D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

T.Y. B. Tech Autonomous Syllabus

(Department of Electronics & Telecommunication Engineering)

w.e.f. 2022-23

Third Year (B.Tech.) Electronics & Telecommunication
SEM-V

Sr. No.	Course Code	Course Type	Name of the Course	Teaching Scheme				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max. Marks	Min. for Passing	
1	201ETL301	PCC	Microprocessor and Microcontroller	3	-		3	100	ISE MSE ESE	20 30 50	20 20	40
2	201ETL302	PCC	Information Theory & Coding	3	1		4	100	ISE MSE ESE	20 30 50	20 20	40
3	201ETL303	PCC	Digital Signal processing	3			3	100	ISE MSE ESE	20 30 50	20 20	40
4	201ETL304-06	PEC	Professional elective-I	3	1		4	100	ISE MSE ESE	20 30 50	20 20	40
5	201ETL307	HSC	Project Management and Economic Policy	3	1		4	100	ISE MSE ESE	20 30 50	20 20	40
6	201ETP308	PCC - LC	Microprocessor and microcontroller - Lab			2	1	50	ISE ESE POE	25 25	10 10	20
7	201ETP309	PCC - LC	Digital Signal Processing -lab			2	1	25	ISE	25	10	10
8	201ETP310	ESC - LC	Programming Practice	2		2	3	50	ISE ESE	25 25	10 10	20
9	201ETL311	MC	Industrial Marketing	2	Non Credit Mandatory Course with 50 marks ESE							
TOTAL				19	3	6	23	675		675		
Total Contact Hours				**29**								

Third Year (B.Tech.) Electronics & Telecommunication
SEM-VI

Sr. No.	Course Code	Course Type	Name of the Course	Teaching Scheme				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max. Marks	Min. for Passing	
10	201ETL312	PCC	Cellular & Mobile Communication	3			3	100	ISE MSE ESE	20 30 50	20 20	40
11	201ETL313	PCC	Embedded Systems	3			3	100	ISE MSE ESE	20 30 50	20 20	40
12	201ETL314	HSC	Industrial Management and Start-ups	3			3	100	ISE MSE ESE	20 30 50	20 20	40
13	201ETL315-17	PEC	Professional Elective-II	3	1		4	100	ISE MSE ESE	20 30 50	20 20	40
14	201ETL318-19	OEC	Open Elective I	3	1		4	100	ISE MSE ESE	20 30 50	20 20	40
15	201ETP320	PCC -LC	Cellular & Mobile Communication Lab.			2	1	50	ISE ESE OE	25 25	10 10	20
16	201ETP321	PCC -LC	Embedded Systems - Lab			2	1	50	ISE ESE POE	25 25	10 10	20
17	201ETP322	PROJ	Mini Project-II			2	1	50	ISE ESE	25 25	10 10	20
				15	2	6	20	650		650		
Total Contact Hours				**23**								

ISE: In Semester Evaluation, MSE: Mid Semester Examination, ESE: End Semester Examination

Note 1: Tutorials and practical shall be conducted in batches with batch strength not exceeding 20 students.

Note 2 : MSE will be conducted for 30 marks

Note 3 : ESE will be conducted for 100 marks and converted to 50 marks

Summer Internship: The students are expected to undergo 4 to 6 weeks internship in the industry and work on the relevant areas assigned by the industry. The work done should be monitored and evaluated by the concerned industry expert based on the report prepared by the student. The department has to assign one faculty mentor, who has to communicate with the industry and monitor the entire internship related work periodically,

- The weightage of evaluation will be as under.
  - Industry Expert/ Supervisor: 70%
  - Department & Faculty Mentor: 30 % (includes presentation & submission of report to the department at the beginning of the subsequent semester)
- The Internship can be availed by the students during the summer vacations after completion of sem IV or VI.
- The credits of the internship will be considered in Sem VII.
- The industry expert/ Supervisor is excepted to assign the work worth minimum 100-200 hrs for 4 to 6 weeks duration & should monitor & evaluate periodically.
- At the completion of the internship work, the student is expected to prepare a report on the work done & get certificate from the industry expert.

Coursee assessment:
The course assessment is to be done on the basis of ISE (In Semester Evaluation), MSE (Mid Semester Examination) and ESE (End Semester Examination). The weightage of components are as follows.

ISE	MSE	ESE
20%	30%	50%

1) ISE (Theory) 20 marks
ISE-1 and ISE-2 can be done by using following modes

1) Online test (on Moodle)
2) Surprise test
3) Open book exam
4) Active learning method as per OBE requirement
5) Self-learning topic
6) Case study
7) Demonstrations
8) Seminars
9) Assignments
10) Self Study

ISE (Lab) 20 marks: Lab assessment is to be done using continuous assessment method in which faculty has to Evaluate student's performance based upon defined rubrics only and shown to the students

2) MSE will be conducted for 30 marks.

3) ESE (End Semester Examinations)50 marks:-ESE will be conducted on entire syllabus for 100 marks for 3 hours duration and converted to 50 marks

*** Environment studies, Financial Management & Industrial Marketing (Non-Credit Mandatory Course):**

1. Self-study course
2. Course will be assessed by conducting objective type examination for 50 marks for which criteria for passing is 40% (20 marks).
3. Result of student will be declared only if student passes this course.

LIST OF ELECTIVES AS PER PROPOSED STRUCTURE

Professional Elective					
I	**II**	**III**	**IV**	**V**	**VI**
Digital Image Processing	Image Processing & Analysis	Computer Vision and Pattern Recognition	Speech Processing	Machine learning	Deep Learning
Fiber Optic Communication	Satellite Communication	Wireless Sensor Network	Micro-wave Theory	Cyber Security	Internet of Things
VLSI design	ASIC Design	System on Chip	MEMS Technology	Nano Electronics	Consumer Electronics

Open Elective:

Open elective courses are offered to gain the knowledge of multidisciplinary areas. Students must choose one open elective course from the list of courses offered by other departments (excluding open elective courses offered by their department). Following is the list of open elective courses. The detailed syllabus is available on to the college website under academic tab.

Sr. No.	**Department**	**Course Code**	**Open Elective-I Course**
1	Chemical	201CHL318	Industrial Safety and Act
		201CHL319	Energy Conservation and Audit
2	Mechanical	201MEL313	Human Resource Management
		201MEL314	Electric Vehicle
3	Civil	201CEL330	Disaster Management
		201CEL331	Green Building
4	Architecture	201ARL318	Residential Gardening
		201ARL319	Role of Art & Technology in Interior Design
5	Computer Science & Engineering	201CSL319	E- Commerce & Digital Marketing
		201CSL320	Python Programming

6	Computer Science & Engineering (Artificial Intelligent & Machine Learning)	201AIML320	Applications of AI ML
		201AIML321	Augmented Reality and Virtual Reality
7	Computer Science & Engineering (Data Science)	201DSL319	Basics of Data Science
		201DSL320	Basics of Database

Course Code and Definition	
Course Code	**Definition**
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSC	Humanities and Social Sciences including Management
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Microprocessor and Microcontroller	
Course Code: 201ETL301	**Semester** : V
Teaching Scheme : L-T-P :3-0-0	**Credi**t: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: The aim of the course is to provide students with the knowledge of Microprocessors and Microcontroller. To solve real world problems in an efficient manner, this course also emphasis on architecture, Programming and system design used in various day to day gadgets.

Course Objectives:

1	Understand fundamentals of 8085 Architecture and Programming.
2	To apply the knowledge of Interrupts and interfacing of memory with 8085.
3	Understand fundamentals of 8051 Architecture and Programming.
4	Analyze Real time requirements using ON-Chip resources of 8051.
5	Evaluate need of I/O peripherals to satisfy system design requirements.
6	Develop Embedded C Programs for I/O Peripherals

Course Outcomes (COs):

At the end of the course the student will be able to:

301.1	distinguish the feature of the 8085 microprocessor, hardware architecture and develop 8085 assembly level programs
301.2	illustrate the interrupts handling and demonstrate interfacing of memory with 8085.
301.3	distinguish the feature of the 8051 microcontroller , hardware architecture and develop 8051 assembly level programs

301.4	demonstrate the use of ON-Chip resources of 8051.
301.5	apply the programming concepts to interface the hardware units with 8051 Microcontroller
301.6	develop Embedded "C" Programs for I/O Peripherals

Prerequisite:	Digital Electronics and C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
301.1	2	2	1	1	1	-	-	-	-	-	-	-	1	1	II
301.2	1	1	1	1	1	-	-	-	-	-	-	-	1	1	III
301.3	2	2	1	1	1	-	-	-	-	-	-	-	1	1	II
301.4	2	2	2	2	2	-	-	-	-	-	-	-	1	1	IV
301.5	1	1	1	1	1	-	-	-	-	-	-	-	2	2	IV
301.6	1	1	1	1	1	-	-	-	-	-	-	-	1	1	IV

Content	Hrs
Unit 1: Introduction to 8085 Microprocessor Functional Pin out, CPU Architecture, Register Organization, Reset Circuit, Clock Circuit, De- multiplexing of Address/Data bus, Generation of control signals, Addressing Modes, Instruction set and programming.	9
Unit 2: 8085 Stack, Interrupts and Interfacing Stack &Subroutines, Interrupts structure of 8085, Memory mapped I/O, I/O mapped I/O, Memory interfacing with 8085.	4
Unit 3: Introduction to MCS51 Introduction to MCS51Family, Functional Pin out diagram, Architecture, Register Organization, Memory Organization, Reset Circuit, Machine Cycle, Oscillator Circuit, Addressing Modes, Instruction Set, Assembly Language Programming.	8
Unit 4: Hardware overview Input / Output Ports, Interrupts, Timers/Counters, Serial Communication (Mode-1), (Structure, Related S.F.R and Programming).	6
Unit 5: Interfacing & Assembly Language Programming with 8051 Microcontroller Keyboard, Seven Segment display, ADC, DAC, stepper motor.	4
Unit 6: Embedded 'C' Programming for 8051 Data types, Programs on Arithmetic & Logical operations, Input / Output Ports, Timer/Counter, Serial communication, LCD.	5

Text Books:

1. Ramesh Gaonkar " Microprocessor Architecture Programming and Applications with the 8085", , 5th Edition , Penram International Publication
2. Muhammad Ali Mazidi, Janice Gillispie, Rolin D. McKinlay"The8051 Microcontroller & Embedded Systems Using Assemble and C", 2nd Edition, Pearson Education
3. Kenneth Ayala, "The 8051 Microcontroller" , 3rd Edition , Cengage Learning India Private Limited

Reference Books:

1. Douglas V Hall, "Microprocessors and Digital Systems"
2. I.Scott Mackenzie, Raphael C.W.Phan, "The 8051 Microcontroller", 4th Edition, Pearson
3. Ajay V. Deshmukh, "Microcontrollers [Theory and Applications]", Tata McGraw Hill Publication
4. Soumitra Kumar Mandal, Microprocessor and Microcontroller Architecture, Programming and Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013.
5. Microprocessor and Microcontrollers Krishna Kant Eastern Company Edition, Prentice Hall of India, New Delhi

T.Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Information Theory and Coding	
Course Code: 201ETL302	**Semester :** V
Teaching Scheme : L-T-P :3-1-0	**Credit:** 4
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks :** 50

Course Description:

Information is the source of a communication system, whether it is analog or digital. Information theory is a mathematical approach to study the coding of information along with the quantification, storage and communication of information.

Course Objectives:

1	To understand information theory, estimate information content of a random variable from its probability distribution.
2	To analyze communication channels, their capacities and develop construct efficient codes for data on imperfect communication channels.
3	To analyze the need & objective of error control coding with encoding & decoding procedure .

Course Outcomes (COs):

At the end of the course the student will be able to:

302.1	demonstrate basic concepts of information theory and entropy coding.
302.2	mathematically analyze communication channel models & Channel capacity.
302.3	analyze the error detecting and correcting capability of different coding schemes.
302.4	design encoder and decoder for various coding techniques as per the need and Specifications.

Prerequisite:	Digital Communication, Probability & Mathematics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
302.1	3	2	2	2	2	2							2	2	III
302.2	3	3	3	3	2	2							3	3	IV
302.3	3	3	3	3	2	2							2	2	IV
302.4	2	2	3	2	2	2							2	2	VI

Content	**Hrs.**
Unit 1: Information Theory Introduction, Concept of information, Entropy, Mathematical expression, Entropy of Binary Source, Properties and Information Rate, Joint Entropy, Conditional entropy, relation between Joint & Conditional Entropy, Mutual Information: Average Mutual Information, Expression for Mutual information, Relation between Mutual Information & Entropy	6
Unit 2: Channel Capacity And Coding Channel Capacity, Redundancy and Efficiency of channel, Discrete memory less channel – Channel Matrix, Classification of channels: lossless Channel, Deterministic Channel, Noise free channel, Binary Symmetric Channel (BSC), Cascaded Channels and Binary Erasure Channel (BEC), Shannon's fundamental theorem, Entropy Coding: Shannon Fano Coding, Huffman's Coding, Coding Efficiency Calculations.	6
Unit 3: Linear Block Codes Introduction, Error Control Coding: Need, Objectives & Approaches of Error Control	6

Coding, Classification, Error Detection and Error Correction Techniques, Linear Block Code: Structure, Matrix Description of Linear Block Code, Generator and Parity Check Matrices, Encoder and Syndrome decoder for (n, k) block Code.	
Unit 4: Cyclic Codes Algebraic structure, Properties, Polynomial representation of Code-word, Generator Polynomial, Generation of Code Vector in Nonsystematic and Systematic form, Generator and Parity check matrices in Systematic form, Encoding of Cyclic Code, Syndrome decoding for Cyclic code, Hardware Representation of (n, k) cyclic code. Cyclic Redundancy Check Code.	6
Unit 5: BCH & RS Code Binary Field Arithmetic, BCH Code: Properties, Primitive element and primitive polynomial, Primitive BCH Code, Generator Polynomial for BCH Code, Decoding of BCH Code, Reed-Solomon code: Introduction, Error correction capability of RS code, RS code inNon-systematic & Systematic form, Decoding of RS code.	6
Unit 6: CONVOLUTIONAL CODE Introduction, Encoding of Convolutional Codes, Generation of Output code sequence : Time Domain Approach, Transform Domain Approach, Generator Matrix, Graphical Approach – Code Tree, State diagram and Trellis Diagram, Decoding of Codes : Maximum Likelihood Decoding -Viterbi Algorithm, Sequential Decoding .	6

Text Book:

1. Muralidhar Kulkarni, K. S. Shivprakasha, “Information Theory & Coding”, Wiley (India) Publication 2014.
2. Arijit Saha, Surajit Mandal, “Information Theory, Coding & Cryptography”, Pearson Education, Ist Edition, 2013.

Reference Books:

1. R. P. Singh & S. D. Sapre , "Communication Systems Analog & Digital", Mc-Graw Hill, IInd Edition, 2001.
2. Ranjan Bose, "Information Theory Coding & Cryptography", Tata McGraw-Hill Publishing Company Ltd, IInd Edition 2008
3. Salvatore Gravano, "Introduction to Error Control Codes", Oxford University Press, Ist Edition, 2001.

