



**NADIMPALLI SATYANARAYANA RAJU
INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)**



Approved by AICTE, New Delhi & Affiliated to JNTU, Kakinada & An ISO 9001:2015 & ISO 45001 Certified Institution.
Recognized under 2(f) of the UGC Act 1956 & Accredited by NAAC with 'A' Grade (3-104-00)
SONTYAM, Pendurthi - Anandapuram Highway, Visakhapatnam - 531173, Ph: 9885824167, 8099464548, www.nsr.it.edu.in

Department of Electronics and Communication Engineering

Few specific feedback received reflecting the needs of stakeholders at Local, Regional, National, International level

(The feedbacks are received through centralised online system using google form with timestamp and reflected in the Feedback Form by the Program Coordinator of Electronics and Communication Engineering for documentation attested by the HoD). The received feedback (s) are further discussed in the internal pre-BoS meeting and escalated to the BoS for necessary approval.

S. No	Few Feedback at	Few specific feedback received from stakeholders	Integration into the curriculum		Semester	POs/PSOs
			Course Code	Course Name		
1	Local Level	Programming Language	20ECS02	Basics of Python Programming	IV	1
		C-Programming Lab	20ESX07	Programming for Problem Solving using 'C' Lab	I	1, 4
		Hardware Description Language	20EC305	Digital System Design	III	1, 3
2	National Level	Internet of Things	20EC015	Communication Protocols for IoT	VII	Professional Elective
		EMI & EMC	20EC006	Electronic Measurements and Instrumentation	V	Professional Elective
			20EC012	Bio Medical Instrumentation	VI	Professional Elective
			20EC404	Electromagnetic Waves and Transmission lines	IV	2, 3, 5, 7, PSO 1
			20EC503	Antennas and Wave Propagation	V	1, 2, 4, 5, PSO 1
			20EC601	Microwave Engineering	VI	1, 2, 3, PSO 1
			20AIO01	Machine Learning for Engineers	VII	01, 02, 04, 05, PS02
		20AIO02	Fundamentals of Deep Learning	VI	01, 03	

Commented [ds1]: Though 'C' Programming is already there in the curriculum, stakeholders feel that Python Programming is very much essential for all. In that context, it is included in the curriculum and shown as proof. All other similar evidences are shown in trailing part of the proof.

Commented [ds2]: Suggested to include the concepts of Communication Protocols & concepts of IoT accordingly this course has been introduced

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Commented [ds3]: Stakeholders suggested to include the concepts of AI, Machine learning and deep learning as in the recent days the applications of these expertise is noted in all disciplines of engineering & Technology, all these feedbacks are taken care in these courses

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Srujan 25/11/23
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		Managerial and PR Skills	20HSX03	Managerial Economics and Financial Analysis	IV	11
		VLSI	20EC008	VLSI Design	VII	
		Pattern Reorganisation	20EC004	Digital Image Processing Techniques	V	
		Summer Internship		Summer Internship #1 ²	IV	5, 8, 9, 10, PSO 1
		Industry		Summer Internship #2 ²	VI	5, 8, 9, 10, PSO 1
3	International Level	Computer Vision Applications	20EC022	Computer Vision Algorithms	VII	
		EW Systems and Drone detection systems	20EC007	Radar Engineering	VII	



Head of the Department

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20EC502 Basics of Python Programming

1 0 2 2

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

Code	Course Outcomes	Mapping with POs	DoK
		PO1	
20CS403.1	Demonstrate the basic programming in Python	3	L1, L2
20CS403.2	Demonstrate use of data structures and object-oriented programming in Python	3	L1, L2
20CS403.3	Build programs using packages like NumPy, Pandas, SciPy, Matplotlib	3	L1, L2

1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create DoK: Depth of Knowledge

Introduction to Python - Input and Output operations - Comments - Variables - Operators - Expressions - Control Statements -
Data Structures: List, Tuples, Sets, Dictionaries, Sequences - Strings: String Formatting, Accessing Character and Substring in Strings,
Data Encryption - Functions: Defining functions, Simple programs with functions - Classes - Objects - Packages - Standard Packages:
NumPy, Pandas, SciPy, Matplotlib

References

1. Kenneth A. Lambert, "Fundamentals of Python First Programs", 1st Edition, Cengage, 2017
2. Vamsi Kurama, "Python Programming: A Modern Approach", 1st Edition, Pearson, 2018
3. Mark Lutz, "Learning Python", 1st Edition, O'Reilly, 2019

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Chairman Board of Studies
(CSE)

PE 20EC006 Electronic Measurements & Instrumentation 3 0 0 3

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

Code	Course Outcomes	Mapping with POs	DoK
20EC006.1	Identify the various parameters that are measurable in electronic instrumentation		L1, L2
20EC006.2	Classify and analyze different signal generators and analyzers		L1, L2, L3
20EC006.3	Explain construction and working principle of different oscilloscopes		L1, L2
20EC006.4	Implement the Bridge measurements for parameters like R, L, C, F		L1, L2, L3, L4
20EC006.5	Demonstrate how different types of Transducers used for measurement of physical parameters		L1, L2, L3, L4

1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge

Unit I: Introduction to Measuring Instruments 12 Hours

Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity, Errors in measurement, Dynamic characteristics-speed of response, Fidelity, Lag and Dynamic error, Errors in measurement, Design of multi range AC, DC meters (Voltmeters & Ammeters), Ohmmeters series type, Shunt type, Multi-meter for voltage, Current and resistance measurements.

