DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.SU/Engg./B.Tech./70/2022

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies & recommended by the Dean, Faculty of Science & Technology, **the Academic Council at its meeting held on 01 November 2021 has accepted revised following syllabus of Bachelor of Technology Third Year (Vth & VIth semester) in accordance with Choice Based Credit & Grading System as per guidelines of AICTE** as appended herewith.

Sr.No.	Syllabi as per CBC & GS
[1]	B.Tech. [Civil Engineering],
[2]	B.Tech. [Mechanical Engineering],
[3]	B.Tech. [Plastic and Polymer Engineering],
[4]	B.Tech. [Electronics and Telecommunication Engineering],
[5]	B.Tech. [Electrical Engineering],
[6]	B.Tech. [Computer Science & Engineering].
[7]	B.Tech.[Agricultural Engineering]

This is effective from the Academic Year 2021-22 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.SU/2022/ 6330-38
Date:- 07.01.2022.

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
   Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

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2] The Section Officer,[Engg.Unit] Examination Branch,Dr.BAMU,A'bad.

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Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Revised Syllabus of Third Year (TY) Bachelor of Technology

Electronics and Telecommunication Engineering

(V & VI Semester)

Under Choice Based Credit System (CBCS)

Under Faculty of Science and Technology

(Effective from 2021-22 and onwards)

I

Syllabus Structure w.e.f. 2021-2022 (Choice Based Credit System)

TY B. Tech. (Electronics and Telecommunication Engineering)

Semester-V

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TUT	TW/PR	Total
ETC301	Microprocessor & Microcontroller	3	-	-	15	15	10	60	-	-	100	3	-	-	3
ETC302	Digital signal processing	3	-	-	15	15	10	60	-	-	100	3	-	-	3
BSH303	Managerial Economics, Finance & Costing	3	-	-	15	15	10	60	-	-	100	3	-	-	3
ETC341-ETC343	Professional Elective Course-II	3	-	-	15	15	10	60	-	-	100	3	-	-	3
	Open Elective-I	3	-	-	15	15	10	60	-	-	100	3	-	-	3
ETC321	Lab: Microprocessor & Microcontroller	-	-	2	-	-	-	-	-	25	25	-	-	1	1
ETC322	Lab: Digital signal processing	-	-	2	-	-	-	-	-	25	25	-	-	1	1
ETC323-325	Lab: Professional Elective Course-II	-	-	2	-	-	-	-	25	-	25	-	-	1	1
ETC326	Minor Project	-	-	2	-	-	-	-	25	-	25	-	-	1	1
ETC327	Lab: Electronic Workshop II	-	-	2	-	-	-	-	-	25	25	-	-	1	1
ETC328	Lab: Experiential/ Problem based learning	-	-	2	-	-	-	-	25	-	25	-	-	1	1
		15	-	12	75	75	50	300	75	75	650	15	-	6	21

Semester-VI

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TUT	TW/PR	Total
ETC351	Embedded System Design	3	-	-	15	15	10	60	-	-	100	3	-	-	3
ETC352	VLSI Design	3	-	-	15	15	10	60	-	-	100	3	-	-	3
ETC353	Electronic Circuit Design Technology	3	-	-	15	15	10	60	-	-	100	3	-	-	3
ETC391-393	Professional Elective Course-III	3	-	-	15	15	10	60	-	-	100	3	-	-	3
	Open Elective-II	3	-	-	15	15	10	60	-	-	100	3	-	-	3
ETC371	Lab: Embedded System Design	-	-	2	-	-	-	-	-	25	25	-	-	1	1
ETC372	Lab: VLSI Design	-	-	2	-	-	-	-	-	25	25	-	-	1	1
ETC373	Lab: Electronic Circuit Design Technology	-	-	2	-	-	-	-	-	25	25	-	-	1	1
ETC374	Major Project-I	-	-	4	-	-	-	-	-	50	50	-	-	2	2
ETC375	Lab: Electronic Workshop III	-	-	2	-	-	-	-	25	-	25	-	-	1	1
	Mandatory Non-Credit Course	2													
		17	-	12	75	75	50	300	25	125	650	15	-	6	21

MSE- Mid Semester Exam, ESE- End Semester Examination, TH-Theory, OR- Oral, TA-Teacher Assessment, TW- Term Work, PR- Practical, Tut- Tutorial

Professional Elective Courses-II (Semester-V)

Group A	Group B	Group C
ETC341: Programming in JAVA	ETC342: Control System	ETC343: Microwave Theory and Techniques

Professional Elective Courses-III (Semester-VI)

Group A	Group B	Group C
ETC391: Python Programming	ETC392: Industrial Automation	ETC393: Antenna Radiating Systems

List of Open Elective-I (Semester V)

Sr. No.	Offered by Department	Name of Course	Course Code
1.	Agricultural Engineering	Statistical Methods in Engineering	AED331
2.	Civil Engineering	Environmental Impact Assessment	CED331
3.	Computer Science and Engineering	Artificial Intelligence and its Applications	CSE331
4.	Electrical Engineering	Special Purpose Machines	EED331
5.	Electronics and Telecommunications Engineering	Electronic Product Design	ETC331
6.	Mechanical Engineering	Operations Research	MED331
7.	Plastic and Polymer Engineering	Introduction to Nanotechnology	PPE331

List of Open Elective-II (Semester VI)

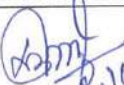| Sr. No.	Offered by Department	Name of Course	Course Code
1.	Agricultural Engineering	Fundamentals of Bioenergy	AED381
2.	Civil Engineering	Solid Waste Management	CED381
3.	Computer Science and Engineering	Information & Cyber Security	CSE381
4.	Electrical Engineering	Electrical Materials	EED381
5.	Electronics and Telecommunications Engineering	Internet of Things	ETC381
6.	Mechanical Engineering	Industry 4.0	MED381
7.	Plastic and Polymer Engineering	Polymer Recycling and Waste Management	PPE381

Mandatory Non-Credit Course (Audit Course) (Semester VI)

Sr. No.	Offered by Department	Course	Course code
1.	First Year	German Language	BSH807
2.	First Year	Japanese Language	BSH808
3.	Civil Engineering	Professional Ethics and Constitution of India	CED801
4.	Computer Science and Engineering	Green Computing	CSE801

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Dr. S. S. Kgosade

5.	Electronics and Telecommunications Engineering	Smart Cities	ETC801
6.	Mechanical Engineering	Research Methodology	MED801
7.	Plastic and Polymer Engineering	Industrial Safety and Management	PPE801

26.10.2017

Dr. S .S. Kanade

Course Code: ETC301	Credits: 3-0-0
Course: Microprocessor and Microcontroller	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
	End Semester Examination: 60 Marks
	End Semester Examination (Duration):3 Hrs

Prerequisite	Digital Electronics
Objectives	To study 1. Microprocessor basics 2. Internal details of microprocessor and Microcontroller 3. Interfacing with different peripherals
Unit-I	**Fundamentals of microprocessor :** Hexadecimal number system,Tri state gate/Buffer, Register, Internal structure of Memory, Memory Address range concept, Types of Memories, 8 bit and 16 bit microprocessor examples, Basic building blocks of microprocessor. **(6 Hrs)**
Unit-II	**Introduction to 8086:** 8086 internal architecture, Register organization, Flag register, Physical memory organization, Physical memory address calculation, Signal descriptions of 8086-common function signals, Addressing modes, Assembler directives, Summary of instruction set **(6 Hrs)**
Unit-III	**Introduction to Microcontroller:** Von Neumann and Harvard Architecture, Difference between Microprocessor and Microcontroller, 8051 Architecture, Pin diagram and alternate functions of pins, Registers of 8051, Memory Organization, Addressing modes, Instruction set, Simple programs(Assembly and C language) **(6 Hrs)**
Unit-IV	**Timer/Counter of 8051:** TMOD,TCON register, Operating modes of timers, Timer/counter programming in assembly and C ,Serial protocol RS232,SCON,PCON register, Serial communication modes, Serial port Programming in assembly and C **(6 Hrs)**
Unit-V	**Interrupts of 8051:** Interrupt concept and Interrupts of 8051, Interrupt enable(IE),interrupt priority(IP) register, Programs based on External hardware interrupt ,Timer interrupt Serial communication interrupt (C programs) **(6 Hrs)**

Unit-VI	Peripheral Interfacing:				
	Interfacing with 7 segment Display, ADC, DAC, Stepper motor, LCD and GLCD				
	(Programs in C for 7 segment display, DAC ,Stepper motor and LCD) **(6 Hrs)**				
	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1	Modern Digital Electronics	R.P.Jain	Tata Mc-Graw hill,	Fourth edition
	2	8051 Microcontroller and Embedded system	Mazidi	Pearson	Second Edition
	3	Microprocessor and Techniques	A.P.Godse	Technical Publication	Fourth edition
	4	8086 Microprocessor and its applications	A.Nagoor kani	Tata Mc-Graw hill,	Second Edition

Course Code: ETC302	Credits: 3-0-0
Course: Digital Signal Processing	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	Knowledge of Signals and Systems
Objectives	1. To understand DTFT and DFT. 2. To understand, analyze and design FIR and IIR filters. 3. To understand realization of FIR and IIR Filters. 4. To understand its hardware implementation using DSP Processor
Unit-I	**Introduction to DSP Systems:** Basic Elements of DSP systems, Advantages of DSP over ASP, Introduction to FIR & IIR Systems **Realization of FIR and IIR Filters:** Introduction, Basic realization blocksdiagram.FIR realization- Direct Form (Non-linear phase and Linear phase), Cascade and Parallel realization.IIR realization- Direct form I and II, Cascade and parallel realization. **(6 Hrs)**
Unit-II	**Discrete Fourier Transform** DFT, Properties of DFT, Circular Convolution and Circular Co-relation using DFT and IDFT, Analysis of LTI System using Circular Convolution, Linear Convolution using Circular Convolution, Fast Convolution: Overlap Save and Overlap add algorithm. Relationship between DTFT, DFT and ZT. FFT Algorithms – Radix 2: DIT-FFT and Radix 2: DIF **(6 Hrs)**
Unit-III	**IIR Filter Design.** Concept of analog filter design (required for digital filter design), Introduction to IIR Filters, IIR Filter Designing by using Approximation of Derivatives, Impulse Invariance Method and Bilinear Z Transformation method, Matched Z Transform Method, Design of Low pass digital Butterworth filter, Comparison of FIR & IIR Filters **(6 Hrs)**
Unit-IV	**FIR Filter Design.** Ideal filter requirements, Gibbs phenomenon, Characteristics of FIR Filters. Properties of FIR Filters.FIR Design using Windowing Technique Rectangular Window, Hamming Window and Hamming Window , Kaiser Window, FIR Design using Frequency Sampling Technique **(6 Hrs)**
Unit-V	**Multirate Signal Processing:** Decimation, Interpolation, Sampling rate conversion by rational factor **Adaptive filters:** Introduction, Basic principles of Forward Linear Predictive filter and applications such as system identification, echo cancellation, equalization of channels, and beam forming. **(6 Hrs)**
Unit-VI	**DSP Processors.** Introduction, Architecture of DSP Processor, TMS320C67XX,Specifications, Comparison between general purpose and DSP Processor, Application of DSP Processor in Image Processing & Communication. **(6 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1.	Digital Signal Processing Principles, Algorithms and Application	John G Prokis, Manolakis,	Pearson Education publication	4th Edition
	2.	Digital Signal Processing	Salivahanam, A Vallavaraj, C. Guanapriya	Tata MCGraw Hill.	2nd Edition
	3.	Digital Signal Processing	P. Ramesh Babu	Scitech Publication	4th Edition
	4.	Digital Signal Processing – A Computer Based Approach	Sanjeet Mitra	Tata Mc Graw Hill	2nd Edition

<table>
<tr><td colspan="2" align="center">Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Third Year B. Tech. (All) Semester V</td></tr>
<tr><td>Course Code: BSH303
Course: Managerial Economics, Finance and Costing
Teaching Scheme:
Theory: 3 Hrs/week</td><td>Credits: 3-0-0
Mid Semester Examination-I: 15 Marks
Mid Semester Examination-II: 15 Marks
Teacher Assessment: 10 Marks
End Semester Examination: 60 Marks
End Semester Examination (Duration): 3 Hrs</td></tr>
<tr><td>Prerequisite</td><td>Basic knowledge of concepts of economics.</td></tr>
<tr><td>Objectives</td><td>On the completion of this course, the learner will be able to
1. Correlate various micro and macro-economic variables and solve numerical problems
2. Analyse, interpret the financial statements, and decide upon the health of a firm.
3. Appreciate and illustrate Economic/Industrial/Trade policies and their implications and Role played by various financial institutions/banks.
4. Apply costing and accounting and costing practices in solving real life problems</td></tr>
<tr><td>Unit I</td><td>Managerial Economics Part-I:
Introduction- Economics, basic concepts - utility, wealth, welfare, price, markets, and opportunity cost. Micro - and macro- economics, economics of growth and development.
(4 Hrs)</td></tr>
<tr><td>Unit II</td><td>Managerial Economics Part-II:
Demand and supply analysis: Law and elasticity of demand and supply. Demand function. Market structure - competition, monopoly, oligopoly and imperfect competition. Market imperfections and state interventions. Role of government; monetary, fiscal and trade policies, BOP, industrial policy; instruments of government policy; taxation, incentives, budget.
Theory of firm: Production and Cost analysis for short run and long run. Cost-Output
Relationship: Cost Function, Cost-Output relationships in Short Run and Long Run. Revenue Analysis and Pricing Policies.
(8 Hrs)</td></tr>
<tr><td>Unit III</td><td>Finance Part-I: Introduction, Basic business function, sources of finance and their relative importance. Long and short term finance. Fund allocation, alternative uses of finance. Time value of money. Analysis of financial statements –Ratio analysis using balance sheet, profit and loss account. Capital budgeting decisions- type, nature and evaluation criteria: NPV, IRR, Payback.
(6 Hrs)</td></tr>
<tr><td>Unit IV</td><td>Finance Part-II: Working capital management. Financial markets; money markets, bill market, discount houses, call loan market, etc., Capital markets; mutual funds, stock markets, industrial banks, world bank, UTI, IDBI, ICICI, SEBI and state finance corporations.
(6 Hrs)</td></tr>
<tr><td>Unit V</td><td>Costing Part-I:
Cost classification: Cost ascertainment; allocation, apportionment, absorption of overheads and non-production cost; overhead analysis, absorption methods, general considerations. Job costing; factory job costing, contract cost.
Unit costing; output and operating cost, simple process costing, normal and abnormal losses in process, waste, scrap, bye-and joint products. Marginal costs and breakdown charges.
(6 Hrs)</td></tr>
</table>

