JNTUA COLLEGE OF ENGINEERING, ANANTAPURAMU (AUTONOMOUS)
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Proposed Course Structure for R20 regulation

Induction Program – 3 weeks

Semester-1(Theory-5,Lab -4)					
S. No.	**CourseNo**	**CourseName**	**Category**	**L-T-P**	**Credits**
1.	20A15101	Linear Algebra and Calculus Common to All branches of Engineering	BS	3-0-0	3
2.	20A15201	AppliedPhysics Common to EEE, ECE, CSE	BS	3-0-0	3
3.	20A15501	Communicative English Common to EEE, ECE, CSE, CHEM	HS	3-0-0	3
4.	20A10201	Fundamentals of Electrical Circuits	ES	3-0-0	3
5.	20A10301	Engineering Drawing Common to EEE, ECE, CSE	LC	1-0-2	2
6.	20A10302	Engineering Graphics Lab Common to EEE, ECE, CSE	LC	0-0-2	1
7.	20A15202	AppliedPhysics Lab Common to EEE, ECE, CSE	BS	0-0-3	1.5
8.	20A15502	Communicative EnglishLab Common to EEE, ECE, CSE, Chem	HS	0-0-3	1.5
9.	20A10202	Fundamentals of Electrical Circuits Lab	ES	0-0-3	1.5
				Total	**19.5**

Semester–2(Theory–4,Lab –5, MC-1)					
S. No.	**CourseNo**	**CourseName**	**Category**	**L-T-P**	**Credits**
1.	20A15102	**Differential Equations and Vector Calculus** Common to all branches of Engineering except CSE	BS	3-0-0	3
2.	20A15303	Chemistry Common to EEE, ECE, CSE	BS	3-0-0	3
3.	20A10506	C-Programming & Data Structures Common to EEE, ECE	ES	3-0-0	3
4.	20A10402	Electronic Devices & Circuits Common to EEE, ECE	ES	3-0-0	3
5	20A10303	EngineeringWorkshop Common to EEE, ECE, CSE	LC	0-0-3	1.5
6	20A10508	IT Workshop Common to EEE, ECE, CSE	LC	0-0-3	1.5
7.	20A10507	C-Programming & Data Structures Lab Common to EEE, ECE	ES	0-0-3	1.5
8.	20A15304	Chemistry Lab Common to EEE, ECE, CSE	BS	0-0-3	1.5
9.	20A10403	Electronic Devices &Circuits Lab Common to EEE, ECE	ES	0-0-3	1.5
10.	20A10803	Environmental Science Common to EEE, ECE, CSE	MC	3-0-0	0.0
				Total	**19.5**

For 20 Batch only

II Year EEE COURSE STRUCTURE – R20 REGULATIONS

Semester-III					
S.No	**Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	20A35102	Complex Variables & Transform Techniques Common to EEE,MECH, ECE	BS	3-0-0	3
2.	20A30201	Electrical Circuit Analysis	PC	3-0-0	3
3.	20A30202	DC Machines & Transformers	PC	3-0-0	3
4.	20A30404	Digital Logic Design	ES	3-0-0	3
5.	20A39101 a 20A39101b 20A39101 c	Humanities Elective-I Common to EEE, ECE, CSE • Managerial Economics and Financial Analysis • Entrepreneurship and Incubation • Business Ethics and Corporate Governance	HS	3-0-0	3
6.	20A30203	Electrical Circuit Analysis Lab	PC	0-0-3	1.5
7.	20A30204	DC Machines & Transformers L ab	PC	0-0-3	1.5
8.	20A30405	Digital Logic Design Lab	ES	0-0-3	1.5
9.	20A30205	Python Programming	SC	1-0-2	2
10.	20A19101	Universal Human Values(Common to EEE, ECE, CSE) (Mandatory credit Course-II)	MC	3-0-0	3
11	20A39901	NSS/NCC/NSO Activities		0-0-2	
				Total	**24.5**

Semester-IV					
S.No	**Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.	20A45101	Numerical Methods & Probability Theory Common to EEE,MECH	BS	3-0-0	3
2.	20A40409	Analog Electronics	ES	3-0-0	3
3.	20A40201	Power Electronics	PC	3-0-0	3
4.	20A40202	AC Machines	PC	3-0-0	3
5.	20A40203	Electromagnetic Field Theory	PC	3-0-0	3
6.	20A40410	Analog Electronics Lab	ES	0-0-3	1.5
7.	20A40204	Power Electronics Lab	PC	0-0-3	1.5
8.	20A40205	AC Machines Lab	PC	0-0-3	1.5
9.	20A40206	Circuits Simulation & Analysis using PSPICE	SC	1-0-2	2
10.	20A49102	Design Thinking for Innovation(Common to All Braches) (Mandatory non-credit Course-II)	MC	2-0-0	0
				Total	**21.5**
Community Service Internship/Project(Mandatory) for 6 - 8 weeks duration during summer vacation					

Note: Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the College.