True RMS meter

Unit II: Signal Generator And Signal Analyzers 12 Hours

Signal Generator- fixed and variable, Standard and AF sine and square wave signal generators, Function generators, Random noise, sweep, Arbitrary waveform, Wave analyzers, Harmonic distortion Analyzers, Spectrum analyzers, Digital Fourier analyzers.

AF oscillators, Square pulse generators

Unit III: Oscilloscope 12 Hours

Oscilloscopes CRT features, Vertical amplifiers, Horizontal deflection system, Sweep, Trigger pulse, Delay line, Sync selector circuits, Triggered sweep CRO, Standard specifications of CRO, Probes for CRO- active & passive, Lissajous method of frequency measurement.

Special purpose CROs : Sampling oscilloscope, Analog storage oscilloscope, Digital storage oscilloscope

Simple CRO

Unit IV: AC and DC Bridges 12 Hours

Measurements using DC and AC bridges: Wheat stone bridge, Kelvin bridge, Maxwell, Schering, Wien, Anderson bridges, Errors and precautions in using bridges, Q-meter

Hey bridge

Unit V: Transducers 12 Hours

Active & passive transducers : Resistance, Capacitance, Inductance; Strain gauges, LVDT, Piezo electric transducers Measurement of physical parameters force, Pressure, Velocity, Humidity and displacement.

Thermistors

Textbooks

1. Kalsi H. S., "Electronic instrumentation", 2nd Edition, Tata McGraw Hill, 2004
2. Helfrick A. D., and Cooper. W. D., "Modern Electronic Instrumentation and Measurement Techniques", 5th Edition, Prentice Hall of India, 2002
3. Bell, D. L., " Electronic Instrumentation and Measurements", 3rd Edition, Oxford University Press, 2013

Reference Books

1. LalKishore K., "Electronic Measurements and Instrumentation", 2nd Edition, Pearson Education, 2010
2. Robert A., "Electronic Test Instruments, Analog and Digital Measurements", 2nd Edition, Pearson Education, 2010

Web Resources

1. <https://www.scribd.com/>
2. <https://www.worldcat.org/>
3. <https://www.infibeam.com/>
4. <https://www.abebooks.co.uk>

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	20
L2	50	50
L3	20	20
L4	-	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define measuring system
2. Define precision and accuracy
3. Recall operation principle of frequency counter
4. Define the basic elements of function generator
5. Define the dynamic range of a spectrum analyser

L2: Understand

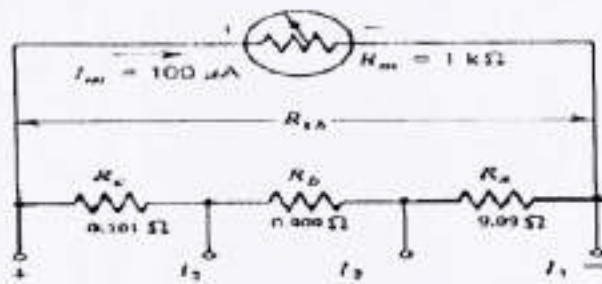
1. Describe the basic performance characteristics of a system? Explain in detail about it
2. Explain the constructional details and difference between Ohmmeter series type and shunt type
3. Describe the function of DC voltmeter and multirange voltmeter with neat operation explanation?
4. Explain the major parts of CRO with a block diagram
5. Draw the block diagram of a function generator and explain its operation
6. Explain how Wien's bridge can be used for experimental determination of frequency. Derive the expression for frequency in terms of bridge parameters