Unit VI	**Costing Part-II:** Cost planning and control, standard cost and budgetary control, setting standards, variance analysis. Cost reduction; tools, techniques and productivity. Depreciation; causes and significance, methods of providing for depreciation, book values, taxes and depreciation. (6 Hrs)				

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1	Economics	Paul Samuelson and William Nordhaus	Tata McGraw Hill.	2005
	2	Financial Management	Prasanna Chandra	McGraw Hill.	10th
	3	Cost Accounting	Jawaharlal	Tata McGraw Hill (TMH).	3rd
	4	Finance Sense - Text and Cases	Prasanna Chandra	Tata McGraw Hill	4th
	5	Managerial Economics	Varshney and Maheshwari	Sultan Chand and Sons, New Delhi	22nd
	6	Indian Economy	Ruddar Datt and Sundaram	S.Chand Publication	72nd
	7	Financial institutions and markets	L.M. Bhole and Jitendra Mahakud	McGraw Hill Education.	6th
	8	Managerial Economics	Paul Keat, Philip Young and Sreejata Banerjee	Pearson Publication	7th
Web Resources:	1	www.nptel.ac.in			

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(Faculty of Science & Technology)	
Syllabus of Third Year B. Tech.(Electronics and Telecommunication Engineering) Semester V	

Course Code: ETC 341	Credits: 3-0-0
Course: Professional Elective Course-II	Mid Semester Examination-I: 15 Marks
(Programming in JAVA)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	Knowledge of C++ programming language.
Objectives	1. To understand Object Oriented Programming concepts and basic characteristics of Java 2. To know the principles of packages, inheritance and interfaces 3. To define exceptions and use I/O streams 4. To design simple applets.
Unit-I	**Introduction to OOP and JAVA** Need of Object-Oriented Programming (OOP), Procedure Oriented Programming (POP) Versus Object Oriented Programming (OOP), Features of Object Oriented Paradigm, History of Java, Features of Java, Difference between Java, C and C++, Java Development Kit (JDK) **(6 Hrs)**
Unit-II	**Java Programming Basics** Keywords and Identifiers, Data types, Variables, Operators, Input and Output in Java, Control structures including selection, Looping, Java methods, Math class, Strings and Arrays in java, Structure of a Java program. **(6 Hrs)**
Unit-III	**Classes and Objects** Defining Class, Field declaration, Method Declaration, Creating Objects, Accessing class Members, Constructors, Static Members, Access modifiers, this keyword. **(6 Hrs)**
Unit-IV	**Inheritance, Interfaces and Packages:** Inheritance in java, types of inheritance, Super and sub class, defining a subclass, method overriding, Finalizers, Abstract class and methods, visibility controls. Interface in java, defining Interfaces, extending and implementing interfaces. Packages: Defining package, creation of package, importing packages. **(6Hrs)**
Unit-V	**Exception Handling and File Processing**

	Exception Handling: types of errors, Definition of an Exception; Exception handling basics, multiple catch statements, using finally, throwing exceptions				
	Input/Output files in Java: Streams Basics, stream classes, byte stream classes, character stream classes, using file class, creating files, Readers and Writers, Random Access Files				
	(6 Hrs)				
Unit-VI	**Multithreading Programming and Applets**				
	Introduction to multithreading, Thread Class, creating thread, stopping and blocking thread, life cycle of thread, using thread methods.				
	What are Applets? applets and applications, creating applet, life Cycle of an Applet, designing a webpage, applet tag, adding applet to html page, running the applet				
	(6 Hrs)				
Text Book/ Reference Books	Sr. No.	Title	Author	Publication	Edition
	1.	Java: The Complete Reference	Herbert Schildt	McGraw Hill Education	11th Edition
	2.	Programming with Java	E Balagurusamy	McGraw Hill Eduction	6th Edition
	3.	Programming in Java	Sachin Malhotra Saurabh Chaudhary	Oxford University Press	2nd Edition
	4.	Java: How to program	Deitel	Pearson	11th Edition

Course Code: ETC342	Credits: 3-0-0
Course: Professional Elective Course-II	Mid Semester Examination-I: 15 Marks
(Control System)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 03 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	Laplace Transform , Matrix Operation , Algebra
Objectives	1. To study the elements of control system and their modelling using various Techniques. 2. To introduce methods for analyzing the time response, the frequency response and the stability of systems using root locus, bode plot etc. 3. To introduce the state variable analysis method. 4. To introduce concepts of PID controllers and digital and control systems.
Unit-I	**Introduction to Control Systems:** Concept of open & closed loop control system, Concept of system: physical system, Physical model, Linear and nonlinear systems, Time variant and invariant system Transfer Function, Equations of physical systems (Mass-Spring-Dashpot system, R-L-C series & parallel circuit) transfer function, Procedure of obtaining transfer function.　(6 Hrs)
Unit-II	**Block diagrams and Signal flow graphs:** Block diagram, Rules for Block Diagram Reduction Technique, Block Diagram reduction, and Numerical examples. Signal flow graph (SFG), Masons gain formula for deriving overall transfer function of systems. Feedback characteristics of control system, Concept of negative and positive feedback, Sensitivity of the system to parameter variation, using negative and positive feedback.　(6 Hrs)
Unit-III	**Time domain analysis:** Standard test signals, Time domain specifications, Steady state response, Types of system, Steady state error constants and steady state error, Numerical examples, transient response, Numericals, Concept of stability and Determination of stability by Routh-Hurwitz criterion.　(6 Hrs)
Unit-IV	**Frequency domain analysis:** Introduction to frequency response, Advantages of frequency domain analysis, Polar plots, Numericals, Bode plots, Principle of argument, Nyquist criterion, Relative stability from Nyquist criterion, Numericals. Definition of Root Locus, Construction of root locus, and Stability from root locus plots, Root counters, Effect of addition of poles & zeros on root

		locus plots.			(6 Hrs)
Unit-V		**PID controllers:** Introduction to Proportional (P), Integral (I) & Derivative (D) controller, individual effect on overall system performance, P-PI & PID control and effect on overall system performance, Numerical examples.			(6 Hrs)
Unit-VI		**State Variable Technique:** Concept of state & state variable, State Variable Analysis: Different forms of state variable representations (Phase, physical & canonical form), Concept of diagonalization, Obtaining state equations from transfer function representation and vice versa, solution of state equations, State transition matrix (STM), Methods of finding STM, Controllability & observability of linear system, Kalman's test.			(6 Hrs)

Text Book/ Reference Books	Sr. No.	Title	Author	Publication	Edition
	1.	Modem control Engineering	Ogata K	Prentice Hall	Third
	2.	Automatic Control System	Benjamin C. Kuo	Prentice Hall	Seventh
	3.	Control System Engineering	Nagarath I. J., Gopal M.	Willey Eastern	Second
	4.	Linear Control System	B.S. Manke	Khanna Publication	-
	5.	Control System Engineering	N. J. Nagrath and M. Gopal	New Age International Publishers	Fifth Edition

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(Faculty of Science & Technology)

Syllabus of Third Year B. Tech. (Electronics and Telecommunication Engineering) Semester V

Course Code: ETC343	Credits: 3-0-0
Course: Professional Elective Course-II	Mid Semester Examination-I: 15 Marks
(Microwave Theory and Techniques)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory:3 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	Fundamentals of Analog and Digital Communication, Electromagnetic Theory, Network Theory
Objectives	To expose students to the basics of microwave communication, transmission media, their sources, detectors, measurements, and applications.
Unit-I	**Microwave Transmission line:** Introduction, Microwave bands, applications, General solution for TEM, TE andTM waves, rectangular and circular waveguide, excitation of modes, power transmission and losses, Strip-lines: Structural details and applications of Strip-lines, Micro-strip line, Parallel Strip line, Coplanar Strip line, Shielded Strip Line smith chart (6 Hrs)
Unit-II	**Microwave Components:** Microwave cavity resonator, Multi port junctions: Construction and operation ofE-plane, H-plane, Magic Tee and Directional couplers. Ferrites components, Ferrite Composition and characteristics, Faraday rotation,Construction and operation of Gyrator, Isolator, Circulator, Phase shifter, Attenuators. (6 Hrs)
Unit-III	**Microwave network Analysis:** Impedance and Admittance matrices, The Transmission (ABCD) matrix, Scattering Matrix:-Significance,formulation and properties. S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler, Isolator and Circulator. (6 Hrs)
Unit-IV	**Microwave solid state devices:** Varactor Diode, PIN Diode, Shottky Barrier Diode, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode, TRAPATT diode. Microwave transistors, Structural details, Principle of operation, various modes, specifications and applications of all these devices (6 Hrs)
Unit-V	**Microwave tubes:** O and M type classification of microwave tubes, reentrant cavity, and velocity modulation. **O type tubes** Two-cavity Klystron, Reflex Klystron. **M-type tubes** Magnetron: Construction and Principle of operation of 8 cavity cylindrical travelling wave magnetron, hull cutoff condition, modes of resonance, PI mode operation, o/p characteristics, Applications. **Slow wave devices** Advantages of slow wave devices, Helix TWT: Construction and principle of operation, Applications. (6 Hrs)
Unit-VI	**Microwave Measurements:** Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter. Measurements: S-parameter, frequency, Power, Attenuation, VSWR, Impedance, Q of cavity resonator (6 Hrs)

	Sr. No.	Title	Author	Publication	Edition
Text Book/ Reference Books	1	Microwave Devices and Circuits	Samuel Y. Liao	Pearson	3rd edition
	2	Microwave and Radar Engineering	M. Kulkarni	Umesh Publications	3rd edition
	3	Microwave Engineering	David M. Pozar	Wiley	4th edition
	4	Microwave Circuits and PassiveDevices	M.L. Sisodia & G.S. Raghuvamshi	Wiley	3rd edition

Course Code: AED 331	Credits: 3-0-0
Course: Open Elective Course-I	Mid Semester Examination-I: 15 Marks
(Statistical Methods in Engineering)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 03 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration):03 Hrs

Prerequisite	Basics of Statistics and Probability Distribution
Objectives	1. To introduce different techniques involved in statistical analysis 2. To learn and practice various statistical methods for data analysis
Unit-I	**Sampling Distribution**: Population and Sample, Sampling Distribution, Standard Error Sampling Distribution of Means, Sampling Distribution of Variance, Sampling Distribution of Proportions **6 Hrs**
Unit-II	**Theory of Estimation**: Estimation Theory, Point Estimation – Basic Concept & Notion, Interval Estimation – Interval Estimation for Large Samples, Confidence Limits for Mean, Proportion, Standard Deviation, Difference of Means, Difference of Proportions **6 Hrs**
Unit-III	**Testing of Hypothesis**: Statistical Hypothesis, Tests of Significance, Null Hypothesis, Alternative Hypothesis, Types of Errors in Testing of Hypothesis, Level of Significance, Critical Region, One-Tailed and Two-Tailed Tests, Critical Values and Critical Region, P-value of Test Statistic, Procedure for testing of hypothesis **6 Hrs**
Unit-IV	**Large Sample Tests**: Sampling of Attributes – Test for Single Proportion, Test of Significance for Difference of Proportions, Sampling of Variables - Test of Significance for a Single Mean **6 Hrs**
Unit-V	**Non- Parametric Tests:** Parametric Tests and Non-Parametric Tests, Sign Test, Wilcoxon Signed-Rank Test, Mann-Whitney Test **6 Hrs**
Unit-VI	**Analysis of Variance (ANOVA)**: Introduction, Analysis of Variance, Assumptions for ANOVA test, One-Way Classification **6 Hrs**

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1.	Statistics for Engineers and Scientists	William Navidi	McGraw	4th Edition
	2.	Probability & Statistics for Engineers & Scientists	Walpole, Myers, Myers Ye	Prentice Hall	9th Edition
	3.	Fundamentals of Statistics	S.C. Gupta	Himalaya Publishing House	7th Edition
	4.	Statistical Methods	S. P. Gupta	Sultan Chand & Sons	1st Edition

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Course Code: CED331 Course: Open Elective Course-I (Environmental Impact Assessment) **Teaching Scheme:** Theory: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 03 Hrs

Prerequisite	Environmental Engineering
Objectives	1. Student would overview the concepts, methods, issues and various forms and stages of EIA process. 2. Student will be able to examine the development of EIA in India and highlight the diversity of approach and impact of the EIA process.
Unit-I	**Introduction and Evolution of EIA:** Introduction to Environmental Impact Assessment, Origin of EIA, Stages in EIA, thorough discussion of steps in EIA. Establishments of Procedure: Legislative Option, Project Screening for EIA, Public Participation in EIA process. **(6 Hrs.)**
Unit-II	**Impact assessment:** Background information, IA methods, environmental impact assessment methodology, documentation and selection process, environmental indices, and indicators for describing affected environment, Life cycle assessment. **(6 Hrs.)**
Unit-III	**Air and noise environment:** Prediction and assessment of impact for air and noise environment, Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation. Basic information of noise, existing noise levels and standards, prediction of noise levels and assessment of impact, mitigations. **(6 Hrs)**
Unit-IV	**Water and soil environment:** Prediction and assessment of impact for water and soil environment, Basic information of water quality (Surface water and ground water), water quality standards, identification of impact, prediction of impact and assessment, mitigations. Background information of soil environment, soil and ground water standards, prediction, and assessment of impact for ground water and soil, mitigations. **(6 Hrs)**
Unit-V	**Decision Methods for Evaluation of Alternative:** Public participation in environmental decision making, Regulatory requirements, environmental impact assessment process, objectives of public participation, verbal communication in EIA studies. **(6 Hrs)**
Unit-VI	**Environmental Impact Assessment Report:** Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan; post environmental monitoring. Latest EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, Procedure for public hearing, post environmental monitoring, Procedure for obtaining Environmental clearance for construction projects. **(6 Hrs)**

Textbook/ Reference Books	Sr. No.	Title	Author	Publication	Edition
	1.	Environmental Impact Assessment	Canter R.L.,	Mc Graw Hill International	2
	2.	Environmental Impact Assessment Theory and Practice	Peter Watten (Eds.)	Unwin Hyman	1