Semester–V						
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A50201	Power System Architecture	3	0	0	3
2.	20A50202	Control Systems	3	0	0	3
3.	20A50203	Digital Computer Platforms	3	0	0	3
4.	20A50204a 20A50204b 20A50204c	**Professional Elective Course – I** **1.** Programmable Logic Controllers 2. Linear & Digital IC Applications 3. Embedded Systems	3	0	0	3
5.	20A50205	**Open Elective Course – I Common to All Branches** (Each department offer one course including Mathematics, Physics, Chemistry and HSS)	3	0	0	3
6.	20A50206	Control Systems Lab	0	0	3	1.5
7.	20A50207	Digital Computer Platforms Lab	0	0	3	1.5
8.	20A55502	**Skill oriented course - III** Soft Skills (EEE, ECE, CSE)	1	0	2	2
9.	20A50208	Evaluation of Community Service Project				1.5
10.	20A59901	**Mandatory Non-credit Course** Intellectual Property Rights & Patents (EEE, ECE, CSE)	2	0	0	0
Total						**21.5**

Note:

1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline

Semester–VI						
S.No.	**CourseCode**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A60201	Power System Analysis	3	0	0	3
2.	20A60202	Measurements & Sensors	3	0	0	3
3.	20A60203	Digital Signal Processing	3	0	0	3
4.	 20A60204a 20A60204b 20A60204c	**Professional Elective Course– II** 1. Switch Gear and Protection 2. Nonlinear System Analysis 3. Design of Photovoltaic Systems	3	0	0	3
5.	20A60205	**Open Elective Course – II** **(Common All Branches)** (Each department offer one course including Mathematics, Physics, Chemistry and HSS) Renewable Energy Systems	3	0	0	3
6.	20A60206	Power Systems Lab	0	0	3	1.5
7.	20A60207	Measurements & Sensors Lab	0	0	3	1.5
8.	20A60208	Digital Signal Processing Lab	0	0	3	1.5
9.	20A60209	**Skill oriented course - IV** Applications of soft computing skills in Electrical Engineering	1	0	2	2
10.	20A65901	**Mandatory Non-credit Course** Indian Constitution (EEE, ECE, CSE)	2	0	0	0
Total						**21.5**
Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation						

Semester-VII						
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	 20A70201a 20A70201b 20A70201c	**Professional Elective Course– III** 1. Power System Operation & Control 2. Switched Mode Power Converters 3. Electrical & Electronic Instrumentation	3	0	0	3
2.	 20A70202a 20A70202b 20A70202c	**Professional Elective Course– IV** 1. Electrical Distribution system Automation 2. Restructured Power Systems 3. Intelligent Control Techniques	3	0	0	3
3.	20A70203	**Professional Elective Course– V(MOOCS)** Courses will be offered according to the available courses under SWAYAM for the academic year.	3	0	0	3
4.	 20A75401a 20A75401b 20A75401c	**Humanities Elective – II(Common to All Branches** 1. Management Science 2. Business Environment 3. Organizational Behaviour	3	0	0	3
5.	20A70204	**Open Elective Course – III** (Each department offer one course including Mathematics, Physics, Chemistry and HSS) Battery Management Systems	3	0	0	3
6.	20A70205	**Open Elective Course – IV** (Each department offer one course including Mathematics, Physics, Chemistry and HSS) IOT Applications in Electrical Engineering	3	0	0	3
7.	20A70206	**Skill oriented course – V** Energy Conservation and Auditing	1	0	2	2
8.	20A70207	Evaluation of Industry Internship				3
Total						**23**

Semester-VIII							
S.No.	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
1.	20A80201	Full Internship & Project work	PR				12
						Total	**12**