L3: Apply

1. Determine the Multiplier resistance on the 50V range of a DC Voltmeter, which uses 300mA meter movement having internal resistance of 1.2Ω . Show that the efficiency of full wave rectifier is 81.2%
2. If a basic DC bridge arms are connected with $R_1 = 2.2\text{ K}$, $R_2 = 3.9\text{ K}$, $R_3 = 10\text{ K}$, find R_4
3. A Maxwell bridge is used to measure inductive impedance. The bridge constants at balance are $C_1=0.01\mu\text{F}$, $R_1=520\text{ k}\Omega$, $R_2=6.2\text{ k}\Omega$ and $R_3=200\text{ k}\Omega$
4. In a Wien bridge oscillator $R_1 = R_2 = 75\text{ k}$, $C_1=C_2= 400\text{ pf}$ with usual notation. Determine the frequency of oscillations?
5. An unbalanced Wheatstone bridge has the following standard arms: $R_1=1\text{K}\Omega$, $R_2=2\text{K}\Omega$, $R_3=3\text{K}\Omega$, $R_4=4\text{K}\Omega$, $R_g=300\Omega$ and $E=5\text{V}$. Calculate the current through the galvanometer

L4: Analyze

1. Identify the bridge used for measurement of inductance and explain the construction and operation of this bridge
2. Find the different ranges of currents can be measured by using multi-range ammeter shown in the figure



3. Simplify the equation for the gauge factor of a resistive strain gauge in terms of Poisson's ratio

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PE 20EC012 Bio-Medical Instrumentation 3 0 0 3

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

Code	Course Outcomes	Mapping with POs	DoK
20EC012.1	Explain the various sources of bio-electric potentials in man-instrumentation system		L1, L2
20EC012.2	Outline the anatomy of Cardiovascular and respiratory system and their measuring instruments		L1, L2, L3
20EC012.3	Summarize the functionality of patient care & monitoring equipment's used to identify the malfunction of human body		L1, L2, L3
20EC012.4	Demonstrate various bio telemetry instruments in the clinical laboratory		L1, L2, L3
20EC012.5	Identify the different diagnostic imaging techniques and monitors, recorders and electrical accident prevention method		L1, L2, L3

1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge

Unit I: Sources of Bioelectric Potentials and Electrodes 12 Hours
Resisting and action potentials, Propagation of action potentials, The bioelectric potentials. Electrodes: Electrode theory, Bio potential electrodes, Biochemical transducers.

Introduction to bio-medical signals

Unit II: The Cardiovascular System 12 Hours
The heart and cardiovascular system, The heart, blood pressure, Characteristics of blood flow, Heart sounds, Cardiovascular measurements, Electrocardiography, Measurement of blood pressure, Measurement of blood flow and cardiac output, Plethysmography, Measurement of heart sounds, Event detection, PQRS & T-Waves in ECG, The first & second heart beats, ECG rhythm analysis, The di-crotic notch in the carotid pulse detection of events and waves, Analysis of exercise ECG, Analysis of event related potentials, Correlation analysis of EEG channels.

Correlation of muscular contraction

Unit III: Patient Care & Monitor and Measurements in Respiratory System 12 Hours
The elements of intensive care monitor, Diagnosis, Calibration and reparability of patient monitoring equipment, Other instrumentation for monitoring patients, Pace makers, defibrillators, the physiology of respiratory system, tests and instrumentation for mechanics of breathing, respiratory theory equipment.

Analysis of respiration

Unit IV: Bio Telemetry and Instrumentation for the Clinical Laboratory 12 Hours
Introduction to biotelemetry, Physiological parameters adaptable to biotelemetry, The components of biotelemetry system, Implantable units, Applications of telemetry in patient care - The blood, tests on blood cells, chemical test.

Automation of chemical tests

Unit V: X-ray and Radioisotope Instrumentation and Electrical Safety of Medical Equipment 12 Hours

Generation of ionizing radiation, Instrumentation for diagnostic X-rays, Special techniques, Instrumentation for the medical use of radioisotopes, Radiation therapy - physiological effects of electrical current, Shock hazards from electrical equipment, Methods of accident prevention.

Modern Imaging Systems: Tomography, Magnetic resonance imaging system, Ultrasonic imaging system.

Medical thermography

OE 20A1001 Machine Learning for Engineers

3 0 0 3

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

Code	Course Outcomes	Mapping with POs	DoK
20A1001.1	Describe different types of learning's		L1, L2
20A1001.2	Explain different supervised learning algorithms		L1, L2
20A1001.3	Explain different unsupervised learning algorithms		L1, L2
20A1001.4	Describe various types of machine learning models		L1, L2
20A1001.5	Choose appropriate machine learning model and algorithm for given task		L1, L2

L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge

Unit I: Introduction to learning

9 hours

Learning - Types of Machine Learning - Supervised Learning - The Brain and the Neuron - Design a Learning System - Perspectives and Issues in Machine Learning - Concept Learning Task - Concept Learning as Search - Finding a Maximally Specific Hypothesis - Version Spaces and the Candidate Elimination Algorithm - Linear Discriminants - Perceptron - Linear Separability - Linear Regression

Examples of regression

Unit II: Linear Models

9 hours

Multi-layer Perceptron - Going Forwards - Going Backwards: Back Propagation Error - Multi-Layer Perceptron in Practice - Examples of using the MLP - Overview - Deriving Back-Propagation - Radial Basis Functions and Splines - Concepts - RBF Network - Curse of Dimensionality - Interpolations and Basis Functions - Support Vector Machines