	3.	Environmental Impact Assessment	R.R. Barthwal	New Age International Publishers	1
	4.	Environmental Impact Analysis Handbook	John G. Rau and David C. Wooten	McGraw Hill Book Company	1

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Syllabus of **Third Year** B. Tech. (All) Semester V

Course Code: CSE331	Credits: 3-0-0
Course: Open Elective -I	Mid Semester Examination-I: 15 Marks
(Artificial Intelligence and its Applications)	Mid Semester Examination-II: 15 Marks
	Teacher Assessment: 10 Marks
Teaching Scheme:	End Semester Examination: 60 Marks
Theory: 3 Hrs/week	End Semester Examination (Duration):3 Hrs

Prerequisite	Data Structures and Algorithms
Objectives	1. To introduce different techniques involved defining and simulating an intelligence. 2. To learn and practice various Artificial Intelligence methods, algorithms, and knowledge representation schemes
Unit-I	**Introduction:** Artificial Intelligence, AI Problems and AI techniques, solving problems by searching, Problem formulation. Application of AI techniques in different branches of engineering, Basic Sciences, Medical Science and equipment, Economy and Finance
Unit-II	**Searching techniques in AI**: DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening, Bidirectional search, Comparing Different Techniques. (6 Hrs)
Unit-III	**Heuristic functions:** Hill Climbing, Simulated Annealing, Best First Search, A*, IDA*, SMA*, Crypto-Arithmetic Problem. (6 Hrs)
Unit-IV	**Agents and Environments** : Structure of Intelligent agents, Types of Agents, Agent Environments PEAS representation for an Agent. A Knowledge Based Agent, Environment, Types of Environments WUMPUS WORLD Environment, **Case Study: Automated Taxi, Vacuum Cleaner** (6 Hrs)
Unit-V	**Expert Systems:** Concept of an Expert System. Characteristics of an Expert System, Components of expert System, Concept of Knowledge Base, Components of Knowledge base, Knowledge Representation methods. **Case Study : DENDRAL, MYCIN, PXDES, CaDeT** (6 Hrs)
Unit-VI	**Propositional Logic:** Introduction, First Order Predicate Logic, Forward and Backward Chaining, Resolution., Introduction to PROLOG and LISP (6 Hrs)

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1.	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig	Pearson Education	2nd Edition
	2.	Artificial Intelligence	Elaine Rich, Kevin Knight, Shivshankar B Nair	McGraw Hill,	3rd Edition
	3.	Artificial Intelligence	Elaine Rich, Kevin Knight	Tata McGraw Hill	2nd Edition

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Syllabus of Third Year B. Tech. (All) Semester V

Course Code: EED331	Credits: 3-0-0
Course: Open Elective-I	Mid Semester Examination-I: 15 Marks
	Mid Semester Examination-II: 15 Marks
(Special Purpose Machines)	Teacher Assessment: 10 Marks
Teaching Scheme:	End Semester Examination: 60 Marks
Theory: 3 Hrs/week	End Semester Examination (Duration):3 Hrs

Prerequisite	They should have basic knowledge about all basic laws and construction / working principle of DC and AC motors and generators,
Objectives	1. To differentiate between generalized machines and control machines. 2. To understand principle and working of different control machines. 3. To be able to identify and implement control machines.
Unit-I	**Hysteresis Motors:** Magnetic field production & nature of torque, Applications. **Reluctance Motors:** F. H. P. Reluctance motors, switched reluctance motors, Principle of working & operation, Applications. **(6 Hrs)**
Unit-II	**Control Motors:** D C servomotors, transfer function of Armature and field-controlled motors their applications, Construction of F. H. P. Induction two-phase servomotors, production of torque, Torque-speed curves-characteristics & features-dynamic equations, Methods of control, Applications. Numerical on DC and AC servos. **(6 Hrs)**
Unit-III	**Eddy Current Devices:** Construction & operation of eddy current couplings & dynamometers, merits & limitations. **(4 Hrs)**
Unit-IV	**Tacho-Generators:** Basic requirements of tacho-generators, Ideal characteristics, classification. i) D.C. Tacho Generators: Output characteristics, Deviation from no load Characteristics, Dead-zone, Tooth ripples, Temperature effect, Accuracy class. ii) Induction Tacho-generators: Operating principle, Output characteristics, Equivalent circuit, Reasons for deviation from desired characteristics, Corrective means, Advantages. iii) A. C. Tacho-generators: Construction & operation, Output characteristics, non-linearities & tooth ripples, Advantages over other tacho-generators. Dynamic characteristics of techno-generators, Applications of tacho-generators. **(8 Hrs)**
Unit-V	**Synchro & Synchro Transformers:** Different types of single phase & three-phase synchro, Differential synchro, Synchro-indicators, Their constructional features, Characteristics & applications, Synchro transformers principle, Characteristics error, applications of synchro transformers. **(6 Hrs)**

Unit-VI	Linear Motors: Construction, Theory of operation of a linear induction motor, System with two-dimensional & three-dimensional field patterns, Performance of linear induction motors, Effect of variation in the air gap, Effect of width & thickness of the reaction plate, Thrust of linear induction motors, Applications. (6 Hrs)

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1.	'Electrical Machine and Power Electronics'	Bhimbhra P. S	Tata McGraw Hill Publication.	Edition 2
	2.	'Modem control Engineering'	Ogata K.	Prentice Hall.	Edition 2
	3.	Principles of Electrical Machines	V.K. Mehta	Chand Publication	Edition 2
	4.	Electrical Machines	Ashfaq Hussain	Dhanpat rai	Edition 3
	5.	Electrical Machines	Nagnath Kothari	TATA McGraw Hill.	Edition 5
	6.	Electrical Technologies	Edward Hughes Elbs	Pearson Education	Edition 2

Course Code: ETC331	Credits: 3-0-0
Course: Open Elective-I	Mid Semester Examination-I: 15 Marks
(Electronic Product Design)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration):3Hrs

Prerequisite	Students should be familiar with Circuit design and PCB design
Objectives	1. To understand the stages of product (hardware/ software) design and development. 2. To be acquainted with methods of PCB design and different tools used for PCB Design. 3. To understand the importance of testing in product design cycle. 4. To understand the processes and importance of documentation.
Unit-I	**Introduction to Electronic product Design**: Product development basics, Product development stages, Redundancy, Ergonomics and Aesthetic Design consideration. (6 Hrs)
Unit-II	**Packaging, Noise and Heat management:** Introduction to product packaging ,Noise in electronic circuits, Grounding, Shielding, Enclosure Sizing ,Thermal management (6 Hrs)
Unit-III	**Fundamentals of PCB and PCB design:** Important terms related to PCB, Types of PCBs, PCB Design elements, PCB design Steps, Requirements of artwork, Layout rules, Grounding, Shielding, Design issues related to supply and ground conductors (6 Hrs)
Unit-IV	**Software Design :** Waterfall model of software development, Phases of Software design, Goals of software design, Design of structured program, Testing and debugging of program (6 Hrs)
Unit-V	**Product Testing:** Environmental Testing, Temperature testing Humidity testing, Various test on enclosures, EMI and EMC related testing, Importance of standards, Classification of standards, IEC standards (6 Hrs)
Unit-VI	**Product Documentation:** Need of documentation, Types of documentation, Manual, Types of manual, Study of one typical manual, Bill of Material-examples, (6 Hrs)

Textbook/ Reference Books	Sr. No.	Title	Author	Publication	Edition
	1	Electronic Product Design	R.G.Kaduskar	Wiley-India	Second
	2	Integrated Circuits	K.R.Botkar	Khanna Publisher	Tenth

	3	Embedded System: A contemporary design Tool	James Peckol	Wiley	Second

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Course Code: MED331	Credits: 3-0-0
Course: Open Elective -1	Mid Semester Examination-I: 15 Marks
(Operations Research)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	1. Fundamental knowledge and understanding of Engineering mathematics
	2. Understanding of concepts of costing and management concepts
Objectives	1. To familiarize the students with formal quantitative approach to problem solving
	2. To formulate real life engineering problems
	3. To solve engineering problems using various Operations Research Techniques
Unit-I	**Introduction to Operations Research:**
	Basics definition, scope, objectives, phases, models, applications, and limitations of Operations Research. **(2 Hrs)**
Unit-II	**Linear Programming Problem:**
	Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, Big-M method, two-phase method, degeneracy and unbound solutions. **(8 Hrs)**
Unit-III	**Transportation Model:**
	Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method, and Vogel's approximation method. Optimality test – the steppingstone method or MODI method. Degeneracy in Transportation Problem.
	Assignment Problem: Hungarian Method to solve Assignment Problem, Travelling Salesman as an Extension of Assignment Problem. **(8 Hrs)**
Unit-IV	**Inventory Control, Replacement Analysis and Theory of Games:**
	Inventory Models: Economic Order Quantity Models, Quantity Discount Models, Stochastic Inventory Models, Multi Product Models, Inventory Control Models in Practice. Replacement Analysis: Replacement of Items that Deteriorate, Replacement of Items that Fail Suddenly.
	Theory of Games: Introduction, Minimax and Maximin Principle, Solution of Game with Saddle Point, Solution by Dominance. **(6 Hrs)**

	Queuing model and Sequencing model:
Unit-V	Queuing Systems and Structures, Notation Parameters, Single Server and Multi Server Models, Poisson Input, Exponential Service, Constant Rate Service, Infinite Population Sequencing Model: Introduction, n jobs through two machines, n jobs through three machines, two jobs through m machines and n jobs through m machines. **(6 Hrs)**
Unit-VI	**Network Models:** Fulkerson 's rule, concept and types of floats, float calculations, CPM and PERT, Crashing cost and crashing Network. **(6 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
	1.	Operations Research	Taha H.A.	Prentice Hall Of India.	Ninth Edition
	2.	Introduction to Operations Research	Frederick S. Hillier and Gerald J. Lieberman	Tata McGraw-Hill	Seventh Edition
	3.	Operations Research	P.K. Gupta, D.S Hira	S. Chand & Co.	Fourth Edition
Text Book/ Reference Books	4.	Operations Research	Man Mohan, P. K. Gupta, Kanti Swarup	S. Chand & Co.	12th Edition
	5.	Operations Research Principles and Practice	Ravindran, Phillips and Solberg	Mc. WSE Willey	Second Edition
	6.	Operations Research: Applications and Algorithms	Wayne L. Winston, Jeffrey B. Goldberg	Thomson Brooks	Fourth edition
	7.	Operations Research: Theory, Methods & Applications	S. D. Sharma, Himanshu Sharma	Kedar Nath Ram Nath	Fourth Edition
	8.	PERT and CPM: Principles & Applications	L. S. Srinath	East-West Press Private Limited,	Third Edition
	9.	Project Planning & Control with PERT & CPM	Dr. B.C. Punmia & K.K. Khandelwal	Firewall Media	Fourth Edition

Course Code: PPE331	Credits: 3-0-0
Course: Open Elective-I:	Mid Semester Examination-I: 15 Marks
(Introduction to Nanotechnology)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Objectives	1. To study the introduction to nanomaterials and the factors affecting it. 2. To study the types and synthesis methods of nanomaterials. 3. To study the characterizations and properties of nanomaterials. 4. To study the different applications of nanomaterials.
Unit-I	**Introduction** Introduction to nanotechnology, conventional micro vs. nano-material properties, role of size in properties of nano-materials, length scale and surface to volume concept, and uniqueness of nanostructured materials; health hazards and handling of nanomaterials. **(4 Hrs)**
Unit-II	**A) Synthesis** Bottom-up and top-down approach for nano materials synthesis, methods: ball milling, chemical vapor deposition, pressure vapor deposition, ultrasound assisted, minimulsion, microemulsion, nanoemulsion, hydrothermal, sol-gel, miscellaneous techniques. **(4 Hrs)** **B) Types of Nano-Materials** Natural and synthetic clays – Montmorillonite and layered double hydroxide (LDH); carbon nanofibers (CNFs), carbon nanotubes, graphene nanosheets, nanosilica, nanoaluminium oxide, nanotitanium oxide, nano-hybrids. **(4 Hrs)**
Unit-III	**Properties of Nanomaterials in terms of Structure Property Relationship** Thermal properties, mechanical properties, gas barrier properties, flame retardant properties, electrical and electrochemical properties, electronic properties, optical properties, magnetic properties, biodegradable properties, antimicrobial properties, catalytic properties. **(6 Hrs)**
Unit-IV	**Preparation of Polymer Nanocomposites** Solution intercalation, melt intercalation, roll milling, emulsion polymerization, in-situ polymerization. **(6 Hrs)**
Unit-V	**Characterization of Nanomaterials and Nanocomposites** X-ray diffraction (XRD), dynamic light scattering (DLS), scanning electron microscopy (SEM), Transmission electron microscopy (TEM), energy dispersive X-ray spectroscopy

		(EDS), atomic force microscopy (AFM), small angle X-ray scattering (SAXS), differential scanning calorimetry (DSC), thermo gravimetric analysis (TGA). (6 Hrs)			
Unit-VI		**Application of Nanomaterials and Nanocomposites** Biomedical-drug delivery, bone replacement; sensors – gas sensor, metal adsorption and recovery, bio-molecule detectors; energy storage and conversion - super capacitors, solar cells, energy generators; electronics; self cleaning and self healing paints, nano-engineering of cement-based materials, agricultural nanotechnologies. (6 Hrs)			
Text Book/ Reference Books	Sr. No.	Title	Author	Publication	Edition
	1.	Polymer Nanocomposites Processing, Characterization, and Applications	Joseph H. Koo	McGraw-Hill Nanoscience and Technology Series	1st 2006
	2.	Encyclopedia of Nanoscience and Nanotechnology	Hari singh Nalwa	American Scientific publishers	-
	3.	Chapter: Advanced Hybrid Nanostructures: Preparation, Properties and Applications, Book: Encyclopedia of Nanoscience and Nanotechnology	Aniruddha Chatterjee et al	American Scientific publishers	2018
	4.	Nanoparticle Technology Handbook	M Hosokawa, K Nogi, M Naito, T Yokoyama	Elsevier	-
	5.	The Science of Nanotechnology: An introductory text	Luanne Tilstra et al	Nova Science Publishers, Inc.	-
	6.	Polymer-Layered Silicate and Silica Nanocomposites	Y.C. Ke, P. Stroeve	Elsevier	2005
	7.	Nanotechnology in concrete – A review	Florence Sanchez, Konstantin Sobolev	Construction and Building Materials, Elsevier	24 (2010) 2060–2071
	8.	Agricultural Nanotechnologies: What are the current possibilities?	Claudia Parisi et al	Nano Today, Elsevier	2014