HONOURS DEGREE IN <Electrical & Electronics Engineering>

S.No.	Course Code	Course Name	Contact Hours per week L	Contact Hours per week T	Credits
1	20A02H11	ElectricVehicle Technology & Mobility	3	1	4
2	20A02H12	Battery Management Systems	3	1	4
3	20A02H13	Special Machines for Electric Vehicles	3	1	4
4	20A02H14	Grid Interface of Electric Vehicles	3	1	4
SUGGESTED MOOCs					
5	20A02H15a	Introduction to Hybrid and Electric Vehicles/ Available Courses under SWAYAM (MOOC-I*)	--	--	2
6	20A02H16a	Electric Vehicles and Renewable Energy/ Available Courses under SWAYAM (MOOC-II*)	--	--	2

MINORS

<Minors in Energy Systems>

S.No.	Course Code	Course Title	Contact Hours per week			Credits
			L	T	P	
1.	20A02M11	Energy Audit and Management	3	1	0	4
2.	20A02M12	Energy Management in Building	3	1	0	4
3.	20A02M13	Energy Conversion Systems	3	1	0	4
4.	20A02M14	Energy Scenario and Energy Policy	3	1	0	4
5.	20A02M15a	Energy Resources & Technology / Available Courses under SWAYAM MOOC I*	--	--	--	2
6.	20A02M16a	Waste to Energy Conversion/ Available Courses under SWAYAM MOOC II*	--	--	--	2

*-MOOC must be 12 week duration in SWAYAM/NPTEL

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Electrical & Electronics Engineering

		Open Elective Course – I*				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A50105	Experimental Stress Analysis	3	0	0	3
2.	20A50205	Electric Vehicle Engineering	3	0	0	3
3.	20A50305	Optimization Techniques	3	0	0	3
4.	20A50405	Basics of Electronics and Communication	3	0	0	3
5.	20A50505	Introduction to Java Programming	3	0	0	3
6.	20A50805	Energy Conversion and Storage Devices	3	0	0	3
7.	20A55101	Optimization Methods (Mathematics)	3	0	0	3
8.	20A55201	Material Characterization	3	0	0	3
9.	20A55401	E-Business (H & SS)	3	0	0	3
10.	20A55301	Chemistry Of Energy Materials (Chemistry)	3	0	0	3

***It is mandatory that the candidate should select any subject other than parent branch subject.**

		Open Elective Course – II				
S.No.	**Course**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A60105	Disaster Management(CIVIL)	3	0	0	3
2.	20A60205	Renewable Energy Systems(EEE)	3	0	0	3
3.	20A60305	Solar Energy Systems(MECH)	3	0	0	3
4.	20A60405	Basics of Integrated Circuits Applications(ECE)	3	0	0	3
5.	20A60505	Introduction to Linux Programming (CSE)	3	0	0	3
6.	20A60805	Green Technology(CHEM)	3	0	0	3
7.	20A65101	Mathematical Modelling & Simulation (Common for CIVIL,MECH &CHEM)(Mathemtics)	3	0	0	3
8.	20A65102	Wavelet transforms and its Applications (Common for EEE&ECE) (Mathemtics)	3	0	0	3
9.	20A65103	Statistical Methods for Data Science CSE (Data Science) (Mathemtics)	3	0	0	3
10.	20A65201	Physics Of Electronic Materials And Devices (Physics)	3	0	0	3
11.	20A65501	Academic Writing and Public Speaking(H &	3	0	0	3
12.	20A65301	Chemistry Of Polymers And Its Applications (Chemistry)	3	0	0	3

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Electrical & Electronics Engineering

		Open Elective Course – III*				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A70103	Building Technology for Engineers (CIVIL)	3	0	0	3
2.	20A70204	Battery Management Systems (EEE)	3	0	0	3
3.	20A70304	Modern Manufacturing Methods (MECH)	3	0	0	3
4.	20A70404	Digital Electronics (ECE)	3	0	0	3
5.	20A70504	CyberSecurity (CSE)	3	0	0	3
6.	20A70804	Industrial Pollution Control Engineering (CHEM)	3	0	0	3
7.	20A75101	Numerical Methods for Engineers	3	0	0	3
8.	20A75201	SMART MATERIALS AND DEVICES (Physics)	**3**	**0**	**0**	**3**
9.	20A75501	Employability Skills (H&SS)	**3**	**0**	**0**	**3**
10.	20A75301	GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (Chemistry)	**3**	**0**	**0**	**3**