Applications of perceptron

Unit III: Trees and Probabilistic Models

9 hours

Learning with Trees - Decision Trees - Constructing Decision Trees - Classification and Regression Trees - Ensemble Learning - Boosting - Bagging - Different ways to Combine Classifiers - Probability and Learning - Data into Probabilities - Basic Statistics - Gaussian Mixture Models - Nearest Neighbour Methods - Unsupervised Learning - K means Algorithms - Vector Quantization

Self-Organizing Feature Map

Unit IV: Dimensionality Reduction and Evolutionary Models

9 hours

Dimensionality Reduction - Linear Discriminant Analysis - Principal Component Analysis - Factor Analysis - Independent Component Analysis - Locally Linear Embedding - Isomap - Least Squares Optimization - Evolutionary Learning - Genetic Algorithms - Genetic Offspring - Genetic Operators - Using Genetic Algorithms

Markov decision process

Unit V: Graphical Models

9 hours

Markov Chain Monte Carlo Methods - Sampling - Proposal Distribution - Markov Chain Monte Carlo - Graphical Models - Bayesian Networks - Markov Random Fields - Hidden Markov Models

Tracking Methods

Text Books

1. Stephen Marsland, "Machine Learning - An Algorithmic Perspective", 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, "Machine Learning", 1st Edition, McGraw Hill Education, 2013

Reference Books

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", 1st Edition, Cambridge University Press, 2012
2. Jason Bell, "Machine learning - Hands on for Developers and Technical Professionals", 1st Edition, Wiley, 2014

3. Elhem Alpaydm. "Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)", 3rd Edition, MIT Press, 2014

Internal Assessment Pattern

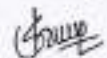
Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels L1: Remember

1. Define Machine Learning.
2. List the types of Machine Learning.
3. State Bayes Theorem.
4. What is Regularization?

L2: Understand

1. Demonstrate Linear Regression.
2. Explain Back Propagation Algorithm.
3. Illustrate Decision Tree Induction process.
4. Explain Genetic Operations with examples.



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20AI002 Fundamentals of Deep Learning 3 0 0 3

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

Code	Course Outcomes	Mapping with POs	DoK
20AI002.1	Describe the fundamental concept of artificial neural networks		L1, L2
20AI002.2	Describe the function of different deep neural networks		L1, L2
20AI002.3	Explain different deep learning algorithms		L1, L2
20AI002.4	Describe the functioning of convolution and recurrent neural networks		L1, L2
20AI002.5	Choose appropriate deep neural network for given application		L1, L2

L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge

Unit 1: Introduction to Deep Learning 9 hours
 Basics: Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.

Logic gates with perceptron

Unit 2: Feedforward Networks 9 hours
 Feedforward Networks: Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization – Regularization, autoencoders

Applications of multilayer perceptron

Unit 3: Convolution Networks 9 hours
 Convolutional Networks: The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs – Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features- LeNet, AlexNet

Applications of CNN

Unit 4: Recurrent Neural Networks 9 hours
 Recurrent Neural Networks: Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks –The Long Short-Term Memory

Applications of RNN

Unit 5: Applications of Deep Neural Networks 9 hours
 Applications: Large-Scale Deep Learning - Computer - Speech Recognition - Natural Language Processing

Healthcare applications

Text Books

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, UK, 2017
2. Antonio Gulli and Sujit Pal, "Deep Learning with Keras", Packt Publishing Ltd, Birmingham, UK, 2017

Reference Books

1. Deng & Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Web References

1. <https://www.coursera.org/specializations/deep-learning>

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)	
L1	50	50	76
L2	50	50	
Total (%)	100	100	

Group

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List any 4 benefits of artificial neural networks
2. List any 4 features of ANN
3. What are deep neural networks?
4. Define supervised and unsupervised learning
5. Define generalization

L2: Understand

1. Explain the design parameters of deep neural networks
2. Describe the dimensionality reduction techniques
3. Explain backpropagation algorithm
4. Describe any 2 applications of deep networks for image processing
5. Write about any 5 applications of deep networks



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Chairperson
Board of Studies
(CSE)

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Electronics and Communication Engineering

Credit requirement for the award of the degree under academic Regulation 2020 – 2021 for the candidates admitted from the academic year 2021 onwards

	Four Years	Three Years
B. Tech. (Regular Degree)	160	121
B. Tech. (Honors Degree)	180	141
B. Tech. (With minor specialization other than Chosen Branch of Engg. & Tech.)	180	141

