Textbooks / Learning Resources :
1. Video lectures 2. Weekly assignments 3. Reference material uploaded by the course instructor

Rules for Open Elective (OE) – Semesters 4 and 5

1. Course Registration & Certificate Submission
Students must register and submit the passing certificate of an NPTEL course chosen from the department-suggested list.

2. Mode of Learning
The NPTEL course must be completed independently by the student (self-learning mode).

3. Assignments & Examination
Students must timely submit all NPTEL assignments and appear for the NPTEL proctored exam.

4. Credit Awarding
After successfully passing the NPTEL course, 4 credits will be awarded on production of certificate from NPTEL.

5. Fees
NPTEL courses are free for enrollment, but the exam fees must be borne by the student.

6. SWAYAM Local Chapter Registration
During NPTEL registration, students must:

- Select YES for "Are you part of a SWAYAM Local Chapter?"
- Choose the college name from the list. (College Code: 2173)

7. ABC Account & APAAR ID
Students must mention their ABC Account Number and APAAR ID in their Profile detail.

8. Fail / Absent in NPTEL Exam

- Students who fail or remain absent must reappear in the next NPTEL re-exam (generally conducted after 6 months).
- If the course is not re-run in the next cycle, the student must choose another course from the department-approved NPTEL list.

9. Result & Mark sheet

- The grading system for Open Elective subjects will remain the same as other subjects.
- If the student fails to pass the subject in the respective semester, against the Open Elective subject No Certificate (NC) would be indicated in the mark sheet, they would loose the grade points of the subject.
- Credits will be awarded as and when the student submits the certification from NPTEL.
- The students who are not able to produce NPTEL certification till the end of 8^{th} semester are bound to clear OE offered by the Institute in the next academic year whose exams will be conducted offline.
- Student shall be permitted to appear for the offline Open Elective examination conducted by the Institute only if they have attempted the corresponding NPTEL examinations at least twice and were unable to pass.

Open Elective Course -I(NPTEL Mooc Courses)

Sr. No.	Course Code	Name Of The Subject
1	NETOE41	German-I
2	NETOE42	Energy and the Climate Crisis: The Path to Net-Zero Emissions
3	NETOE43	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems
4	NETOE44	Energy Resources, Economics and Environment