List of tutorials		
Sr. No.	**Name of Tutorial**	**Unit No.**
1	Find out the mutual and conditional entropy	
2	Differentiation between various channels	
3	Analysis of entropy coding using shanon fano coding	
4	Analysis of entropy coding using huffman's coding	
5	Generation of linear block codes and parity matrix	
6	Error Detection and Error Correction Techniques	
7	Generation of Code Vector in Nonsystematic and Systematic form	
8	Problems for encoding of Cyclic Code	
9.	Solve Generator Polynomial for BCH Code and decoding of BCH Code	
10	Encoding and decoding of Reed Soleman code	
11	Encoding of Convolutional Codes	
12	Maximum Likelihood Decoding & Sequential Decoding	

(The instructor may choose minimum 10 tutorials)

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Digital Signal Processing	
Course Code: 201ETL303	**Semester :** V
Teaching Scheme: L-T-P :3-0-0	**Credit**s: 4
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description:

This is prerequisite course for Image and Speech Processing. In this students will learn FFT algorithms. The Digital filter design and multi-rate digital signal processing will be studied as the application of digital signal processing.

Course Objectives:

1	To impart the knowledge to classify FFT algorithms and implementation of it for linear filtering of signal.
2	To expose the students about the Digital filter design.
3	To impart the skill for realization of digital filters.
4	To make the students aware about Multi-rate signal processing

Course Outcomes (COs):

At the end of the course the student will be able to:

303.1	implement FFT algorithms for linear filtering.
303.2	design digital filters by various methods.
303.3	test the methods of realization of filters
303.4	use knowledge of multi-rate signal processing for its applications

Prerequisite:	Signals and Systems

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
C303.1	2	2	2	2									2	2	IV
C303.2	3	3	3	3									3	3	IV
C303.3	2	2	2	2									2	2	III
C303.4	2	2	2	2									3	3	II

Content	Hrs
Unit 1: Efficient computation of the DFT:Fast Fourier Transform Algorithms Radix -2 DIT and DIF for DFT and IDFT computations, Circular convolution, Fast Convolution : Overlap-Add and Overlap-save algorithm.(Numerical)	6
Unit 2: Design of FIR Filter Symmetric and anti symmetric FIR filters, Design of FIR filter by Fourier series method, windowing method , frequency sampling method	6
Unit 3: Design of IIR Filter Analog filters approximations, mapping of S-plane to Z-plane, Design of IIR filter using Impulse Invariance Method, Bilinear Transformation method, Frequency Transformation, Filter design methods: Butterworth filters, Chebyshev filters and its conversion to digital filter	6
Unit 4: Realization of Digital filters FIR and IIR filter realization in cascade form and parallel form, Effect of finite word length on realization.	6
Unit 5: Multi-rate digital signal processing Need of Multi-rate digital signal processing , decimation by factor D, two stage decimator, interpolation by factor I , two stage Interpolator , sampling rate	6

conversion by rational factor I/D	
Unit 6: Applications of Multi-rate signal processing Digital phase filter, Interfacing of digital systems with different sampling rate, Implementations of narrowband low pass filters, Implementation of digital filter bank , Subband coding of speech signals	6

Text Book:

1. 1.John G.Proakis and Dimitris G.Manolakis, "Digital Signal Processing:Principles,Alogorithms and Applications",Prentice Hall India,3rd Edition
2. Salivahanam, A Vallavaraj, C. Guanapriya, "Digital Signal Processing", Tata McGraw Hill Publication.

Reference Books:

1. Anand Kumar, " Digital Signal Processing", PHI Publications
2. P. Ramesh Babu, "Digital Signal Processing" , SciTech Publication

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Digital Image Processing (Professional Elective –I)	
Course Code: 201ETL304	**Semester:** V
Teaching Scheme: L-T-P :3-1-0	**Credits:** 4
Evaluation Scheme : ISE + MSE Marks: 20 + 30	**ESE Marks:** 50

Course Description:

In this course students will learn digital image processing fundamentals which includes image acquisition, representation, image transforms, image enhancement, image smoothing and sharpening, image segmentation and basics of color image processing.

Course Objectives:

1	To learn the fundamental concepts of Digital Image Processing and study basic image processing operations.
2	To understand the basic analytical methods which are widely used in image processing, linear and nonlinear filtering and image transformations.
3	To introduce various image segmentation techniques.
4	To introduce basic color image processing.

Course Outcomes (COs):

At the end of the course the student will be able to:

304.1	list fundamental steps involved in Digital Image Processing.
304.2	apply different transforms and filtering techniques on an image.
304.3	perform image segmentation.
304.4	perform various operations on color image.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
304.1	2	2	2	-	-	-	-	-	-	-	-	-	1	-	I
304.2	3	3	2	-	-	-	-	-	-	-	-	-	2	-	III
304.3	2	2	2	-	-	-	-	-	-	-	-	-	1	-	III
304.4	2	2	2	-	-	-	-	-	-	-	-	-	1	-	II

Prerequisite:	Basic probability theory

Content	Hrs
Unit 1: Introduction Concept of digital image processing, steps in image processing, components of image processing system, Applications areas.	4
Unit 2: Digital Image Fundamentals Image sensing and acquisition, Basic concept of sampling and quantization, representations of digital image, spatial and gray level resolution, zooming and shrinking of image, Basic relationship between pixels.	7
Unit 3 : Image Enhancement In Spatial Domain Basic gray level transformations: image negation, log transformations, power law transformations, piece wise linear transformations Histogram processing: histogram equalization, histogram matching, Image enhancement using arithmetic and logical operations.	7
Unit 4: Spatial Filters Smoothing spatial filters: smoothing linear, order statistic filters sharpening spatial filters: Use of first derivatives and second derivatives for enhancement.	6

Unit 5: Edge Detection and Segmentation Detection of discontinuities: point, line and edge detection, Thresholding, Region based segmentation.	6
Unit 6: Color Image Processing Color fundamentals, color models, RGB color model, CMY color model, HSI color model, pseudocolor image processing: intensity slicing, gray level to color transformation.	6

Text Book:

Rafael C. Gonzalez and Richard E. Woods, "Digital image processing", (Pearson Education Publication)

Reference Books:

1. S. Sridhar, "Digital Image Processing", (Oxford)
2. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", (PHI)

List of tutorials		
Sr. No.	**Name of Tutorial**	**Unit No.**
1	Steps in image processing	1
2	Application areas	1
3	Image sensing & Acquisition	2
4	Sampling & quantization , resolution	2
5	Basic relationship between pixels	2
6	Gray level transformation	3
7	Histogram Equalization	3
8	Histogram Matching	3
9.	Smoothing & sharpening filter	4
10	Edge detection	5
11	Segmentation	5
12	Basic Color models and processing	6

(The instructor may choose minimum 10 tutorials)

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Fiber Optic Communication (Professional elective-I)	
Course Code: 201ETL305	**Semester :** V
Teaching Scheme : L-T-P :3-1-0	**Credit:** 4
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks :** 50

Course Description: The aim of introducing this course is to provide the knowledge of optical communication through optical fibers and to carry out fast, large bandwidth and low interference communication in real world communication, This course plays vital role & also emphasizes on SONET/SDH, EDFA amplifiers and optical CDMA

Course Objectives: The course aims to :	
1	describe the basics of optical communication along with optical fiber structure and light propagating mechanism in detail.
2	analyze the signal degradation mechanisms in optical fiber
3	explain the construction and working of optical sources and detectors.

Course Outcomes:

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

305.1	differentiate the different types of optical fiber structures and light propagating mechanisms.
305.2	acquire knowledge of signal degradation mechanism in optical fiber.
305.3	understand the construction and working of optical sources and detectors.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
305.1	2	3	2	2	2	_	-	-	-	-	-	-	2	-	III
305.2	2	2	2	2	2	-	-	-	-	-	-	-	1	-	I
305.3	2	2	2	2	2	-	-	-	-	-	-	-	1	-	II

Content	Hrs
Unit 1: Overview of Optical Fiber Communication Motivation for light wave communication, Optical spectral bands, Network Information Rates, Evolution of Optic System, Key Elements of Optical Fiber communication Link. The Nature of Light, Basic Optical Laws and Definitions.	**6**
Unit 2: Optical Fibers: Structures and Wave guiding Optical fiber modes: Single Mode Fibers, multimode fibers and Graded Index fiber structures., Fiber Materials, Fiber fabrication , Fiber Optic cables.	**6**
Unit 3: Transmission Characteristics of Optical Fibers. Attenuation, Material absorption losses, Scattering losses, Bending losses, **Signal dispersion in Fibers:** overview of dispersion origins, Polarization, **Nonlinear Effects:** over view of non linearities, effective length and area.	**6**
Unit 4: Optical Sources	**6**

Semiconductor physics of optical sources, Types of optical sources: Light Emitting Diodes (LEDs), LASER diodes, Light source linearity. Reliability considerations.	
Unit 5: Optical Detectors Physical Principle of Photodiode, Photo detector Noise, Detector Response Time, Structure for InGaAsAPDs, Temperature effect of Avalanche Gain, Comparison of Photo detectors, Fundamental Receiver Operation	**6**
Unit 6: Advances in Optical Fiber System Over view of WDM, Passive Optical Couplers, Isolators and circulators Tunable Light Sources, Optical Switching, SONET/SDH, Performance of EDFA Amplifiers, Optical CDMA	**6**

Text Book:

Gerd Keiser, "Optical Fiber Communication", 5th Edition, Tata Mcgraw Hill Publication.

Reference Books:

1. Senior, "Optical Communication", 3rd Edition, Pearson Education.
2. Agarwal, "Optical Fiber Communication", 3rd edition, Wiley India.
3. Ramaswamy, "Optical Networks" , Elsevier India
4. R. P. Khare, "Fiber optics and optoelectronics", Oxford University Press
5. Anuradha, "Optical fiber and laser principles and applications", New Age Publications.
6. Dr .R .K .Singh "Fiber optic communication systems", Willey India.

List of tutorials		
Sr. No.	**Name of Tutorial**	**Unit No.**
1	Tutorial on Unit No. 01	01
2	Tutorial on Unit No. 01	01
3	Tutorial on Unit No. 02	02
4	Tutorial on Unit No. 02	02
5	Tutorial on Unit No. 03	03
6	Tutorial on Unit No. 03	03
7	Tutorial on Unit No. 04	04
8	Tutorial on Unit No. 04	04
9.	Tutorial on Unit No. 05	05
10	Tutorial on Unit No. 05	05
11	Tutorial on Unit No. 06	06
12	Tutorial on Unit No. 06	07

(The instructor may choose minimum 10 tutorials)

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: VLSI Design (Professional Elective –I)	
Course Code: 201ETL306	**Semester** : V
Teaching Scheme : L-T-P :3-1-0	**Credi**t: 4
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: The course focuses on basics of VLSI design. This creates an integrated circuit (IC) by combining millions of MOS (Metal Oxide Silicon transistor) transistors over a single chip.

Course Objectives:

1	To understand VLSI design and challenges in VLSI technology
2	To understand the fabrication steps involved in the MOS transistor.
3	To analyze modes of operation of MOS transistor and its basic electrical properties.
4	To measure the performance parameters like threshold voltage, noise margins, time delays etc of CMOS inverter.
5	To design static CMOS combinational logic at the transistor level.
6	To design static CMOS sequential logic at the transistor level.

Course Outcomes (COs):

At the end of the course the student will be able to:

306.1	understand VLSI design and challenges in VLSI technology
306.2	understand the fabrication steps involved in the MOS transistor.
306.3	analyze modes of operation of MOS transistor and its basic electrical properties.
306.4	measure the performance parameters like threshold voltage, noise margins, time delays etc of CMOS inverter.

306.5	Demonstrate the ability to design static CMOS combinational logic at the transistor level.
306.6	Demonstrate the ability to design static CMOS sequential logic at the transistor level.

Prerequisite:	Basic device electronics, MOSFET properties, and logic circuits.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BT L
306.1	3	2	2	2	2	-	-	-	-	-	-	2	2	2	II
306.2	3	2	2	2	2	-	-	-	-	-	-	2	2	2	II
306.3	2	2	2	2	2	-	-	-	-	-	-	2	2	2	IV
306.4	3	2	3	2	2	-	-	-	-	-	-	2	2	2	IV
306.5	3	3	3	2	3	-	-	-	-	-	-	3	3	3	III
306.6	3	3	3	2	3	-	-	-	-	-	-	3	3	3	III

Content	Hrs
Unit 1: Introduction to VLSI design Introduction to VLSI Design; Moore's Law; Scale of Integration; Types of VLSI Chips; Design principles (Digital VLSI); Design Domains(Y-Chart), Challenges of VLSI design- power, timing area, noise, testability reliability, and yield; CAD tools for VLSI design.	6
Unit 2: Introduction to VLSI Technology VLSI Technology-An Overview-Wafer Processing, Oxidation, Epitaxial Deposition, Ion-implantation and Diffusion; The Silicon Gate Process- Basic CMOS Technology; basic n-well CMOS process, p-well CMOS process; Twin tub process.	6
Unit 3: Introduction To MOS Transistor Introduction to MOS Transistor Theory: nMOS, pMOS Enhancement Transistor, MOSFET as a Switch, Threshold voltage, Body effect. MOS Device Design Equations, Basic DC equations, Short Channel Effects and Device Models – Scaling Theory .	6
Unit 4: MOS Inverters Introduction, Voltage Transfer Characteristic (VTC), Noise Immunity and Noise margins, Resistive-Load Inverter, Inverters with n-Type MOSFET Load and CMOS Inverter, DC Characteristics of CMOS Inverter, Calculation of VIL, VIH, VOL, VOH and Vth, Design of CMOS Inverters, Supply Voltage Scaling in CMOS Inverters, Power and Area considerations, Switching Characteristics of CMOS Inverter	6
Unit 5: Combinational MOS Logic Circuits CMOS Logic Circuits (NAND, NOR and Complex Logic Gates, Multiplexers etc.), CMOS Transmission Gates (Pass Gates), Pseudo nMOS logic, Dynamic CMOS logic, Clocked CMOS logic and CMOS Domino logic.	6
Unit 6: Sequential MOS Logic Circuits	6

Behavior of Bistable Elements, The SR Latch Circuit, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop. Subsystem design process- design of 4-bit shifter, arithmetic building blocks like adders, multipliers and ALU.	

Text Books:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Eshraghian Dougles, A. Pucknell, 2005, PHI.
2. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.

Reference Books:

1. Pucknell, "Basic VLSI Design", Prentice Hall of India Publication, 1995.
2. Wayne Wolf, "Modern VLSI Design System on chip", Pearson Education, 2002.
3. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.