Semester I					Contact Hours				
No.	Course Code	Course	POs	L	T	P	C		
01	20HSX01	Communicative English	10	3	0	0	3.0	HS	
02	20BSX11	Linear Algebra and Differential Equation	1,12 ¹	3	1	0	3.0	BS	
03	20BSX23	Applied Chemistry	1	3	1	0	3.0	BS	
04	20ESX02	Programming for Problem Solving using 'C'	1	3	1	0	3.0	ES	
05	20ESX05	Basic Electrical and Electronics Engineering	1	3	0	0	3.0	ES	
06	20BSX24	Applied Chemistry Lab	1,4	-	-	3	1.5	BS	
07	20HSX02	Communicative English Lab	10	-	-	3	1.5	HS	
08	20ESX07	Programming for Problem Solving using 'C' Lab	1	-	-	3	1.5	ES	
Sub-total				15	03	09	19.5		
Semester II									
01	20BSX12	Partial Differential Equations and Vector Calculus	1	3	1	0	3.0	BS	
02	20BSX33	Applied Physics	1,3	3	1	0	3.0	BS	
03	20ESX01	Engineering Drawing	1,5,10	1	0	4	3.0	ES	
04	20EE201	Network Analysis & Synthesis	1,3,10,PS01	3	1	0	3.0	ES	
05	20EC201	Principles of Electronics & Communication System	1	3	0	0	3.0	ES	
06	20BSX34	Applied Physics Lab	1,4	0	0	3	1.5	BS	
07	20EE202	Network Analysis and Electrical Technology Lab	1,4	-	-	3	1.5	ES	
08	20EC202	Electronics Workshop	4	0	0	3	1.5	ES	
09	20MCX01	Environmental Science	1	3	0	0	-	MC	
Sub-total				16	03	13	19.5		
Semester III									
01	20BSX14	Complex Variables and Transforms	1	3	1	0	3	BS	
02	20EC302	Electronic Devices and Circuits	1,2,3,PS01	3	0	0	3	PC	
03	20EC303	Signals and Systems	1,2,PS02	3	1	0	3	PC	
04	20EC304	Random Variables and Stochastic Processes	1,2	3	1	0	3	PC	
05	20EC305	Digital System Design	1,2,3,PS02	3	0	0	3	PC	
06	20EC306	Electronic Devices and Circuits Lab	4,9,PS01	0	0	3	1.5	PC	
07	20EC307	Signals and Systems Lab	4,5,9,PS02	0	0	3	1.5	PC	
08	20EC308	Digital System Design Lab	4,9,PS02	0	0	3	1.5	PC	
09	20ECS01	Printed Circuit Board Design	4	1	0	2	2.0	SC	
10	20MCX02	Constitution of India ²	-	2	0	0	0	MC	
Sub-total				18	03	11	21.5		

¹ Suggested tutorial hours will not carry any credits

² By default, all courses are mapped to PO 12 as they are weakly contributing

³ It is mandate for all students to pursue an online certification course for minimum duration of 30 hours covering the areas of Sustainability, Climate changes, Environmental Impact Assessment in line with Sustainable Development Goals (SDG)

Semester IV

No.	Course Code	Course	POs	Contact Hours				
				L	T	P	C	
01	20HSX03	Managerial Economics & Financial Analysis	11	3	0	0	3.0	HS
02	20EE403	Control Systems	3,PS01	3	1	0	3.0	ES
03	20EC403	Pulse and Digital Circuits	1,2,3, PS01	3	0	0	3.0	PC
04	20EC404	Electromagnetic Waves & Transmission Lines	1,2,3,7,PS01	3	1	0	3.0	PC
05	20EC405	Electronic Circuit Analysis	1,2,3, PS01	3	1	0	3.0	PC
06	20EC406	Pulse and Digital Circuits Lab	4,9,PS01	0	0	3	1.5	PC
07	20EC407	Electronic Circuit Analysis Lab	4,5,9,PS01	0	0	3	1.5	PC
08	20EE408	Control Systems Lab	4,PS01	0	0	3	1.5	ES
09	20ECS02	Basics of Python Programming	1,5	1	0	2	2.0	SC
Sub-total				16	3	11	21.5	

Semester V

01	20EC501	Analog & Digital Communications	1,2,3,PS01	3	1	0	3	PC
02	20EC502	Linear & Digital IC Applications	1,2,3,PS01	3	1	0	3	PC
03	20EC503	Antennas & Wave Propagation	1,2,3,7,PS01	3	1	0	3	PC
04	-	Professional Elective I	-	3	0	0	3	PE
05	-	Open Elective I	-	3	0	0	3	OE
06	20EC506	Linear & Digital IC Applications Lab	4,5,9,PS02	0	0	3	1.5	PC
07	20EC507	Analog & Digital Communications Lab	4,5,9,PS01,2	0	0	3	1.5	PC
08	20ECS03	Fundamentals of Internet of Things	1,2,3,4,9, PS01	0	0	4	2.0	SC
09	-	Technical Paper Writing ⁴	-	-	-	2	-	AC
10	20MCX03	Intellectual Property Rights and Patents ⁵	-	2	0	0	0.0	MC
11	-	Summer Internship #1 ⁶ /CSP	4,5,9,10,PS01	0	0	0	1.5	IR
Sub-total				17	3	12	21.5	

