

T.E. Semester –VI (E&TC)
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)

B. E. (Electronics & Telecommunication Engineering)					T.E. (SEM: VI)					
Course Name: Microelectronics					Course Code: PEC-ETC6011					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory			Practical/Oral	Term Work	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW	125
3	-	-	3	3	20	20	60	-	25	
ISE: In-Semester Examination - Paper Duration – 1 Hours IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 3 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: EDC and AC										

Course Objective: The course intends to develop in students the ability to analyze and design analog MOS integrated circuits, emphasizing fundamentals as well as new techniques that students need to master in today's industry.

Course Outcomes: Upon completion of the course students will be able to:

Sr.No.	Course outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Identify the fabrication process of NMOS and PMOS along with mask layout diagram.	L1
2	Analyze various constant current source circuit using MOS.	L1, L2, L3
3	Analyze MOS active and advance active load for its Parameters	L1, L2, L3, L4
4	Design and implement active load MOS amplifier.	L1, L2, L3, L4, L5
5	Design and implement active load differential amplifier	L1, L2, L3, L4
6	Explain passive device fabrication in IC, its need and analyze various power amplifiers using MOS.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basics of MOSFETs	8	L1
	Introduction to various fabrication process (in brief) Fabrication of NMOS and PMOS transistors along with mask layout diagram, Scaling of MOSFET, Various Short channel effects in MOSFET, Second order effects in MOSFET, MOS as controlled resistor, MOS device capacitances.		
2	Integrated Circuit Biasing		L1, L2, L3, L4

	Current Mirror, cascade current source, Wilson current source, bias independent current source using MOSFET.	7	
3	Active Loads using MOSFET	7	L1, L2, L3, L4
	DC analysis and small signal analysis of MOS active load, DC analysis and small signal analysis of MOS advanced active load.		
4	Single Stage MOS Active Load amplifiers	08	L1, L2, L3, L4, L5
	CS amplifier with current source load, CS amplifier with diode connected load, CS amplifier with current source load, Common gate circuit, Cascode amplifier, Double Cascoding, Folded Cascode.		
5	Active Load MOSFET Differential Amplifier	08	L1, L2, L3, L4
	Basic MOS Differential Amplifier, DC transfer characteristics, small signal equivalent analysis, MOS differential amplifier with active load, MOS differential amplifier with cascode active load.		
6	Power Amplifiers & Passive Device Fabrication in IC	7	L1, L2, L3
	Class A, class B, Class C, Class D, Class E, Class F using MOSFET. Fabrication of inductors, fabrication of transformers, fabrication of capacitors.		
	Total Hours	45	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Microelectronic Circuits-Theory and Application Advanced engineering mathematics	Sedra, K. Smith, adapted by A. Chanorkar	Oxford Higher Education	7 th	2015
2	Electronic Circuits Analysis and Design	D. Neamen	McGraw Hill Education	3 rd	2007
3	Design of Analog Integrated Circuits	B. Razavi	McGraw Hill Education	Indian Edition	2000
4	R F Microelectronics	B. Razavi	Pearson Education	2 nd	2011

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.swayam.gov.in	https://swayam.gov.in/nd1_noc19_ee38/preview	M1-M5
2	www.edx.org	https://www.edx.org/course/essentials-of-mosfetshttps://www.studytonight.com/data-structures/introduction-to-data-structures	M1, M6
3	www.swayam.gov.in	https://swayam.gov.in/nd1_noc19_ee54/preview	M1-M4

B. E. (Electronics & Telecommunication Engineering)					T.E. (SEM: VI)					
Course Name: Antenna & Wave Propagation					Course Code: PEC-ETC6012					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory			Practical/Oral	Term Work	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW	125
3	-	-	3	3	20	20	60	-	25	
ISE: In-Semester Examination - Paper Duration – 1 Hours IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 3 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Electromagnetic Engineering										

Course Objectives:

The course intends to give understanding of fundamental parameters and its measurement along with design concept of linear wire antenna, patch antenna, antenna array. This course also explains about different modes of wave propagation.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course outcomes	Cognitive Level as per Bloom's Taxonomy
1	Define Basic antenna parameters like radiation pattern, directivity and gain etc.	L1, L2, L3
2	Derive the field equations for the basic radiating elements like linear wire antenna and loop antenna.	L1, L2, L3, L4
3	Explain construction and working of micro strip antenna. Design micro strip antenna for a given application.	L1, L2, L3,L4,L5
4	Derive expression for N Element array. Design linear arrays with given specification.	L1,L2,L3,L4,L5
5	Explain special types of Antennas like Reflectors and Horn antenna.	L2
6	Explain method for measuring different parameters of antenna. Explain wave propagation and its parameters.	L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive Level as per Bloom's Taxonomy
	Antenna Fundamentals		

1	Introduction, Radiation Mechanism, basic antenna parameters, Radiation pattern, radiation power density, radiation intensity, Beam width, directivity, Antenna efficiency, Gain, beam efficiency, bandwidth, polarization, input impedance, antenna vector effective length and equivalent areas, Antenna radiation efficiency, Friis transmission equation, Basic concepts of Maxwell's equation, Retarded vector Potential, near field and far field radiation, Principal significance of vector Analysis and co-ordinate system	07	L1, L2, L3
2	Wire Elements: Dipoles, Monopoles, Loops and Helical Infinitesimal dipole, radiation fields, radiation resistance, radiation sphere, near field, far field directivity, small dipole, finite length dipole, half wave length dipole, Monopole antenna and Effect of imperfect earth, Loop Antenna: Small circular loop, radiation patterns its parameters and their application, Helical Antennas: Axial mode and normal mode propagation, Circular polarization using Helical Antenna.	09	L1, L2, L3, L4
3	Patch Antenna Microstrip antenna (MSA): Introduction, Feeding Techniques, Regular Shape MSAs (Rectangular, Circular, Equilateral Triangular), Design of Regular shape MSAs	04	L1, L2, L3, L4, L5
4	Arrays Linear arrays, Array of two isotropic point sources, linear arrays of N elements, principle of pattern multiplication applicable to non- isotropic sources, broadside and End-fire Array, Calculations of Directivity, Beam width, Maxima and null directions for N-element Array. Design of Yagi antenna and Log Periodic antenna and its Radiation pattern	10	L1, L2, L3, L4, L5
5	Aperture Antennas Horn Antennas: E-Plane Sectoral Horn, H-Plane Sectoral Horn, Pyramidal Horn, Conical Horn, Reflector Antennas: Introduction, Plane Reflector, Corner Reflector, Parabolic Reflector, Design Considerations and comparison, Cassegrain Feed	07	L2
6	Antenna Measurements & Wave Propagation Antenna Measurements: Measurement of Antenna parameters: Input Impedance, Radiation Pattern, Gain (Two and Three antenna method), Polarization, Ground wave Propagation and effect of imperfect earth Sky Wave Propagation, Ionosphere and Earth magnetic field effect, Critical frequency, Angle of incidence, Maximum usable frequency, Skip distance, Virtual height, Variations in ionosphere and Attenuation and fading of waves in ionosphere, Space Wave Propagation	08	L2
	Total	45	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
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1	Antenna Theory Analysis and Design	C. A. Balanis	John Wiley & Sons, Hoboken, NJ	3 rd Edition,	2005
2	Antennas & Wave Propagation	. J. D. Kraus, R. J. Marhefka, A.S. Khan	McGraw Hill.	4th Edition	2011
3	Broadband Microstrip Antenna	G. Kumar, K. P. Ray	Artech House	4th Edition	2002
4	Antenna Theory and Design	Stutzman, Theile	John Wiley and Sons	3 rd Edition	-
5	Antennas and Radio Wave Propagation	. R. E. Collin	McGraw Hill.	International Student Edition	-

Online References:

Sr.No	Website Name	URL	Module covered
01	www.nptel.ac.in	https://onlinecourses-archive.nptel.ac.in/noc19_ee19/preview	M1 to M5

B. E. (Electronics & Telecommunication Engineering)					T.E. (SEM: VI)					
Course Name: Digital Image Processing					Course Code: PEC-ETC6013					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory			Practical/Oral	Term Work	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW	125
3	-	-	3	3	20	20	60	-	25	
ISE: In-Semester Examination - Paper Duration – 1 Hours IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 3 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Signals and systems, Discrete Time Signal Processing										

Course Objectives:

To introduce students, the concept and theory of Digital Image Processing, apply transform on digital images and analysis and its characterization in spatial and frequency domain. This course introduces students to the fundamentals of digital image processing, and various image transforms, image restoration techniques, image compression and segmentation used in digital image processing.