List of tutorials		
Sr. No.	**Name of Tutorial**	**Unit No.**
1	Design Domain & challenges of VLSI Design	1
2	CAD tools for VLSI Design	1
3	VLSI technology	2
4	Basic CMOS technology	2
5	Introduction to MOS transistor	3
6	Short Channel effects & Scaling theory	3
7	MOS inverter characteristics	4
8	Design of MOS inverter	4
9.	Design of CMOS logic circuits	5
10	CMOS Logic Structure	5
11	Design of CMOS latches and flipflops	6
12	Subsystem Design	6

(The instructor may choose minimum 10 tutorials)

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Project Management and Economic Policy	
Course Code: 201ETL307	**Semester :** V
Teaching Scheme: L-T-P :3-1-0	**Credit:** 4
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks:** 50

Course Description:

In this course students will learn Project management and the process of leading the work of a team to achieve all project goals within the given time. Its main objective is to produce a complete project that combines the client's objective and to make aware of government policy for E&TC and recent trends in a global market concerning E&TC

Course Objectives:

1	To impart the knowledge to conduct a project in the management aspect systematically and scientifically to carry the project development activity
2	To make aware of problems analysis and its conversion in to project to resolve problems with effective risk management technique
3	To make aware of project management tools and techniques for cost and time-effective project management
4	To make aware of Resource requirements and their proper management for successful design development and deployment in projects. To understand the importance of team and teamwork activity and to be able to construct an effective team for a project
5	To make aware of ethics in project management for sponsors, funding agencies, project partners, also the ethical, lawful and effective closing of projects
6	To make aware of government policy for E&TC and recent trends in Electronics and telecommunication all over the world

Course Outcomes (COs):

At the end of the course the student will be able to:

307.1	understand project management principles and practice during project work.
307.2	analyse and identify needs, which shall be converted into a Problem statement of project and risk management in the project
307.3	apply effective handling of a project in time with the help of time management tools and techniques for cost-effective project management
307.4	estimate the cost and effective use of project resources, Team building with effective use of, talents, and strengths while minimizing individual weaknesses and/or gaps of team members.
307.5	apply and practice project ethics and the proper closing of a project
307.6	understand government policy for E&TC and Discover recent trends in the global market

Prerequisite:	Commercial aspects

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	PSO1	PSO2	BTL
307.1	1	2	1	-	-	-	-	-	-	-	2	2	-	2	II
307.2	2	2	2	2	-	-	-	-	1	-	2	2	-	-	IV
307.3	1	2	2	1	-	-	-	-	-	-	2	-	-	-	III
307.4	-	1	1	1	-	-	-	-	2	2	2	1	-	-	V

307.5	-	-	-	-	-	-	1	2	-	1	2	-	-	-	III
307.6	-	-	-	-	-	1	-	1	-	1	-	-	-	-	II

Content	Hrs
Unit 1: Fundamentals of Project Management: Definition, Need of Project management, Project Management process and its importance, Phases of Project Management. Role of project manager, Negotiations and resolving conflicts, various organization structures, Impact of Delays in Project Completions,Project Management Principles, Introduction to project execution plan.	6
Unit 2: Project Identification, Selection and Risk Management: Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point. Introduction to Project Risk Management, Role of Risk Management in Overall Project Management,Steps in Risk Management, Risk Identification, Reducing Risks	6
Unit: 3: Project Management tools and techniques: PERT and CPM: Introduction, Development of Project Network, Time Estimation, Determination of the Critical Path, PERT Model,CPM Model, Network Cost System Resources Considerations in Projects, Gantt Chart.	6
Unit 4: Resource Allocation in the project: Introduction to resource management: - 7 M's of Management in context with Project Management. Estimating Cost,Manpower, Skill, Technology and Raw material Requirement Estimate and Budgeting project Cost Forecasts, Financial Management in Projects: Project Finance structure, Process of Project Financial Management: Conducting Feasibility Studies, Planning the Project Finance, Controlling Financial Risk,	6

Team building practices.	
Unit 5: Ethics and Project Closer A.) Project Leadership and Ethics: Introduction to project leadership, ethics in projects,Multicultural and virtual projects, Ethical issues and solutions in project management. B.) Closing the Project: Customer acceptance; Reasons for project termination, various types of project terminations (Extinction, Addition, Integration, and Starvation), Process of project termination, completing a final report, Project management templates and other resources; Managing without authority; Ethical moral and financial responsibility after project closing.	6
Unit 6: Recent Trends and Government Policy for E&TC The national policy of government on Electronics, Present situation and budgetary funds and schemes provided to electronics and telecommunication sector,Various trends in present E&TC sector in the local and global market.	6

Text Book:

1. H.Kerzer, "Project Management: A Systems Approach to Planning, Scheduling, and Controlling", John Wiley & Sons, Inc., 10th Edition, 2009.
2. Chandra, P., "Projects", Tata McGraw-Hill Education, 8th Edition, 2009.

Reference Books:

1. Morris, P. W. G. and Pinto, J. K., "The Wiley Guide to Managing Projects", JohnWiley & Sons, 2004.
2. Karl Ulrich, Steven Eppinger, "Product Design and Development", McGraw Hill / Irvin, 3rd Edition 2009.
3. R. Majumdar, "Product Management in India", PHI, 2nd Edition, 2010.
4. G.S. Batra, "Development of Entrepreneurship", Deep and Deep publications, New Delhi.
5. Christine Petersen, "The Practical Guide to Project Management", PMP,1 st Edition, 2013.

6. Russell W. Darnall, John M. Preston, "Project Management from Simple to Complex", The Saylor Foundation.
7. Levy, F. K. and Wiest, J. D., "A Management Guide to PERT/CPM", Prentice-Hall, 2ed Edition, 1969.
8. Lewis, R., "Project Management: Strategic Design and Implementation", McGraw-Hill, 5th Edition. 2006.
9. Venkataraman. R., J.K. Pinto, "Cost and Value Management in Projects", John Wiley & sons.

List of tutorials:

Sr.No.	Name of Tutorial	Unit No.
1	Assignment on project management	1
2	Assignment on project Risk management	2
3	Case Study on project Risk management	2
4	Numerical on Properties of CPM/PERT	3
5	Problem illustration using Project Management tools	3
6	Prepare cost and efforts estimation of a sample project	4
7	Prepare a Business plan for a sample Product/ Service to be launched.	4
8	Effective Team building practice with a group activity	4
9.	Assignment on project ethics and project closing	5
10	Case Study on project ethics and project closing	5
11	Study of National policy of the government for Electronics	6
12	Case study on recent trends in E&TC	6

(The instructor may choose minimum 10 tutorials)

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Microprocessor and Microcontroller - Lab	
Course Code: 2201ETP308	**Semester** : V
Teaching Scheme : L-T-P :0-0-2	**Credit**:1
Evaluation Scheme : ISE Marks : 25	**ESE Marks** : 25

Course Description: This course introduces the assembly language and embedded 'C' programming of 8085 microprocessor and 8051 microcontroller. It gives a practical training of interfacing the peripheral devices with the 8085 microprocessor and 8051 microcontroller.

Course Objectives:

1	To understand fundamentals of 8085 Architecture and Programming.
2	To apply the knowledge of Interrupts of 8085.
3	To understand fundamentals of 8051 Architecture and Programming.
4	To evaluate need of I/O peripherals to satisfy system design requirements.
5	To develop Embedded C Programs for I/O Peripherals

Course Outcomes (COs):

At the end of the course the student will be able to:

308.1	design and implement programs on 8085 microprocessor.
308.2	implement Interrupts programming of 8085.
308.3	design and implement programs on 8051 microcontroller.
308.4	design and implement microprocessor and microcontroller bases system
308.5	develop Embedded "C" Programs for I/O Peripherals

Prerequisite:	Digital Electronics and C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
308.1	2	2	1	1	1								1	1	IV
308.2	1	1	1	1	1								1	1	III
308.3	2	2	1	1	1								1	1	IV
308.4	2	2	2	2	2								1	1	III
308.5	1	1	1	1	1								2	2	III
308.6	1	1	1	1	1								1	1	III

List of Practicals			
Experiment No.	**Name of Experiment**	**S/O**	**Hours**
1	Arithmetic & Logical operations using 8085	O	2
2	Data transfer & Exchange using 8085	O	2
3	Data conversions using 8085	O	4
4	Interrupts Programming for 8085	O	2
5	Arithmetic & Logical operations using 8051	O	2
6	Ascending/ Descending order sorting using 8051	O	2
7	Interface ADC using 8051	O	2
8	Interface DAC using 8051	O	2
9	Interface Stepper motor using 8051	O	2
10	Use of Timer & counter operation in 8051 using Embedded C	O	2
11	Serial Communication with 8051 using Embedded C	O	2
12	Interface LCD to 8051 using Embedded C	O	2

S: Study, O: Operational

(The instructor may choose minimum 10 experiments)

Text Books:

1. Ramesh Gaonkar " Microprocessor Architecture Programming and Applications with the 8085", 5th Edition, Penram International Publication
2. Muhammad Ali Mazidi, Janice Gillispie, Rolin D. McKinlay "The8051 Microcontroller & Embedded Systems Using Assemble and C", 2nd Edition, Pearson Education
3. Kenneth Ayala, "The 8051 Microcontroller" , 3rd Edition, Cengage Learning India Private Limited

Reference Books:

1. Douglas V Hall, “Microprocessors and Digital Systems”
2. I.Scott Mackenzie, Raphael C.W.Phan, “The 8051 Microcontroller” , 4th Edition, Pearson
3. Ajay V. Deshmukh, “Microcontrollers [Theory and Applications]”, Tata McGraw Hill Publication
4. Soumitra Kumar Mandal, Microprocessor and Microcontroller Architecture, Programming and Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013.
5. Microprocessor and Microcontrollers Krishna Kant Eastern Company Edition, Prentice Hall of India, New Delhi

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title : Digital signal processing - Lab	
Course Code: 201ETP309	**Semester** : V
Teaching Scheme: L-T-P :0-0-2	**Credit:** 1
Evaluation Scheme : ISE Marks : 25	

Course Description:

This is prerequisite course for Image and Speech Processing. In this students will learn FFT algorithms. The Digital filter design and Multi-rate digital signal processing will be studied as application of digital signal processing.

Course Objectives:

1	To impart the knowledge to classify FFT algorithms and implementation of it for linear filtering of signals.
2	To expose the students about the Digital filter design.
3	To impart the skill for realization of digital filters.
4	To aware the students about Multi-rate signal processing

Course Outcomes (COs):

At the end of the course the student will be able to:

309.1	implement FFT algorithms for linear filtering.
309.2	design digital filters by various methods.
309.3	test the methods of realization of filters
309.4	use knowledge of multi-rate signal processing for its applications

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
309.1	2	2	2	2	2								2	2	IV
309.2	3	3	3	3	2								3	3	IV
309.3	2	2	2	2	2								2	2	III
309.4	2	2	2	2	2								3	3	II

Prerequisite:	Signals and Systems

List of Practicals			
Experiment No.	**Name of Experiment**	**S/O**	**Hours**
1	Generation of DT signals a) Study of Unit impulse sequence b) Study of Unit step sequence c) Study of Exponential sequence d) Study of Sinusoidal sequence	O	2
2	Convolution and correlation of signals	O	2
3	Computation of DFT & IDFT using standard formula	O	4
4	Computation of DFT using FFT algorithms	O	2
5	Computation of circular convolution	O	2
6	Design of FIR LPF, HPF, BPF, BRF filter using Kaiser window	O	2
7	Design of FIR LPF, HPF, BPF, BRF filter using Hamming window	O	2
8	Design of FIR filter using frequency sampling method	O	2
9	Design of IIR LPF, HPF, BPF, BRF filter using impulse	O	2

	invariance method		
10	Design of IIR LPF, HPF, BPF, BRF filter using bilinear transformation method	O	2
11	Design of Multi-rate FIR filter	O	2
12	Study of FIR & IIR filter using TMS320C67XX processor	O	2

S: Study, O: Operational

(The instructor may choose minimum 10 experiments)

Text Books:

1. John G.Proakis and Dimitris G.Manolakis, "Digital Signal Processing: Principles, Alogorithms and Applications" ,Prentice Hall India,3rd Edition
2. Salivahanam, A Vallavaraj, C. Guanapriya, "Digital Signal Processing", Tata McGraw Hill Publication.

Reference Books:

1. Anand Kumar, " Digital Signal Processing", PHI Publications
2. P. Ramesh Babu, "Digital Signal Processing" , SciTech Publication

T. Y. B. Tech. Curriculum
w.e.f. 2022-2023

Course Title: Programming Practice	
Course Code: 201ETP310	**Semester:** V
Teaching Scheme: L-T-P : 2-0-2	**Credits:** 3
Evaluation Scheme: ISE Marks : 25	**ESE Marks:** 25

Course Description:

This course provides the object-oriented approach using Java programming constructs. The course includes basics of Java language programming, the different object-oriented features, and packages, file handling and multithreading. This course enables the students to develop the GUI based applications using advanced features such as swing, database handling, networking and collection. This course provides the basics for developing android applications, games, and many more programming language applications in the different fields.

Course Objective:

1	To introduce the concepts of object-oriented programming using JAVA programming constructs.
2	To expose the students with JAVA concepts using inheritance, interface, package, I/O and exception handling mechanisms.
3	To develop the problem-solving ability using GUI designing components.
4	To build the foundations of advanced java programming for application development.

Course Outcomes (COs):

At the end of the course the student will be able to:

310.1	use the java programming constructs for solving the problems with object-oriented approach.
310.2	develop the reliable and user -friendly application using inheritance, interface, package, I/O and exception handling mechanisms.
310.3	create the applications using the GUI designing components with the use of modern tools.
310.4	apply the knowledge of the advanced java programming concepts for developing the applications from different domains.

Prerequisite:	Basic knowledge of C programming and object-oriented programming.

Course Articulation Matrix:
Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
310.1	2	2	2	2	-	-	-	-	-	-	-	-	-	-	III
310.2	2	2	2	2	-	-	-	-	-	-	-	-	-	-	III
310.3	2	2	3	2	1	-	-	-	2	-	-	-	2	-	III
310.4	3	2	2	2	-	-	-	-	2	-	-	-	1	-	III

Content	Hours
Unit 1: Fundamental Programming in Java: The Java Buzzwords, The Java Programming Environment- JVM, JIT Compiler, Byte Code Concept, A Simple Java Program, Source File Declaration Rules, Comments, Data Types, Variables, Operators, Strings, Input and Output, Control Flow, Array. **Objects and Classes:** Object-Oriented Programming Concepts, Declaring Classes, Declaring Member Variables, Defining Methods, Constructor, Passing Information to a Method or a Constructor, Creating and using objects, Controlling Access to Class Members, Static Fields and Methods, this keyword	3
Unit 2: Inheritance, Interface and Package: **Inheritance:** Definition, Super classes, and Subclasses, Overriding and Hiding Methods, Polymorphism, Inheritance Hierarchies, Super keyword, Final Classes and Methods, Abstract Classes and Methods, casting, Design Hints for Inheritance, Inner Classes, garbage collection**.** **Interfaces:** Defining an Interface, Implementing an Interface, Using an Interface as a Type, Evolving Interfaces, and Default Methods. **Packages:** Class importing, Creating a Package, Naming a Package, Using Package Members, Managing Source and Class Files.	4
Unit 3: Exception and I/O Streams **Exception:** Definition, Dealing with Errors, The Classification of Exceptions, Declaring Checked Exceptions, Throw an Exception, Creating Exception Classes, Catching Exceptions, Catching Multiple Exceptions, Re-throwing and Chaining Exceptions, finally clause. **I/O Streams:** Byte Stream – Input Stream, Output Stream, Data Input Stream, Data Output Stream, File Input Stream, File Output Stream, Character Streams, Buffered Stream, Scanner class	4

Unit 4: Graphical User Interfaces using AWT and Swing Introduction to AWT components, Frame, Applet, Introduction to the Swing, Swing components. **Layout Management:** Introduction to Layout Management, APIs for Border Layout, Flow Layout, Grid Layout **Event Handling:** Basics of Event Handling, The AWT Event Hierarchy, Semantic and Low-Level Events in the AWT, Low-Level Event Types	6
Unit 5: Multithreading, Collections **Multithreading:** Processes and Threads, Runnable Interface and Thread Class, Thread Objects, Defining and Starting a Thread, Pausing Execution with Sleep, Thread States, Thread Properties, Synchronization **Collections:** Collection Interfaces, Concrete Collections-List, Queue, Set, Map, the Collections Framework	4
Unit 6: Database Programming and Networking **Database Programming:** The Design of JDBC, The Structured Query Language, Basic JDBC Programming Concepts, Query Execution, Scrollable and Updatable Result Sets. **Networking:** Overview of Networking, Networking Basics, Sockets, reading from and Writing to a Socket, Writing the Server Side of a Socket	3

List of Practicals			
Assignment No.	**Name of Assignment**	**S/O**	**Hours**
1	Study of JAVA basics.	S	2
2	Implementation of a problem statement using class and object.	O	2
3	Design and develop the programs for different types of inheritance	O	4
4	Implementation of stack/queue operations using Interface	O	2
5	Implementation of user defined package.	O	2
6	Implementation of any type of Exception Handling	O	2
7	Implementation of different I/O operations using console and file.	O	2
8	Implementation of program for designing the GUI using swing components.	O	2
9	Implementation of different types of event handling.	O	2
10	Implementation of programs for demonstrating the different types of Layout Managers.	O	2
11	Design and develop an application for demonstration of multithreading	O	2
12	Implementation of any program using collections.	O	2
13	Implementation of different database operations using JDBC	O	2
14	Develop any application using networking.	O	2
15	Design an application using any **modern tools available for java programming** such as Eclipse IDE, NetBeans, Oracle JDeveloper, IntelliJ IDEA 13.1 etc.	O	2
16	Design and develop the **mini project** for solving the	O	4

	different real time problems using java language in the group of 4-5 students. Problem Statements like 1. Online quiz management system 2. Smart city project 3. Network packet sniffer 4. Email client software 5. File Compression 6. Virtual Classroom 7. Text Editor 8. Advanced Payroll System 9. Datamart Management System		

S-STUDY, O-OPERATIONAL

Note: The instructor may choose minimum 10 assignments from assignment no. 1 to 15 & assignment no. 16 is mandatory and should start working on 16th assignment after mid semester as home assignment.