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		Open Elective Course – IV*				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A70104	Environmental Impact and Assessment (CIVIL)	3	0	0	3
2.	20A70205	IOT Applications in Electrical Engineering	3	0	0	3
3.	20A70305	Material Handling Equipment (MECH)	3	0	0	3
4.	20A70405	Principles of Digital Signal Processing (ECE)	3	0	0	3
5.	20A70505	Introduction to DBMS (CSE)	3	0	0	3
6.	20A70805	Solid Waste management (CHEM)	3	0	0	3
7.	20A75102	Number theory and its Applications	3	0	0	3
8.	20A75202	Sensors and Actuators For Engineering Applications (Physics)	**3**	**0**	**0**	**3**
9.	20A79102	English Literary Spectrum (H & Ss)	**3**	**0**	**0**	**3**
10.	20A75302	Chemistry Of Nanomaterials And Applications (Chemistry)	**3**	**0**	**0**	**3**

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A15101	Linear Algebra & Calculus	3	0	0	3

(Common to all branches of Engineering)

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Bridge Course: Limits, continuity, Types of matrices

Unit 1:Matrices **10 hrs**

Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigenvalues and Eigenvectors and their properties, Properties of Eigen values and Eigen vectors on special matrices, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix.

Learning Outcomes:

At the end of this unit, the student will be able to

- solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigenvalues and eigenvectors (L3).
- identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (L3)

Unit 2: Mean Value Theorems **6hrs**

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), related problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Translate the given function as series of Taylor’s and Maclaurin’s with remainders (L3)
- analyze the behaviour of functions by using mean value theorems (L3)

Unit 3:Multivariable calculus **10 hrs**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

Unit 4:Multiple Integrals **10hrs**

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

Learning Outcomes:

- At the end of this unit, the student will be able to
- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)
- Evaluate multiple integrals in Cartesian, cylindrical and spherical geometries (L5)

Unit 5:Beta and Gamma functions **6 hrs**

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.
4. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
5. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
6. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
7. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
8. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education
9. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
10. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Course Outcomes:

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

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- Utilize mean value theorems to real life problems (L3)
- familiarize with functions of several variables which is useful in optimization (L3)
- Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems (L5)
- Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

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B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A15201	Applied Physics	3	0	0	3

(Common to ECE, EEE & CSE)

PREAMBLE

There has been an exponential growth of knowledge in the recent past opening up new areas and challenges in the understanding of basic laws of nature. This helped to the discovery of new phenomena in macro, micro and nano scale device technologies. The laws of physics play a key role in the development of science, engineering and technology. Sound knowledge of physical principles is of paramount importance in understanding new discoveries, recent trends and latest developments in the field of engineering.

To keep in pace with the recent scientific advancements in the areas of emerging technologies, the syllabi of applied physics has been thoroughly revised keeping in view of the basic needs of engineering branches like ECE, EEE and CSE branches by including the topics like optics, quantum mechanics, free electron theory. Also new phenomenon, properties and device applications of semiconducting, dielectric, magnetic and superconducting materials along with their modern device applications have been introduced.

COURSE OBJECTIVES	
1	To make a bridge between the physics in school and engineering courses.
2	To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications
3	To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibres along with engineering applications.
4	To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
5	To enlighten the concepts of Quantum Mechanics and to provide fundamentals of de'Broglie waves, quantum mechanical wave equation and its applications, the importance of free electron theory and band theory of solids.
6.	Evolution of band theory to distinguish materials, basic concepts and transport phenomenon of charge carriers in semiconductors. To give an impetus on the subtle

	mechanism of superconductors using the concept of BCS theory and their fascinating applications.

Unit-I: Wave Optics
12hrs
Interference- Principle of superposition – Interference of light – Conditions for sustained interference - Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit and N-slits (qualitative) – Grating spectrum.

Polarization-Introduction – Types of polarization – Polarization by reflection, refraction and double refraction - Nicol's Prism - Half wave and Quarter wave plates with applications.