Course Outcomes:

SN	Course outcomes	RBT Levels
1	Able to describe the formation of digital images in a computer and also various image color models.	L1, L2, L3
2	Able to calculate the transform and also the inverse transform of a given image.	L1, L2, L3
3	Able to describe and perform image enhancement in spatial and frequency domain	L1, L2, L3
4	Able to describe image restoration models and techniques	L1, L2, L3
5	Able to describe image segmentation techniques based on Discontinuities and Similarities	L1, L2, L3
6	Able to describe texture Description Methods.	L1

Detailed Syllabus:

Module No.	Topics	Hrs.	RBT Levels
1	Digital Image Fundamentals	6	L1, L2, L3
	Introduction – Origin – Steps in Digital Image Processing , Components, Elements of Visual Perception – Image Sensing and Acquisition, Image Sampling and Quantization – Relationships between pixels, Transformation: Orthogonal, Euclidean, Affine. Color Image Processing: Color Fundamentals Color models.		
2	Image Transforms	6	L1, L2, L3
	1-D DFT, 2-D Discrete Fourier Transform and Its Inverse, Some Properties of 2D DFT, Walsh -Hadamard, Discrete Cosine Transform, Haar Transform		
3	Image Enhancement	8	L1, L2, L3
	Image Negative, Log Transform, Power Law transform, Histogram equalization and Histogram Specification Spatial Domain: Basics of Spatial Filtering, The Mechanics of Spatial Filtering, Generating Spatial Filter Masks–Smoothing and Sharpening Spatial Filtering Frequency Domain: The Basics of Filtering in the Frequency Domain, Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Laplacian, Unsharp Masking and Homomorphic filters		
4	Morphology & Image Restoration	6	L1, L2, L3
	Morphology: Erosion and Dilation, Opening and Closing, The Hit- or-Miss Transformation. Restoration :Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters		
5	Image Segmentation	12	L1, L2, L3
	Point edge models, basic and advance edge detection, Edge linking and boundary detection , Canny's edge detection algorithm, Line, and Edge Detection: Detection of Isolated Points, Line detection Thresholding : Foundation, Role of illumination, Basic Global thresholding Region Based segmentation: Region Growing, Region Splitting and merging Region Identification , chain code, simple geometric border representation, Fourier Transform of boundaries, Boundary description using segment sequences, B-spline representation		
6	Boundary Description & Object Recognition		L1, L2

	<p>Texture: Statistical Texture Description Methods- Methods based on spatial frequencies, co-occurrence matrices, edge frequency, primitive length, Law’s texture energy measures</p> <p>Object Recognition: Knowledge representation, Classification Principles, Classifier setting, Classifier Learning, Support vector machine, cluster analysis</p>	10
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Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Digital Image Processing	Gonzales and Woods	Pearson Education	3 rd Edition,	2011
2	Image Processing, Analysis, and Machine Vision	Milan Sonka, Vaclav Hlavac, Roger Boyle	Cengage Engineering	3 rd Edition,	2013
3	Fundamentals of Image Processing	Anil K. Jain	Prentice Hall of India	1 st Edition,	1989
4	Digital Image Processing	W Pratt	Wiley Publication	3 rd Edition,	2002

Online Resources:

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.nptel.ac.in	Digital Image Processing - Course (nptel.ac.in)	M1-M3 M1-M5
2	https://www.coursera.org/	Fundamentals of Digital Image and Video Processing Course (NWU) Coursera	M1-M5
3	https://www.coursera.org/	Image and Video Processing: From Mars to Hollywood with a Stop at the Hospital Course (Duke) Coursera	M1-M5

BE (Electronics & Telecommunication Engineering)						T. E. (SEM: VI)					
Course Name: Fiber Optics & Networks						Course Code: PEC-ETC6014					
Teaching Scheme (Program Specific)						Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage						Modes of Continuous Assessment / Evaluation					
Hours Per Week						IA		ESE	Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	-	25	125	
3	-	-	3	3	20	20	60				
IA: In Semester Assessment- Paper Duration – 1 Hours											
ESE: End Semester Evaluation- Paper Duration - 2 Hours											
The weightage of marks for continuous evaluation of Term work/Report: Formative (50%), Timely, Attendance/Learning Attitude (50%)											
Prerequisite: Analog Communication, Digital Communication, Engineering Physics, Electromagnetic Engineering											

Course Objective:

To understand the optical fiber communication system, High data rate WDM optical transport networks, link budget design and management.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the fundamentals, advantages, and advances in optical communication system	L1, L2, L3,L4,L5
2	Acquire a detailed understanding of types, basic properties, and transmission characteristics of optical fibers	L1, L2, L3, L4
3	Understand nonlinear optical effects in optical fiber and their applications.	L1, L2, L3,L4,L5
4	Design time and power budget for optical communication link.	L1, L2, L3, L4
5	Identify the issues related to signal degradation and multiplexing.	L1, L2, L3
6	Explore concepts like Fiber to the X (FTTX), Passive Optical networks, WDM, DWD.	L1, L2, L3

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	Optical Fibers and their Properties	10	

	Optical fiber waveguides, Ray theory, cylindrical fiber (no derivations), single mode fiber, cutoff wavelength, and mode field diameter. Wave guiding principles, Types and classification of optical fibers, loss and bandwidth, Fiber materials, Fabrication, and mechanical properties		L1, L2, L3, L4, L5
2	Transmission Characteristics of Optical Fiber	09	L1, L2, L3, L4, L5
	Attenuation, absorption, linear and nonlinear scattering losses, bending losses, modal dispersion, waveguide dispersion, dispersion and pulse broadening, dispersion shifted, and dispersion flattened fibers. General Overview of non-linearities, Stimulated Raman Scattering, Stimulated Brillouin Scattering, Self-Phase modulation, Cross-Phase modulation, Four Wave Mixing, Solitons. Measurements of attenuation, dispersion and OTDR		
3	Components of WDM and Link design	08	L1, L2, L3
	Optical Components – Fiber joints and splices, Couplers, Isolators and Circulators, Multiplexers, Gratings, Filters Optical Amplifiers. Transmitters, Detectors, Switches, Wavelength Converters, Link power budget and rise time budget.		
4	WDM Network Design	06	L1, L2, L3
	Introduction to DWDM & CWDM, Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers, OADM Architectures, Optical Cross connects.		
5	Passive Optical Network (PON) and Photonic Packet Switching	06	L1, L2, L3
	Passive Optical Networks, Fiber to the X, Optical Time Division Multiplexing & Demultiplexing, Bit Interleaving, Packet Interleaving, Optical AND Gates, Synchronization Tunable Delays, Optical Phase Lock Loop, Header Processing, Buffering, Burst switching		
6	Fi-Wi System: The Path to 5G	06	L1, L2, L3, L4, L5
	LTE Principles of Operation and Deployment, Fiber Wireless System, Fiber-Wireless Convergence and Technology Evolution, Analog and Digitized Radio-over-Fiber, Novel Network Architectures for Fi-Wi Networks, Advanced Architectures for PON Supporting Fi-Wi Convergence.		
Total Hours		45	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Optical Networks: A Practical Perspective	Sivarajan and Rajiv Ramaswamy	Elsevier Publication	3rd	2010
2	Fiber Optic Communication Systems	G. Agarwal	John Wiley and Sons	3rd	2010
3	WDM Optical Networks: Concept, Design and Algorithms	C. Siva Ram Moorthy and Mohan Gurusamy	Prentice Hall of India	1 st	2002
4	Advanced Optical Communication Systems and Networks	Milorad Cvijetic, Ivan B. Djordjevic	Pearson education	1 st	2007

5	Optical Networks	Biswajit Mukherjee	Artech House	1st	2012
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Online References:

Sr. No.	Website Name	URL	Modules Covered
1	NPTEL	https://swayam.gov.in/nd1_noc19_ee67/preview	M1, M2, M3, M4, M5, M6
2	NPTEL	https://nptel.ac.in/courses/117101054/	M1, M2, M3, M4, M5, M6
3	NPTEL	https://nptel.ac.in/noc/individual_course.php?id=noc17-ec07	M5, M6

B. E. (Electronics & Telecommunication Engineering)					T.E. (SEM: VI)					
Course Name: Embedded Systems & RTOS					Course Code: PEC-ETC6015					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory			Practical/Oral	Term Work	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW	125
3	-	-	3	3	20	20	60	-	25	
ISE: In-Semester Examination - Paper Duration – 1 Hours IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 3 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Digital Electronics, Basics of Microcontrollers										

Course Objective:

To explore key concepts related to Embedded Hardware and Software for system implementation. Understanding the principles of contemporary microcontroller cores such as the ARM-Cortex. Learn real-time programming for designing embedded systems with time constraints.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Identify and describe various characteristic features and applications of embedded systems.	L1, L2, L3,
2	Analyze and select hardware for embedded system implementation.	L1, L2, L3, L4
3	Evaluate various communication protocols for embedded system implementation.	L1, L2, L3,L4,L5
4	Compare GPOS and RTOS and investigate the concepts of RTOS.	L1, L2, L3, L4
5	Evaluate and use various tools for testing and debugging embedded systems	L1, L2, L3, L4
6	Design a system for different requirements based on life-cycle for the embedded system, keeping oneself aware of ethics and environmental issues.	L1, L2, L3,L4,L5