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Syllabus of Third Year B. Tech. (Electronics and Telecommunication Engineering) Semester V

Course Code: ETC321	Credits: 0-0-1
Course: Lab: Microprocessor and Microcontroller	PR/OR: 25 Marks
Teaching Scheme: Practical: 2 Hr/week	

Prerequisite	Digital Electronics
Objectives	To Study 1. Practical's based on 8086 TASM or MASM 2. Practical's based on 8051 family 3. IDE software
List of Practicals	1) Study of Microprocessor Kit 2) Perform Arithmetic operations on 8086 kit 3) Perform arithmetic operation using TASM or MASM software 4) Pattern generation on LED using 8051 Microcontroller kit 5) Interfacing with 7 segment display(Static mode and dynamic mode) 6) Interfacing with LCD (4 bit mode & 8 bit mode) 7) Interfacing with ADC 8) Waveform generation using DAC 9) Blink the LED using external hardware interrupt 10) Interfacing with GLCD(* Practical's from 4th onwards based on 8051)
List of Equipments /Instruments	1) 8086 Kit 2) MASM or TASM Software 3) Keil software or MicroC software 4) 8051 Kit 5) LED,ADC,7 segment display,GLCD

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1	Modern Digital Electronics	R.P.Jain	Tata Mc-Graw hill,	Fourth edition
	2	8051 Microcontroller and Embedded system	Mazidi	Pearson	Second Edition
	3	Microprocessor and Techniques	A.P.Godse	Technical Publication	Fourth edition
	4	8086 Microprocessor and its applications	A.Nagoor kani	Tata Mc-Graw hill,	Second Edition

Course Code: ETC322 Course: Lab: Digital Signal Processing **Teaching Scheme:** Practical: 02 Hrs/week	Credits: : 0-0-1 PR/OR: 25 Marks

Prerequisite	Knowledge of Signals and Systems
Objectives	1. To understand Digital Signal Processing Concept using Software 2. Study of Digital Signal Processor using Code Composer Studio
List of Practicals	1. Write a program to study discrete time system described by difference equation. 2. Write a program to find N point DFT & IDFT. 3. Write a program to calculate circular convolution using DFT & IDFT. 4. Write a program to calculate linear convolution using DFT & IDFT. 5. Write a program to design FIR filter using hamming & hanning windowing techniques. 6. Write a program to design FIR filter using rectangular windowing technique. 7. Write a program to design FIR filter using frequency sampling technique. 8. Write a program to design & implementation of IIR filter using bilinear transformation 9. Write a program to design & implementation of IIR filter using impulse invariance Method 10. Write a program to study interpolation & decimation. 11. Familiarization with Code Composer Studio 12. Study of FFT, Linear Convolution, Factorial implementation using DSP TMS320C6713
List of Equipments /Instruments	1. MATLAB Software/Scilab/Python/C++. 2. DSP Processor, 3. Code Composer Studio

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1	Digital Signal Processing MATLAB	Ingle, John G. Proakis	Asia Edition, Thomson	3rd Edition
	2	Digital Signal Processing – A Computer Based Approach	Sanjeet Mitra	Tata Mc Graw Hill	2nd Edition
	3	Understanding Digital Signal Processing with MATLAB® and Solutions	Alexander D. Poularikas	CRC Press	2nd Edition

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Course Code: ETC 323	Credits: 0-0-1
Course: Lab: Professional Elective Course-II (Programming in JAVA) **Teaching Scheme:** Practical: 2 Hrs/week	Term Work: 25 Marks

Prerequisite	Knowledge of C++ programming language.
Objectives	1.To understand Object Oriented Programming concepts and basic characteristics of Java 2.To know the principles of packages, inheritance and interfaces 3.To define exceptions and use I/O streams 4. To design simple applets.
List of Practicals	1. Develop a program to accept and display the details of an employee using class and object. 2. Write a program to sort the integers in an array. 3. Write a program that uses constructor overloading. 4. Write a program using inheritance. 5. Write a program to handle Arithmetic exception using try - catch statement. 6. Write a program for implementing an interface. 7. Write a Program to create a user- defined package. 8. Write a program for creating, opening, closing, reading and writing a file. 9. Write a Program to create multiple threads. 10. Write a Program to create a simple applet.

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1	Java: The Complete Reference	Herbert Schildt	McGraw Hill Education	11th Edition
	2	Programming with Java	E Balagurusamy	McGraw Hill Eduction	6th Edition
	3	Programming in Java	Sachin Malhotra Saurabh Chaudhary	Oxford University Press	2nd Edition
	4	Java: How to program	Deitel	Pearson	11th Ed

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Course Code: ETC324 Course: Lab: Professional Elective Course-II (Control System) **Teaching Scheme:** Practical: 2Hr/week	Credits: 0-0-1 Term Work: 25 Marks

Prerequisite	Knowledge of Matlab software.
Objectives	The aim of this Control system laboratory is to provide sound knowledge in the basic concepts of linear control theory and design of control system, to understand the methods of representation of systems and getting their transfer function models, to provide adequate knowledge in the time response of systems and steady state error analysis, to give basic knowledge is obtaining the open loop and closed–loop frequency responses of systems and to understand the concept of stability of control system and methods of stability analysis
List of Practicals	1. Familiarization With Matlab Control System Tool Box, Matlab/Simulink Tool Box. 2. Determination Of Step & Impulse Response For A First Order Unity Feedback System 3. Determination Of Step & Impulse Response For A Second Order Unity Feedback System 4. Plot The Pole-Zero Configuration In S-Plane For The Given Transfer Function. 5. Determine The Transfer Function For Given Closed Loop System In Block Diagram Representation. 6. Determination Of Bode Plot Using Matlab Control System Toolbox For 2nd Order System &Obtain Controller Specification Parameters 7. Determination Of Root Locus Plot Using Matlab Control System Toolbox For 2nd Order System & Obtain Controller Specification Parameters. 8. Determination Of Nyquist Plot Using Matlab Control System Toolbox. 9. Study The Effect Of Pi&Pd Controller On System Performance 10. Study The Effect Of Addition Of Zeros To The Forward Path Transfer Function Of A Closed Loop System 11. Study The Effect Of Addition Of Poles To The Forward Path Transfer Function Of A Closed Loop System
List of Equipments /Instruments	Spoken Tutorial MOOCs, ' Course on Scilab', IIT Bombay (http://spoken-tutorial.org/) Spoken Tutorial MOOCs, ' Course on Matlab', IIT Bombay (http://spoken-tutorial.org/

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1.	Modem control Engineering	Ogata K	Prentice Hall	Third
	2.	Automatic Control System	Benjamin C. Kuo	Prentice Hall	Seventh
	3.	Control System Engineering	Nagarath I. J., Gopal M.	Willey Eastern	Second

	4.	Linear Control System	B.S. Manke	Khanna Publication	-
	5.	Control System Engineering	N. J. Nagrath and M. Gopal	New Age International Publishers	Fifth Edition

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Course Code: ETC325 Course: Lab: Professional Elective Course-II Microwave Theory and Techniques **Teaching Scheme:** Theory: 2 Hrs/week	Credits: 0-0-1 Term Work: 25 Marks

Prerequisite	Fundamentals of Analog and Digital Communication, Electromagnetic Theory,Network Theory
Objectives	To expose students to the basics of microwave communication, transmissionmedia, their sources, detectors, measurements and applications.
List of Practicals	1. Study of Microwave components used at X-Band Frequency 2. Study of the characteristics of the Reflex Klystron tube 3. Study of Gunn Oscillator characteristics 4. Measurement of frequency of microwave source and demonstrate relationship among frequency, free space wavelength and guided wavelength. 5. Measurement of coupling factor and directivity of directional coupler 6. Measurement of insertion loss and isolation loss of three port circulator 7. Measurement of insertion loss and isolation loss of isolator. 8. Measurement of S-parameter of Magic Tee. 9. Measurement of standing wave ratio and reflection coefficient. 10. Measurement of attenuation/insertion loss of attenuator.
List of Equipments /Instruments	1. Microwave test bench including slotted line, 2. VSWR meter 3. Klystron power supply 4. Gunn power supply 5. CRO/DSO

Textbook/ Reference Books	Sr. No.	Title	Author	Publication	Edition
	1	Microwave Devices and Circuits	Samuel Y. Liao	Pearson	3rd edition
	2	Microwave and Radar Engineering	M. Kulkarni	Umesh Publications	3rd edition
	3	Microwave Engineering	David M. Pozar	Wiley	4th edition
	4	Microwave Circuits and PassiveDevices	M.L. Sisodia& G.S. Raghuvamshi	Wiley	3rd edition

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Course Code : ETC326 Course: Minor Project Teaching Scheme: Practical: 2 Hrs/week	Credits:0-0-1 TW Marks: 25

Objectives	:	1. To plan for various activities of the project and distribute the work amongst team members. 2. To develop the ability to define and design the problem and lead to its accomplishment with proper planning. 3. To understand the importance of document design by compiling Technical Report on the Minor Project work carried out. 4. To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Minor Project.
Guidelines	:	1. Students should select a problem which addresses some basic home, office or other real-life applications. 2. Projects which will address the social issues will be given due weightage. 3. It is desirable that the systems developed by the students have some novel features. 4. The batch size shall not exceed TWO students per batch. 5. The students have to select a suitable problem, design, prepare the drawings, produce the components, assemble and commission the project. 6. Institute may arrange demonstration with poster presentation of all minor projects developed by the students at the end of semester. 7. At the end of the semester, the students have to prepare and present 20-25 pages project report. 8. Final evaluation shall be based on continuous internal assessment followed by Viva-Voce.

Course Code: ETC327	Credits: 0-0-1
Course: Lab: Electronics Workshop- II	PR/OR: 25 Marks
Teaching Scheme: Theory: 2 Hrs/week	

Prerequisite	Basic Electronics
Objectives	The course content should be implemented with the aim to develop different types of skills related electronics product development.

List of Practicals	1. Prepare layout (Manually) of a given circuit on paper.
	2. Create schematic and layout of any one of given electronic circuit using any PCB design software:
	    • +/-12V Regulated Power supply Using 7812 & 7912
	    • Light operated Relay
	    • Touch switch using transistor
	    • Water level alarm using single transistor
	    • Opaque Object sensing alarm using LDR, transistor & Buzzer
	3. Trace electronic circuit from the given PCB layout of an electronic circuit.
	4. Mini project
	    • Create schematic, layout and fabricate PCB for given electronic circuit.
	5. Mini project
	    • Build extension board with four 5-pin socket, four switches, fuse and indicating lamp. (This is for guideline only; faculty can allot other required electrical wiring related project).

List of Equipments /Instruments	CRO, Function Generator, Power Supply, Multimeter, Ammeter, Voltmeter, Zero PCB, Breadboard, Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Crimping tool, Hot air soldering and de- soldering station , Electronic active and passive components, Single multi strand wire, Relay, Single sided PCB, Etching solution FeCl3, PCB Drill machine, PCB cutter

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1	Integrated Electronics	Miliman, Halkies	TataMc-Graw Hill, New Delhi	
	2	Applied Electronics	R.S. Sedha	S.Chand& Co , New Delhi	
	3	Printed Circuit Boards: Design and Technology	Bossart	TMH, 2008 or latest edition	
	4	Build Your Own Printed Circuit Board	Al Williams	Mc GrawHill, 2003 or latest edition	
	5	Making Printed Circuit Boards	Jan Axelsen	Mc GrawHill, 1993 or latest edition	

Course Code: ETC328	Credits: 0-0-1
Course: Lab: Experiential / Problem Based Learning	Term Work: 25 Marks
Teaching Scheme: Practical: 2 Hrs/week	

Course Objectives:

On completion of the course, learner will be able to –

- To develop positive attitude, new skills or new ways of thinking.
- To introduce independent and group learning by solving real world problem with the help of available resources.
- To be able to develop systematic approach in technical documentation.
- To select and utilize appropriate Software tools/Equipment/Problem solving tools to solve real life problems.

Guidelines:

The students plan, manage and complete a activity which addresses the stated problem.

1. The students must work in group to solve real life problem.

2. Open ended problems from course teachers can be considered from any course related to engineering field(It can be domain specific/multidisciplinary but emphasis on Electronics and Telecommunication Engineering)

3. A mentor to be assigned to 3-4 groups / one batch.

4. The steps to be followed for problem based learning are as mentioned below:

Step 1: Explore the issue.

Gather necessary information; learn new concepts, principles, and skills about the proposed topic.

Step 2: State what is known.

Individual students and groups list what they already know about the scenario and list what areas they are lacking information.

Step 3: Define the issues.

Frame the problem in a context of what is already known and information the students expect to learn.

Step 4: Research the knowledge.

Find resources and information that will help create a compelling argument.

Step 5: Investigate solutions.

List possible actions and solutions to the problem, formulate and test potential hypotheses

Step 6: Present and support the chosen solution.

Clearly state and support your conclusion with relevant information and evidence.

Step 7: Review your performance.

Often forgotten, this is a crucial step in improving the problem-solving skills. Students must evaluate their performance and plan improvements for the next problem.