Text Books:

1. Cay Horstmann and Gary Cornell, Core Java- Volume I Fundamentals Pearson, Eight edition (Unit 1 to Unit 4).
2. Cay Horstmann and Gary Cornell, Core Java- Volume II Advanced Features, Pearson, Eight edition (Unit 5 and Unit 6).

Reference Books:

1. Herbert Schildt, JAVA-The Complete Reference, Mcgraw Hill, Ninth edition.
Online Resources
2. https://nptel.ac.in/courses/106/105/106105191
3. https://java-iitd.vlabs.ac.in/List%20of%20experiments.html

T. Y. B. Tech. Curriculum
w.e.f. 2022-2023

Course Name: Industrial Marketing	
Course Code: 201ETL311	**Semester :** V
Teaching Scheme: L-T-P :2-0-0	**Credit:** Non credit mandetory
Evaluation Scheme: ESE: 50 marks	

Course Description:

In this the students will learn Industrial marketing which is required by companies for industrial marketing especially those who are not in the FMCG sector and selling technology and selling a consumer products In E&TC Engg. maximum marketing is done under B2B form and sometimes B2C with professionals for retailing in electronic goods. but it is a specific course which teaches how to do non-retail marketing may be for technology gadgets spare parts and many more electronic stuff to target NET ZERO Imports and maximise the sales of electronic goods and technology all across the globe to make India Electronic Export Hub.

Course Objectives:

1	To impart the knowledge of Industrial Marketing to Engineering Students
2	To make aware of organisational buying process
3	To make aware of industry segments and find out the exact position of business
4	To make aware of distribution channels and product promotion policy in Industrial Market
5	To make aware of market intelligence and market research

6	To make aware of industrial strategy planning, product development strategy and product price policy in a competitive Industrial market

Course Outcomes (COs):

At the end of the course the student will be able to:

311.1	understand industrial Marketing and Find Its need in E&TC.
311.2	analyse and Identify organizational buying process and Estimate the Strategic Policy accordingly.
311.3	understand Market segmentation and Apply better positioning in market
311.4	judge various distribution and promotion channels and Choose a proper product promotion policy
311.5	understand Industrial market Intelligence and Develop, Apply and practice Industrial market research.
311.6	understand strategy planning for Industrial marketing, Evaluate product development strategy and Estimate the product pricing

Prerequisite:	Commercial aspects

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
311.1	2	1	-	-	2	2	-	-	-	-	-	2	3	2	II
311.2	1	-	1	2	-	3	2	3	3	2	-	2	3	2	VI
311.3	1	1	2	1	2	-	-	-	-	-	2	-	3	2	III
311.4	-	3	3	2	3	-	-	-	3	3	2	2	3	2	VI
311.5	2	2	2	2	2	-	-	-	1	3	-	2	1	2	VI
311.6	1	2	3	3	-	-	3	1	2	-	2	3	2	2	VI

Content	Hrs
Unit 1: Nature of Industrial Marketing: Industrial Marketing Vs. Consumer Marketing Relational approach to Industrial Marketing- The Nature of Industrial Demand & Industrial Customer. Introduction to different types of Industrial Products: Major Equipment; Accessory Equipment; Raw and Processed Materials; Component Parts and Sub- Assemblies; Operating Supplies; Standardized and Non-standardized parts, Out Sourcing, Innovation of assembly and parts Industrial services Characteristics of services Service Strategy Value Creation Service Assets Service Provider Types Service Portfolio Management Business Relationship Management	4

Unit 2: Organizational Buying structure and Ethics Phases in purchasing decision process & their marketing implications, Buying centres, value analysis & vendor analysis. Factors influencing Organizational Buying: Buying Roles; Organizational Buying Decision Process; Environmental & organizational Influences Organizational Influences on Buying Behaviour	4
Unit 3: Industrial market segmentation: Bases for segmenting industrial market-macro and micro variables. Targeting the industrial product, positioning the industrial product. Industrial product life cycle, product mix, Service component Industrial Product Decisions: Industrial Product Life Cycle Industrial Product Mix determinants.	4
Unit 4: Distribution channel and product promotions: The distribution channel component Industrial distributors, Formulation of channel strategy conditions influencing channel structure. A brief introduction to Marketing Logistics. Channel Structure for Industrial Products Geographical, size, operating characteristics manufacturers' and sales agents Brokers Channel Logistics.	4
Unit 5: Market Intelligence and Research MARKET INTELLIGENCE a) Market Intelligence System definition Benefits Key Elements Information Management Processes Intelligence Development Processes Purpose of Market Intelligence Market entry and market expansion studies INDUSTRIAL MARKETING RESEARCH b) Industrial Marketing Research Definition Studying the business trends New Product Studies Sales quota determination and forecasting Market potential and market share analysis Differences in Industrial and Consumer Marketing Research Industrial Marketing Research	4

Unit.6: Strategy planning and pricing policy A) STRATEGY PLANNING Market Selection Segmentation criteria Targeting and Positioning and Targeting Strategy Undifferentiated, Differentiated &Concentrated Marketing Customized Marketing B) PRODUCT DEVELOPMENT STRATEGY Developing product strategy Product Policy New Product Development Define product Identify market needs Identify key issues and approaches Idea Generation Idea Screening Concept development & testing Business Analysis Product Development Marketing Testing Commercialization Environmental sustainability of a product. C) PRICING IN INDUSTRIAL MARKETING Pricing Environment Characteristics of Price The Pricing Process in Industrial Marketing Factors affecting industrial pricing decision Pricing Objectives Market Skimming Market Penetration Product Differentiation Other pricing objectives Pricing Policies	4

Text Books:

1. Industrial Marketing – P K Ghosh
2. Industrial Marketing – Hawaldar

Reference Books:

1. Alexander, R.S. Cross, J.S. & Hill, M.: Industrial Marketing, Richard Irwin, Homewood, Illinois.
2. Reeder & Reeder: Industrial Marketing, Prentice-Hall, India.
3. Cox. F. (Jr.): Industrial Marketing Research, John-Willey & Sons, New York, 1971.
4. Fisher, L.: Industrial Marketing, Business Books, 1969.

T.Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Cellular and Mobile Communications	
Course Code: 201ETL312	**Semester :** VI
Teaching Scheme: L-T-P :3-0-0	**Credits:** 3
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks:** 50

Course Description:

Cellular communication is a form of communication technology that enables the use of mobile phones. Cellular communication is based on the geographic division of the communication coverage area into cells, and within cells. This course is useful for better understanding of cellular communication this course is useful.

Course Objectives:

1	To understand the evolution of Mobile communication and cell concept to improve capacity of the system.
2	To analyze the fading mechanism types of fading and effect of fading on Mobile communication.
3	To study the role of equalization in Mobile communication and to study different types of Equalizers and Diversity techniques.
4	To understand the types of channel coding techniques, data transmission modes and services of GSM& CDMA.

Course Outcomes (COs):

At the end of the course the student will be able to:

312.1	demonstrate cellular concepts like frequency reuse, fading, equalization, GSM,CDMA.
312.2	analyze the equalization and different diversity techniques.
312.3	apply the concept to calculate link budget using path loss model
312.4	apply the concept of GSM & CDMA in real time applications.

Prerequisite:	Analog and digital Communication

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	PSO1	PSO2	BTL
312.1	3	2	1	1	2	-	-	-	-	-	-	2	2	2	III
312.2	3	2	1	2	-	-	-	-	-	-	-	-	2	1	IV
312.3	3	2	2	2	2	-	-	-	-	-	-	2	2	2	III
312.4	2	2	2	2	2	-	-	-	-	-	-	-	2	2	III

Content	**Hrs.**
Unit 1: Introduction to Mobile Communication Evolution of Mobile Radio Communication, Paging system, Cordless telephone systems, Cellular telephone Systems, Cellular concept: Frequency reuse, Channel Assignment strategies, Hand off strategies. Interference and System capacity, Improving coverage and capacity in cellular systems.	6
Unit 2: Mobile Radio Propagation **Large Scale Fading**: Free space propagation mode, Three basic propagation mechanisms, Reflection, Ground Reflection(Two-Ray)Model, Diffraction, Scattering, Practical link budget using path loss models. **Small Scale Fading**: Multipath Propagation, Types of small Scale fading, Parameters of Mobile Multipath channels, and fading effects due to multipath time delay Spread and Doppler spread.	6

Unit 3: Equalization & Diversity Techniques **Equalization:** Fundamentals of Equalizers, Linear equalizers, Non-linear equalizers, Decision feedback equalizers, MLSE. **Diversity Techniques:** Space diversity: MRC, EGC Selection diversity, Polarization diversity, Frequency diversity, Time diversity.	6
Unit 4: Multiple Access Techniques FDMA,TDMA,CDMA Systems, FDM / TDM Cellular systems, Cellular CDMA, comparison of FDM / TDM systems and Cellular CDMA	6
Unit 5: GSM System Overview GSM: GSM Network architecture, GSM signaling protocol architecture, identifiers used in GSM system, GSM channels, frame structure for GSM, GSM speech coding, authentication and security in GSM, GSM call procedures, GSM hand-off procedures, GSM services and features	6
Unit 6: GSM Evolution GPRS And EDGE- architecture, radio specifications, channels. IS-95: Architecture of CDMA system, CDMA air interface, power control in CDMA system, power control, handoff, rake receiver	6

Text Book:

1. Theodore S. Rappaport - Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003.
2. Andreas F. Molisch - Wireless Communications ,John Wiley, 2nd Edition, 2006

Reference Books:

1. Kamilo Feher - Wireless Digital Communications, PHI, 2003
2. W.C.Y. Lee - Mobile Cellular Communications, 2nd Edition, MC Graw Hill, 1995.
3. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Embedded Systems	
Course Code: 201ETL313	**Semester :** VI
Teaching Scheme: L-T-P :3-0-0	**Credits:** 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks:** 50

Course Description:

This is a core course which gives the detailed knowledge of Embedded Systems. It gives the introduction to embedded systems. It also gives the exposure of assembly language programming for ARM Processor and Embedded C programming for ARM LPC 2148 Microcontroller.

Course Objectives:

1	To understand the characteristics of Embedded systems and its Architectures.
2	To develop skills of ARM programming.
3	To introduce devices and buses used for embedded networking.
4	To study key features of Microcontroller LPC214X.
5	To develop skills of programming on chip resources of LPC214X.
6	To understand the concept of real time operating systems.

Course Outcomes (COs):

At the end of the course the student will be able to:

313.1	apply important attributes of Embedded system.
313.2	develop a meaningful assembly language program using the ARM programmer's model.
313.3	design small applications of UART, I^2C, SPI.
313.4	demonstrate the use of on chip resources of LPC 2148.
313.5	design small applications of ON CHIP resources using embedded C.
313.6	apply the concepts of RTOS in the Embedded system design.

Prerequisite:	Microprocessors & Microcontrollers, C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
313.1	2	1	1	1	-	-	-	-	-	-	-	-	-	2	III
313.2	2	2	3	2	-	-	-	-	-	-	-	-	-	2	IV
313.3	1	1	2	2	-	-	-	-	-	-	-	-	-	2	IV
313.4	1	1	1	1	-	-	-	-	-	-	-	-	-	-	III
313.5	1	1	2	2	-	-	-	-	-	-	-	-	-	2	IV
313.6	1	1	1	1	-	-	-	-	-	-	-	-	-	-	IV

Content	Hrs
Unit 1: Introduction Introduction to Embedded Systems, Classification of Embedded System, processor selection in Embedded System, Components of Embedded systems, Hardware and Software Systems Development tools: Assembler, cross compiler, Simulator, ICE, IDE	4
Unit 2: Introduction to ARM Processor ARM Core data flow model, registers, operating modes, pipeline, exceptions, interrupts & the vector table, ARM processor families ARM instruction set: conditional execution. Branch and Load/Store, software interrupt instruction, program status register instruction, Thumb instruction set introduction. Exception handling schemes	10
Unit 3: Embedded Networking Serial Bus communication protocols: RS232 standard, RS485, Serial Peripheral Interface (SPI), Inter Integrated Circuits (I2C). CAN Bus	4
Unit 4: ARM7TDMI-S Microcontroller LPC 2148 Features, LPC 214X Device Information, Block Diagram, Memory Maps, Memory Acceleration Module-Block Diagram & Operation, System Control Block(SCB)-Register Description, Fosc. Selection Algorithm, external interrupt logic, power control, Reset- Block Diagram& RSI register.	6
Unit 5: LPC 2148 On Chip Resources Features, Block diagram and SFR planning: Pin connect block, GPIO, UART & Architecture, I2C, SPI, Timer, PWM, ADC & DAC, Real time clock, Watchdog timer, Vectored interrupt controller, features of on chip USB	8
Unit 6: Introduction to RTOS Architecture of kernel, task and task scheduler, ISR, Semaphores, Mutex,	4

Mailboxes and Pipes, Message Queues, Timers, Memory Management	

Text Book:

1. Rajkamal, "Embedded Systems :Architecture, Programming and Design",TMH
2. Sloss, Symes, Wright, "ARM system developers guide", Morgan Kaufman (Elsevier) publication.