Unit Outcomes:

The students will be able to

- **Explain** the need of coherent sources and the conditions for sustained interference (L2)
- **Identify** engineering applications of interference (L3)
- **Analyze** the differences between interference and diffraction with applications (L4)
- **Illustrate** the concept of polarization of light and its applications (L2)
- **Classify** ordinary polarized light and extraordinary polarized light (L2)

Unit-II: Lasers and Fiber optics
8hrs
Lasers-Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics-Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Fiber optic communication system – Losses in optical fibers – Applications.

Unit Outcomes:

The students will be able to

- **Understand** the basic concepts of LASER light Sources (L2)
- **Apply** the concepts to learn the types of lasers (L3)
- **Identifies** the Engineering applications of lasers (L2)
- **Explain** the working principle of optical fibers (L2)
- **Classify** optical fibers based on refractive index profile and mode of propagation (L2)
- **Identify** the applications of optical fibers in various fields (L2)

Unit-III: Dielectric and Magnetic Materials 8hrs

Dielectric Materials-Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Orientation polarization (Qualitative), Electronic and Ionic polarization – Lorentz internal field – Clausius-Mossotti equation – Dielectric breakdown - Dielectric Loss – Piezoelectricity and Ferro electricity.

Magnetic Materials-Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, Para, Ferro, Ferri&Antiferro – Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

Unit Outcomes:

The students will be able to

- **Explain** the concept of dielectric constant and polarization in dielectric materials (L2)
- **Summarize** various types of polarization of dielectrics (L2)
- **Interpret** Lorentz field and Claussius-Mosotti relation in dielectrics (L2)
- **Apply** the concept of polarization to materials like piezoelectric and ferroelectrics (L3)
- **Classify** the magnetic materials based on susceptibility and their temperature dependence (L2)
- **Explain** the applications of dielectric and magnetic materials (L2)
- **Apply** the concept of magnetism to magnetic devices (L3)

Unit IV: Quantum Mechanics, Free Electron Theory and Band theory of Solids 10hrs

Quantum Mechanics- Dual nature of matter – Schrodinger's time independent and dependent wave equation – Significance of wave function – Particle in a one-dimensional infinite potential well.

Free Electron Theory-Classical free electron theory – Quantum free electron theory – Equation for electrical conductivity based on quantum free electron theory – Origin of resistance – Fermi-Dirac distribution – Density of states – Fermi energy.

Band theory of Solids- Bloch's Theorem (Qualitative) – Kronig-Penney model (Qualitative) – E vs K diagram – Classification of crystalline solids – Effective mass of electron – m^* vs K diagram – Concept of hole.

Unit Outcomes:

The students will be able to

- **Explain** the concept of dual nature of matter (L2)
- **Understand** the significance of wave function (L2)
- **Interpret** the concepts of classical and quantum free electron theories (L2)

- **Explain** the importance of K-P model
- **Classify** the materials based on band theory (L2)
- **Apply** the concept of effective mass of electron (L3)

Unit – V: Semiconductors and Superconductors
10hrs

Semiconductors- Introduction – Intrinsic semiconductors – Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors – Density of charge carriers – Dependence of Fermi energy on carrier concentration and temperature – Drift and diffusion currents – Einstein's equation – Direct and indirect band gap semiconductors – Hall effect – Hall coefficient – Applications of Hall effect.

Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – Josephson effects (AC and DC) – High T_c superconductors – Applications of superconductors.

Unit Outcomes:

The students will be able to

- **Classify** the energy bands of semiconductors (L2)
- **Interpret** the direct and indirect band gap semiconductors (L2)
- **Identify** the type of semiconductor using Hall effect (L2)
- **Identify** applications of semiconductors in electronic devices (L2)
- **Explain** how electrical resistivity of solids changes with temperature (L2)
- **Classify** superconductors based on Meissner's effect (L2)
- **Explain** Meissner's effect, BCS theory & Josephson effect in superconductors (L2)

Text books:

1. Engineering Physics by M. N. Avadhanulu, P.G.Kshirsagar& TVS Arun Murthy S.Chand Publications, 11th Edition 2019.
2. Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2018).
3. Applied Physics by P.K.Palanisamy ,SciTech publications (2018)

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons, 11th Edition (2018)
2. Engineering Physics by M.R.Srinivasan, New Age international publishers (2014).
3. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers (2018).
4. Engineering Physics by Shatendra Sharma, Jyotsna Sharma, Pearson Education (2018)
5. Engineering Physics by Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press(2016)
6. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill(2014)
7. Engineering Physics by B.K. Pandey and S. Chaturvedi, Cengage Learning(2018)
8. University Physics by H.D.Young and R.A. Freedman,Pearson(2017)