⁴ The students are expected to identify one research area in the recent trends, collect recent research articles, prepare a technical research review paper and publish in renowned annual conferences/ journals, preferably indexed in Scopus or UGC care

⁵ The students are expected to identify one research area in the recent trends, collect recent research articles, prepare a technical research review paper and publish in renowned annual conferences/ journals, preferably indexed in Scopus or UGC care

⁶ The work pertaining to summer Internship #1 and #2 shall be completed at the end of the semesters IV & VI respectively. The assessment shall be carried out during the semesters V and VII It is mandate for all the students to undergo 4-6 weeks of industrial training and appear for assessment during Semester V with report. With regard to Community Service Project (CSP), based on the availability the students can opt CSP as an alternate option for summer internship #1 for a duration of 08 weeks

Semester VI

No.	Course Code	Course	POs	Contact Hours				
				L	T	P	C	
01	20EC601	Microwave Engineering	1,2,3,7,PSO1	3	1	0	3.0	PC
02	20EC602	Digital Signal Processing	1,2,3,4,PSO1	3	1	0	3.0	PC
03	20EC603	Microprocessors and Microcontrollers	1,2,3	3	1	0	3.0	PC
04	-	Professional Elective II	-	3	0	0	3.0	PE
05	-	Open Elective II	-	3	0	0	3.0	OE
06	20EC606	Microprocessors and Microcontrollers Lab	4,5,9,PSO2	0	-	3	1.5	PC
07	20EC607	Digital Signal Processing Lab	4,5,PSO2	0	-	3	1.5	PC
08	20EC608	Microwave and Radiating Systems Lab	4,5,6,PSO1,2	0	-	3	1.5	PC
09	20ECS04	Fundamentals of Machine Learning	1,2,3	1	-	2	2.0	SO
10	20MCX04	Indian Traditional Knowledge ⁷	-	2	-	-	-	IS
Sub-total				18	3	11	21.5	

Semester VII

01	-	Professional Elective III	-	3	0	0	3	PE
02	-	Professional Elective IV	-	3	0	0	3	PE
03	-	Professional Elective V	-	3	0	0	3	PE
04	-	Open Elective III	-	3	0	0	3	OE
05	-	Open Elective IV	-	3	0	0	3	OE
06	20HSX04	Professional Ethics	8	3	0	0	3	HS
07	20ECS05	Android App Development	1,2,3,5,PSO1	1	0	2	2	SO
08	-	Summer Internship #2 ⁸	4,5,9,10,PSO1	-	-	-	3	IS
Sub-total				19	0	2	23.0	

Semester VIII

01	-	Full Semester Internship#3 ⁹	5,8,9,10,PSO1	0	0	0	6	IS
02	-	Capstone Project	1-10,PSO1&2	0	0	0	6	IS
Sub-total				-	-	-	12.0	
Total Credits							160	

⁷ It is mandate for all the students to pursue an online certification course for minimum duration of 30 hours covering the application of ITK in Science Engineering & Technology

⁸ It is mandate for all the students to undergo 6-8 weeks of industrial training and appear for assessment during Semester VII with report and those opted FSI during Semester VII shall appear through online for reviews

⁹ Students opting for FSI in VII semester have to take up courses of VII semester in VIII semester. The students are expected to do a capstone project parallelly demonstrating their POs & PSOs and submit a separate report