Reference Books:

1. William Hohel , "ARM assembly language: fundamentals and Technique"
2. ARM Architecture Reference Manual By: ARM
3. LPC214x USER MANUAL By Philips/ NXP semiconductor
4. An Embedded Software Primer. David E. Simon. Pearson Education

T. Y. B. Tech. Curriculum
W.E.F 2022-2023

Course Name: Industrial Management and Start-ups	
Course Code: 201ETL314	**Semester :** VI
Teaching Scheme: L-T-P :3-1-0	**Credits:** 4
Evaluation Scheme: ISE + MSE Marks : 20 + 30	ESE Marks: 50

Course Description:

Management has become inevitable for students of engineering to learn Industrial Management and its application. The basic goal is to make aware of students about of industrial revolution 4.0 and make them ready for Industrial revolution 5.0 to introduce the students to the fundamentals of Management and aware them about the jargon commonly used Management techniques. This course will clear the concepts of management, especially Industry related management and processes. That will effectively motivate them to be an Entrepreneur. also empowering them to utilize various management concepts for new business start-ups management problems and risk involved in it and steps involved in new business start-ups with various Government Schemes

Course Objectives:

1	To impart the knowledge on business management and strategic management systematically
2	To make aware of innovation and engineering designing process in management aspect.
3	To make aware of quality control and its methods
4	To make aware of entrepreneur skills and motivate them for a new business venture
5	To make aware of financial policies and legal perspective required for a business
6	To make aware of MSME, SSI, and DPIIT Schemes for new start-ups

Course Outcomes (COs):

At the end of the course the student will be able to:

314.1	understand fundamentals of management and strategic management to Build new skill sets for Entrepreneurship
314.2	analyse and identify needs of innovation and engineering designing process in the management aspect
314.3	understand and Apply effective quality control techniques and Evaluate the quality control with the help of various tools of QC.
314.4	understand entrepreneurship and Identify the qualities to improve and enhance to be a successful entrepreneur and Apprise the business.
314.5	apply various effective financial policies and Understand various legal prospective businesses to Plan for cost-effective legal start-up
314.6	understand government policy of MSME, SSI, and DPIIT for E&TC or any new start-ups and able to plan for new Start-up

Prerequisite:	Commercial aspects

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
314.1	1	2	1	1	1	1	1	1	2	2	1	2	3	2	III
314.2	3	3	3	2	2	-	2	2	-	-	3	3	3	3	IV
314.3	3	3	3	3	2	-	2	-	-	-	3	-	3	3	IV
314.4	-	3	3	2	1	-	-	-	3	2	3	1	3	3	IV

314.5	-	-	-	-	-	1	2	2	3	2	3	2	1	3	II, III VI
314.6	-	-	-	-	-	2	2	1	2	2	3	3	3	3	II, I, VI

Content	Hrs
Unit 1: Fundamentals of management and strategic management a) History of industrial development, Introduction, Definition of management, characteristics of management, functions of management, Principles of Management, Administration and management, Nature and levels of management, managerial skills, managerial roles, Forms of Organization. Forms of ownerships introduction to Globalisation b) Military origins of strategy Evolution Concept and Characteristics of strategic management Mintzberg's 5P's of strategy Corporate, Business and Functional Levels of strategy Strategic Management Process. Preparing an Environmental Threat and Opportunity Profile (ETOP) – Industry Analysis - Porter's Five Forces Model.BCG Matrix – GE 9 Cell Model -Balanced Scorecard, Generic Competitive Strategies,Business Model Canvas.	6
Unit 2: Fundamentals of Innovation and Engineering Design Process a) Introduction to Engineering Design Process; Design Approaches Forward and Reverse Engineering and goal of Reverse engineering (RE); Methods and techniques of Reengineering, Redesign and Engineering Product Development; Innovative Product Design and Engineering Optimization. Benchmarking and establishing engineering specifications; Design Requirement Analysis and Planning; Integrated Product and Process Design; b) Theory of inventive problem solving (TRIZ): Fundamentals, methods and techniques, inventive design strategies Engineering Product Design	6

Analytics; Remanufacturing and Product Design: Engineering Manufacturing and Materials; Sustainability and Design: Recyclability; Reliability and Lean Design Engineering; Interface with Industrial design; Economic considerations in design; Eco Design and Green Engineering Product Development.	
Unit 3: Quality Control Management Definition of quality, goalpost view of quality, continuous improvement definition of quality, types of quality based on design, conformance and performance, phases of quality management, Juan's and Deming's view of quality, Quality Management Assistance Tools: Ishikawa diagram – Pareto Analysis – Pokka Yoke (Mistake Proofing).quality circles, TQM, Kaizen, Five S (5S), Six Sigma Quality Management Standards (Introductory aspects only)- The ISO 9001:2000 Quality Management System Standard- The ISO 14001:2004 Environmental Management System Standard- ISO 27001:2005 Information Security Management System	6
Unit 4: Fundamentals of Entrepreneurship Definition characteristics of entrepreneur Entrepreneurial traits, true motivation & leadership, understanding of the Entrepreneurial process, Opportunity assessment for new ventures, creating a business model with technology differentiators, launching and managing venture, Human resource aspects, understanding of personal aspirations, Entrepreneurial personality development, Entrepreneurial communication, determinants of winning business model, building a balanced team, and sources of capital for creating fixed and working assets including government incentives Entrepreneurship in Indian Scenario and Future prospects in India and emerging economies.	6
Unit 5 :Financial and Legal Aspects of Business a) Process for effective financial planning, where to start, types of budgets preparation, budget a value-added activity, Concise overview of specific	

ratios to measure financial performance, liquidity, asset management, profitability, leverage, market value ratios, and comparative analysis, Venture capital and its relation to grants and loan opportunities b) business laws enshrined in the Indian constitution, the policies of the state, Income tax structure, the labour laws, Indian commercial laws, EXIM policies, Intellectual property rights (IPR)	6
Unit 6: MSME, DPIIT and various government schemes for start-ups **a)** Challenges of MSMEs, Preventing Sickness in Enterprises Specific Management Problems; Industrial Sickness; Industrial Sickness in India Symptoms, process and Rehabilitation of Sick Units. Various schemes of government for new start-ups **b)** Process of applying for MSME, SSI proposal and writing a project proposal for a new business start-up	6

Text Books:

1. Dr. N. Mishra, Dr. O. P. Gupta , 2022 "Fundamentals Of Management 1st Edition ",SBPD Publishing House

Reference Books:

1. Fred R. David Jun 2010 "Fundamentals of Strategic Management, Volume 1", Merrill Publishing Company, 1986 , ISBN 0675205514
2. Stephen P. Robbins, Mary ,June 2016, "Fundamentals of Management 9th edition Pearson Education India.
3. Shuchen B. Thakore Bharat I. Bhatt July 2017 "Introduction to Process Engineering and Design" McGraw Hill Education; Second edition
4. Hardcover, Mehregany Mehran"Innovation for Engineers "
5. Barry Hyman Nov2002, "Fundamentals of Engineering Design", Pearson; IIed edition
6. Yousef Haik Jan2017 "Engineering Design Process" CL Engineering; 3nd edition

7. Kenneth Rose May 2014"Project Quality Management", J Ross Publishing; 2nd edition
8. David L. Goetsch Apr 2002 "Introduction to Total Quality Management for Production, Processing, and Services" Pearson; 4th edition
9. Ravinder Kuamr July 2016Legal Aspects of Business Cengage Learning India Private Limited; Fourth edition
10. Prasanna Chandra , "Financial Management: Theory and Practice" McGrawHill
11. Rashmi Aggarwal "Legal Aspects of Business" Pearson Education First Edition

List of tutorials		
Sr.No.	**Name of Tutorial**	**Unit No.**
1	Assignment on Fundaments of management and strategic management	1
2	Assignment on Innovation and Engineering Design	2
3	Case Study on Innovation and Engineering Design	2
4	Assignment on quality control management	3
5	Case Study on quality control management	3
6	Assignment on Eterprenureship	4
7	Case Study / Role play on Eterprenureship	4
8	Assignment on the legal aspect	5
9.	Case Study on the financial and legal aspect	5
10	Case study on new start-up	6
11	Study of MSME,SSI, DPIIT Schemes	6
12	Project report and proposal writing for a new start-up	6

(The instructor may choose minimum 10 tutorials)

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Image Processing and Analysis (Professional Elective –II)	
Course Code: 201ETL315	**Semester :** VI
Teaching Scheme: L-T-P :3-1-0	**Credits:** 4
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks:** 50

Course Description: To familiarize students with image enhancement in frequency domain, morphological processing techniques and image compression methods, at the same time they learn how images are described and represented.

Course Objectives:

1	To introduce frequency domain approach for image processing.
2	To study fundamentals of wavelet transform
3	To understand different morphological operations and image compression methods
4	To learn image representation & description techniques.

Course Outcomes (COs):

At the end of the course the student will be able to:

315.1	apply frequency domain approach for image enhancement.
315.2	compare compression techniques.
315.3	apply morphological operations
315.4	represent and describe images in various methods.

Prerequisite:	Basics of image processing

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
315.1	2	2	2	-	-	-	-	-	-	-	-	-	2	-	II
315.2	2	2	2	-	-	-	-	-	-	-	-	-	1	-	II
315.3	2	2	2	-	-	-	-	-	-	-	-	-	1	-	III
315.4	2	2	2	-	-	-	-	-	-	-	-	-	2	-	II

Content	Hrs
Unit 1: Frequency Domain Filters Basics of filtering in the Frequency Domain , Smoothing: Ideal low pass filter, Butterworth, Gaussian low pass filters, Sharpening in frequency domain: Ideal high pass filter, Butterworth high pass filters, Gaussian high pass filters. Laplacian in frequency domain.	6
Unit 2: Wavelets And Multi resolution Processing Image pyramids, Sub-band coding, the Haar transform, Series expansions, scaling functions, wavelet functions, the discrete wavelet transform.	6
Unit 3: Image Compression Fundamentals, coding redundancy, inter pixel redundancy, psycho visual redundancy, fidelity criteria, image compression models, elements of information theory, lossless predictive coding, Lossy predictive coding.	6
Unit 4: Morphological Image Processing	

Dilation & erosion, opening and closing operation, Hit- or – miss transformation. Basic morphological algorithms: Boundary extraction, region filling, thinning and thickening, skeletons	8
Unit 5: Image Representation Introduction to Boundary, Chain Code, Polygonal Approximation, signature, boundary Segments, skeletons.	5
Unit 6: Image Description Boundary Descriptors: Simple Descriptor, shape numbers, Fourier descriptors, statistical moments, Regional Descriptors: Simple Descriptors, Topological Descriptors and Relational Descriptors.	5

Text Book:

Rafael C. Gonzalez and Richard E. Woods, “Digital image processing”, Pearson Education publication

Reference Books:

1. S. Sridhar , “Digital Image Processing”, Oxford
2. M. K. Pakhira , “Digital Image Processing and Pattern Recognition”, PHI
3. B.Chanda , D. Dutta Majumder , “Digital Image Processing and Analysis”, PHI

List of tutorials		
Sr. No.	**Name of Tutorial**	**Unit No.**
1	Smoothing Filtering in frequency domain	1
2	Sharpening Filtering in frequency domain	1
3	Image Pyramid	2
4	Haar Transform	2
5	Scaling function, Wavelet function	2
6	Redundancy & Fidelity Criteria	3
7	Lossy & Lossless Compression	3
8	Basic morphological operation	4
9.	Basic morphological algorithm	4
10	Image representation	5
11	Boundary descriptors	6
12	Regional Descriptors	6

(The instructor may choose minimum 10 tutorials)

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Satellite Communication (Professional Elective-II)	
Course Code: 201ETL316	**Semester :** VI
Teaching Scheme: L-T-P : 3-1-0	**Credits:** 4
Evaluation Scheme: ISE +MSE Marks : 20+30	**ESE Marks:** 50

Course Description:

The course introduces the students to the basic concept in the field of satellite communication. This will enable the students to know how to place a satellite in an orbit and about the earth & space segment. Satellite telecommunication systems with an emphasis on modern systems and their link budgets. Topics will include a historical perspective, orbital mechanics and constellations, choice of orbital parameters, propagation considerations, link budgets, interference issues and other obstacles.

Course Objectives:

1	Understand the basics of satellite orbits
2	Understand the satellite segment and earth segment
3	Analyse the various methods of satellite access
4	Understand the applications of satellites
5	Understand the basics of satellite Networks
6	Understand the basics of satellite orbits

Course Outcomes (COs):

At the end of the course the student will be able to:

316.1	understand Orbital aspects involved in satellite communication.
316.2	understand various subsystems in satellite communication system
316.3	explain and Analyse Link budget calculation
316.4	understand Satellite Network System
316.5	explain Non Geostationary Satellite Systems
316.6	explain different applications of Satellite Systems

Prerequisite: Analog & Digital Communication system

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs)	PO												PSO		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
316.1	3	2	3	-	2	-	-	-	-	2	1	1	1	3	III
316.2	3	2	3	-	2	-	-	-	-	2	1	1	1	3	III
316.3	3	2	3	-	2	-	-	-	-	2	1	1	1	3	IV
316.4	3	2	3	-	2	-	-	-	1	2	1	1	1	3	IV
316.5	3	2	3	-	2	-	-	-	2	2	1	1	2	3	IV
316.6	3	2	3	-	2	-	-	-	2	2	1	1	2	3	IV

Content	Hrs
Unit 1: Introduction Of Satellite: Introduction, Basic Concept Of Satellite Communication, Satellite Orbits, Keple's Laws, Newton's Law, Orbital Parameters Orbital Mechanics, Look Angle Determination, Orbital Perturbation, Orbital Determination Launchers And Launch Vehicles, Orbital Effects in Communication System Performance.	7
Unit 2: Satellite Space Segment Subsystem: Introduction, Attitude And Control System (AOCS), Telemetry, Tracking, Command And Monitoring, Power Systems, Communication Subsystem, Satellite Antennas, Telemetry ,Equipment Reliability And Space Qualification, The Antenna Subsystem	7
Unit 3: Satellite Link Design: Introduction, Basic Transmission Theory, System Noise Temperature And G/T Ration, Design Of Downlinks, Uplink Design, Design Of Specified C/N : Combining C/N And C/I Values in Satellite Links. Link Design With And Without Frequency Reuse **(Numerical Expected)**	6
Unit 4: Satellite Networks: Reference Architecture For Satellite Networks, Basic Characteristics of Satellite Networks, Onboard Connectivity With Transparent Processing, Analogue Transparent Switching, Frame Organization, Window Organization, On Board Connectivity With Beam Scanning.	6
Unit 5: Low Earth Orbit And Non Geo-Stationary Satellite System: Introduction, Orbit Considerations, Coverage And Frequency Consideration, Delay And Throughput Consideration, Operational NGSO Constellation Design: Iridium, Teledesic.	4
Unit 6: Satellite Applications: Communication Satellite-Digital DBS TV, Mobile Satellite Services: GSM,	6

GPS, Inmarsat, LEO, MEO, Satellite Radio Broadcasting, Navigation Satellite, GPS Position Location Principles, GPS Receivers and Codes. Military Satellite- Directed Energy Laser Weapons, Weather Forecasting Satellite Application	

Text Book:

1. Satellite Communications-Timothy Pratt, Charles Bostian, Jeremy Allnut John Wiley &Sons (Ii Edition) (For Unit 1,2,3,5)
2. Satellite Communications-Anil K. Maine And Varsha Agaraval, Wiley Publications (All Units)
3. Satellite Technology Principles And Applications Anil K. Maini And Varsha Agarawal, Wiley Publications, Third Edition (Unit 6)
4. Dennis Roddy, ―Satellite Communication‖, 4th Edition, Mc Graw Hill International, 2006.

Reference Books:

1. Satellite Communications- Gerard Maral And Michel Bousquet, Wiley Publication (5th Edition For Unit 4)
2. Satellite Communications Systems Engineering, 2nd Edition- Wilbur L. Pritchard, Henri G.Suyderhoud And Robert A. Nelson. (Unit I)
3. N.Agarwal, ―Design Of Geosynchronous Space Craft‖, Prentice Hall, 1986.
4. Bruce R. Elbert, ―The Satellite Communication Applications‖, Hand Book, Artech House Bostan London, 1997.
5. Tri T. Ha, ―Digital Satellite Communication‖, Ii Nd Edition, 1990
6. Emanuel Fthenakis, ―Manual Of Satellite Communications‖, Mc Graw Hill Book Co., 1984.
7. G.B.Bleazard, ―Introducing Satellite Communications―, Ncc Publication, 1985.
8. M.Richharia, ―Satellite Communication Systems-Design Principles‖, Macmillan 2003

List of tutorials		
Sr. No.	**Name of Tutorial**	**Unit No.**
1	Kepler's Laws	
2	Look angle determination	
3	Attitude and control system(AOCS)	
4	The Antenna Subsystem	
5	Design of Downlinks & Uplink Design	
6	Link Design with and without frequency reuse	
7	Architecture for satellite networks	
8	Onboard Connectivity	
9.	Non Geo-Stationary Satellite System	
10	Operational NGSO constellation design	
11	Satellite Radio Broadcasting	
12	Satellite Application	

(The instructor may choose minimum 10 tutorials)

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: ASIC Design	
Course Code: 201ETL317	**Semester** : VI
Teaching Scheme : L-T-P :3-1-0	**Credit**:4
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: An application-specific integrated circuit (ASIC) is an integrated circuit (IC) customized for a particular use, rather than intended for general-purpose use. Application-specific standard products (ASSPs) are intermediate between ASICs and industry standard integrated circuits like the7400 or the 4000 series .As feature sizes have shrunk and design tools improved over the years, the maximum complexity (and hence functionality) possible in an ASIC has grown from 5,000 gates to over 100 million.