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy

1	Introduction to Embedded Systems	10	L1, L2, L3, L1, L2, L3, L4
	Definition, Characteristics, Classification, Applications, Design metrics of Embedded system and Challenges in optimization of metrics		
2	Embedded Hardware Elements	09	L1, L2, L3,L4,L5 L1, L2, L3, L4
	Features of Embedded cores- μ C, ASIC, ASSP, SoC, FPGA, RISC and CISC cores, Types of memories, Case Study: ARM Cortex-M3 Features, Architecture, Programmer's model, Special, Registers, Operating Modes and States, MPU, Memory map and NVIC, Low power - Need and techniques. Case study of Low Power modes in Cortex-M3, Communication Interfaces: Comparative study of Serial communication Interfaces -RS-232, RS-485, SPI, I2C, CAN, USB (v2.0), Bluetooth, Zig-Bee. (Frame formats of above protocols are not expected), Selection Criteria of Sensors and Actuators		
3	Embedded Software	08	L1, L2, L3, L4
	Program Modelling concepts: DFG, CDFG, FSM, Real-time Operating system: Need of RTOS in Embedded system software and comparison with GPOS. Task, Task states, Multi-tasking, Task scheduling, and algorithms- Preemptive SJF, Round-Robin, Priority, Rate Monotonic Scheduling, Earliest Deadline First Inter-process communication: Message queues, Mailbox, Event timers, Task synchronization: Need, Issues- Deadlock, Race condition, live Lock, Solutions using Mutex, Semaphores, Shared Data problem, Priority inversion.		
4	Testing and Debugging Methodology	06	L1, L2, L3, L1, L2, L3, L4
	Testing & Debugging: Hardware testing tools, Boundary-scan/JTAG interface concepts, Emulator, Software Testing tools, Simulator, Debugger. White-Box and Black-Box testing.		
5	System Integration (Case Studies)	06	L1, L2, L3,L4,L5
	Embedded Product Design Life-Cycle (EDLC)- Waterfall Model, Hardware-Software Co-design, Case studies for Automatic Chocolate Vending Machine, Washing Machine, Smart Card, highlighting 1. Specification requirements (choice of components), 2. Hardware architecture 3. Software architecture		
6	Introduction to FreeRTOS	06	L1, L2, L3, L4, L5
	FreeRTOS Task Management features, Resource Management features, Task, Synchronization features, Event Management features, Calculation of CPU, Utilization of an RTOS, Interrupt Management features, Time Management features..		
Total Hours		45	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Embedded Real Time System: Concepts, Design and Programming	Dr. K.V. K. K. Prasad	Dreamtech Publication	3 rd	2014

2	Embedded Systems: Architecture, Programming and Design	Rajkamal	McGraw Hill Education (India) Private Limited	3 rd	2015
3	Embedded Real Time Systems Programming	SriramIyer, Pankaj Gupta	Tata McGraw Hill Publishing Company Ltd	1 st	2003
4	The Definitive guide to ARM CORTEX-M3 & CORTEX-M4 Processors	Joseph Yiu	Elsevier	3 rd	2014
5	ARM System Developer's Guide Designing and Optimizing System Software	Andrew N. Sloss, Dominic Sysmes and Chris Wright	Elsevier Inc Morgan Kaufmann	1 st	2004

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	NPTEL	https://nptel.ac.in/courses/108102045	M1, M2, M3, M4, M5, M6
2	NPTEL	https://archive.nptel.ac.in/courses/106/105/106105193/	M1, M2, M3, M4, M5
3	NPTEL	https://onlinecourses.nptel.ac.in/noc20_cs14/preview	M1, M2, M3, M4,
4	NPTEL	https://onlinecourses.nptel.ac.in/noc20_ee98/preview	M1, M2, M3, M4, M5, M6

Semester-VI

**Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)
 Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)**

B.E. Computer Science & Engineering (Cyber Security)						T.E. SEM: VI				
Course Name: Open Elective I (Basics of Cyber Security and Laws)						Course Code: OEC701X				
Teaching Scheme (Program Specific)						Examination Scheme (Academic)				
Modes of Teaching / Learning / Weightage						Modes of Continuous Assessment / Evaluation				
Hours Per Week						Theory (100)		Practical/Oral/ Presentation (25)	Term Work (25)	Total
						40/20	60/30			
Theory	Tutorial	Practical	Contact Hours	Credits	IA		ESE	PR/OR	TW	100
					ISE	IE				
3	-	-	3	3	20	20	60	-	-	
IA: In-Semester Assessment - Paper Duration – 1 Hour ESE: End Semester Examination - Paper Duration – 2 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Cryptography and Network Security										

Course Objective: The course intends to deliver the fundamental knowledge to understand concepts of cyber law, intellectual property, cybercrimes, trademarks, domain theft, tools used in cyber security and analyze security policies, protocols applied in Indian IT Act 2008, security standards compliances.

Course Outcomes: Upon completion of the course students will be able to:

S.No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the concept of cybercrime and its effect on outside world	L1
2	Interpret and apply IT law in various legal issues , Analyse security challenges and issues	L1, L2, L3, L4
3	Understand and analyse various attack using tools like wire shark , key logger etc.	L1
4	Distinguish different aspects of cyber law	L1, L2, L3, L4
5	Study India IT Act and analyse different case studies	L1, L2, L3, L4
6	Apply Information Security Standards compliance during software design and development	L1, L2, L3, L4

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to Cybercrime	07	L1
	Introduction to Cybercrime: Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes		
2	Symmetric and Asymmetric Cryptography	09	L1, L2, L3, L4
	Introduction to symmetric cryptography, Substitution cipher, transposition cipher, stream and block cipher, and arithmetic modes for block ciphers, Introduction to asymmetric cryptography Primes, factorization, Fermat's little theorem, Euler's theorem, and extended Euclidean algorithm, RSA, attacks on RSA, Diffie Hellman key exchange, Message integrity, message authentication, MAC, hash function, H MAC		
3	Cyber offenses & Cybercrime	10	L1
	Cyber offenses & Cybercrime: How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Bot nets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops		
4	Tools and Methods Used in Cyber line	08	L1, L2, L3, L4
	Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)		
5	The Concept of Cyberspace	09	L1, L2, L3, L4
	E-Commerce, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law, Global Trends in Cyber Law, Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking, The Need for an Indian Cyber Law		
6	Indian IT Act.	07	L1, L2, L3, L4
	Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments		
Total Hours		45	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Cyber Security	Nina Godbole, Sunit Belapure	Wiley India, New Delhi	2 nd	2011
2	The Indian Cyber Law	Suresh T. Vishwanathan	Bharat Law House, New Delhi	2 nd	2015
3	Cyber Law & Cyber Crimes	Advocate Prashant Mali	Snow White Publications, Mumbai	2 nd	2015

4	Information Systems Security	Nina Godbole	Wiley India, New Delhi	2 nd	2014
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5	Cyber Security & Global Information Assurance	Kennetch J. Knapp	Information Science Publishing	1st	2009
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Online Resource

S.No.	Website Name	URL	Modules covered
1.	http://www.cyberralegalservices.com	http://www.cyberralegalservices.com/detail-casestudies.php	M1
2.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/information_security_cyber_law/offences_and_penalties	M2
3.	https://www.educba.com	https://www.educba.com/32-most-important-cyber-security-tools/	M3
4.	https://www.itu.int	https://www.itu.int/en/ITU-D/Cybersecurity/Documents/Introduction%20to%20the%20Concept%20of%20IT%20Security.pdf	M4
5.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/information_security_cyber_law/information_technology_act.htm	M5
6.	https://www.cimcor.com	https://www.cimcor.com	M6



TCET

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING (E&TC)

(Accredited by NBA for 3 years, 4th Cycle Accreditation w.e.f. 1st July 2022)

Choice Based Credit Grading System (CBCGS)

Under TCET Autonomy



T.E.Semester -VI

**Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
 Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)**

B.E Information Technology					(SEM : VI)							
Course Name: Basics of Robotic Process Automation (RPA)					Course Code : OEC6012							
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)							
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation							
Hours Per Week					Theory (100)			Practical/Oral (25)		Term Work (25)		Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR /OR		TW	125	
3	-	-	3	3	20	20	60	--		25		
ISE: In-Semester Examination- Paper Duration – 1Hours IE: Innovative Examination – 1 Hour ESE : End Semester Examination- Paper Duration - 3 Hours												
Prerequisite: Programming Languages , Software process.												

Course Objective: The course intends to deliver the fundamentals concepts of robotic process automation and the use of RPA tool for process automation in detail. It also focus on the development of bots and its deployment.