List of Electives

Professional Elective #1	
1	20EC001 Computer Hardware Description Language - 3 0 0 3.0 PE
2	20EC002 Communication Systems - 3 0 0 3.0 PE
3	20EC003 Artificial Intelligence - 3 0 0 3.0 PE
4	20EC004 Computer Architecture and Organization - 3 0 0 3.0 PE
5	20EC005 Advanced Electromagnetic - 3 0 0 3.0 PE
6	20EC006 Electronic Measurements & Instrumentation - 3 0 0 3.0 PE
Professional Elective #2	
7	20EC007 VLSI Design - 3 0 0 3.0 PE
8	20EC008 Wireless Communications and Networks - 3 0 0 3.0 PE
9	20EC009 Speech Processing - 3 0 0 3.0 PE
10	20EC010 Computer Networks - 3 0 0 3.0 PE
11	20EC011 RF Components and Circuit Design - 3 0 0 3.0 PE
12	20EC012 Bio-Medical Instrumentation - 3 0 0 3.0 PE
Professional Elective #3	
13	20EC013 Digital VLSI - 3 0 0 3.0 PE
14	20EC014 Satellite Communications - 3 0 0 3.0 PE
15	20EC015 Digital Image Processing Techniques - 3 0 0 3.0 PE
16	20EC016 Embedded System Design - 3 0 0 3.0 PE
17	20EC017 Smart Antennas - 3 0 0 3.0 PE
18	20EC018 Process Control Instrumentation - 3 0 0 3.0 PE
Professional Elective #4	
19	20EC019 Analog VLSI - 3 0 0 3.0 PE
20	20EC020 Radar Engineering - 3 0 0 3.0 PE
21	20EC021 Video Processing and Applications - 3 0 0 3.0 PE
22	20EC022 Embedded Internet of Things - 3 0 0 3.0 PE
23	20EC023 Micro Electro Mechanical Systems - 3 0 0 3.0 PE
24	20EC024 Modern Industrial Automation - 3 0 0 3.0 PE
Professional Elective #5	
The curriculum provides academic flexibility to choose any of the domain specific courses from MOOCs as approved by the respective Board of Studies and Academic Council. The students can take up this course on self-study mode. The course shall be of 45 – 60 hours duration (4-credits) and the assessment shall be as per the academic regulation 2020. PE	
Open Elective #1	
25	20CE001 Urban Environmental Service - 3 0 0 3.0 OE
26	20CS001 Data Structures and Algorithms - 3 0 0 3.0 OE
27	20AIC01 Machine Learning for Engineers - 3 0 0 3.0 OE
28	20DS001 Introduction to Database Management Systems - 3 0 0 3.0 OE
29	20ECD01 Architectures and Algorithms of IoT - 3 0 0 3.0 OE
30	20EED01 Introduction to Renewable Energy Sources - 3 0 0 3.0 OE
31	20MEO01 Nano Technology - 3 0 0 3.0 OE
32	20SHO01 Women and Society - 3 0 0 3.0 OE
Open Elective #2	
33	20CED02 Ecology, Environment and Resource Management - 3 0 0 3.0 OE
34	20CS002 Internet of Things - 3 0 0 3.0 OE
35	20AIC02 Fundamentals of Deep Learning - 3 0 0 3.0 OE
36	20DS002 Introduction to Data Science - 3 0 0 3.0 OE
37	20ECD02 IoT for Smart Grids - 3 0 0 3.0 OE
38	20EEO02 Electrical Safety and Management - 3 0 0 3.0 OE
39	20MEO02 Fundamentals of Automobile Engineering - 3 0 0 3.0 OE
Open Elective #3	
40	20CE003 Disaster, Risk Mitigation and Management - 3 0 0 3.0 OE
41	20CS404 Operating Systems - 3 0 0 3.0 OE
42	20AIC03 Fundamentals of AI - 3 0 0 3.0 OE

43	20DSO03	Introduction to Big Data	-	3	0	0	3.0	OE
44	20ECO03	Privacy and Security in IoT	-	3	0	0	3.0	OE
45	20EEO03	Low-cost Automation	-	3	0	0	3.0	OE
46	20MEO03	Industrial Automation	-	3	0	0	3.0	OE
47	20SHO02	Design Innovations	-	3	0	0	3.0	OE

Open Elective #4

The curriculum provides academic flexibility to choose any of the inter-disciplinary courses from MOOCs as approved by the respective Board of Studies and Academic Council. The students can take up this course on self-study mode. The course shall be of 45 - 60 hours duration and the assessment shall be as per the academic regulation 2020.

OE

B. Tech. (Honors)

Category I

1	20ECH01	Low Power VLSI Design	-	4	0	0	4.0	HO
2	20ECH02	DSP Processors and Architectures	-	4	0	0	4.0	HO
3	20ECH03	Information Theory and Coding	-	4	0	0	4.0	HO

Category II

4	20ECH04	Hardware Design using Verilog	-	4	0	0	4.0	HO
5	20ECH05	Advanced Digital Signal Processing	-	4	0	0	4.0	HO
6	20ECH06	Advanced Digital Communications	-	4	0	0	4.0	HO

Category III

7	20ECH07	Design of Digital Integrated Circuits	-	4	0	0	4.0	HO
8	20ECH08	Pattern Recognition	-	4	0	0	4.0	HO
9	20ECH09	Advanced 3G and 4G Mobile Communications	-	4	0	0	4.0	HO

Category IV

10	20ECH10	Simulation and Testing Methods for VLSI Design	-	4	0	0	4.0	HO
11	20ECH11	Digital Signal & Image Processing using MATLAB	-	4	0	0	4.0	HO
12	20ECH12	5G Mobile and Wireless Technology	-	4	0	0	4.0	HO