Course Objectives:

1	To study the design flow of different types of ASIC.
2	To familiarize the different types of programming technologies and logic devices.
3	To gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC
4	To analyse the synthesis, Simulation and testing of systems
5	To know about different high performance algorithms and its applications in ASIC
6	To study the basic of FPGA.

Course Outcomes (COs):

At the end of the course the student will be able to:

317.1	understand the design flow of different types of ASIC.
317.2	understand the different types of programming technologies and logic devices.
317.3	apply the knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC
317 .4	analyse the synthesis, Simulation and testing of systems
317.5	understand the different high performance algorithms and its applications in ASIC
317.6	understand the basic of FPGA.

Prerequisite:	Digital Electronics and C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
317.1	3	2	2	2								2	2	2	II
317.2	3	2	2	2								2	2	2	II
317.3	3	3	3	3								3	3	3	III
317.4	3	3	3	3								3	3	3	IV
317.5	3	2	2	2								2	2	2	II
317.6	3	3	2	2								2	2	2	II

Content	Hrs

Unit 1: Introduction to ASIC Types of ASICs ,Design flow ,Economics of ASICs ,ASIC cell libraries ,CMOS logic cell data path logic cells, I/O cells ,cell compilers.	6
Unit 2: ASIC Physical Design System partition ,partitioning ,partitioning methods , interconnect delay models and measurement of delay, floor planning, placement , Routing: global routing , detailed routing, special routing , circuit extraction , DRC	6
Unit 3: Logic Synthesis Design systems , Logic Synthesis ,Half gate ASIC ,Schematic entry, Low level design language, PLA tools, EDIF,CFI design representation. Verilog and logic synthesis ,VHDL and logic synthesis	6
Unit 4: Simulation And Testing Types of simulation, fault models, stuck at faults, boundary scan test ,fault simulation , automatic test pattern generation.	6
Unit 5: Programmable ASICS, Programmable ASIC Logic Cells And Programmable ASIC I/O Cells Anti fuse, static RAM , EPROM and EEPROM technology , Actel ACT , Xilinx LCA, Altera FLEX, Altera MAX DC & AC inputs and outputs Clock & Power inputs Xilinx I/O blocks.	6
Unit 6: FPGA Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology –mapping for FPGAs, Xilinx XC4000 –ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance	6

Text Books:

1. J.S.Smith, " Application – Specific Integrated Circuits", Pearson,2003

2. Douglas J. Smith, HDL Chip Design, Madison, AL, USA: Doone Publications, 1996

Reference Books:

1. K.Chan& S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall, 1994.
2. Nekoogar. Timing Verification of Application-Specific Integrated Circuits (ASICs).Prentice Hall PTR, 1999.
3. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
4. Steve Kilts, "Advanced FPGA Design," Wiley Inter-Science

List of tutorials		
Sr. No.	**Name of Tutorial**	**Unit No.**
1	Commercial ASICs	1
2	Design flow of ASICs	1
3	Interconnect & delay models	2
4	Placement & routing	2
5	PLA tools	3
6	Verilog & VHDL logic synthesis	3
7	Fault models and boundary scan test	4
8	Fault simulation & ATPG	4
9.	Static RAM, EPROM, EEPROM technology	5
10	Programmable I/O blocks	5
11	Design flow technology for FPGA	6
12	FPGA Architectures	6

(The instructor may choose minimum 10 tutorials)

T.Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Cellular & Mobile Communication- Lab	
Course Code: 201ETP320	**Semester :** VI
Teaching Scheme: L-T-P :0-0-2	**Credit:** 1
Evaluation Scheme: ISE + MSE Marks : 25	**ESE OE Marks:** 25

Course Description:

Cellular communication is a form of communication technology that enables the use of mobile phones. Cellular communication is based on the geographic division of the communication coverage area into cells, and within cells. For getting the better understanding of the cellular communication this course is useful.

Course Objectives:

1	To understand the evolution of Mobile communication and cell concept to improve capacity of the system.
2	To Analyze the fading mechanism and types of fading and effect of fading on Mobile communication.
3	To study the role of equalization in Mobile communication and to study different types of Equalizers and Diversity techniques.
4	To understand the types of channel coding techniques, data transmission modes and services of GSM & CDMA.

Course Outcomes (COs):

At the end of the course the student will be able to:

320.1	demonstrate cellular concepts like frequency reuse, fading, equalization, GSM, CDMA.
320.2	analyze the equalization and different diversity techniques.
320.3	apply the concept to calculate link budget using path loss model
320.4	apply the concept of GSM & CDMA in real time applications.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	PSO1	PSO2	BTL
320.1	3	2	1	1	2	-	-	-	-	-	-	2	2	3	III
320.2	3	2	1	2	1	-	-	-	-	-	-		2	2	IV
320.3	3	1	2	1	2	-	-	-	-	-	-	1	2	1	III
320.4	2	2	2	2	2	-	-	-	-	-	-		2	2	III

Prerequisite:	Digital Communication, Probability, Mathematics

List of Experiments			
Expt. No.	**Name of Experiment**	**Type**	**Hours**
1	Use AT commands to understand working of GSM & 3G network	O	2
2	Simulate Bluetooth voice transmission to observe effect of AWGN and interference of 802.11b on transmission using MATLAB Simulink	O	2

3	Develop a mobile application for wireless technology using any wizards	O	2
4	Simulate the Binary amplitude shift keying using MATLAB Simulink	O	2
5	Simulate the Delta Modulation using MATLAB Simulink.	O	2
6	Study of Bluetooth files transfer in android.	O	2
7	Simulate WSN node to determine position on node and blink LED using cupcarbon simulator and senscript	O	2
8	To implement a basic function of Code Division Multiple Access (CDMA) to test the orthogonality and autocorrelation of a code to be used for CDMA operation.	O	2
9	To implement Mobile node discovery	O	2
10	Implementation of GSM security algorithms (A3/A5/A8)	O	2

S: Study O: Operational

Text Book:

1. Theodore S. Rappaport - Wireless Communication Principles and Practice 2nd Edition, Pearson Education, 2003.
2. Andreas F.Molisch - Wireless Communications ,John Wiley, 2nd Edition, 2006

Reference Books:

1. Kamilo Feher - Wireless Digital Communications, PHI, 2003
2. W.C.Y. Lee - Mobile Cellular Communications, 2nd Edition, MC Graw Hill, 1995.
3. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Embedded Systems -Lab	
Course Code: 201ETP321	**Semester :** VI
Teaching Scheme: L-T-P :0-0-2	**Credit:** 1
Evaluation Scheme: ISE Marks : 25	**ESE POE Marks:** 25

Lab Course Description: This lab-oriented course introduces the assembly language programming of ARM processor as well as Embedded C programming of ARM LPC 2148 Microcontroller useful for the development of Embedded System.

Course Objectives:

1	To understand the characteristics of Embedded systems and its Architectures.
2	To develop skills of ARM programming.
3	To introduce devices and buses used for embedded networking.
4	To study key features of Microcontroller LPC214X.
5	To develop skills of programming on chip resources of LPC214X.

Course Outcomes (COs):

At the end of course the student will able to:

321.1	apply important attributes of Embedded system.
321.2	develop a meaningful assembly language program using the ARM programmer's model.
321.3	design small applications of UART, I^2C, SPI.
321.4	demonstrate the use of on chip resources of LPC 2148.
321.5	design small applications of ON CHIP resources using embedded C.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
321.1	1	1	1	1	-	-	-	-	-	-	-	-	-	1	III
321.2	2	2	2	2	2	-	-	-	-	-	-	-	-	-	IV
321.3	1	1	2	1	2	-	-	-	-	-	-	-	-	2	IV
321.4	1	1	1	1	-	-	-	-	-	-	-	-	-	-	III
321.5	1	1	1	1	1	-	-	-	-	-	-	-	-	1	IV

List of Experiments			
Expt. No.	**Name of Experiment**	**Type**	**Hours**
1	To design and simulate the assembly code for ALU operations for ARM Processor.	O	2
2	To design and simulate the assembly code for block move & block exchange operations for ARM Processor.	O	2
3	To design and simulate the assembly code to find largest number for ARM Processor.	O	2
4	To design and simulate the assembly code for ascending order sorting for ARM Processor.	O	2
5	To design, simulate and demonstrate the embedded C code for LED blinking using GPIO of ARM LPC 2148.	O	2
6	To design, simulate and demonstrate the embedded C code for key pad interface using GPIO of ARM LPC 2148.	O	2

7	To design, simulate and demonstrate the embedded C code for stepper motor interface using GPIO of ARM LPC 2148.	O	2
8	To design, simulate and demonstrate the embedded C code for relay interface using GPIO of ARM LPC 2148.	O	2
9	To design, simulate and demonstrate the embedded C code for On chip I2C interface of ARM LPC 2148.	O	2
10	To design, simulate and demonstrate the embedded C code for On chip ADC interface of ARM LPC 2148.	O	2
11	To design, simulate and demonstrate the embedded C code for On chip DAC interface of ARM LPC 2148.	O	2
12	To design, simulate and demonstrate the embedded C code for On chip Timer interface of ARM LPC 2148.	O	2

S: indicates Study type and O: Operational type

* Minimum ten (10) experiments should be performed so as to teach the entire curriculum of course.

Text Books:

1. Rajkamal, “Embedded Systems: Architecture, Programming and Design”, TMH
2. Sloss, Symes, Wright, “ARM system developers guide”, Morgan Kaufman (Elsevier) publication.

Reference Books:

1. William Hohel , “ARM assembly language: fundamentals and Technique”
2. ARM Architecture Reference Manual By: ARM
3. LPC214x USER MANUAL By Philips/ NXP semiconductor
4. An Embedded Software Primer. David E. Simon. Pearson Education

T. Y. B. Tech. Curriculum
w.e.f. 2022-2023

Course Title : Mini-Project-II	
Course Code : 201ETP322	**Semester :** VI
Teaching Scheme : L-T-P : 0-0-2	**Credits :** 1
Evaluation Scheme : ISE Marks : 25	**POE Marks :** 25

Lab Course Description: This course gives introduction of electronic hardware systems and provides hands-on training with identification, testing, assembling, dismantling, and fabrication of new electronics project.

Course Objectives:

1	To provide students for knowledge of Electronics Components and soldering techniques and its package information for electronics circuit design
2	To provide students for knowledge of the assembling of electronics circuit with components on PCB (Printed Circuit Board) of circuit design.
3	To design and development of Small electronic project based on hardware and software for electronics systems.

Course Outcomes (COs):

At the end of the course the student will be able to:

322.1	practice acquired knowledge within the chosen area of technology for project development.
322.2	identify, discuss and justify the technical aspects of the chosen project with a Comprehensive and systematic approach.
322.3	reproduce, improve and refine technical aspects for engineering projects

322.4	work as an individual or in a team in development of technical projects.
322.5	communicate and report effectively project related activities and findings.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
322.1	3	-	-	-		-	-	-	-	-	-	1	1	-	III
322.2	3	1	-	-	1	-	-	-	-	-	-	1	1	-	III
322.3	3	2	1	-	2	-	-	-	-	-	-	1	1	-	IV
322.4	3	2	1	-	2	-	-	-	1	1	-	1	1	-	IV

Mini project work should consist of following steps.

Sr. No.	Mini project work should consist of following steps
1	Students should propose project ideas & finalize the project idea in consultation with guide. (Problem statement).
2	Students should submit implementation plan in the form of PERT/CPM chart. This will cover weekly activity of project report.
3	Problem definition and specification development in the form of synopsis.
4	Design of circuit with calculation & should include a) Analog part b) digital part c) Power supply d) Test strategy if firmware is required produce flow chart.
5	Simulation of design using tools like eSim, OrCAD, Matlab, etc.
6	Design calculation component selection.
7	Fabrication & assembly of PCB & enclosure.

8	Test measure of specifications& calibration.
9	Bill of Material.
10	Final Demo and Project Report.

References:

1. The First Book of Electronics Workshop: Can't Beat a Practical Approach – River Publishers Series in Communications.
2. Handbook of Electronic projects, by Arsath Natheem.
3. Fundamentals of Electrical Engineering – Bharati Dwivedi and Anurasg Tripathi – Willey Precise
4. Electronics Devices and Circuit Theory- Robert L. Boylestad and Louis Nashelsky, Pearson Education Publication

T. Y. B. Tech. Curriculum

w.e.f. 2022-2023

Course Title: Sensor Technology (Open Elective-I)	
Course Code: 201ETL318	**Semester :** VI
Teaching Scheme: L-T-P : 3-1-0	**Credits:** 4
Evaluation Scheme: ISE + MSE Marks : **20 + 30**	**ESE marks:** 50

Course Description: The aim of the course is to provide students with the knowledge of transduction principles, sensors, transducer technology and measurement systems. To provide better familiarity with theoretical concepts of sensors. To provide familiarity with different sensors and their application .

Course Objectives:

1	To provide basic knowledge in transduction principles, sensors and transducer technology
2	To provide better familiarity with the theoretical and practical concepts of Transducer .
3	To provide familiarity with different sensors and their application in real life.
4	To provide knowledge of various measurement methods of physical and electrical parameters.

Course Outcomes (COs):

At the end of the course the student will be able to:

318.1	identify suitable sensors and transducers for real time applications.
318.2	use and translate theoretical concepts into working models
318.3	design the experimental applications to engineering modules and practices
318.4	design engineering solution to the Industry/society needs and develop products.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
318.1	3	2	2	2	2	2	2	-	-	-	-	2	2	3	IV
318.2	3	3	2	2	2	2	2	-	-	-	-	2	2	2	III
318.3	3	3	3	2	3	3	2	-	-	-	-	2	2	2	IV
318.4	3	3	3	3	3	3	3	-	-	-	-	3	2	3	IV

Content	Hrs
Unit No 1: Sensor fundamentals and characteristics Sensor, Sensor Classification, Performance and Types, Error Analysis characteristics.	**6**
Unit No 2: Optical Sources and Detectors Electronic And Optical properties of semiconductor as sensors, LED, Semiconductor lasers, Fiber optic sensors, Thermal detectors, Photo multipliers, photoconductive detectors, Photo diodes, CCDs.	**6**
Unit No 3: Velocity and Acceleration sensors Capacitive Accelerometer, Piezo resistive Accelerometers, Piezoelectric Accelerometer, Piezoelectric cables.	**6**
Unit No 4: Strain, Force, and Pressure sensors Strain gauges, Potentiometric and capacitive sensors, Piezoelectric sensor, load cell, optoelectronic pressure sensors,bellows,MEMS Sensors, Piezoelectric force sensors.	**6**
Unit No 5: Position, Displacement and Level sensors Potentiometric sensor, capacitive sensor, Inductive and magnetic sensor: LVDT and RVDT, Hall effect sensors. Optical sensors: Optical bridge, Proximity detector, linear optical sensor, Ultrasonic sensor.	**7**

Unit No 6: Flow, Temperature ,Humidity and Acoustic sensors Flow sensors: Ultrasonic, electromagnetic and Breeze sensor., Temperature sensors-thermo resistive, thermoelectric, semiconductor and optical. Piezoelectric temperature sensor. Acoustic sensors- microphones-resistive, capacitive, piezoelectric, fiber optic. Concept of Humidity, capacitive sensor, Optical Hygrometer.	**8**

Reference Books:

1. Sensors, Actuators, and their Interfaces: A Multidisciplinary Introduction by Nathan Ida,SciTech Publishing, an imprint of IET
2. Pearson Gerd Keiser,", "Wireless Communication Optical Fiber Communications", 2012, 4th edition, McGraw-Hill Science, Delhi. & Networks", Pearson Education
3. John G Webster, "Measurement, Instrumentation and sensor Handbook", 2014, 2nd edition, CRC Press, Florida
4. Eric Udd and W.B. Spillman, "Fiber optic sensors: An introduction for engineers andscientists", 2013, 2nd edition, Wiley, New Jersey
5. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York.
6. Sawhney A.K., Sensor & Instrumentation, DhanpatRai& Co.02ndEd.
7. O.N.Pandey & S.K.Kataria & Sons , Sensor And Instrumentation, First edition,2013.