Course Outcomes: Upon completion of the course, student will be able to:

S.No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand and analyze business functionalities in Robotics Process Automation	L1, L2,L4
2	Analyze various tool software bots development	L1,L2,L3
3	Understand and apply variable and data manipulation using tool	L1,L2,L4
4	Implementing recorder and scraping utility for robotic process automation	L2,L3,L5
5	Perform exception handling and error reporting for RPA	L2,L3
6	Understand the steps involve for publishing the bots for automation	L2,L3, L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction	07	L1, L2, L4
	Robotic process automation need, benefits , component of RPA , databases , API Programming interface, Artificial Intelligence , Cognitive Automations , Agile , Scrum, Kanban and waterfall. Natural language processing and RPA		
2	Workflows & Control flows in RPA	09	L1, L2, L3
	Introduction, Installation and activation, Interfaces, Different types of workflows, Creating-a-basic-workflow, Debugging, Managing packages, Reusing Library, Source control, Activities guide, Workflow, Control Flow, Sequences, Flowcharts, State Machines, Control Flows, The-assign-activity, The-delay-activity, The-do-while-activity, The-if-activity, The-switch-activity, The-while-activity, The-for-each-activity, The-break-activity		
3	Variable , Datatable and Recording for RPA	09	L1, L2, L4
	Managing-variables, Naming-best-practices, The-variables-panel, Generic-value-variables, Text-variables, True-or-false-variables, Number-variables, Array-variables, Date-and-time-variables, Datatable-variables, Managing-arguments, Using-arguments, Data Manipulations, Data table , Excel Automation,		
4	Recording and Scraping	09	L2, L3, L5
	Recording Introduction, Recording Types- Automatic Recording, Manual Recording Scraping : UI Elements, Output-or-screen-scraping-methods, Examples-of-using-output-or-screen-scraping-methods, About-web-scraping, Example-of-using-web-scraping, data scraping		
5	Exception Handling , Debugging and Logging Exception Handling	08	L2, L3
	Unavailability of UI element, Handling runtime exceptions, Logging and taking screenshot, Debugging techniques, Collecting crush dumps, Error reporting.		
6	Deploy and Marinating Bots publishing using utility	06	L2, L3, L5
	How to publish a workflow, Writing editing publish package to .jsonfile. Overview of Orchestration Server- Queues, assets, process, developing a process. Using Orchestration server to control bots. Publish and managing update.		
	Total Hr.	45	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1.	Learning Robotic Process Automation Create software robots and automate business process with the leading RPA tool	Alok Mani Tripathi	Packt	1st	2018
4.	Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere	Nandan Mullakara , Arun Kumar Asokan	Packt	1 st	2020
3.	The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems 1st ed. Edition	Tom Taulli	Apress	1 st	2020

Online Recourses:

S. No.	Website Name	URL	Modules covered
1.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.htm	M1
2.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_working.htm	M2
3.	https://www.uipath.com	https://www.uipath.com/developers/video-tutorials/excel-and-datatables-automation	M3
4.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uipath/uipath_studio_data_scraping_and_screen_scraping.htm	M4
5.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uipath/uipath_studio_automation_projects_and_debugging.htm	M5
6.	https://docs.uipath.com	https://docs.uipath.com/orchestrator/docs/publishing-a-project-from-studio-to-orchestrator	M6

T.E.Semester -VI

**Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
 Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)**

B.E Information Technology					(SEM : VI)							
Course Name: Basics of Robotic Process Automation (RPA)					Course Code : OEC6012							
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)							
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation							
Hours Per Week					Theory (100)			Practical/Oral (25)		Term Work (25)		Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR /OR		TW	125	
3	-	-	3	3	20	20	60	--		25		
ISE: In-Semester Examination- Paper Duration – 1Hours IE: Innovative Examination – 1 Hour ESE : End Semester Examination- Paper Duration - 3 Hours												
Prerequisite: Programming Languages , Software process.												

Course Objective: The course intends to deliver the fundamentals concepts of robotic process automation and the use of RPA tool for process automation in detail. It also focus on the development of bots and its deployment.

Course Outcomes: Upon completion of the course, student will be able to:

S.No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand and analyze business functionalities in Robotics Process Automation	L1, L2,L4
2	Analyze various tool software bots development	L1,L2,L3
3	Understand and apply variable and data manipulation using tool	L1,L2,L4
4	Implementing recorder and scraping utility for robotic process automation	L2,L3,L5
5	Perform exception handling and error reporting for RPA	L2,L3
6	Understand the steps involve for publishing the bots for automation	L2,L3, L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction	07	L1, L2, L4
	Robotic process automation need, benefits , component of RPA , databases , API Programming interface, Artificial Intelligence , Cognitive Automations , Agile , Scrum, Kanban and waterfall. Natural language processing and RPA		
2	Workflows & Control flows in RPA	09	L1, L2, L3
	Introduction, Installation and activation, Interfaces, Different types of workflows, Creating-a-basic-workflow, Debugging, Managing packages, Reusing Library, Source control, Activities guide, Workflow, Control Flow, Sequences, Flowcharts, State Machines, Control Flows, The-assign-activity, The-delay-activity, The-do-while-activity, The-if-activity, The-switch-activity, The-while-activity, The-for-each-activity, The-break-activity		
3	Variable , Datatable and Recording for RPA	09	L1, L2, L4
	Managing-variables, Naming-best-practices, The-variables-panel, Generic-value-variables, Text-variables, True-or-false-variables, Number-variables, Array-variables, Date-and-time-variables, Datatable-variables, Managing-arguments, Using-arguments, Data Manipulations, Data table , Excel Automation,		
4	Recording and Scraping	09	L2, L3, L5
	Recording Introduction, Recording Types- Automatic Recording, Manual Recording Scraping : UI Elements, Output-or-screen-scraping-methods, Examples-of-using-output-or-screen-scraping-methods, About-web-scraping, Example-of-using-web-scraping, data scraping		
5	Exception Handling , Debugging and Logging Exception Handling	08	L2, L3
	Unavailability of UI element, Handling runtime exceptions, Logging and taking screenshot, Debugging techniques, Collecting crush dumps, Error reporting.		
6	Deploy and Marinating Bots publishing using utility	06	L2, L3, L5
	How to publish a workflow, Writing editing publish package to .jsonfile. Overview of Orchestration Server- Queues, assets, process, developing a process. Using Orchestration server to control bots. Publish and managing update.		
	Total Hr.	45	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1.	Learning Robotic Process Automation Create software robots and automate business process with the leading RPA tool	Alok Mani Tripathi	Packt	1st	2018
4.	Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere	Nandan Mullakara , Arun Kumar Asokan	Packt	1 st	2020
3.	The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems 1st ed. Edition	Tom Taulli	Apress	1 st	2020

Online Recourses:

S. No.	Website Name	URL	Modules covered
1.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.htm	M1
2.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_working.htm	M2
3.	https://www.uipath.com	https://www.uipath.com/developers/video-tutorials/excel-and-datatables-automation	M3
4.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uipath/uipath_studio_data_scraping_and_screen_scraping.htm	M4
5.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uipath/uipath_studio_automation_projects_and_debugging.htm	M5
6.	https://docs.uipath.com	https://docs.uipath.com/orchestrator/docs/publishing-a-project-from-studio-to-orchestrator	M6

Semester –VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary
Education (CBCGS-HME 2020)

T.E. ()					(SEM: VI)						
Course Name: English for Competitive Examinations					Course Code:						
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)						
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment/ Evaluation						
Hours Per Week					Theory 60			Practical/ Oral		Term Work	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	OR		TW	60
	-						60			-	
Prerequisite- Basic knowledge of English language, Grammar and Vocabulary											

Course Objective: The course will be able to develop understanding of English from competitive examination perspective.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive Levels of Attainment as per Revised Bloom's Taxonomy
1	Understanding vocabulary, intensive and extensive comprehension	L1, L2, L3
2	To gain competence in grammatical rules and different types of sentence construction	L1, L2, L3
3	To Develop writing skills required for competitive examination	L1, L2, L3
4	Accomplishing communicative skills	L1, L2, L3
5	To enhance competitive oriented critical reasoning and logic	L1, L2, L3
6	To increase the awareness about current affairs and general awareness	L1, L2, L3

Detailed Syllabus (Total No. of Hours: 30):

Module No.	Topics	Hrs.	Cognitive Levels of Attainment as per Revised Bloom's Taxonomy
1	Vocabulary Building and Comprehension	05	L1, L2, L3
	1.1 Vocabulary Expansion, Word roots, prefixes, and suffixes, Synonyms and antonyms, Idioms and phrasal verbs		
	1.2 Reading Comprehension		
	1.3 Strategies for effective reading		
	1.4 Practice with diverse text types		

	1.5 Inference and critical analysis		
2	Grammar and Sentence Structure 2.1 Parts of Speech: Nouns, pronouns, verbs, adjectives, adverbs, etc. Sentence construction and analysis 2.2 Tenses and Verb Forms: Present, past, and future tenses Conditional sentences 2.3 Sentence Structure 2.4 Types of sentences (simple, compound, complex) 2.5 Subject-verb agreement 2.6 Question Tag 2.7 Degrees of Comparison 2.8 Reported Speech 2.9 Change the Voice	05	L1, L2, L3
3	Writing Skills 3.1 Essay Writing 3.2 Types of essays (descriptive, argumentative, narrative) 3.3 Planning and structuring essays 3.4 Letter and Email Writing 3.5 Formal and informal correspondence 3.6 Business communication	06	L1, L2, L3
4	Communication Skills 4.1 Speaking Skills: Public speaking and presentation skills 4.2 Pronunciation and intonation 4.3 Listening Skills: Active listening techniques 4.4 Understanding various accents	04	L1, L2, L3
5	Critical Reasoning and Logic 5.1 Logical Reasoning: Deductive and inductive reasoning, Analyzing arguments 5.2 Critical Thinking 5.3 Identifying fallacies 5.4 Problem-solving through critical thinking	04	L1, L2, L3
6	Current Affairs and General Awareness 6.1 Reading News Articles 6.2 Understanding news articles and editorials 6.3 Extracting important information 6.4 Discussion and Debates 6.5 Participating in group discussions 6.6 Structured debates on current topics	06	L1, L2, L3

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Suggested List of Practical/ Experiments:

Books and References:

Sr. No	Name of the Book	Name of the Author	Publisher	Edition	Year of Publication
1	Practical English Usage	Michael Swan	OUP	4th Edition	1995
2	Remedial English Grammar	F.T. Wood	Macmillan	2014 Edition	2007
3	On Writing Well	William Zinsser	Harper Resource Book	25 th Anniversary Edition	2001
4	Study Writing	Liz Hamp- Lyons and Ben Heasley	Cambridge University Press	2nd Edition	2006
5	Communication Skills	Sanjay Kumar and PushpLata	OUP	1st Edition	2011
6	Exercises in Spoken English Parts. I-III	CIEFL	University Press	1997 Edition	1997
7	The Briefest English Grammar	Ruth Colman	UNSW Press	1 st Edition	2004
8	English Grammar in Use	Raymond Murphy	Cambridge University	5 th Edition	2019

T. E. Semester –VI
Choice-Based Credit Grading Scheme with Holistic Student Development (CBCGS HME 2023)
Proposed Syllabus under Autonomy Scheme

BE Course					T.E. (SEM: VI)						
Course Name: Fundamentals of Communication Engineering					Course Code :						
Teaching Scheme					Examination Scheme (Formative/ Summative)						
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation						
Hours Per Week					Theory (100)			Practical/Oral (25)		Term Work (25)	Total
Theor y	Tutori al	Practic al	Contact Hours	Credi ts	IA	ISE	ES E	PR/OR		TW	100
3	-	-	3	3	20	20	60	-		---	
IA: In-Semester Assessment - Paper Duration – 1 Hour ESE: End Semester Examination - Paper Duration - 3 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)											
Prerequisite: Basic Mathematics											

Course Objectives: The course intends to give an overview of communication engineering and will be able to equip students to comprehend, design, and apply communication systems in a diverse array of domains, laying a strong foundation for their future endeavors in the field of communication engineering and technology. Students would be able to acquire a solid foundation in the fundamental theories and principles underlying analog and digital communications, computer networks, optical communications, mobile communications, and sensor networks.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy Levels
1	Explain the fundamental principles of analog communication systems, modulation techniques, and noise and its impact on analog communication.	L1,L2,L3
2	Describe sampling, digital baseband, passband transmission, different modulation techniques, noise, and Shannon's Information Theory.	L1,L2,L3

3	Draw and explain computer network layered architecture layers including protocols and their services and describe the functions of physical layer and various hardware components such as physical media, networking components required in data transmission and multiplexing techniques	L1,L2,L3
4	Explain the fundamentals, advantages, and advances in optical communication systems and explore concepts like WDM, Fiber to the X (FTTX), and RF over Fiber for Optical Networks.	L1,L2,L3
5	Describe the operation of sensor networks with respect to architecture, routing protocols, and applications.	L1,L2,L3
6	Describe the cellular design concepts and 2G, 3G, 4G and 5G architectures and radio interfaces.	L1,L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Analog Communications	08	L1,L2,L3
	Overview of communication systems, Types of communication systems, need for analog communication, Basics of amplitude, frequency, and phase modulation, Advantages and disadvantages of AM, FM, and PM, sources of noise in communication, Calculating SNR and its importance, Real-world applications of analog communication, and Future trends in analog communication.		
2	Digital Communication	08	L1,L2,L3
	Advantages of digital communication over analog, Sampling and quantization, Baseband and passband transmission, Pulse Amplitude Modulation (PAM), Nyquist and Shannon criteria, Digital Modulation Techniques, AWGN channel and its modeling Multipath fading channels, Shannon's Information Theory Channel capacity and the capacity theorem, Application of digital communication in wireless, optical communication.		
3	Computer Communication Networks	08	L1,L2,L3
	Computer Network Applications, Network Hardware, Network Software. Reference Models, overview of OSI and TCP/IP, layer Functions, sockets and ports, types of networks (LAN,MAN,WAN), networks topologies, multiplexing and multiple access techniques.		
4	Optical Fiber Communication & Networks	08	L1,L2,L3
	Ray theory, Numerical Aperture, Types and classification of optical fibers, Fiber materials, Attenuation, and dispersion, OTDR, Optical Components (Fiber joints and splices, Couplers, Isolators and Circulators, Multiplexers, Detectors, Switches), Link power budget and rise time budget, WDM, Fiber to the X, Radio-over-Fiber.		

5	Wireless Sensor Networks	06	L1,L2,L3
	Definition and characteristics of WSNs, Applications and significance, Sensor Node Architecture and Components, Sensor node structure and components, Sensor types and their applications, Communication Protocols in WSNs, Wireless communication principles, MAC (Medium Access Control) protocols, Routing protocols: Overview and types Data Aggregation and Fusion, and Energy consumption analysis in WSNs.		
6	Mobile Communication	07	L1,L2,L3
	Introduction to wireless communication: basic terms used in wireless communication. Features of all conventional multiple access techniques: OFDM- OFDMA. The Cellular Concept System Design Fundamentals. 2G, 3G, 4G, and 5G system architecture and radio specifications.		
		45	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Electronics Communication Systems	Wayne Tomasi	Pearson education.	5th Edition	2009
2	Digital Communication Systems	Haykin Simon John	Wiley and Sons, New Delhi	4th Edition,	2014
3	Fiber Optic Communication Systems	G. Agarwal	John Wiley and Sons	3 rd	2010
4	Computer Networks	A. S. Tanenbaum	Prentice Hall	5th Edition	2013
5	Adhoc & Sensor Networks Theory and Applications	Cordeiro, Agrawal	Cambridge University Press India Pvt. Ltd	Second Edition	2010
6	Wireless Communications	Andreas F. Molisch	Wiley-IEEE Press	Second	2012

Online References:

S. No.	Website Name	URL	Modules Covered
1	NPTEL	https://onlinecoursesarchive.nptel.ac.in/noc17_ec11	M1
2	NPTEL	https://nptel.ac.in/courses/117/105/117105144/	M2
3	NPTEL	https://swayam.gov.in/nd1_noc19_ee67/preview	M3
4	NPTEL	https://nptel.ac.in/courses/106105183	M3
5	NPTEL	https://nptel.ac.in/courses/106/105/106105160/	M1, M2, M4
6	NPTEL	http://nptel.ac.in/courses/117104099/	M6

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)

BE- All Branches					SEM: VI					
Course Name: Open Elective-I Fundamentals of Development Engineering					Course Code: OEC-601X					
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			Practical / Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW	
3	-	-	-	3	20	20	60	-	-	100
ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)										
Prerequisite:										

Course Objectives:

Understand Rural Development Concepts and Historical Roots, Examine Post-Independence Rural Development Initiatives, Explore Rural Development in Five Year Plans, Analyze Impact Post-73rd Amendment Scenario, Comprehend Urbanization and Rural-Urban Interface, Grasp Urban Governance and Local Planning Principles

Course Outcomes:

SN	Course Outcome	Cognitive levels as per bloom's Taxonomy
1	Understand rural development and its historical roots in India, including Sarvodaya Movement and Panchayati Raj.	L1, L2, L3
2	Discuss the recommendations of the Balwant Rai Mehta Committee, emphasize people's participation, and analyze the linkage with Ashok Mehta Committee for rural development.	L1, L2, L3
3	Grasp the role of Five Year Plans, planning processes, and the importance of integrated approaches, special component plans, and micro-eco zones in rural development.	L1, L2, L3
4	Assess environmental impacts and implications of the 73rd Constitutional Amendment Act for decentralized rural governance.	L1, L2, L3

5	Analyze urbanization trends, causes, and challenges in managing the rural-urban interface in India.	L1, L2, L3
6	Acquire knowledge about urban governance structures, decentralized planning, smart cities, and sustainable urban development strategies.	L1, L2, L3

Detailed Syllabus

Module No.	Topics	Hrs.	Cognitive levels as per bloom's Taxonomy
1	Introduction to Rural Development	06	L1, L2, L3
	Introduction to Rural Development Meaning, nature and scope of development; Nature of rural society in India; Hierarchy of settlements; Social, economic and ecological constraints for rural development. Roots of Rural Development in India Rural reconstruction and Sarvodaya programme before independence; Impact of voluntary effort and Sarvodaya Movement on rural development; Constitutional direction, directive principles; Panchayati Raj - beginning of planning and community development; National extension services.		
2	Post-Independence rural Development	09	L1, L2, L3
	Post-Independence rural Development Balwant Rai Mehta Committee - three tier system of rural local Government; Need and scope for people's participation and Panchayati Raj; Ashok Mehta Committee - linkage between Panchayati Raj, participation and rural development.		
3	Rural Development Initiatives in Five Year Plans	10	L1, L2, L3
	Rural Development Initiatives in Five Year Plans Five Year Plans and Rural Development; Planning process at National, State, Regional and District levels; Planning, development, implementing and monitoring organizations and agencies; Urban and rural interface - integrated approach and local plans; Development initiatives and their convergence; Special component plan and sub-plan for the weaker section; Micro-eco zones; Data base for local planning; Need for decentralized planning; Sustainable rural development		
4	Environmental Impact Assessment	06	L1, L2, L3
	Post 73rd Amendment Scenario 73rd Constitution Amendment Act, including - XI schedule, devolution of powers, functions and finance; Panchayati Raj institutions - organizational linkages; Recent changes in rural local planning; Gram Sabha - revitalized Panchayati Raj; Institutionalization; resource mapping, resource mobilization including social mobilization; Information Technology and rural planning; Need for further amendments.		L1, L2, L3