B. Tech. (Minor with Specialization)

Category I

1	20CEM01	Air Pollution	-	3	0	0	3.0	MI
2	20CSM01	E-Commerce	-	3	0	0	3.0	MI
3	20MEM01	Biomaterials	-	3	0	0	3.0	MI
4	20EEM01	Basic Control Systems	-	3	0	0	3.0	MI
5	20ECM01	Semiconductor Devices and Circuits	-	3	0	0	3.0	MI
6	20AIM01	Fundamentals of Neural Networks	-	3	0	0	3.0	MI
7	20DSM01	Introduction to R Programming	-	3	0	0	3.0	MI
8	20SHM01	Psychology	-	3	0	0	3.0	MI
9	20SHM02	Statistical Methods	-	3	0	0	3.0	MI
10	20MBM01	General Management	-	3	0	0	3.0	MI
11	20MBM02	Human Resource Planning	-	3	0	0	3.0	MI

Category II

12	20CEM02	Climate Change Mitigation and Adaptation	-	3	0	0	3.0	MI
13	20CSM02	Knowledge Discovery and Databases	-	3	0	0	3.0	MI
14	20MEM02	Micro Electromechanical Systems	-	3	0	0	3.0	MI
15	20EEM02	Basics of Electrical Machines and drives	-	3	0	0	3.0	MI
16	20ECM02	Digital Electronics	-	3	0	0	3.0	MI
17	20AIM02	Machine Learning with Python	-	3	0	0	3.0	MI
18	20DSM02	Data Management and Analysis	-	3	0	0	3.0	MI
19	20SHM03	English for Media	-	3	0	0	3.0	MI
20	20SHM04	Statistical Inference	-	3	0	0	3.0	MI
21	20MBM03	Organization Behaviour	-	3	0	0	3.0	MI
22	20MBM04	Compensation Management & Employee Welfare Laws	-	3	0	0	3.0	MI

Category III

23	20CEM03	Sustainability and Pollution Prevention Practices	-	3	0	0	3.0	MI
24	20CSM03	Database Security	-	3	0	0	3.0	MI
25	20MEM03	Surface Engineering	-	3	0	0	3.0	MI
26	20EEM03	Electrical Engineering Material Science	-	3	0	0	3.0	MI

27	20ECM03	Analog Electronic Circuits	-	3	0	0	3.0	MI
28	20AIM03	Interpretable Machine Learning	-	3	0	0	3.0	MI
29	20DSM03	Data Governance	-	3	0	0	3.0	MI
30	20SHM06	Journalism	-	3	0	0	3.0	MI
31	20SHM07	Statistical Quality Control	-	3	0	0	3.0	MI
32	20MBM05	Entrepreneurship & Business Venture Planning	-	3	0	0	3.0	MI
33	20MBM06	Performance Management & Talent Management	-	3	0	0	3.0	MI

Short Term Skill Oriented Electives

34	20ECS01	Printed Circuit Board Design	4	0	0	4	2.0	SC
35	20ECS02	Basics of Python Programming	1,5	0	0	4	2.0	SC
36	20ECS03	Fundamentals of Machine Learning	1,5	0	0	4	2.0	SC

Long Term Skill Oriented Courses (Industry Oriented)¹⁰

37	20ICC01	Competitive Programming	-	2	0	8	6.0	ICC
38	20ICC02	Web Technologies - Transferring to Practice	-	2	0	8	6.0	ICC
39	20ICC03	Java and Spring boot	-	2	0	8	6.0	ICC
40	20ICC04	Robotics Process Automation	-	2	0	8	6.0	ICC
41	20ICC05	Information Security and Forensics	-	2	0	8	6.0	ICC
42	20ICC06	Battery System - Design Engineering	-	2	0	8	6.0	ICC
43	20ICC07	Blockchain Technology	-	2	0	8	6.0	ICC
44	20ICC08	Network Administration	-	2	0	8	6.0	ICC
45	20ICC09	Product Engineering	-	2	0	14	9.0	ICC
46	20ICC10	Machine Learning Engineer	-	2	0	8	6.0	ICC
47	20ICC11	Data Scientist	-	2	0	8	6.0	ICC
48	20ICC12	Industrial IOT	-	2	0	8	6.0	ICC

List of Honors offered by Electronics & Communication Engineering Program

1. VLSI System Design
2. Digital Signal & Image Processing
3. Advanced Communication Systems

List of Minor with Specialization offered by Electronics & Communication Engineering Program

1. Semiconductor Devices and Circuits
2. Digital Electronics
3. Analog Electronics Circuits

List of Minor's offered by the Freshman Engineering and Management studies such as

1. Liberal Arts
2. Statistics
3. General Management
4. Human Resource Management these will be implemented for the 2021 admitted students

¹⁰ The credits earned through Industry Connect Courses (Skill Oriented Course) can be tradeoff with any other 3-Credit course other than Professional Core