Recommended parameters for assessment, evaluation and weightage:

1. Identification of the Problem (20%)
2. Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents). (30%)
3. Demonstration (Poster Presentation/Model Exhibition etc). (20%).
4. Awareness /Consideration of - Environment/ Social /Ethics/ Safety measures/Legal aspects. (10%)
5. Outcome (Participation in technical events / publication in national international conference journal/copyright/patent/prototype). (20%)

Reference	Sr. No.	Title	Author
Books/ Research Articles:	01	A new model of problem based learning	Terry Barrett
	02	Research Methodology: Methods and Techniques	C. R. Kothari
Web Resources:		1. Problem-Based Learning: https://www.coursera.org/lecture/university-teaching/problem-based-learning-i-pbl-in-practice-SMXol 2. Problem-Based Learning: https://onlinecourses.swayam2.ac.in/ntr20_ed29/preview	

Course Code:ETC351	Credits: 3-0-0
Course: Embedded System Design **Teaching Scheme:** Theory: 3 Hrs/week	Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration):3 Hrs

Prerequisite	Digital electronics, Microprocessor based systems.
Objectives	1. To understand the applications of Microcontrollers. 2. To understand need of microcontrollers in embedded system. 3. To understand architecture and features of typical Microcontroller. 4. To learn interfacing of real world input and output devices. 5. To study various hardware & software tools for developing applications
Unit-I	**Fundamentals of Embedded System:** Definition of Embedded system, Core of Embedded system, Processors in embedded system, RISC and CISC concept, Examples of embedded systems:-i) Digital thermometer, Navigation system, Software defined radio and RF tags (6 Hrs)
Unit-II	**System design using 8 bit microcontroller Part-1:** PIC family PIC 10, PIC12, PIC16, PIC18 review, PIC18F4550:Features, registers, memory organization , stack, oscillator options, Interrupts, Instruction Set: Data movement ii)Arithmetic iii)Logical (6 Hrs)
Unit-III	**System design using 8 bit microcontroller Part-2:** Timers, CCP modes: Capture, Compare and PWM generation, Sensor interfacing using ADC, LCD (4&8 bits), DC Motor speed control with CCP, MSSP structure (SPI & I2C) (6 Hrs)
Unit-IV	**System design using 32 bit Microcontroller Part1 :**. ARM core dataflow model, registers, Operating modes, three stage and five stage pipeline in ARM ,exceptions and interrupts, ARM instruction Set: i)data movement ii)Arithmetic iii)Logical (6 Hrs)
Unit-V	**System design using 32 bit Microcontroller Part2 :**ARM Cortex M0,M1,M3 review, Cortex-M3 (STM32F103C8T6)features, Registers, Timers, Pin diagram of STM32 board, Interfacing with Temperature sensor, PIR sensor, pressure sensor and seven segment display (6 Hrs)

Textbook/ Reference Books	Sr. No.	Title	Author	Publication	Edition
	1	Embedded System: A unified hardware/Software Approach	Frank Vahid	Tata Mc-Graw hill,	Fourth edition
	2	PIC microcontroller and Embedded system using Assembly and C	Muhammad AliMazidi	Pearson Education	Second Edition

	3	Beginning with STM32	Warren Gay	Apress	Second Edition
	4	A definitive guide to ARM Cortex-M3 processor	Joseph Yiu	Newnes	Third Edition

Course Code: ETC352	Credits: 3-0-0
Course: VLSI Design	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	Combinational and Sequential Circuit Design.
Objectives	1. To understand fundamental concepts in classical and modern digital circuits using design tools. 2. To design digital circuits using different design styles. 3. To understand FSM design.
Unit-I	**Introduction to VHDL:** Introduction to Computer-aided design tools for digital systems,Hardware description languages, Introduction to VHDL, Entity and Architecture Declaration, Introduction to behavioral, dataflow and structural models, Data objects, Classes and data types, Operators, Overloading, Types of delays. **(6 Hrs)**
Unit-II	**VHDL Statements:** Sequential and Concurrent Statements, Conditional statements, Array and loops, Resolution functions, Functions & Procedures, Packages & Libraries, Generics, Configurations, Attributes, Test Bench. **(6 Hrs)**
Unit-III	**Combinational & Sequential Circuit Design:** VHDL models of combinational circuits such as adder, Subtractor, Multiplexer, Encoder, Decoders, Code converters, Comparators, VHDL model of sequential circuits, Flip-flops, Shift registers, Counter. **(6 Hrs)**
Unit-IV	**Simulation & Synthesis:** Design flow, Fundamental of simulation, Simulation Process, Types of simulation, Synthesis process, Optimization. **(6 Hrs)**
Unit-V	**FSM Design:** State Diagram, Moore and Mealy state model, Synchronous and asynchronous FSM design, Basic Design steps, State Encoding techniques, Algorithmic state machines(ASM)charts **(6 Hrs)**

Unit-VI	**Circuit Design & Testability**: Introduction to Programmable Logic Devices: PAL, PLA, PLD, CPLD, FPGA. Need of design for testability, Introduction to fault coverage, Need of boundary scan check, Test Access Port (TAP) controller, Built-In Self-Test **(6 Hrs)**				
	Sr. No.	**Title**	**Author**	**Publication**	**Edition**
	1.	Fundamentals of Digital Logic with VHDL Design	Brown and Vranesic	TMH	III
Text Book/ Reference Books	2.	VHDL	J.Bhasker	PHI	II
	3.	Digital Design with VHDL	Charles Roth	Thomson Learning	II
	4.	VHDL	D.Perry	Mc Graw Hill	III
	5.	Digital Integrated circuits	Jan M. Rabaey	PHI Publication	II

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Course Code: ETC353	Credits: 3-0-0
Course: Electronics Circuit Design Techniques	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3Hrs/week	Teacher Assessment: 10 Marks
	End Semester Examination: 60 Marks
	End Semester Examination (Duration):3 Hrs

Prerequisite	Basic Electronics, Electronic Devices & Circuits.
Objectives	To study and design electronic circuits, motor driving circuits, measuring instrument (voltmeters and ammeter), modern sensor, noise reduction technique and PCB design.
Unit-I	**Design of Regulated Power Supply:** Design positive power supply using LM7805 voltage regulators, Design negative power supply using LM790, LM1117 family regulators, LM337 voltage regulators, Design of constant current source using LM317, Design of dual power supply, Design of power supply using LM2576 voltage regulator **(6 Hrs)**
Unit-II	**Design of Electronic Voltmeters and Ammeter :** Basic DC voltmeter and ammeter, design of multi ranges voltmeters, design of multi ranges ammeters, IC 7107 Based design of voltmeters **(6 Hrs)**
Unit-III	**Design of Motor &Relay Drivers:** BLDC motor, Stepper Motor, Servo motor, Design of Stepper Motor driver using MC3479, Design of dc motor using L293D and L298, ULN2000 family of driver, Isolation techniques using Opto-coupler PC817, Concept of solid state relay. **(6 Hrs)**
Unit-IV	**Concept of Sensors:** Sensor, Capacitive touch sensor, resistive touch sensor, Accelerometers, Gyroscopes. PIR Sensor, Ultrasonic, Optical encoder, Pneumatic sensors, Environmental sensors: Humidity, Moisture. **(6 Hrs)**
Unit-V	**Noise Reduction Techniques:** Noise Sources, Noise from Power Electronic Systems, Origin of Conducted EMI/EMC, Common and Normal mode Noise, Grounding Techniques, Shielding Techniques, Cabling Techniques **(6 Hrs)**
Unit-VI	**PCB Designing:** PCB, Types of PCBs, selection criteria, Design rules for analog, digital and mixed circuits, Ground rules in PCB Design, PCB manufacturing process **(6 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
Text Book/ Reference Books	1.	Printed circuit board: Design, Fabrication, Assembly and Testing	R.S. Khandpur,	Tata McGraw-Hill Education	
	2.	Electronic Circuit Design	D. S. Mantri, & G. P. Jain"	Nikita Publication.	

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3.	Jacob Fraden	Handbook of Modern Sensors Physics, Designs, and Applications	Springer	Fourth Edition.
4.	Electronic Circuit Design	Dr. T.R. Sontakke and S.N. Talbar	SadhuSudha Publications.	
5.	Pavel Ripka, AloisTipek.	Modern sensors handbook		
6.	Datasheets and application note			

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Course Code: ETC391	Credits: 3-0-0
Course: Professional Elective Course-III	Mid Semester Examination-I: 15 Marks
(Python Programming)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs.

Prerequisite	Basic Mathematics
Objectives	1. To introduce basic elements of python programming language 2. To develop understanding on python data types and their operations 3. To develop understanding on aspects of object-oriented programming and file handling
Unit-I	**Introduction to Python Programming:** Python Language history, features, advantages, comparison with other programming languages. Installing Python IDE. Structure of python program, print statement, comments (6Hrs)
Unit-II	**Control Flow** Indentation, conditional statement, if else, elif. Loops for loop, while loop. Transfer statement – pass, break, return, assert. Examples of looping (6Hrs)
Unit-III	**Functions & Modules** Python functions: Creating, calling function parameters, variable arguments, scope of function, function documentation, recursive functions. Python module naming, defining, using variable in modules, import, dir() function. (6Hrs)
Unit-IV	**Datatypes** Python List – Syntax, add – remove item, access, modify. Python Set – Syntax, add remove, modify. Tuples- add – remove, access, change value, loop through tuple. Dictionary – Syntax, add – remove, access, change value, loop through values, levels of dictionary (6 Hrs)
Unit-V	**Exception and File Handling** Exceptions: Error, exception handling with try, handling multiple exceptions, writing own exceptions. File Handling: File Handling Modes, Reading files, writing & appending to files, handling file exceptions (6 Hrs)
Unit-VI	**Object Oriented Programming** Python Classes and Objects, creating classes, initialize object, init () function, self, delete object. Inheritance in python. (6 Hrs)

Text Book/	Sr. No.	Title	Author	Publication	Edition
Reference	1.	Think Python	Allen B. Downey	O' Really	2nd Edition

Books	2.	Dive into Python 3	Mark Pilgrim	Apress	2nd Edition
	3.	Learning with Python	Allen B. Downey	Dreamtech Press	1st edition

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Course Code: ETC392	Credits: 3-0-0
Course: Professional Elective Course III:	Mid Semester Examination-I: 15 Marks
(Industrial Automation)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 03 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	Knowledge of Basic Electrical Engineering, Basic Electronics, Digital Electronics, Electronics Measurement and Instruments
Objectives	1. Understand process control, PLC architecture and interfacing 2. Develop PLC ladder logic for industrial applications 3. Design Automation systems for industrial applications
Unit-I	**Process Control & Automation:** Process control principles, Analog and Digital control, Types of Automation; Architecture of Industrial Automation Systems, Advantages and limitations of Automation, Industrial revolutions **(6 Hrs)**
Unit-II	**Transmitters and Signal Conditioning:** Need of transmitters, Standardization of signals, Current, Voltage and Pneumatic signal standards, 2-Wire & 3-Wire transmitters, Analog and Digital signal conditioning for sensors, Smart and Intelligent transmitters **(6 Hrs)**
Unit-III	**Controllers and Actuators:** PID Controller, Mechanical switches, Solid-state switches, Electrical actuators: Solenoids, Relays and Contactors, AC Motor, energy conservation schemes through VFD, DC Motors, Servo Motor, Pneumatic and hydraulic actuators. **(6 Hrs)**
Unit-IV	**PLC:** Functions of PLC, Architecture, Selection of PLC, Networking of PLCs, Ladder Programming, Interfacing Input and Output devices with PLC, PLC based automated systems. High frequency inputs. PLC programming standard IEC61131 **(6 Hrs)**
Unit-V	**SCADA & Distributed control system:** Elements of SCADA, Features of SCADA, MTU, RTU Functions, Applications of SCADA, Communications in SCADA, Introduction to DCS, Architecture, Input and output modules, Specifications of DCS. **(6 Hrs)**
Unit-VI	**Industrial Communication and Human Machine Interface (HMI):** Device network: CAN, PROFIBUS-PA, Control network: ControlNet, PROFIBUS-DP, Ethernet, Interfaces: RFID, Barcode, HMI: Block Diagram, Types, Advantages and industrial applications. **(6 Hrs)**

Text Book/	Sr. No.	Title	Author	Publication	Edition

Reference Books					
	1.	Programmable Logic controllers and Industrial Automation	Madhuchhanda Mitra, Samarjit Sen Gupta	Penram International Publishing India Pvt. Ltd	2nd Edition
	2.	Programmable Logic Controllers, Principles and Applications	John W. Webb, Ronold A Reis	Prentice Hall of India Pvt. Ltd	5th Edition
	3.	SCADA supervisory control and data acquisition	Stuart A. Boyer	ISA Publication	4th Edition
	4.	Process Control Instrumentation Technology	Curtis Johnson	Pearson Education	8th Edition
	5.	Anatomy of Automation	Amber G.H & P.S. Amber	Prentice Hall	2nd Edition

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Course Code: ETC393	Credits: 3-0-0
Course: Professional Elective Courses-III	Mid Semester Examination-I: 15 Marks
(Antenna Radiating Systems)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 03 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	Electromagnetic Engineering and Vector Analysis.
Objectives	1. Make students aware of the fundamentals of Antenna system in order to reach the desire industry skills sets. 2. Introduce the students about various Antenna types to know their applications in various domains. 3. Prepare the students for Emerging Technologies hardware using fundamentals of design concepts. 4. Design, fabricate and measurement of various types of antennas Motivate about design & fabrication process & its allied material knowledge
Unit-I	**Fundamentals:** Definitions, Antenna Parameters (radiation resistance, types of patterns, beam area, radiation intensity, efficiency, directivity and gain, antenna aperture, and radar cross sections, Radio Communication Link (Friis formula), polarization co polarization Vs cross polarizations and types, antenna heights, types of towers, radiation mechanism. **(6 Hrs)**
Unit-II	**Wire antenna:** Half wavelength dipole Dipole Vs Monopole, folded dipole Yagi- Uda, Small circular loop antennas. **Broadband antennas**: Principles of frequency independent antennas & study of Log - periodic antennas. Helix **(6 Hrs)**
Unit-III	**Microwave antennas:** Huygen's principle, E and H- plane, pyramid horn, conical horn **Reflector Antennas:** Introduction, plane reflector, corner reflector, parabolic reflector. Planar antennas: Micro strip antennas, basic characteristics, feeding methods, rectangular patch, circular patch, Planar Inverted F antenna (PIFA) **(6 Hrs)**
Unit-IV	**Antenna measurements:** Measurements of different antenna parameters like Directional pattern, Gain, Reciprocity, polarization, impedance, efficiency, Specific absorption rate (SAR). Introduction to Open area Test Vs Chamber Test Measurement. **(6 Hrs)**
Unit-V	**Design, modeling fabrication and testing of antenna:** Introduction to Antenna material, connectors, cables, Software, LNBC. Fabrication process of wired and planar antennas. Design equitation's assignment for various antenna RMSA, folded dipole, Yagi, helix. **(6 Hrs)**
Unit-VI	**Introduction to antenna arrays:** Types of arrays, two element array, Feed technique in array antenna. Pattern multiplication concept Broadside array and End-fire arrays, Design of Binomial