List of tutorials

Sr. No.	Name of Tutorial	Unit No.
1	Explain the classification of sensor	1
2	Explain characteristics of sensor	1
3	Study of optical sources	2
4	Study of optical detectors	2
5	Study of velocity sensors	3
6	Study of Acceleration Sensors	3
7	Study of Strain sensors	4
8	Study of Torque and pressure sensors	4
9	Study of Position sensors	5
10	Study of displacement and level sensors	5
11	Study of flow and Temperature sensor	6
12	Study of acoustic sensor	6

(The instructor may choose minimum 10 tutorials)

T. Y. B. Tech. Curriculum
w. e .f. 2022-2023

Course Title : Electronic Instrumentation (Open Elective I)	
Course Code : 201ETL319	**Semester :** VI
Teaching Scheme : L-T-P : 3-1-0	**Credits :** 4
Evaluation Scheme : ISE +MSE Marks : 20+30	**ESE:** 50 marks

Course Description:

Instrumentation system plays primary role in the designing of measurement applications . In today's telecommunication world knowing physical parameter is very important to forecast certain things, and this is possible only when we study instrumentation and control system subject. The students will learn different types of Measuring instrument, Virtual Instrumentation along with basic concepts of measurement systems.

Course Objectives:

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

1	explain student types of Measuring Instruments along with working principles the digital voltmeter
2	motivate the students to study Virtual instrument with lab view
3	motivate students to study AC and DC bridges
4	explain students the study of Digital storage oscilloscope, signal generators and analysers

Course Outcomes (COs):

At the end of the course the student should be able to:

319.1	understand and identify the instrument suitable for specific measurements.
319.2	use and identify the basic principles of Virtual instrument
319.3	understand construction, working principle of AC and DC bridges
319.4	acquire knowledge of analysing different types of Digital storage oscilloscope, signal generators and Analysers.

Prerequisite:	Physics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
319.1	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
319.2	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
319.3	1	1	1	1	-	-	-	-	-	-	-	-	1	1	2
319.4	3	3	3	3	-	-	-	-	-	-	-	-	3	3	4

Content	Hrs
Unit 1: Introduction to Measurement Systems and Measuring Instruments: Measurements, significance of measurements, methods of measurements- Direct & indirect method, elements of generalized measurement system, measurement system performance, Performance characteristics- static and dynamic characteristic, Errors- Types & source of error.	**7**
Unit 2: **Digital voltmeters** Introduction, Dual Slope Integrating type DVM, Integrating type DVM & successive approximation principles, general specifications of DVM, digital multimeter	**6**
Unit 3: Virtual Instrumentation Introduction to virtual instrumentation, Role of Software in Virtual Instrumentation, Virtual Instrumentation with Lab VIEW, Components of Lab VIEW application	**5**
Unit 4: AC and DC Bridges DC bridges: Introduction , wheatstone's bridge, Kelvin bridge, guarded Wheatstone bridge, AC bridges : Condition for bridge balance .Maxwell bridge	**5**
Unit 5: Digital Storage Oscilloscope and Spectrum Analyser Digital Storage oscilloscope blocks diagram, sampling rate, and bandwidth. 10X Probe Spectrum analyzer block diagram	**6**
Unit 6: Signal Generators and Analysers Signal generators: Function generators, Sweep, pulse and square wave generator. Wave Analyzers: Introduction, basic wave analyzer, heterodyne harmonic distortion analyzer, spectrum analyser, Wobbluscope	**7**

Text Books:

1. Sawhney A.K., Electrical and Electronics Measurements and Instruments, Dhanpat Rai & Co.02ndEd.
2. W. D. Cooper & A. D. Helfrick, Electronic Instrumentation and Measurement Techniques", PHI, 4the/d,1987.
3. David Bell ," Electronic Instrumentation and Measurements",PHI,2e/d

Reference Books:

1. Hewlett Packard, Tektronics, Advantest, Aplab,"Application Noteson Measurement".
2. Bouwens A.J. Digital Instrumentation, McGraw-Hill, second edition
3. Ogata Katsuhiko, "Modern Control Engineering",5thEdition,PHI
4. NagrathI .J.andM. Gopal,"Control Systems Engineering",6th edition, New Age international

List of tutorials		
Sr. No.	**Name of Tutorial**	**Unit No.**
1	Explain the methods of measurements	1
2	Explain static and dynamic characteristics	1
3	Study of Digital voltmeters	2
4	Study of virtual instrumentation	3
5	Study of components of lab view application	3
6	Study of DC bridges	4
7	Study of AC bridges	4
8	Study of digital storage oscilloscope	5
9.	Study of 10x probe spectrum analyzer	5
10	Study of signal generator	6
11	Study of function generator	6
12	Study of wave analyzer	6

(The instructor may choose minimum 10 tutorials)

D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

(An Autonomous Institute)

Accredited by NAAC with 'A' Grade

Department of Electronics & Telecommunication Engineering

Program Structure and Syllabus

Minor Degree

In

Internet of Things (IoT)

(To be implemented from academic year **2022-23**)

Minor Degree details

With a view to enhance the employability skills and impart knowledge in emerging areas which are usually not being covered in Undergraduate Degree credit framework, AICTE has come up with the concept of 'Minor Degree' in emerging areas.

Minor specialization in EMERGING AREAS in Under Graduate Degree Courses is allowed where a student of another Department shall take the minimum additional Credits in the range of 18-20 and get a degree with minors in specialized area. These credits are in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline.

Knowledge of these emerging areas will help students in capturing the plethora of employment opportunities available in these domains. With the help of industry-academia experts, the institute has framed the curriculum of Minor Degrees. Following are the minor degrees offered by the various departments:

Sr. No.	Department	Minor Degree Offered
1	Architecture	Sustainable Energy Practices
2	Chemical Engineering	Food and Nutrition Technology
3	Civil Engineering	Environmental Sustainability
4	Mechanical Engineering	Robotics and Industry 4.0
5	Electronics & Telecommunication Engineering	Internet of Things (IoT)
6	Computer Science & Engineering	Cyber Security
7	Computer Science & Engineering (Artificial Intelligent & Machine Learning)	Artificial Intelligence & Machine Learning
8	Computer Science & Engineering (Data Science)	Data Science

Interested students studying in semester III can choose only one minor degree track offered by other department (excluding minors offered by their core undergraduate course). The final list of allocation will be displayed, following the eligibility criteria mentioned in the academic rules and regulations, before beginning of semester IV.

The minor degree will be run only when the minimum students count is 30 for respective track.

Students once enrolled for any minor degree are not permitted to change the track. However, a student can withdraw at any semester.

The fee for minor degree is to be paid in addition to the college fees. There will not be any fee concession/relaxation for any category student. The fee will not be refunded when withdrawn from the minor degree.

Minor degree courses will begin from semester IV onwards as per the structure of the respective tracks.

Sr. No	Course Code	Course Type	Name of the Course	Sem	Teaching Scheme Per Week			Credits	Total Marks	Evaluation scheme			
					L	T	P						
1	201ETMIL221	PCC	Introduction to IoT	IV	3	-	-	3	100	ISE MSE ESE	20 30 50	20 20	40
2	201ETMIP222	LC	Introduction to IoT Lab	IV	-	-	2	1	100	ISE ESE (POE)	25 25	10 10	20
3	201ETMIL323	PCC	IoT Protocols	V	3	-	-	3	100	ISE MSE ESE	20 30 50	20 20	40
4	201ETMIP324	LC	IoT Protocols Lab	V	-	-	2	1	100	ISE ESE (POE)	25 25	10 10	20
6	201ETMIL325	PCC	IoT System Design	VI	3	-	-	3	50	ISE MSE ESE	20 30 50	20 20	40
7	201ETMIP326	LC	IoT System Design Lab	VI	-	-	2	1	50	ISE ESE (POE)	25 25	10 10	10 10
8	201ETMIP327	PCC	Industry 4.0 and IIoT	VI	3	-	-	3	50	ISE MSE ESE	20 30 50	20 20	40
9	201ETMIP328	LC	Industry 4.0 and IIoT Lab	VI	-	-	2	1	50	ISE ESE (POE)	25 25	10 10	10 10
10	201ETMIP425	PROJ	Mini Project	VII	-	-	2	2	100	ISE ESE (POE)	50 50	40	40
				Total	**12**	**-**	**10**	**18**	**700**	**Total Credits: 18**			
										Total Contact Hrs.: 5/week			

Course Code	Definition
PCC	Professional Core Course
LC	Laboratory Course
PROJ	Project

Abbreviations:

ISE: In Semester Evaluation,

MSE: Mid semester Examination,

ESE: End Semester Examination

Course Plan:

Course Title: Introduction to Internet of Things (IoT)	
Course Code: 201ETMIL221	**Semester:** IV
Teaching Scheme: L-T-P: 3-0-0	**Credits :** 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks :** 50

Course Description: The course familiarizes students with basic terminologies of internet of things and the essential knowledge to get started in the field of IoT.

Course Objectives:

To make students

1. To know the IoT ecosystem.
2. To provide an understanding of the technologies and the standards relating to the Internet of Things.
3. To develop skills on IoT technical planning.

Course Outcomes:

At the end of the course the student should be able to

Co. No.	Statement
1	Understand the basics of Networking and Security.
2	Understand predecessor of IoT technology and emergence of Internet of Things
3	Understand architecture of Internet of Things
4	Recognize various devices, sensors, actuators, and various processing paradigms for IoT.

Contents	Hours
Unit No.01: Basics of Networking & Basics of Network Security: Network Types, Layered Network Models, Addressing , Internet of Things TCP/IP Transport layer, Security ,Network Confidentiality, Cryptography, Message Integrity and Authenticity, Digital signatures, Key Management, Internet Security & Firewall.	**6**
Unit No.02: Predecessors of IoT & Emergence of IoT– Introduction, Wireless Sensor Networks, Machine-to-Machine Communications, Cyber Physical Systems, Architectural components of CPS, IoT versus M2M, IoT versus CPS, IoT versus WoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT.	**6**
Unit No.03: IoT Architecture -State of the Art – Architecture Reference Model, IoT reference Model, IoT Reference Architecture, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.	**6**
Unit No.04: IoT Sensing - Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics, Data Formats.	**6**
Unit No.05: IoT Processing - Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading, Offload location, Offload decision making, Offloading considerations.	**6**
Unit No.06: IoT Case Studies: Agricultural IoT, Components of an agricultural IoT, Advantages of IoT in agriculture, Vehicular IoT, Components of vehicular IoT, Advantages of vehicular IoT, Healthcare IoT, Components of healthcare IoT, Advantages and risk of healthcare IoT, Case Studies.	**6**

Text Books:

1. Sudip Mishra, Anandarup Mukherjee, Arijit Roy: Introduction to IOT, Cambridge University Press
2. Bassi, Alessandro, et al, "Enabling things to talk", Springer-Verlag Berlin -2016

Reference Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
2. Neil Cameron: Arduino Applied-Comprehensive Projects for Everyday Electronics, Apress.
3. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, John Wiley & Sons.
4. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers.

Course Plan:

Course Title: Introduction to Internet of Things (IoT) Lab	
Course Code: 201ETMIP222	**Semester:** IV
Teaching Scheme: L-T-P: 0-0-2	**Credit:** 1
Evaluation Scheme: ISE Marks: 25	**ESE (POE):** 25

Course Description: The course familiarizes students with basic terminologies of internet of things and the essential knowledge to get started in the field of IoT.

Course Objectives:

01. To provide handson practice of IoT ecosystem, an understanding of the technologies and the standards relating to the Internet of Things.
02. The course will also develop skills on IoT technical planning.

Course Outcomes:

At the end of the course the student should be able to

Co. No.	Statement
1	Understand the basics of Networking and Security.
2	Understand predecessor of IoT technology and emergence of Internet of Things
3	Understand architecture for Internet of Things
4	Recognize various devices, sensors, actuators, and various processing paradigms for IoT.

	List of Experiments		
Expt. No.	**Name of Experiment**	**Type**	**Hrs**
1	Introduction to Arduino programming.	S	2
2	Introduction to Arduino Uno R3	S	2
3	To blink the LED with Arduino.	O	2
4	To interface push button with Arduino.	O	2
5	To interface LCD with Arduino.	O	2
6	To read the analog voltage using ADC on Arduino.	O	2
7	To detect occupancy of an area using PIR sensors	O	2
8	To interface real time clock IC DS1307 with Arduino.	O	2
9	To measure the distance of an object using ultrasonic sensor	O	2
10	To display temperature and humidity data.	O	2
11	To control LED using remote control.	O	2
12	To implement RFID based parking system.	O	2

***Perform any 10 experiment from above list.**

S - Study, O – Operation

Text Books:

1. Sudip Mishra, Anandarup Mukherjee, Arijit Roy: Introduction to IOT, Cambridge University Press
2. Bassi, Alessandro, et al, “Enabling things to talk”, Springer-Verlag Berlin -2016

Reference Books:

a. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017
b. Neil Cameron: Arduino Applied-Comprehensive Projects for Everyday Electronics, Apress.
c. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, John Wiley & Sons.
d. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers.

Course Plan:

Course Title: IoT Protocols	
Course Code: 201ETMIL323	**Semester:** V
Teaching Scheme: L-T-P: 3-0-0	**Credits :** 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks :** 50

Course Description: The course gives knowledge about various protocols designed for implementation of Internet of Things.

Course Objectives:

The main objective of the course is to make students.

1. To know the basic concept and architecture of embedded systems.
2. To make students to know different design protocols used for an embedded system for IoT applications.
3. To make students to gain knowledge about the IoT enabled technology.

Course Outcomes:

At the end of the course the student should be able to

Co. No.	Statement
1	Understand the basics of IoT Networking.
2	Learn working of IoT Connectivity/Medium access protocols
3	Understand about IoT network layer/communication protocols
4	Analyze various IoT Application layer Protocols.