5	Urbanization and Rural-Urban Interface	08	L1, L2, L3
	5.1. Definition and concept, Trends and patterns of urbanization in India, Causes and consequences of urbanization, Challenges posed by rapid urbanization, Rural-Urban Interface, Planning and Policies for Urban Development		
6	Urban Governance and Local Planning	06	L1, L2, L3
	Urban Governance and Local Government, Decentralized Planning in Urban Areas, Smart Cities and Sustainable Urban Development, Urban-Rural Linkages and Convergence, Exploring ways to bridge the urban-rural divide, Urban and rural development convergence models		
Total Hours		45	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	ITPI, Village Planning and Rural Development,	ITPI,	New Delhi	-	-
2	GoI, Constitution (73rdGoI, New Delhi Amendment) Act,	GoI, New Delhi	GoI, New Delhi	-	-
3	Planning Commission, Manual of Integrated District Planning, 2006,	Planning Commission New Delhi Planning Commission	New Delhi	-	-
4	The Urban Complex, Doubleday	Weaver, R.C.,			
5	Planning Commission, Five Year Plans,	NITI Ayog			

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Multidisciplinary Education (CBCGS-HME 2023)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)

BE ,B.Tech (All Branches)					B.E ,B.Tech (SEM : VI) Open Elective					
Course Name: Introduction to Blockchain Technologies					Course Code: OEC-6019					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)		Practical/Oral (25)		Term Work (25)	Total
Theor y	Tutoria l	Practical	Contact Hours	Credit s	ISE	IE	ESE	--	--	125
3	-	--	3	3	40		60	--	25	
IA: In-Semester Assessment- Paper Duration – 1 Hour ESE: End Semester Examination- Paper Duration - 02 Hours										
Prerequisite: Substantial programming experience, software engineering										

Course Objective: The course intends to deliver understanding of fundamentals of blockchain, list the concepts and blockchain technologies that can be used in application development

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	PO	Weightage
1	Understand the components of blockchain and cryptocurrencies	PO1,PO2,PO3, PO4	16%
2	Describe the concepts, technology and applications of Blockchain to be applied in the application	PO1,PO2,PO3, PO4,PO5,PO6,PO8	18%
3	Distinguish and apply different consensus algorithm as per the requirement of application	PO2,PO3,PO4,PO5,PO8	18%
4	Get acquainted with different crypto currencies and their characteristics	PO2,PO3,PO4,PO5,PO8,P O11	16%
5	Apply blockchain technology thinking to improve on existing products in IT	PO2,PO3,PO4,PO5,PO8,P O9,PO11	20%
6	Design, build, and deploy a distributed application	PO2,PO3,PO4,PO5,PO8,P O11,PO12	13%

Module No.	Topics	Hrs.	Cognitive level of attainment as per Bloom's Taxonomy
1	Basics of Blockchain	7	L1,L2
	Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance ,Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.		
2	Distributed Ledger Technology	8	L1,L2
	Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof, Digital Trust, Asset, Transactions, Distributed Ledger Technology, Types of network Components of blockchain or DLT,Ledger Blocks, Blockchain and Cryptography, Private keys, public keys, Hashing, Digital Signature		
3	Distributed Consensus	8	L1,L2,L3,L4
	Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn,Difficulty Level, Sybil Attack, Energy utilization and alternate		
4	Cryptocurrency	7	L1,L2,L3,L4
	Currency, Double Spending, Cryptocurrency, P2P Payment Gateway, Wallet, Mining, public blockchain and private blockchain, Other Crypt currencies		
5	Ethereum and Hyperledger Fabric	9	L1,L2,L3,L4,L5, L6
	Ethereum network, EVM, Transaction fee, Mist, Ether, gas , Solidity, Smart contracts ,Truffle ,Web3, Design and issue Cryptocurrency , Mining. Introduction to Hyperledger, What is Hyperledger, Why Hyperledger, Where can Hyperledger be used, Hyperledger Architecture ,Membership , Blockchain ,Transaction , Chain code , Hyperledger Fabric ,Features of Hyperledger		
6	Applications of Blockchain	6	L1,L2,L3,L4,L5, L6
	Blockchain in Finance: Cryptocurrencies, Smart Contracts for financial services, Supply Chain Management with Blockchain, Identity Management and Blockchain, Healthcare applications and Electronic Health Records (EHR).		
Total Hours		45	

Book References:

Sr. No	Title	Authors	Publisher	Edition	Year
1.	Bitcoin and cryptocurrency technologies: a comprehensive introduction.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder	Princeton University Press, 2016.	Second	2016

2.	Mastering Bitcoin	Andreas Antonopoulos	O'REILLY	First	2014
3.	Mastering Blockchain	Imran Bashir	Packt Publishing	First	2017

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	https://www.coursera.org	https://www.coursera.org/learn/blockchainprofessionals	M1,M2,M3
2.	https://www.coursera.org	https://www.coursera.org/learn/smarter-contracts	M1.M2,M3
3.	3 https://www.coursera.org	https://www.coursera.org/learn/blockchainfoundations-and-use-cases	M1.M2,M3
4.	https://www.dappuniversity.com	https://www.dappuniversity.com/articles/theultimate-ethereum-dapp-tutorial	M4,M5
5.	://www.hyperledger.org	https://www.hyperledger.org/use/fabric	M6
6.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/blockchain/index.htm	M4,M5,M6
7.	https://www.guru99.com	https://www.guru99.com/blockchain-tutorial.html	M1,M2,M5,M6
8.	https://www.javatpoint.com/	https://www.javatpoint.com/blockchain-tutorial	M1,M2,M5,M6
9.	https://ghostvolt.com	https://ghostvolt.com/articles/blockchain_intro.html	M1,M2,M3,M4,M6
10.	https://hackr.io/	https://hackr.io/blog/blockchain-programmingbeginners-guide	M4,M5,M6

B.Tech. Semester –VII B. Tech. Artificial Intelligence and Data Science
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
Syllabus under Autonomy Scheme (w.e.f. AY 2023-24)

B. Tech. Artificial Intelligence and Data Science					B. Tech. SEM: VI						
Course Name: Open Elective (Introduction to Artificial Intelligence and Data Science)					Course Code: OEC701X						
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)						
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation						
Hours Per Week					Theory (100)			Practical/ Oral (25)		Term Work (25)	Total
Theory	Tutorial	Practical/I TP	Contact Hours	Credits	IA	IE	ESE	PR/OR	TW	100	
3	-	-	3	3	20	20	60	-	-		
IA: In-Semester Assessment - Paper Duration – 1 Hour ESE: End Semester Examination - Paper Duration - 2 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)											
Prerequisite: Basic linear algebra, basic probability and statistics											

Course Objective: This course aims to Equip students with foundational knowledge, skills, and ethical awareness in Artificial Intelligence and Data Science, enabling them to analyse data, develop models, and understand AI's societal impact.

Course Outcomes: Upon completion of the course students will be able to

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the concept of Data Science and its related terminologies	L1, L2
2	Understand and apply EDA using Python programming	L1, L2, L3, L4
3	Analyze and apply Feature Selection Techniques using Python programming	L1, L2, L3,L4
4	Understand, Apply and Demonstrate different tools for Data Visualization	L1, L2, L3, L4
5	Understand and Apply various AI search algorithms (uninformed, informed), local and adversarial search algorithms to real-world problems.	L1, L2, L3, L4

6	Analyze different case studies on Applications of Data Science to solve real - world problems	L1, L2, L3, L4
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Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to Artificial Intelligence and Data Science	7	L1, L2
	Introduction: Data Science History, Increasing attention to Data Science, Data Science and Related Terminologies, Types of Analytics, Applications of Data Science, Data Science Process Models, Intelligence and it's type, Categorization of Artificial Intelligent based System, Agents & Environments		
2	Exploratory Data Analysis	8	L1, L2, L3, L4
	Introduction, Steps in Data Pre-processing, Understanding Data, Looking at the Data, Dealing with Missing Values, Standardizing Data, Steps involved in EDA using Python Programming		
3	Data Modelling: Feature Selection, Engineering, and Data Pipelines	8	L1, L2, L3, L4
	Feature Selection, Dimensionality Reduction, Independent and Dependent Variables, Relationship between Variables: Correlation, Multi-collinearity, Factor Analysis, Treatment of Outliers		
4	Data Visualization	8	L1, L2, L3, L4
	Importance of Data Visualization, Looking at Data, Visualization of Data- Histogram, Countplot, Boxplot, Data Visualization for Machine Learning, Data Visualization Techniques		
5	Problem Solving in AI	8	L1, L2, L3, L4
	Problem Solving Agent, Formulating Problems, Example Problems, Uninformed Search Methods, Informed Search Method, Local Search Methods, Genetic algorithms		
6	Applying Domain Expertise to Solve Real-World Problems Using Data Science	6	L1, L2, L3, L4
	The role of sustainable agriculture in ensuring food security, Global and local food systems, Challenges and opportunities in feeding a growing population		
Total Hours		45	

Books and Reference:

S.N	Title	Authors	Publisher	Edition	Year
1	Introduction to Data Science	B.Uma Maheshwari, R.Sujatha	Wiley	First Edition	2021
2	Data Science for Dummies	Lillian Pierson	Wiley	Second Edition	2019
3	Python for Data Science	Dr. Mohd Abdul Hameed	Wiley	First Edition	2021
4	A First Course in Artificial Intelligence	Deepak Khemani	McGraw Hill Education	First Edition	2013
5	Artificial Intelligence and Intelligent Systems	N. P. Padhy	Oxford	First Edition	2005

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.edureka.co	https://www.edureka.co/blog/what-is-data-science/	M1-M6
2	www.w3schools.in	https://www.w3schools.in/python-data-science/	M1-M3, M5
3	nptel.ac.in	https://onlinecourses.nptel.ac.in/noc20_cs81/previous	M1-M4, M6
4	www.tutorialspoint.com	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm	M1, M2, M6

T.E. Semester –VI

**Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- H 2019)
 Under TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)**

B.E. Course					T.E. Open Elective SEM : VI				
Course Name : Introduction to Industry 4.0					Course Code : OEC- 6012				
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)	Practical/Oral (25)	Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	----	----	3	3	25	75	----	----	100
IA: In-Semester Assessment- Paper Duration – 1.5 Hours ESE : End Semester Examination- Paper Duration - 3 Hours									
Prerequisite: Sensor/ transducer, field transmitters, converters, final control element, Computer based control system architecture, Basics of Internet of Things (IoT)									

Course Objective:

The objective of the course is to introduce to the students about the Industry 4.0 is to drive manufacturing forward: to be faster, more efficient and customer-centric while pushing beyond automation and optimization to discover new business opportunities and models.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the drivers and enablers of Industry 4.0	L1, L2
2	Appreciate the smartness in Smart Factories, Smart cities, smart products and smart services	L1, L2, L3,L4
3	Outline the various systems used in a manufacturing plant and their role in an Industry 4.0 world	L1, L2, L3,L4
4	Understand the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits	L1, L2, L3,L4
5	Publish and distribute Android Application	L1, L2, L3,L4
6	Understand and identify the various Business issues in Industry 4.0	L1, L2, L3,L4

Detailed Syllabus:

Module No	Topics	Hrs.	Cognitive levels as per bloom's Taxonomy
1	Module 1: Introduction to Industry 4.0 1.1 The Various Industrial Revolutions 1.2 Digitalization and the Networked Economy 1.3 Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 1.4 The Journey so far: Developments in USA, Europe, China and other countries 1.5 Comparison of Industry 4.0 Factory and Today's Factory 1.6 Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation	8	L1, L2
2	Module 2: Road to Industry 4.0 2.1 Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services 2.2 Smart Manufacturing 2.3 Smart Devices and Products 2.4 Smart Logistics 2.5 Smart Cities 2.6 Predictive Analytics	6	L1, L2, L3,L4
3	Module 3: Related Disciplines, System, Technologies for enabling Industry 4.0 3.1 Cyber physical Systems 3.2 Robotic Automation and Collaborative Robots 3.3 Support System for Industry 4.0 3.4 Mobile Computing 3.5 Related Disciplines 3.6 Cyber Security	8	L1, L2, L3,L4
4	Module 4: Role of data, information, knowledge and collaboration in future organizations 4.1 Resource-based view of a firm 4.2 Data as a new resource for organizations 4.3 Harnessing and sharing knowledge in organizations 4.4 Cloud Computing Basics 4.5 Cloud Computing and Industry 4.0	8	L1, L2, L3,L4
5	Module 5: Other Applications and Case Studies 5.1 IIoT case studies 5.2 Case studies from students	4	L1, L2, L3,L4
6	Module 6: Business issues in Industry 4.0	4	L1, L2, L3,L4

	6.1 Opportunities and Challenges 6.2 Future of Works and Skills for Workers in the Industry 4.0 Era 6.3 Strategies for competing in an Industry 4.0 world		
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Books and References:

Sr No	Title	Authors	Publisher	Edition	Year
1	Industry 4.0: The Industrial Internet of Things	Alasdair Gilchrist	Apress	-----	2016
2	Additive Manufacturing Technologies Rapid Prototyping to Direct Digital Manufacturing	Lan Gibson, et.al	Springer	-----	2010
3	Industrial Internet of Things: Cyber manufacturing Systems	Sabina Jeschke, et.al	Springer	-----	-----
4	Designing the Internet of Things	A. McEwen et. al	Wiley	1st edition	2013
5	Healthcare 4.0 Next Generation Processes with the Latest Technologies	J. Chanchaichujit et.al	Palgrave Pivot		2019
6	Industrial Automation: Hands	F. Lamb	McGraw-Hill Education	1st edition	2013
7	The Industrial Internet of Things: Reference Architecture – IIC	-----	-----	Volume G1	-----
8	Industrial Internet of Things: Security Framework –IIC	-----	-----	Volume G4	-----

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://nptel.ac.in/	https://onlinecourses.nptel.ac.in/noc20_cs69/preview	M1,M2,M3, M4,M5,M6

T.E. Semester –VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS- HME 2023) Syllabus under Autonomy Scheme

B.TECH. Internet of Things (IOT)							T.E. SEM: VI		
Course Name: Introduction to IoT Applications							Course Code: OEC701X		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week- Theory (100)							Practical/ Oral (25)	Term Work (25)	Tota l
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	100
3	-	-	3	3	40	60	-	-	
IA: In Semester Assessment - Paper Duration – 1 Hour ESE: End Semester Examination - Paper Duration - 2 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Basic Computer skills, programming knowledge, electronics and circuits, mathematics and statistics, databases.									

Course Objective: To make students understand, concepts of IoT (Internet of Things), covering fundamentals and architecture of various hardware components, communication protocols, and its impact on industries and societal domains, along with emerging IoT technologies and trends.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive level of attainment as per Bloom's Taxonomy
1	Key IoT concepts and describe the architecture and components of IoT systems, including sensors, microcontrollers, and communication modules.	L1, L2
2	Apply data acquisition, preprocessing, storage, and real-time analytics techniques to IoT data.	L1, L2, L3
3	Recognize security threats and vulnerabilities in IoT and implement security measures.	L1, L2, L3
4	Understand ethical considerations and privacy concerns in IoT application design.	L1, L2, L3, L4
5	Analyze real-world IoT applications in domains like smart homes, healthcare, and industry.	L1, L2, L3, L4
6	Recognize emerging IoT technologies and trends in quantum computing, sustainability, and 5G.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to IoT Defining IoT- Introduction to IoT, Historical evolution of IoT, Key components and architecture, IoT use cases and impact IoT Ecosystem - IoT stakeholders and roles, Protocols and communication in IoT, Challenges and opportunities in the IoT ecosystem	6	L1, L2, L3
2	IoT Hardware and Sensors IoT Hardware Components - Microcontrollers and development boards Sensors and actuators, Communication modules Data Acquisition and Processing - Data types and formats, Data acquisition methods, Data processing at the edge and in the cloud	6	L1, L2, L3, L4
3	Data Handling and Analysis Data Storage and Management - Data storage options, Databases for IoT, Data security and privacy considerations, Real-time Data Analytics and Visualization, Real-time data analytics tools Data visualization techniques, Real-world applications of data analytics in IoT	7	L1, L2, L3
4	IoT Security and Privacy IoT Security Threats - Common security threats and vulnerabilities in IoT, Security protocols and encryption, Access control and authentication in IoT Ethical Considerations and Data Privacy - Ethical considerations in IoT design, Regulatory frameworks (e.g., GDPR), Best practices for ensuring data privacy in IoT applications	8	L1, L2, L3
5	IoT Applications domain Smart Homes and Cities- IoT in smart homes, Smart city applications Case studies in smart living environments. IoT in Healthcare and Industry - IoT applications in healthcare, Industrial IoT (IIoT) and Industry 4.0, Real-world examples of IoT in healthcare and industry	9	L1, L2, L3, L4
6	Future Trends and Emerging Technologies Emerging IoT Technologies - Quantum computing and its potential impact on IoT, Edge computing advancements, IoT's role in 5G networks Environmental Sustainability and IoT - IoT's contribution to environmental monitoring and sustainability, Green IoT solutions Ethical and ecological implications of IoT	9	L1, L2, L4
Total Hours		45	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Internet of Things: Principles and Paradigms	Rajkumar Buyya, Amir Vahid Dastjerdi, and Arkady Zaslavsky	Morgan Kaufmann	1st	2016
2	Getting Started with Arduino	Massimo Banzi	Maker Media, Inc.	3rd	2014
3	Designing Data-Intensive Applications	Martin Kleppmann	O'Reilly Media	1st	2017
4.	Big Data: A Revolution That Will Transform How We Live, Work, and Think	Viktor Mayer-Schönberger and Kenneth Cukier	Eamon Dolan/Houghton Mifflin Harcourt	1st	2013
5.	IoT Security: Practical Guide Book	Daniele Catteddu and Lorenzo Pupillo	CreateSpace Independent Publishing	1st	2017
6.	Security Engineering: A Guide to Building Dependable Distributed Systems	Ross J. Anderson	Wiley	2nd	2008
7.	Smart Homes for Dummies	Danny Briere and Pat Hurley	Wiley	2nd	2011
8.	Quantum Computing for Everyone	Chris Bernhardt	The MIT Press,	1st	2019
9.	5G for the Connected World	Devaki Chandramouli, Rainer Liebhart, and Juho Pirskanen	Wiley	1st	2019

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	IoT For All.	https://www.iotforall.com/	M1,M2,M3,M4,M5,M6
2.	IoT Tech News	https://www.iottechnews.com/	M4,M5,M6
3.	IoT Analytics	https://iot-analytics.com/	M1,M2,M3,M4,M5,M6

B.E. Mechanical and Mechatronics Engineering (Additive Manufacturing) T.E. Semester –VI

B.E. Mechanical and Mechatronics Engineering (Additive Manufacturing)					B.E. SEM: VI					
Course Name: Introduction to Robotics					Course Code:					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			Oral (25)	Term Work (25)	Total
Theor y	Tutori al	Practic al	Contac t Hours	Credit s	ISE	IE	ESE	OR	TW	100
3	-	-	3	3	20	20	60			
ISE: In-Semester Examination - Paper Duration – 1 Hours										
IE: Innovative Examination - Paper Duration – 1 Hours										
ESE: End Semester Examination - Paper Duration - 2 Hours										
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%)										
Prerequisite: Sensors and Actuators, Design of Machine Elements & Mechanical System.										