	Sr. No.	Title	Author	Publication	Edition
		arrays.		(6 Hrs)	
Text Book/ Reference Books	1.	Antenna and wave propagation	G.S.N. Raju	Pearson Education.	
	2.	Antennas for all applications	J.D. Krauss	TMH	3rd Edition
	3.	Electromagnetic Waves	R K Shegonkar	Tata McGraw-Hill Education India	
	4.	Antenna & Wave Propagation	K.D. Prasad	Satyaprakash Publications	
	5.	Antenna Theory: Analysis and design	C. Balanis	Wiley India	

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Course Code: AED381	Credits: 3-0-0
Course: Open Elective-II	Mid Semester Examination-I: 15 Marks
(Fundamentals of Bioenergy)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60Marks
	End Semester Examination (Duration):3 Hrs

Prerequisite	Biomass sources and waste to energy recovery
Objectives	1.Understand bioenergy technologies, processes, reactions and energy conversion rates for anaerobic Digestion, gasification, pyrolysis and combustion 2.Know what constitutes a suitable feedstock for bioenergy applications
Unit-I	**Introduction to bioenergy-** Introduction ,Unit of Energy and Introduction of Bioenergy, How Biomass Formed on the Earth, Road Map of Bioenergy, Basic Biomass Technology (Resources and Production) Exploration of Photosynthesis Process **(6 Hrs)**
Unit-II	**Biogas-** Basic concept in anaerobic digestion and biogasification, mechanism of anaerobic digestion, Biochemical methane potential assay and calculations for biogasification feasibility analysis, Biogas utilization, Biomass production System and their Categorization, Components of biogas plants **(6 Hrs)**
Unit-III	**Bioethanol-** Basic concept of Cellulosic Bioethanol Process, Pretreatment and Enzyme treatment of Cellulosic Bioethanol Process, Fermentation and Distillation in Cellulosic Bioethanol Production, characteristics of bioethanol **(6 Hrs)**
Unit-IV	**Biodiesel-** Biodiesel production processes, Biodiesel characterization , Biodiesel feedstocks, biodiesel characteristics, Environmental permitting and safety considerations for biodiesel production **(6 Hrs)**
Unit-V	**Thermo Chemical Processes:** Basic concepts in gasification and pyrolysis, Gasification and pyrolysis systems, Gasification Types - Up Drift Gasifier, Down Draft and cross flow gasifier, operation and performance of gasifier **(6 Hrs)**
Unit-VI	Bioenergy distritribution and end use for a sustainable future: Biological root of gasification, non-conventional energy sources, waste-to-energy recovery **(6 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1.	Introduction to Bioenergy (Energy and the Environment)	Vaughn C. Nelson (Author), Kenneth L. Starcher	CRC press	-
	2.	Bioenergy: Biomass to Biofuels	Anju Dahiya	AP Publications	-
	3.	Bioenergy: Principles and Applications	Yebo Li and Samir Kumar Khanal	Wiley Publications	1st edition

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Course Code: CED381	Credits: 3-0-0
Course: Open Elective-II	Mid Semester Examination-I: 15 Marks
(Solid Waste Management)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	1. Environmental Engineering
Objectives	1. To get introduced to the generation, collection and management of the various types of solid waste and different waste management techniques.
Unit-I	**Introduction to Solid Waste Management (SWM):** Need and Objectives, Waste Management Hierarchy, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, types, Composition, Quantities, Physical, chemical and Biological properties. **(6 Hrs)**
Unit-II	**Generation of solid waste: Factors affecting. Storage and collection:** General considerations for waste storage at source, Types of collection Systems, Transfer station: Meaning, Necessity, Transportation of solid waste: Means and Methods, Routing of vehicles. **(6 Hrs)**
Unit-III	**Segregation and Material Recovery:** Objectives, Stages of segregation, sorting operations, Guidelines for sorting for materials recovery, E waste management, Biomedical waste management. **(6 Hrs)**
Unit-IV	**Waste processing: processing technologies:** Composting, thermal conversion technologies incineration, treatment of biomedical wastes. Energy recovery from solid waste: Parameters affecting energy recovery, Bio-methanation, Fundamentals of thermal processing, Pyrolysis, Incineration, Advantages and disadvantages of various technological options. **(6 Hrs)**
Unit-V	**Disposal:** Landfills and its introduction, Definition, Essential components, Site selection, Land filling methods, Leachate analysis and landfill gas management, treatment & disposal, Determination of capacity of landfill disposal site. **(6 Hrs)**
Unit-VI	**Hazardous waste management (HWM):** Types of hazardous waste (such as nuclear, biomedical and industrial waste), problems and issues related to HWM, Need for HWM, Legislations on management and handling of HW, Hazardous Characteristics, reduction of wastes at source, Recycling and reuse, labeling and handling of hazardous wastes, incineration, solidification & stabilization of hazardous waste. **(6 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1.	Integrated Solid Waste Management	Hilary Theisen and Samuel A, Vigil, George Tchobanoglous	McGraw- Hill, New York	1993
	2.	Manual on Municipal Solid waste management	CPHEEO, Central Public Health and Environmental Engineering Organization	Government of India, New Delhi	2000
	3.	Environmental Resources Management and Hazardous waste Management,	Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans	Mc-Graw Hill International edition, New York	2001
	4.	Solid waste Engineering	Vesilind P.A., Worrell W and Reinhart	Thomson Learning Inc., Singapore	2002
	5.	Hazardous Waste Management	Charles A. Wentz	McGraw Hill International Edition,New York	1995 Second Edition

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Course Code: CSE381	Credits: 3-0-0
Course: Open Elective-II	Mid Semester Examination-I: 15 Marks
(Information &Cyber Security)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60Marks
	End Semester Examination (Duration):3 Hrs

Prerequisite	Knowledge of Computer Networking is necessary to understand the concepts.
Objectives	1. To understand the foundations of Information Security. 2. To learn various types of algorithms and its applications of Cyber Security 3. To identify insights on how to apply Cyber Security
Unit-I	**Introduction** The History of Information Security, Balancing Information Security and Access, Introduction and Security Trends, General Security Concepts, and introduction to what is an "infosphere", Operational Security and People's Role in Information Security. **(6 Hrs)**
Unit-II	**Security Needs** The Need for Security, Business Needs, needs to protect against Threats and Attacks, Security in Emails.Secure Software Development. Essential Terminologies: CIA, Risks, Breaches, Threats, Attacks, Exploits. **(6 Hrs)**
Unit-III	**Cryptography Concepts** Concepts of Data encryption, Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric &Asymmetric key Cryptography. Public Key Infrastructure (PKI), Different attacks on Cryptosystems. **(6 Hrs)**
Unit-IV	**Internet Standards and Authentication** Basic concepts of Internet Standards and Physical Security, Network Security and Infrastructure, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Basics of authentication in Wireless Networks, Need of authentication in Wireless Communication. **(6 Hrs)**
Unit-V	**Security in Evolving Technology** Biometrics, Mobile Computing and Hardening on android and ios, IOT Security, Web server configuration and Security. Introduction, Basic security for HTTP Applications and Services, Basic Security for Web Services like SOAP, REST etc., Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges. Open Source/ Free/ Trial Tools: adb for android, xcode for ios, **(6 Hrs)**
Unit-VI	**Cyber Security Vulnerabilities& Safeguards** Vulnerabilities-Overview, vulnerabilities in software, System administration, Open Access to Organizational Data, Weak Authentication, Authorization, Unprotected

Broadband communications, Poor Cyber Security Awareness.

Cyber Security Safeguards- Overview, Access control, IT Audit, Authentication. Open Web Application Security Project (OWASP), Web Site Audit and Vulnerabilities assessment .Open Source/ Free/ Trial Tools: WinAudit, Zap proxy (OWASP), burp suite, DVWA kit.

(6 Hrs)

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1.	Cryptography and Network Security	William Stallings	Pearson Education/PHI	2006
	2.	Cryptography and Network Security	V.K. Jain	Khanna Publishing House.	2017
	3.	Principles of Information Security	Michael E Whitman and Herbert J Mattord	Vikas Publishing House, New Delhi.	5th
	1.	Handbook of Information Security Management	Micki Krause, Harold F. Tipton	CRC Press LLC	6th
	2.	Information security and Cyber Laws	Gupta Sarika	Khanna Publishing House, Delhi.	-
	3.	Cryptography and Network Security	Atul Kahate	McGraw Hill.	4th

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Course Code: EED381	Credits: 3-0-0
Course: Open Elective II	Mid Semester Examination-I: 15Marks
(Electrical materials)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	Basics of Electrical and Electronics Engineering, Physics, Chemistry
Course Objectives	1. To understand Basic electrical and electronics engineering. 2. To understand Electromagnetism and its laws. 3.To study the conducting and superconducting materials 4. To study the dielectric and nano materials
Unit-I	**Crystallography** Crystal directions and planes, Diatomic Crystal (CsCl, NaCl, Diamond, BaTiO3) Crystal imperfection, Point defects, Line defects, Surface and Volume defects, Structure properties relationship, structure determination by X-ray diffraction. **(8 Hrs)**
Unit-II	**Magnetic Materials** Origin of magnetization using atomic theory, classification of magnetic materials and properties, Laws of magnetism, comparison of electrical and magnetic circuits theory of Día, Para and ferromagnetism, Soft and Hard magnetic materials and their uses, Domain theory of ferromagnetism, Hysteresis loss, Antiferromagnetic and Ferrimagnetic materials, Ferrites and Garnets. **(5 Hrs)**
Unit-III	**Conducting and Superconducting Materials** Band theory of solids, Classical free electron theory of metals, Quantum free electron theory, Density of energy states and carrier concentration, Fermi energy, Temperature and Fermi energy distribution, Superconductivity, Factor affecting Superconductivity, Meissner effect, Type-I and Type-II superconductors, BCS theory, Josephson effect, High temperature superconductors, Application of superconductors. **(5 Hrs)**
Unit-IV	**Semiconducting Materials** Band structure of semiconductor, Charge carrier concentration, Fermi level and temperature, Electrical conductivity, Hall effect in semiconductors, P-N junction diode, Preparation of single crystals, LED, Photovoltaic cell. **(6 Hrs)**
Unit-V	**Dielectric Materials** Dielectric constant and polarizability, types of polarization, temperature and frequency dependences of Dielectric parameter, internal fields in solids, Clausius-Mosotti equation, dielectric loss, dielectric breakdown, ferroelectric, pyroelectric and piezoelectric materials, applications of dielectric materials. **(6 Hrs)**
Unit-VI	**Nano Materials** Nanomaterials: Introduction and properties, synthesis of nanomaterials, Carbon Nano

		Tubes, Characterization techniques of nanomaterials- SEM, TEM, EDAX, FMR, XRD. Applications of nanomaterials. (6 Hrs)			
	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1.	Electrical engineering materials	A.J. Dekkar	McGraw Hill Publication	Edition 2
	2.	Science of Engineering Materials and Carbon Nanotubes	C.M. Srivastava and C. Srinivasan	New Academic Science	Edition 3
	3.	Material Science and Engineering	V.Raghavan	PHI Learning	Edition 5
	4.	Solid State Physics	A.J. Dekkar	Laxmi publication	Edition 3

Course Code: ETC381	Credits: 3-0-0
Course: Open Elective-II (Internet of Things) **Teaching Scheme:** Theory: 3 Hrs/week	Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration):3 Hrs

Prerequisite	Python Fundamentals, basics of electronics, Networking fundamentals, WWW Terminology
Objectives	1. To understand IoT value chain structure (device, data cloud), application areas and technologies involved 2. To understand IoT sensors and technological challenges faces by IoT devices. 3. Explore and learn about Internet of things with the help of projects
Unit-I	**Introduction to IoT:** Industry 4.0., Definition of IoT- Evolution of IoT and related terms, hardware, software, network stack for IoT, SAAS Model. **(6 Hrs)**
Unit-II	**Elements of IoT:** Introduction to elements of IoT, Basic Architecture of an IoT application sensors, and Actuators, WPAN and LPWAN, 6LoPAN, Sigfox. **(6 Hrs)**
Unit-III	**IoT Sensors:** Node MCU ESP 8266- hardware specification, GPIO programming, WIFI connectivity programming, Access Point Programming, Introduction to basis looping and conditional statements, basics of HTML. **(6 Hrs)**
Unit-IV	**Communication and Connectivity Technologies:** Introduction to: TCP/IP, UDP, NTP, MQTT, Network and Sockets, Cloud Computing in IoT, IoT Communication Model. **(6 Hrs)**
Unit-V	**Data Analytics and IoT Platforms:** Basics of statistics, Descriptive statistics and probability distributions. Big Data Analytics, Hadoop, Data Visualization, IoT Platforms Things speak, Microsoft Azure and Amazon Web Services, IBM Watson, Google Home and Amazon's Alexa . **(6 Hrs)**
Unit-VI	**Preparing IoT Projects** Creating the sensor project with Node MCU ESP 8266, Sensor libraries, Internal representation of sensor values, External representation of sensor values, Exporting sensor data, Creating the actuator project. **(6 Hrs)**

Text Book/ Reference Books/ Web	Sr. No.	Title	Author	Publication	Edition
	1.	The Internet of Things: Applications and Protocols,	Oliver Hersent, David Boswarthick, Omar Elloumi	Wiley publications	First

	2.	Architecting the Internet of Things,	Dieter Uckelmann, Mark Harrison, Florian Michahelles	Springer publications.	First
	3.	Internet of Things with Arduino	Marco Schwatrz	Cookbook, Packt Publications	First
	4.	Internet of Things	Arshdeep Bagha, Vijay Madisetti	Universities Press (India) Pvt. Ltd.	First
	5.	Introduction to internet of things - Course (nptel.ac.in)			

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Course Code: MED381 Course: Open Elective II (Industry 4.0) **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 3 Hrs