Contents	Hours
Unit No. 01: Introduction to Things in IoT: Introduction, Edge Devices- Node MCU/ESP 32, Programming edge node, Introduction to Gateways, Gateways types and configurations, Gateway as an extension of the cloud, HTTP access method using API.	**6**
Unit No. 02: IoT Connectivity Technologies: RFID , NFC, Wi-Fi, Bluetooth low energy, IEEE 802.15.4, Zigbee, Thread, Wireless HART, Z-Wave, LoRa, NB-IoT.	**6**
Unit No. 03: IoT Communication Technologies– Introduction, Constrained nodes, Constrained networks, Types of constrained devices, Low power and lossy networks, Infrastructure protocols, Internet protocol version 6 (IPv6), RPL,6LoWPAN, Content-centric networking (CCN), Discovery Protocols, Physical web, Multicast DNS (mDNS), Universal plug and play (UPnP), Data Protocols, MQTT, CoAP, AMQP, XMPP, REST, WebSocket, Identification Protocols, EPC, URIs, Device Management, Semantic Protocols, JSON-LD, Web thing model.	**8**
Unit No. 04: IoT Interoperability: Introduction, Taxonomy of interoperability, Standards, DLNA, Konnex, UPnP, Frameworks, universal, IoTivity, HomeKit.	**4**
Unit No. 05: IOT Associated Technologies: Introduction, Virtualization, Advantages of virtualization, Types of virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Importance of SLA, Metrics for SLA.	**6**
Unit No. 06: Cloud Computing- Cloud Implementation, Cloud simulation, An open-source cloud: Open Stack, A commercial cloud: Amazon web services (AWS), Sensor-Cloud: Sensors-as-a-Service, Importance of sensor-cloud, Architecture of a sensor-cloud platform	**6**

Text Books:

1. Sudip Mishra, Anandarup Mukherjee, Arijit Roy: Introduction to IOT, Cambridge University Press.
2. Hanes et al “IoT Fundamentals”, Cisco Press.

Reference Books:

1. Rahul Dubey, “An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications”, Cengage India Publication.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Keyapplicationsand Protocols”, Wiley, 2012.
3. RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, Internet of Things, John Wiley and Sons.
4. Klaus Elk, “Embedded Software for the IoT”.
5. Perry Xiao, “Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed”.
6. Elizabeth Gootman et. al, “Designing Connected Products”, Shroff Publisher/O‟Reilly Publisher.

Course Plan:

Course Title: IoT Protocols Lab	
Course Code: 201ETMIP324	**Semester:** V
Teaching Scheme: L-T-P: 0-0-2	**Credit:** 1
Evaluation Scheme: ISE Marks: 25	**ESE (POE):** 25

Course Description: The course gives knowledge about various protocols designed for implementation of Internet of Things.

Course Objectives:

The main objective of the course is

1. To provide hands-on practice on the architecture of embedded systems and different design protocols used for an embedded system for IoT applications.
2. To make Students to gain knowledge about the IoT enabled technology.

Course Outcomes:

At the end of the course the student should be able to

Co. No.	Statement
1	Understand the basics of IoT Networking.
2	Learn working of IoT Connectivity/Medium access protocols
3	Understand about IoT network layer/communication protocols
4	Analyze various IoT Application layer Protocols.

	List of Experiments		
Expt. No.	**Name of Experiment**	**Type**	**Hrs**
1	To connect to WiFI and implement Soft API on IOT nodes.	O	2
2	To Create a standalone web server that controls outputs (two LEDs).	O	2
3	To build a web server with a slider to control the LED brightness.	O	2
4	To create an SMS notification system that sends an SMS when sensor readings are above orbelow a certain threshold.	O	2
5	To make HTTP GET and HTTP POST requests to get values, post JSON objects and URLencoded requests with IOT node.	O	2
6	To implement client-server communication between two IOT nodes.	O	2
7	To implement WebSocket communication protocol to control IOT node.	O	2
8	To send emails with the IOT node using an SMTP Server	O	2
9	To make HTTP POST requests to post JSON data or URL encoded values to Thing Speak.	O	2
10	To make HTTP GET requests to decode JSON data from OpenWeatherMap.org and plotvalues in charts using Thing Speak.	O	2
11	To use MQTT communication protocol to publish messages and subscribe to topics.	O	2
12	To create a simple LoRa Sender and LoRa Receiver with the RFM95 transceiver module.	O	2

***Perform any 10 experiment from above list.**

O - Operational

Text Books:

1. Sudip Mishra, Anandarup Mukherjee, Arijit Roy: Introduction to IOT, Cambridge University Press.
2. Hanes et al “IoT Fundamentals”, Cisco Press.

Reference Books:

1. Rahul Dubey, “An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications”, Cengage India Publication.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Keyapplicationsand Protocols”, Wiley, 2012.
3. RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, Internet of Things, John Wiley and Sons.
4. Klaus Elk, “Embedded Software for the IoT”.
5. Perry Xiao, “Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed”.
6. Elizabeth Gootman et. al, “Designing Connected Products”, Shroff Publisher/O‟Reilly Publisher.

Course Plan:

Course Title: IoT System Design	
Course Code: 201ETMIL325	**Semester:** VI
Teaching Scheme: L-T-P: 3-0-0	**Credits :** 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks :** 50

Course Description: The course emphasizes on design, requirements, data interfacing capabilities of IoT in industrial applications.

Course Objectives:

1. To give students knowledge about different IoT architectures, interfacing sensors and actuators with different IoT architectures.
2. To apply Cloud computing, Machine learning and Data analytics for industrial applications based on IoT.

Course Outcomes:

At the end of the course the student should be able to

Co. No.	Statement
1	Learn Python for Machine learning applications
2	Understand Raspberry PI along with critical protocols and its communication to cloud.
3	Design web/cloud based IoT applications.
4	Install, configure and use of AWS CLI and SDK on a Linux system with applications of various AWS services.

Contents	Hours
Unit No. 01: Introduction to Raspberry Pi & Gateways: Introduction, Edge Devices- Raspberry Pi, A short tour of Linux operating system, Programming edge node, Introduction to Gateways, Gateways types and configurations, Gateway as an extension of the cloud, HTTP access method using API, Introduction and installing the Raspbian Stretch OS, Headless.	**6**
Unit No. 02: Interfacing of Raspberry Pi: A short tour of Linux operating system - Computer and Rpi configuration to connect Rpi remotely without Ethernet cable via SSH, IP address, Rpi - Testing the GPIO pins through Scripts, Raspberry pi3 interfacing with Sensor DHT11, Raspberry pi pythonlibrary install and reading sensor feed, Storing sensor data in cloud and in database, MySQL server on Raspi.	**6**
Unit No. 03: IoT and data analytics: IoT and Data Management, Data cleaning and processing, Data storage models. Search techniques, Deep Web, Semantic sensor web, Semantic Web Data Management, Searching in IoT, Real-time and Big Data Analytics for The Internet of Things,	**6**
Unit No. 04: Data Processing: Heterogeneous Data Processing, High-dimensional Data Processing, Parallel and Distributed Data Processing.	**7**
Unit No. 05: Cloud of Things: IoT Physical Servers, Cloud Offerings, and IoT Case Studies, Introduction to Cloud Storage Models, Communication API, Eclipse IoT, AWS IoT, Google Cloud IoT, ThingWorx.	**6**
Unit No. 06: Python Libraries for Machine Learning: Pyhton basics and its libraries for machine learning, NumPy, Pandas, SciPy, MatPlotLib and SciKit Learn	**5**

Text Books:

1. Sudip Misra, Chandana Roy and Anandarup Mukherjee, “Introduction to Industrial Internet ofThings and Industry 4.0”, CRC Press
2. Rahul Dubey, “An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications”, Cengage India Publication

Reference Books:

1. Richardson, M., & Wallace, S. (2012). Getting started with raspberry PI. " O‟Reilly Publisher Media, Inc."
2. Shrirang Ambaji Kulkarni: Introduction to IOT with Machine learning and Image Processing using Raspberry Pi, CRC Press
3. Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd

Course Plan:

Course Title: IoT System Design Lab	
Course Code: 201ETMIP326	**Semester:** VI
Teaching Scheme: L-T-P: 0-0-2	**Credit:** 1
Evaluation Scheme: ISE Marks: 25	**ESE (POE):** 25

Course Description: The course emphasizes on design, requirements, data interfacing capabilities of IoT in industrial applications.

Course Objectives:

1. To give students hands-on experience using different IoT architectures and provide skills for interfacing sensors and actuators with different IoT architectures.
2. To apply Cloud computing, Machine learning and Data analytics for industrial applications based on IoT.

Course Outcomes:

At the end of the course the student should be able to

Co. No.	Statement
1	Learn Python for Machine learning applications
2	Understand Raspberry PI along with critical protocols and its communication to cloud.
3	Design web/cloud based IoT applications.
4	Install, configure and use of AWS CLI and SDK on a Linux system with applications of various AWS services.

	List of Experiments		
Expt. No.	**Name of Experiment**	**Type**	**Hrs**
1	Rpi3 introduction and installing the Raspbian Stretch OS.	S	2
2	Overview of the graphic user interface for Raspian Linux distribution and operate the Raspberry Pi in "headless mode".	S	2
3	Testing the GPIO pins of Rpiby python programs and scripts.	O	2
4	Raspberry pi3 python library installation and reading sensor feed.	O	2
5	'Plug and play ' type cloud platform overview for integration to IoT devices.	O	2
6	To create a standalone web server with a Raspberry Pi that displays temperature and humidity readings with a DHT11 sensor (Connected to 8266).	O	2
7	Control two outputs of an ESP8266 using MQTT protocol.	O	2
8	Real time license plate recognition using raspberry pi	O	2
9	Design a face recognition robot using Raspberry pi.	O	2
10	Environment setup for Android Things with Raspberry pi.	O	2
11	Implement an artificial neural network that can recognize keywords in speech.	O	2
12	Design a line follower robot using Raspberry pi.	O	2

***Perform any 10 experiment from above list.**

S – Study, O - Operational

Text Books:

1. Sudip Misra, Chandana Roy and Anandarup Mukherjee, “Introduction to Industrial Internet of Things and Industry 4.0”, CRC Press
2. Rahul Dubey, “An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications”, Cengage India Publication

Reference Books:

1. Sudip Misra, Chandana Roy and Anandarup Mukherjee, “Introduction to Industrial Internet of Things and Industry 4.0”, CRC Press
2. Rahul Dubey, “An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications”, Cengage India Publication
3. Richardson, M., & Wallace, S. (2012). Getting started with raspberry PI. " O‟Reilly Publisher Media, Inc."
4. Shrirang Ambaji Kulkarni: Introduction to IOT with Machine learning and Image Processing using Raspberry Pi, CRC Press
5. Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3and JavaScript to build exciting IoT projects. Packt Publishing Ltd

Course Plan:

Course Title: Industry 4.0 and Industrial Internal of Things (IIoT)	
Course Code: 201ETMIL327	**Semester:** VI
Teaching Scheme: L-T-P: 3-0-0	**Credits :** 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks :** 50

Course Description: This course focuses on how industrial processes have changed through integration of modern Technology along with introduction Industrial Internet of Things (IIoT).

Course Objectives: The objectives of the course are

1. To integrate modern technologies such as sensors, communication, and computational processing.
2. To role of Cyber Physical System (CPS) and IoT for industrial transformation.
3. To Students will also learn how to apply IoT in industries to modify the various existing industrial systems.

Course Outcomes:

At the end of the course the student should be able to

Co. No.	Statement
1	Study sensing and actuation in industries.
2	Understand the basics of industrial IoT (IIoT).
3	Apply Big data analytics and Software defined networks in IIoT.
4	Study IIoT security and various IIoT application domains.

Contents	Hours
Unit No. 01: Introduction: Globalization, The Fourth Revolution, LEAN Production Systems; Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management,Augmented Reality and Virtual Reality.	**6**
Unit No. 02: Basics of Industrial IoT: IIoT introduction, Industrial Processes-Part I, Part II, Industrial Sensing & Actuation; Industrial IoT: Business Model and Reference Architecture: Part I, Part II, Industrial IoT-Layers: IIoT Sensing- Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I	**6**
Unit No. 03: IIoT-Big Data Analytics: Introduction, Machine Learning and Data Science Part I, Part Il. Data Center Networks.	**6**
Unit No. 04: IIoT and Software Defined Networks: Software Defined Networks: SDN in IIoT-Part I, Part II,	**6**
Unit No. 05: Industrial IoT Security: Fog Computing in IIoT, Security in IIoT-Part I, Part II, Plant Safety and Security (Including AR and VR safety applications), Facility Management.	**4**
Unit No. 06: Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Health care, Power plants, Inventory Management & quality control, case studies.	**8**

Books:

1. Sudip Misra, Chandana Roy and AnandarupMukherjee, “Introduction to Industrial Internet of Things and Industry 4.0”, CRC Press
2. G Veneri Antonio, “Hands-on Industrial Internet of Things”, Packt Publication.

Course Plan:

Course Title: Industry 4.0 and Industrial Internal of Things (IIoT) Lab	
Course Code: 201ETMIP328	**Semester:** VI
Teaching Scheme: L-T-P: 0-0-2	**Credit:** 1
Evaluation Scheme: ISE Marks: 25	**ESE (POE):** 25

Course Description: This course focuses on how industrial processes have changed through integration of modern Technology along with introduction of Industrial / Internet of Things (IIoT).

Course Objectives:

The objective of the course is

1. To integrate modern technologies such as sensors, communication, and computational processing.
2. To role of CPS and IoT for industrial transformation.
3. To make Students to learn how to apply IoT in industries to modify the various existing industrial systems.

Course Outcomes:

At the end of the course the student should be able to

Co. No.	Statement
1	Learn Python for Machine learning applications
2	Understand Raspberry PI along with critical protocols and its communication to cloud.
3	Design web/cloud based IoT applications.
4	Install, configure and use of AWS CLI and SDK on a Linux system with applications of various AWS services.

	List of Experiments		
Expt. No.	**Name of Experiment**	**Type**	**Hrs**
1	Smart Home Assistant with cloud integration	O	2
2	Intelligent and Weather Adaptive Street Lighting system	O	2
3	Development of Agricultural IoT Gateway	O	2
4	Connected Agri Warehouses cloud enabled infrastructure	O	2
5	Soldier health & Position tracking system with LORA Communication	O	2
6	e-health monitoring system for remote patient health monitoring	O	2
7	Smart Biometric Attendance System with Raspberry Pi	O	2
8	Cloud integrated smart attendance system	O	2
9	Automatic Vehicle Accident Alert System using AWS IoT.	O	2
10	Design and implement a RFID based smart attendance system.	O	2
11	Design and implement a smart liquid level monitoring system.	O	2
12	Design a Smart factory for Industry 4.0 (Sketch)	O	2

***Perform any 10 experiments from above list.**

O – Operational

Books:

1. Sudip Misra, Chandana Roy and AnandarupMukherjee, “Introduction to Industrial Internet of Things and Industry 4.0”, CRC Press
2. G Veneri Antonio, “Hands-on Industrial Internet of Things”, Packt Publication.

Course Plan:

Course Title: Mini Project	
Course Code: 201ETMIP425	**Semester:** VII
Teaching Scheme: L-T-P: 0-0-2	**Credits:** 2
Evaluation Scheme: ISE Marks: 50	**ESE (POE):** 50

Course Description:

Course Objectives: The main objective of Mini Project is

1. To let the students apply the theoretical knowledge.
2. To solve real time problems or situations.

Course Outcomes:

At the end of the course the student should be able to

Co. No.	Statement
1	Understand, plan, and execute a Mini Project with team.
2	Acquire knowledge within the chosen area of technology for project development.
3	Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
4	Communicate and report effectively project related activities and findings.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Ability to conceptualize interdisciplinary domain knowledge to specific branch of engineering.
2. Ability to acquire employability skills and deep knowledge in emerging and multidisciplinary areas.
3. To Carry out engineering projects in broad areas of engineering.

Guidelines:

- The mini project is desirable to be done in a group of 3 students. Each group has to prepare a title related to any engineering discipline, and the title must emulate any real-world problem.
- Submit an early proposal. This proposal is a 1-2page(s) report, describes what the project and the final product's outcomes. The project proposal should be submitted to the respective guide.

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