Course Objectives:

Course intends to provide the student with the significance of robotic system with robotic elements/ peripherals, their selection and interface with manufacturing equipment's. To familiarize the students with the basics of robot kinematics.

Course Outcomes:

SN	Course Outcomes	Cognitive levels as per bloom's Taxonomy
1	Acquire the skills in understanding robot basic knowledge	L1, L2
2	Develop skills in understanding various robot subsystems and wheeled Mobile Robot Vehicles	L1, L2, L3
3	Develop skills in understanding various sensors, robot peripherals and their use.	L1, L2, L3
4	Develop skills in robot Kinematics for robot control.	L1, L2, L3, L4
5	Select robot for industrial task and identify areas in which robot can be deployed in industry	L1, L2, L3
6	Develop skills in machine vision	L1, L2, L3, L4

Detailed Syllabus

Module No.	Topics	Hrs.	Cognitive levels as per bloom's Taxonomy
1	Introduction and Fundamentals of Robotics	7	L1, L2
	Automation & robotics, Robotic System & Anatomy Classification, Future Prospects Robotic Application in Manufacturing: Material transfer, Machine loading & unloading, Processing operations, Assembly & Inspectors		
2	Robot Subsystems and Wheeled Mobile Robot Vehicles	7	L1, L2, L3
	Motion, Recognition, Control Industrial Robot Anatomy, 4 Common Configurations, Robot Motions, Joint Notation Scheme, Work Volume, Drive Systems, Speed, Load Carrying Capacity, Precision of Movement (Resolution, Accuracy, Repeatability, Compliance). Motion Control Programming, Wheeled Mobile Robot Vehicles: Wheeled Mobile Robots: Differential Drive, Car (Ackermann) Drive, Synchronous Drive, Omnidirectional Drive		
3	Robotics System & Components	7	L1, L2, L3
	Control Loops, Basic Control System Concepts & Models, Control System Analysis, Robot Activation & Feedback Components, Position & Velocity Sensors, Actuators, Power Transmission Systems, Homogeneous Coordinates, DH parameters		
4	Robot Kinematics	10	L1, L2, L3, L4
	Coordinate Frames, Rotations, Homogeneous Coordinates, Arm Equation of Planer Robot, Four axis SCARA Robot, TCV, forward kinematics, Inverse Kinematics of Planer Robot, Four Axis SCARA Robot.		
5	Trajectory Planning & Robot Dynamics	8	L1, L2, L3
	Manipulator Path Control- Linear, Quadratic and Cubic Interpolation, Work Space Analysis, Robot Dynamics –Langrangian Dynamics of one and two link robot arm Robot languages; Programming in suitable languages Characteristics of robot		
6	Robot Vision-Based Control	6	L1, L2, L3, L4
	Introduction, Low level & High level vision, Sensing & Digitizing, Template Matching, Image processing & analysis, Segmentation, Edge detection, Object description & recognition, Interpretation, Noises in Image, Applications		

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Introduction to Robotics	S. K. Saha	McGraw Hill	1st Edition	2008
2	Industrial Robotics	Groover and Simmers	SIE	1st Edition	2015
3	Introduction to Robotics Mechanics and Control	John Craig	Pearson	-	2008
4	Industrial Robotics Technology Programming and Applications	MP Groover, M. Weiss, R. N. Nagel, N. G. Odrey	SIE	2nd Edition	2017
5	Wheeled Mobile Robotics From Fundamentals Towards Autonomous Systems	Gregor Klančar ,Andrej Zdešar, Sašo Blažič, Igor Škrjanc	Elesvier ButterworthHe inemann	-	2017

Online References:

Sr.No.	Website Name	URL	Modules Covered
1	http://nptel.ac.in	https://nptel.ac.in/courses/112105249	M1, M2, M3, M4
2	http://nptel.ac.in	https://nptel.ac.in/courses/107106090	M5, M6

B.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
Proposed TCET Autonomy Syllabus (w.e.f. A.Y. 2023-2024)

B.E. (Computer Engineering)					B.E. SEM : VI					
Course Name : Social Network Analysis					Course Code :					
Teaching Scheme (Program Specific)					Examination Scheme (Academic)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)		Practical/Oral/ Presentation (25)	Term Work (25)	Total	
					40/20	60/30				
Theory	Tutorial	Practical	Contact Hours	Credits	IA		ESE	PR/OR	TW	150
					ISE	IE				
3	-	-	3	3	20	20	60	25	25	
IA: In-Semester Assessment - Paper Duration – 1 Hour ESE: End Semester Examination - Paper Duration – 2/1 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Basics of Computer networks, graphs, algorithms										

Course Objective:

This course provides an overview of the technology of social networks and how an individual can influence others on a network.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy	PO Mapping (Write only Number/s)	PSO Mapping (Write only Number/s)	PI	Module wise % weightage in exam
1.	Understand the basic concepts of social networks	L1, L2, L3	1,2, 3,4	1,2	1.1.1, 1.3.1, 2.1.3, 3.1.1	20
2	Understand the fundamental concepts in social network mining	L1, L2, L3	1,2, 3,4, 5	1,2,3	1.1.1, 1.3.1, 2.1.3, 3.1.1	15
3	Understand the modelling and visualization of network	L1, L2, L3	1,2, 3,4, 5	1,2,3	1.1.1, 1.3.1, 2.1.3, 3.1.1, 5.1.2	10
4	Understand the concepts of social network graph analysis	L1, L2, L3,L4	1,2, 3,4, 5	1,2	1.1.1, 1.3.1, 2.1.3, 3.1.1, 5.1.2	15
5	Perform visualization and exploration using Gephi	L1, L2, L3,L4	1,2, 3,4, 5	1,2,3	1.1.1, 1.3.1,	20

	software.				2.1.3, 3.1.1, 65.1.2, 2.2.4	
6	Understand the dynamic social networks	L1,L2	1,2, 3,4, 5	1,2,3	1.1.1, 1.3.1, 2.1.3, 3.1.1, 5.1.2, 2.2.4	20

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction Introduction to Semantic Web, the Social Web - Social Network analysis, Development of Social Network Analysis – the concepts and measures in network analysis, Blogs and online communities - Web-based networks - Applications of Social Network Analysis. Advantages and disadvantages in social networks.	9	L1, L2, L3
2	Social Network Mining Introduction to social network mining. Social network extraction from big data, Various social network mining tasks with real-world examples. Community detection and Shingling algorithm, Social Networks as Graphs. Random graph models, ranking algorithms, Graph and Matrices, Basic measures for individuals and networks,	7	L1, L2, L3, L4
3	Modelling and visualization of network Mechanisms: Homophily, Opportunity, and Balance, edges , nodes Analyze a social network by data wrangling and visualizing a network	7	L1, L2, L3, L4, L5
4	Social Network Graph Analysis Graph kernels, Graph classification, mining and outlier detection, centrality measures , network level measures, partitioning of graphs, components and bridges, cliques	7	L1, L2, L3, L4, L5
5	Gephi Download and Install Gephi, load network data, manipulate the color, structures and shapes, get Network-Level Measures, centrality measures,.	9	L1, L2, L3, L4, L5
6	Dynamic Social Networks Social learning on networks, Information and Biological networks, Various L1, L2 applications of Social Network mining in real world applications, Social Connects: Affiliation and identity	6	L1, L2
	Total Hours	45	

Text /Reference Books:

Sr. No.	Title	Authors	Publisher	Year
1	Social Network Data Analytics	Charu C Aggarwal	Springer	2011
2	Network Graph Analysis and Visualization with Gephi	Ken Cherven	Packt	2013
3	Social network analysis: A handbook	Scott,J.	Sage	2007
4	Social Network Analysis,	Knoke	Sage	2008

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	towardsdatascience.com	https://towardsdatascience.com/how-to-get-started-withsocial-network-analysis-6d527685d374	M6
2	iopscience.iop.org	https://iopscience.iop.org/article/10.1088/1742-6596/1235/1/012111/pdf	M1-M5