Prerequisite	1.Computer fundamentals and understanding of basics of information technology. 2.Understanding of basic concepts of production and manufacturing technology
Objectives	1. To make students aware of the structure and role of Industry 4.0, in current evolving industrial environment. 2. To give learners overview of Industry 4.0 technologies and their integration.
Unit-I	**Introduction-** Four industrial revolutions, Digital transformation of Industry and the fourth industrial revolution, Scope of Industry 4.0, Automation pyramid and Industry 4.0, Principles of Industry 4.0. **(6 Hrs)**
Unit-II	**Internet of Things (IoT)–** Concept of IoT, IoT Architecture – Sensing layer, Network layer, Data processing layer, Application layer, Applications of IoT – for automobiles, homes, etc. Internet of Service (IoS), Internet of Energy (IoE). **(6 Hrs)**
Unit-III	**Technologies in Industry 4.0 (1)-** Augmented reality and Virtual Reality, 3D Printing, Collaborative robots, Smart material handling, Smart sensors, Concept of smart products. **(6Hrs)**
Unit-IV	**Technologies in Industry 4.0 (2)-** Machine learning, Introduction to Cyber Physical Systems (CPS), Components of Cyber Physical Systems, Digital twins, Machine vision, Smart factory, Artificial intelligence. **(6Hrs)**
Unit-V	**Data in Industry 4.0-** Big Data, Data Mining, Data Analytics, Cloud computing, Data – a new resource of organization, Data analysis for optimal decision making, Digitalization of the entire value chain. **(6Hrs)**
Unit-VI	**Applications of Industry 4.0-** Industry 4.0 in Manufacturing – Predictive maintenance, Real-time supply-chain optimization, Digital performance management, Smart energy consumption, Challenges in implementing Industry 4.0. **(6Hrs)**

	Sr. No.	Title	Author	Publication	Edition
Text Book/ Reference Books	1.	Industry 4.0_ the Industrial Internet of Things	Industry 4.0_ the Industrial Internet of Things	Industry 4.0_ the Industrial Internet of Things	
	2.	Industry 4.0_ Managing The Digital Transformation	Alp Ustundag, Emre Cevikcan	Springer	
	3.	Automated Manufacturing System	Hugh Jack	-	
	4.	Industry 4.0_Opportunities Behind The Challenge	Dr. Mirjana Stankovic, Ravi Gupta and Dr. Juan E. Figueroa	UNIDO General Conference 2017	
	5	Handbook of Ind. Automation	Richard L. Shell Ernest L. Hall	Marcel Dekker	

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Course Code: PPE381	Credits: 3-0-0
Course: Open Elective-II:	Mid Semester Examination-I: 15 Marks
(Polymer Recycling and Waste Management)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	1. Basic knowledge of polymeric materials, additives and their properties. 2. Basic knowledge of polymer rheology and processing.
Objectives	To learn the basic concepts used in the recycling of polymers along with learning about solid waste management.
Unit-I	**Significance of Recycling** Introduction and classification of waste. Global polymer production and consumption, Global polymer waste composition, quantities and disposal, Identification of polymer for recycling. Recycling Process: collection, sorting and segregation of waste, Use of advanced technologies such as artificial intelligence in sorting, Recycling methods: primary, secondary, tertiary and quaternary recycling, landfilling. **(6 Hrs)**
Unit-II	**Recycling Equipment/Machinery** Equipment for primary and secondary recycling: shredder, granulator, pulverizer, shredder, cutter, Classification and types of reactors for tertiary recycling, Case study on waste to energy conversion plant. **(5 Hrs)**
Unit-III	**Recycling of Plastics from Urban Waste** Physiochemical, mechanical and rheological characteristics of recycled plastics, hydrolytic treatment of plastics waste containing paper, mixed plastic waste and its processing, recycling extrusion and additives used in polymer recycling, wood plastic composites, use of x-ray photoelectron spectroscopy (XPS) in recycling, international standards in recycling. **(7 Hrs)**
Unit-IV	**Recycling Techniques** PE/PP packaging films and woven sacks, PET bottles and films, PVC products, fiber reinforced plastics (FRP), and rubber products. **(6 Hrs)**
Unit-V	**Municipal Solid Waste Management and Treatment Techniques** Collection, storage, transportation and disposal of municipal solid waste, sorting of MSW, vehicles and equipment for primary collection, secondary collection and transport. a) Sanitary landfilling: Requirements, layout, leachate management, waste placement

		and inspection.

		b) Composting: windrow, aerated static pile, in vessel, decentralized, bin, box and vermicomposting.
		c) Biomethanation and refuse derived fuel.
		(7 Hrs)

Unit-VI

Tools for Combating Polymer Waste

Combating tools for waste management: Case studies on extended producer responsibility, product stewardship, usage of green products and usage of biodegradable or environmentally degradable polymers, plastic roads.

(5 Hrs)

Text Book/ Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Plastics Fabrication and Recycling	Manas Chanda and Salil K. Roy	CRC Press	4th (2007)
2.	Introduction to Plastics Recycling	Vannessa Goodship	Smithers Rapra	2nd (2006)
3.	Recycling of Polymers	Raju Francis	Wiley-VCH	1st (2016)
4.	Recycling of Plastic Materials	Francesco Paolo La Mantia	Chemtec Publishing	2nd (1993)
5.	Feedstock Recycling and pyrolysis of waste plastics	John Schiers & W. Kaminsky	John Wiley and Sons	1st (2006)
6.	Mixed Plastic Recycling Technology	B. Hegberg, G. Brenniman	Noyes Data Corporation	1st (1992)
7.	Plastics Waste: Recovery of Economic value	Jacob Leidner	Marcel Decker Inc.	2nd (2001)
8.	Management of municipal solid waste	T. V. Ramchandra	TERI Press	1st (2009)
9.	Waste Management	Martin F. Lehmann	I. A. Publishers	1st (2008)
10.	Environmental Waste Management	Ram Chandra	CRC Press	1st (2015)
11.	Plastic Waste	Jacob Leidner	Marcel Decker Inc.	1st (1981)

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Course Code: ETC371	Credits: 0-0-1
Course: Lab: Embedded System Design **Teaching Scheme:** Practical: 2 Hr/week	PR/OR: 25 Marks

Prerequisite	Microcontroller Basics
Objectives	To enhance Programming Techniques of 8 bit, 32 bit microcontroller and to understand System Peripheral and Interface.
List of Practicals	1. Write a program for interfacing button, LED, relay & buzzer to PIC18F4550 as 2. Interface a DC motor and write a program to control speed and direction using PWM. 3. Interface Seven Segment Display to display 0 to 99. 4. Serially transfer the data on PC using serial port of PIC18F4550. 5. Generate square wave using timer with interrupt for PIC18F4550 6. Interface temperature sensor to internal ADC and display value on LCD. 7. Study of STM32F103C8T6 8. Generate a pattern on LED(Blinking, chasing etc) 9. Design a system for obstacle detection 10. Designa system for temperature measurement using suitable sensor 11. Design a system for heart rate monitoring. 12. Demonstrate basic multitasking capabilities of μ/OS-II **(* Practical's 7 to 10 is based on STM32F103C8T6)**
List of Equipments /Instruments	Hardware: PIC18F4550 Arduino R3 Microcontroller Trainer kits, CRO, Power **suppply.** **Software:** MPLAB IDE, Arduino IDE

Textbook/ Reference Books	Sr. No.	Title	Author	Publication	Edition
	1	Modern Digital Electronics	R.P.Jain	Tata Mc-Graw hill,	Fourth edition
	2	1. "PIC microcontroller & embedded system"	Mazidi,	Pearson	3rd Edition
	3	A definitive guide to ARM Cortex-M3processor	JosephYiu	Newnes	Third Edition
	4	Beginning with STM32	Warren Gay	Apress	Second Edition

Course Code: ETC 372	Credits: 0-0-1
Course: Lab: VLSI Design	PR/OR:25 Marks
Teaching Scheme:	
Practical: 2 Hrs/week	

Prerequisite	Combinational and Sequential Circuit Design.
Objectives	1. To design circuits using VHDL. 2. To simulate, Synthesize and Test the functionality of circuits.
List of Practicals	1. Implement VHDL code for all logic gates. 2. Implement VHDL code for XOR gate using other basic gates. 3. Implement VHDL code for Half-Adder and Full Adder. 4. Implement VHDL code for Half Subtractor and Full Subtractor 5. Implement VHDL code for Multiplexer. 6. Implement VHDL code for Encoder . 7. Implement VHDL code for 4 Bit Binary to Grey code Converter. 8 Implement VHDL code for all Flip-flops. 9. Implement VHDL code for counter. 10. Implement VHDL code for shift register.
List of Equipments /Instruments	1. Xilinx ISE Software 2. FPGA/CPLD Board

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1	Digital Design with VHDL	Charles Roth	Thomson Learning	II
	2	VHDL	J.Bhasker	PHI	II
	3	VHDL	D.Perry	Mc Graw Hill	III

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Course Code: ETC373
Course: Lab: Electronics Circuit Design Techniques
Teaching Scheme:
Practical: 2 Hrs/week

Credits: 0-0-1
PR/OR: 25 Marks

Prerequisite	Basic Electronics, Electronic Devices & Circuits.			
Objectives	To study and design electronic circuits, motor driving circuits, measuring instrument (voltmeters and ammeter), modern sensor, noise reduction technique and PCB design.			
List of Practicals	1. Design of PCB layout using software. 2. Design DC power supply using LM2576. 3. Design constant current source using LM317 4. Design DC voltmeter using ICL7107. 5. Design stepper motor driver using MC3479. 6. Design isolated relay driver board using ULN2003 and PC817. 7. Design DC motor driver using L293D. 8. Design motor driver circuit using L298. 9. Design battery charger for lead-acid battery. 10. To Study of various sensors. 11. To Study of relay switching noise and its effects on electronic system.			
List of Equipments /Instruments	Proteus circuit simulation software, Eagle PCB layout design software, Multimeter, Power Supply, Connecting wires, Patch chord, Copper clad, Solder metal, Zero PCB, Solder gun, Flux, PCB drilling machine, Drill beats, Etching machine, Etching solution, Photo-printing machine.			

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1	Printed circuit board: Design, Fabrication, Assembly and Testing	R.S. Khandpur,	Tata McGraw-Hill Education	
	2	Electronic Circuit Design	D. S. Mantri, & G. P. Jain"	Nikita Publication.	
	3	Jacob Fraden	Handbook of Modern Sensors Physics, Designs, and Applications	Springer	Fourth Edition.
	4	Electronic Circuit Design	Dr. T.R. Sontakke and S.N. Talbar	SadhuSudha Publications.	
	5	Pavel Ripka, AloisTipek.	Modern sensors handbook		

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Course Code.: ETC374	Credits:0-0-2
Course: Major Project I	
Teaching Scheme:	Practical Examination(Marks): 50
Practical: 4 Hrs/week	

Objectives	:	The Projects in the undergraduate study of engineering aims at developing in the student, knowledge and skills to match the current and projected needs of industry, society or user systems and to create social awareness and professional attitudes. Apart from monitoring the engineering processes and maintenance of engineering work, machines and equipment, an engineer has to do investigate survey, collect data, refer handbooks/datasheets, prepare estimates and design the systems.
Contents	:	• The completion of project is to be carried out in two semesters i.e. in Third Year Sem. VI and Final Year B. Tech Sem. VII.
		• The students shall form project group of maximum 3 students for within department projects and maximum of 6 students in case of interdisciplinary projects of their choice.
		• The students groups shall collect the information on the topic/area of interest and submit brief synopsis to Project Coordinator.
		• The Project Coordinator shall allot the Project Guide depending upon the area or specialization of eligible faculty members from the department.
		• The individual student from the project group shall maintain the project diary and update weekly by taking remark of respective guide.
		• The industry sponsored projects and inter departmental projects shall be encouraged and in case of inter departmental projects, students of maximum 3 different departments/disciplines shall work together by forming the group. The guide allotment and internal/external assessment of such groups shall be done by the respective departments.
		• The projects addressing issues related to environmental, rural development and societal issues shall be preferred.
		• The selected project shall help to promote participation in government approved schemes like Unnat Maharashtra Abhiyaan (UMA) and Unnat Bharat Abhiyaan (UBA).
		• The students shall aim to promote their project work in project exhibitions/competitions, paper presentation/publication in reputed journals and

	conferences.
	• The relevance of project and implementation including details of attainment of POs and PSOs addressed through the projects with justification must be clearly stated.
	Phases of Major Project - I:
	Phase I: Problem Identification, Literature survey, data collection, deciding scope of topic and objectives and Methodology of the project.
	Phase II: Confirmation of block diagram or layout of the proposed project.
	Phase III: Submission of report of project work.

Course Code: ETC375	Credits: 0-0-1
Course: Lab: Electronics Workshop- III	PR/OR: 25 Marks
Teaching Scheme: Theory: 2 Hrs/week	

Prerequisite	Basic Electronics, Embedded System
Objectives	The course content should be implemented with the aim to develop different types of skills related electronics product development.
List of Practical's	1. Introduction to robotics- Familiarization of components used in robotics and assembling of simple robotic configurations. 2. Assembling and dismantling of desktop computer. 3. Introduction to application based embedded system (8051 Microcontroller/Arduino/ARM Cortex). 4. Mini Project: a. Develop prototype for given electronic circuit. b. Performance analysis of the mini project.
List of Equipments /Instruments	CRO, Function Generator, Power Supply, Multimeter, Ammeter, Voltmeter, Zero PCB, Breadboard, Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Crimping tool, Hot air soldering and de- soldering station , Electronic active and passive components, Single multi strand wire, Relay, Single sided PCB, Etching solution FeCl3, PCB Drill machine, PCB cutter

	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1	Integrated Electronics	Miliman, Halkies	TataMc-Graw Hill, New Delhi	
	2	Applied Electronics	R.S. Sedha	S.Chand& Co , New Delhi	
	3	Printed Circuit Boards: Design and Technology	Bossart	TMH, 2008 or latest edition	
	4	Build Your Own Printed Circuit Board	Al Williams	Mc GrawHill, 2003 or latest edition	
	5	Making Printed Circuit Boards	Jan Axelsen	Mc GrawHill, 1993 or latest edition	
	6	The 8051 Microcontroller and Embedded Systems: Using Assembly and C	Muhammad Ali Mazidi	Pearson education Ltd.	IInd edition
	7	PIC Microcontroller and Embedded Systems: Using Assembly and C	Muhammad Ali Mazidi	Pearson education Ltd.	

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Course Code: BSH807	Credits: 0-0-0
Course: Mandatory non-credit course (German Language)	Marks: 50 (Continuous Assessment)
Teaching Scheme: Theory: 02 Hrs/week	

Objectives	1. Students will be able to apply communicative German Grammar in communication. 2. Students will be able to enhance the level of German vocabulary. 3. Students will be able to pronounce and articulate words as well as sentences accurately. 4. Students will be able to understand and apply German language eventually. 5. Students will be able to develop German language skills. 6. Students will be able to manage situational communication in German. .
Unit-I	**Introduction** - Self –Introduction - Nos. up to 10,000 - Weekdays, Months - Date and Time - Greetings **(6 Hrs)**
Unit-II	**Vocabulary** - My house - My family - Daily routine - Hobbies - Food **(6 Hrs)**
Unit-III	**Grammar** - Verb forms (Present Tense) - Articles - Possessive pronouns - Auxiliary verbs - Wh-Questions / Yes-No Questions - Past-Tense of haben and sein **(12 Hrs)**

	Sr. No.	Title	Author	Publication
List of Reference Books	1	German Made Simple: Learn to speak and understand German quickly and easily	Arnold Leitner PhD	Namrata's Amazon.in
	2	The Everything Learning German Book: Speak, write, and understand basic German	Edward Swick	Adams Media

		in no time		
	3	Langenscheidt German in 30 Days	Von Angelika G. Beck	Langenscheidt
	4	Complete German Beginner to Intermediate Book and Audio Course: Learn to read, write, speak and understand a new language with Teach Yourself	Heiner Schenke	The McGraw Hill
	5	German: How to Speak and Write It (Beginners' Guides)	Joseph Rosenberg	Repro Books
	6	Collins Easy Learning – Collins Easy Learning German Grammar and Practice	Collins	Collins

Course Code: BSH808	Credits: 0-0-0
Course: Mandatory non-credit course (Japanese Language)	Marks: 50 (Continuous Assessment)
Teaching Scheme: Theory: 02 Hrs/week	

Objectives	1. Students will be able to apply communicative Japanese Grammar in communication. 2. Students will be able to enhance the level of Japanese vocabulary. 3. Students will be able to pronounce and articulate words as well as sentences accurately. 4. Students will be able to understand and apply Japanese language eventually. 5. Students will be able to develop Japanese language skills. 6. Students will be able to manage situational communication in Japanese.
Unit-I	**Introduction** - Introduction - Numbers - Days, Months, Dates **(8 Hrs)**
Unit-II	**Grammar** - Verb and verb forms - Present and Past Tense **(8 Hrs)**
Unit-III	**Communication** - Introduction of Japanese script - Dialogues (Shopping, in the restaurant) - Themes: Family, my city, my country, my friend **(8 Hrs)**

Sr. No.	Title	Author	Publication
1	Japanese Kanji for Beginners	Timothy G. Stout and Kaori Hakone	Tuttle Publishing
2	Essential Japanese Grammar: A Comprehensive Guide to Contemporary Usage	Masahiro Tanimori and Eriko Sato Ph.D.	Tuttle Publishing
3	15-Minute Japanese: Learn in Just 12 Weeks	D.K. Goel and Rajesh Goel	Amazon.in
4	Oxford Japanese Grammar and Verbs (Dictionary)	Bunt Jonathan	Oxford Publication
5	Read and write Japanese scripts: Teach yourself	Helen Gilhooly	Teach Yourself
6	Complete Japanese Beginner to Intermediate Book and Audio Course: Learn to read, write, speak and understand a new language with Teach Yourself	Helen Gilhooly	Teach Yourself

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Course Code: CED801 Course: Mandatory non-credit course (Professional Ethics and Constitution ofIndia) **Teaching Scheme:** Theory: 2 Hrs/week	Credits: 0-0-0 Marks:50 (Continuous Assessment)

Prerequisite	Knowledge of the basic structure of constitution of India.
Objectives	To create awareness of Engineering Ethics and human values, instill moral social values, loyalty and ethical issues. It will allow the students to assimilate with basic information about Indian Constitution, know its salient features and thus functioning of Democracy in India.
Unit-I	**Professional Ethics:** Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift v/s Bribery, Environmental breaches, Negligence, Deficiencies in state of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. (4 Hrs)
Unit-II	**Engineering and Professionalism:** Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. (4 Hrs)
Unit-III	**Responsibility and reliability in Engineering:** Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering. (4 Hrs)
Unit-IV	**Introduction to Indian Constitution:** The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building. (4 Hrs)
Unit-V	**Union Executive and State Executive:** Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370.371,371J) for some States. (4 Hrs)

Unit-VI	Elections, Amendments and Emergency Provisions:Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences.
	(4 Hrs)

Textbook/ Reference Books	Sr. No.	Title	Author	Publication	Edition
	1.	–Engineering Ethics(Including Human Values)	Govindrajan.M, Natrajan S, Values)	PHI publication	
	2.	Ethics, Integrity and Aptitude	Reddy.N H, Ajmera, Santosh,	Tata McGraw Hill	2014
	3.	Introduction to the Constitution on India	Durga Das Basu	Prentice –Hall EEE, 19th / 20th Ed.	2008 and latest
	4.	–Constitution of India and Professional Ethics	Shubham Singles, Charles E. Haries, and Et al	Cengage Learning India Private Limited	Edition – 2018
	5.	An Introduction to Constitution of India	M.V.Pylee	Vikas Publishing	2002

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Course Code: CSE801	Credits: 0-0-0
Audit Course: Mandatory non-credit course	Marks:50 (Continuous Assessment)
(Green Computing)	
Teaching Scheme:	
Theory: 2 Hrs /week	
Prerequisite	Nil
Objectives	1. To learn the fundamentals of Green Computing. 2. To understand the concepts related to Green IT, Green devices and hardware along with software methods, green enterprise activities. 3. To study the various laws, standards, protocols for regulating green IT 4. To study various case studies related to the application of Green IT strategies.
Unit-I	**Green IT: An Overview** Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green IT, Holistic Approach to Greening IT, Applying IT for enhancing Environmental sustainability, Green IT Standards and Eco-Labelling of IT. **(4Hrs)**
Unit-II	**Green Devices and Hardware with Green Software** Green Devices and Hardware: Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Introduction, Energy-saving software techniques. **(4Hrs)**
Unit-III	**Green Enterprises and the Role of IT (04 hrs)** Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues. **(4Hrs)**
Unit-IV	**Managing Green IT:** Introduction, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social media. **(4Hrs)**
Unit-V	**Regulating the Green IT: Laws, Standards and Protocols** Introduction, The regulatory environment and IT manufacturers, Non regulatory government initiatives, Industry associations and standards bodies, Green building standards, Green data centers, Social movements and Greenpeace. **(4Hrs)**
Unit-VI	**Case Studies** The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital. **(4Hrs)**

	Sr. No.	Title	Author	Publication	Edition
References	1.	Harnessing Green IT Principles and Practices	San Murugesan, G.R. Gangadharan	Wiley Publication	
	2.	Green IT Strategies and Applications-Using Environmental Intelligence	Bhuvan Unhelkar	CRC Press	June 2014
	3.	The Greening of IT	John Lamb	Pearson Education	2009
	4.	Green Home computing for dummies	Woody Leonhard, Katherine Murray		2012

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Course Code: ETC801	Credits: 0-0-0
Course: Mandatory non-credit course (Smart Cities)	Marks:50 (Continuous Assessment)
Teaching Scheme: Theory: 2 Hrs/week	

Prerequisite	Nil
Objectives	1. To identify urban problems. 2. To study Effective and feasible ways to coordinate urban technologies. 3. To study models and methods for effective implementation of Smart Cities.
Unit-I	**Smart cities:** Ideal Smart City loop, Socio-economic and environmental issues, Implications of Urbanization, Urbanization models and global trends, Urbanization in India (4 Hrs)
Unit-II	**Criteria for smart cities:** Smartness - Citizens, Living, Environment, Mobility, Economy, Governance Pillars of Smart cities, Buildings, Utilities, Transportation and road Infrastructure, Health Care, Sustainability issues (4 Hrs)
Unit-III	**Fundamental Technologies:** Ubiquitous computing, Big Data, Networking, Internet of Things, Cloud computing, Cyber security architectures (4 Hrs)
Unit-IV	**ICT for Smart Cities:** Complex Urban systems ICT Infrastructure modelling, Typical Edge Environment, Smart Cities as Systems of Systems, IoT Centric approach, IoT technologies: WiFi, 6LowPAN, Cellular, NFC, LoRa, Bluetooth, RFID, Zigbee (4 Hrs)
Unit-V	**Smart City:** Smart Street lighting, Smart Parking, Environmental pollution monitoring, Vehicular tracking, Smart Traffic Control, Waste Management, Smart Grid, Amenity availability, Heritage Information portal, Mobile application design, development and Visualization (4 Hrs)
Unit-VI	**Case Studies of Smart Cities:** National and International smart cities, their model, Clusters and Urbanization, Environmental Issues: The Role of Local and Global Climate Change (4 Hrs)

Text Book/	Sr. No.	Title	Author	Publication	Edition
Reference Books	1.	The City of Tomorrow: Sensors, Networks,	Carlo Ratti and Matthew Claudel	Yale University Press	

		Hackers, and the Future of Urban Life (The Future Series)			
	2.	The Responsive City: Engaging Communities Through Data-Smart Governance	Stephen Goldsmith, Susan Crawford	Jossey Bass – Wiley	‖, 1st Edition.

	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
	(Faculty of Science & Technology)
	Syllabus of Third Year B. Tech. (All) Semester VI

Course Code: MED801	Credits: 0-0-0
Course: Mandatory non-credit course (Research Methodology)	Marks:50 (Continuous Assessment)
Teaching Scheme: Theory: 2 Hrs/week	

Prerequisite	Nil
Objectives	1. To introduce students to quantitative and qualitative methods for conducting meaningful inquiry and research. 2. Prepare a preliminary research design for projects in their subject matter areas 3. Accurately collect, analyse, and report data 4. Present complex data or situations clearly
Unit-I	**Research Problems and Research Design:** -Meaning of research, objectives of research, motivation in research, types of research, steps in involved in research process, criteria of good research, significance of research, research methods versus methodology, selection of research problem, steps involved in defining research problem, research process, need for research design, types of research designs, basic principles of experimental design, formal and informal experimental design. **(4 Hrs)**
Unit-II	**Sampling Design:** -Need for sampling, steps in sampling design, different types of sampling designs, sampling distributions, concept of central limit and standard error, sources of errors, population mean and proportion, sample size calculations, tests of measurements for validity, reliability, and practicality **(4 Hrs)**
Unit-III	**Data collection, Processing and Analysis:** -Methods for collection of data, selection of data collection method, data processing operations, statistics in research, confidence level, measures of central tendency, dispersion, asymmetry and relationship. Spearman's and Pearson's coefficient of correlation, simple & multiple regression analysis, analysis of variance (ANOVA), factor analysis methods. **(4 Hrs)**
Unit-IV	**Hypothesis Test:-**Concept of research hypothesis, concept of testing of hypothesis, Procedure for hypothesis testing, Flow diagram for hypothesis testing, Measuring the power of a hypothesis test, Parametric tests (z, t, F and chi-square tests), Hypothesis testing of means and correlation coefficient, Limitations of the tests of hypotheses. **(4 Hrs)**
Unit-V	**Report Writing** **Interpretation:** Meaning of Interpretation, Why Interpretation? Technique of Interpretation, Precaution in Interpretation. **Report Writing:** Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Conclusions. **(4 Hrs)**

		Ethics: - Ethical Issues, Ethical Committees, Commercialization, copy right, royalty, Intellectual Property rights and patent law, Reproduction of published material, Plagiarism, Citation and Acknowledgement, Reproducibility and accountability. **(4 Hrs)**			
Unit-VI					
Text Book/ Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Research Methodology: Methods & Techniques	C. R. Kothari and G. Garg	New Age International	4th
	2.	Research Methodology	R. Pannerselvam	PHI Learning,	2nd
	3.	Research Methods and Statistics	Bernard C. Beins & Maureen A. McCarthy	Pearson Education Inc.	2012
	4.	Research Methods Handbook	Stuart MacDonald & Nicola Headlam	CLES	-
	5.	Intellectual Property Rights--Unleashing the Knowledge Economy,	Ganguli Prabuddha.	Tata McGraw-Hill,	2001
	6.	Intellectual Property Rights	Neeraj Pandey and Khushdeep Dharni.	PHI Learning	1st
	7.	Fundamentals of Intellectual Property Rights,	Ramakrishna B.	Notion Press	1st
	8.	The Indian Patents Act 1970 (as amended in 2005)	-	-	-

Course Code: PPE801	Credits: 0-0-0
Course: Mandatory non-credit audit course: (Industrial Safety and Management) **Teaching Scheme:** Theory: 02 Hrs/week	Marks:50 (Continuous Assessment)

Objectives	1. To understand the fundamental concepts, and methods in Industrial Safety. 2. To understand the impact of safe industrial operations, its benefits and safety management.
Unit-I	**Introduction to Industrial Safety** Introduction, key concepts, terminologies, Need for safety, Safety information system. (4 Hrs)
Unit-II	**Safety Management** Safety inspection, procedure, checklist, safety sampling, safety audit, safety survey, accident prevention, training for safety. (4Hrs)
Unit-III	**Safety in Process** Safety in material handling and equipments used, design for safety in process. (4 Hrs)
Unit-IV	**Fire Safety** Classification of fires. Common causes of industrial fires. Fire protection systems. (4 Hrs)
Unit-V	**Hazards** Occupational health hazards, physical and chemical hazards. (4 Hrs)
Unit-VI	**Hazard Analysis** Fault tree and event tree analysis, hazard identification techniques (e.g., HAZOP, HAZAN, OSHAS 18001). (4 Hrs)

	Sr. No.	Title	Author	Publication	Edition
Text Book/ Reference Books	1.	Industrial Safety, Health and Environment Management Systems	R.K.Jain and Sunil S.Rao	Khanna Publishers, New Delhi	2006
	2.	Industrial Safety Management	Deshmukh L M	Tata McGraw-Hill	
	3.	Handbook of Occupational Safety and Health	Slote.L	John Willey and Sons, New York	

	4.	Safety at Work	Ridley J and Channing J	Butterworth-Heinemann UK	
	5.	Loss of prevention in Process Industries , Vol. 1 and 2	Frank P. Lees	Butterworth-Heinemann Ltd., London	1991
	6.	Safety Management	Grimaldi and Simonds	AITBS Publishers, New Delhi	2001
Website		https://nptel.ac.in/courses/110/105/110105094/			

26-10-2021

Dr. V. A. More.

26.10.2021

Dr. S. S. Kamade

26/10/21

Dr. Hamosh Salle