COURSE OUTCOMES	
CO1	**Study** the different realms of physics and their applications in both scientific and technological systems through physical optics. (L2)
CO2	**Identify** the wave properties of light and the interaction of energy with the matter (L3). **Asses** the electromagnetic wave propagation and its power in different media (L5).
CO3	**Understands** the response of dielectric and magnetic materials to the applied electric and magnetic fields. (L3)
CO4	**Study** the quantum mechanical picture of subatomic world along with the discrepancies between the classical estimates and laboratory observations of electron transportation phenomena by free electron theory and band theory. (L2)
CO5	**Elaborate** the physical properties exhibited by materials through the understanding of properties of semiconductors and superconductors. (L5)

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A15501	**COMMUNICATIVE ENGLISH**	**3**	**0**	**0**	**3**

(Common to ECE, EEE, CSE& CHEM)

Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

COURSE OBJECTIVES	
1	Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
2	Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
3	Help improve speaking skills through participation in activities such as role plays,discussions and structured talks/oral presentations
4	Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5	Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

COURSE OUTCOMES	
CO1	Retrieve the knowledge of basic grammatical concepts

CO2	Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
CO3	Apply grammatical structures to formulate sentences and correct word forms
CO4	Analyze discourse markers to speak clearly on a specific topic in informal discussions
CO5	Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
CO6	Create a coherent paragraph interpreting a figure/graph/chart/table

Course Outcomes

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

- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
- Apply grammatical structures to formulate sentences and correct word forms
- Analyze discourse markers to speak clearly on a specific topic in informal discussions
- Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
- Create a coherent paragraph interpreting a figure/graph/chart/table

Unit 1

Lesson: On the Conduct of Life: William Hazlitt

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Reading for Writing :**Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Learning Outcomes

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

Unit 2

Lesson: The Brook: Alfred Tennyson

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

Learning Outcomes

At the end of the module, the learners will be able to

- comprehend short talks on general topics
- participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- understand the use of cohesive devices for better reading comprehension
- write well structured paragraphs on specific topics
- identify basic errors of grammar/ usage and make necessary corrections in short texts

Unit 3

Lesson: The Death Trap: Saki

Listening: Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.**Writing:** Summarizing, Paragraph Writing **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Learning Outcomes

At the end of the module, the learners will be able to

- comprehend short talks and summarize the content with clarity and precision
- participate in informal discussions and report what is discussed
- infer meanings of unfamiliar words using contextual clues
- write summaries based on global comprehension of reading/listening texts
- use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing

Unit4

Lesson: Innovation: Muhammad Yunus

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Letter Writing: Official Letters/Report Writing **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice

Learning Outcomes

At the end of the module, the learners will be able to

- infer and predict about content of spoken discourse
- understand verbal and non-verbal features of communication and hold formal/informal conversations
- interpret graphic elements used in academic texts
- produce a coherent paragraph interpreting a figure/graph/chart/table
- use language appropriate for description and interpretation of graphical elements

Unit 5

Lesson: Politics and the English Language: George Orwell

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences. **Grammar and Vocabulary:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Learning Outcomes

At the end of the module, the learners will be able to

- take notes while listening to a talk/lecture and make use of them to answer questions
- make formal oral presentations using effective strategies
- comprehend, discuss and respond to academic texts orally and in writing
- produce a well-organized essay with adequate support and detail
- edit short texts by correcting common errors

Prescribed Text:

Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

Reference Books

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
- Raymond Murphy's *English Grammar in Use* Fourth Edition (2012) E-book
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
- Oxford Learners Dictionary, 12th Edition, 2011
- Norman Lewis *Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary* (2014)
- *Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words* by David Butler

Web links

- www.englishclub.com
- www.easyworldofenglish.com
- www.languageguide.org/english/
- www.bbc.co.uk/learningenglish
- www.eslpod.com/index.html
- www.myenglishpages.com

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10201	**FUNDAMENTALS OF ELECTRICAL CIRCUITS**	**3**	**0**	**0**	**3**

Course Objectives:

To make the students learn about

- the basic concepts of network topology and to distinguish analogy between electrical and magnetic circuits
- the various laws, reduction techniques and different methods used to analyze networks
- the various theorems and their applications
- the basic concepts and calculation of various powers in Single phase and Three phase AC circuits

Unit- 1 Introduction to Electrical & Magnetic Circuits

Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage - Current Relationship for Passive Elements. Kirchhoff's Laws – Network Reduction Techniques-Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuits -Analysis of Series and Parallel Magnetic Circuits, MMF Calculations

Learning Outcomes: Students should be able to

- remember and understand the basic characteristics of R,L,C parameters, their voltage and current relations in electrical circuits; concepts of self, mutual and coefficient of coupling in magnetic circuits
- understand and analyze the concepts of Kirchhoff's and Faradays laws and to distinguish analogy between electrical and magnetic circuits
- apply various network reduction techniques on simple circuits

Unit- 2 Network Topology

Definitions – Graph – Oriented Graph-Tree, Cutset, Tieset, Basic Cutset, Basic Tieset Matrices for Networks – Loop and Nodal Analysis of Networks with Independent and Dependent Voltage and Current Sources – Incidence Matrices - Duality & Dual Networks

Learning Outcomes: Students should be able to

- understand and remember basic graph theory definitions
- understand and analyze the concepts of nodal analysis, mesh analysis and principle of duality
- apply the various methodologies in solving electrical circuits based on the topology

Unit- 3 Single Phase A.C Circuits

Sinusoidal Alternating Quantities - Average Value, R.M.S, Form Factor and Peak Factor for Different Periodic Wave Forms – Phasor Representation of alternating quantities– Complex and Polar Form of Representation, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation- Phasor diagrams - Concept of

Reactance, Impedance, Susceptance and Admittance- Apparent Power, Active and Reactive Power - Concept of Power Factor

Learning Outcomes: **S**tudents should be able to

- understand and remember the fundamental definitions of 1-ϕ AC circuits and its representation
- understand Steady State Analysis of R, L, C in various combinations with sinusoidal excitation
- understand the classification of power and concept of power factor

Unit- 4 Network Theorems

Superposition Theorem - Reciprocity Theorem - Thevenin's Theorem - Norton's Theorem - Maximum Power Transfer Theorem - Millmann's Theorem - Tellegen's Theorem - Compensation Theorem- Substitution Theorem (All theorems for both D.C and A.C Excitation)

Learning Outcomes: **S**tudents should be able to

- remember and understand the various theorems and to know their applications in network analysis.
- apply various theorems on simple electrical circuits

Unit- 5 Three Phase A.C. Circuits

Introduction - Analysis of Balanced and Unbalanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems – Representation and Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems - Advantages of Three Phase System

Learning Outcomes: **S**tudents should be able to

- remember and understand the concept of three phase AC circuits and the relation between line and phase voltages and currents in star and delta connections.
- understand and analyze the measurement of active and reactive power in balanced and unbalanced circuits

Text Books:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.

Reference Books:

1. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018.
2. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
3. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
4. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
5. Fundamentals of Electrical Engineering NPTEL Lectures by Prof. Debapriya Das, IIT Kharagpur.

Course Outcomes:

After completing the course, the student should be able to

- distinguish analogy between electrical and magnetic circuits
- determine the dual of the network, develop the various matrices for a given circuit
- determine the current through and voltage across any element in the given circuit by using various methods.
- calculate different powers for both single and three phase AC circuits

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10301	Engineering Drawing	1	0	2	2

(Common to ECE, EEE & CSE)

Course Objectives:

- Bring awareness that Engineering Drawing is the Language ofEngineers.
- Familiarize how industry communicates technicalinformation.
- Teach the practices for accuracy and clarity in presenting the technicalinformation.
- Develop the engineering imagination essential for successfuldesign.

Unit:I

Introduction to Engineering Drawing: Principles of Engineering Drawing and its significance-Conventions in drawing-lettering - BIS conventions.
a)Conic sections including the rectangular hyperbola- general methodonly,
b) Cycloid, epicycloids andhypocycloid c) Involutes

Learning Outcomes:

At the end of this unit the student will be able to

1. Lettering and dimensioning by freehand (L1)
2. Create geometric constructions; drawing parallel and perpendicular lines, and to construct circles, arcs, tangencies, and irregular curves (L6)
3. Create Conic sections and cycloidal curves.(L6)

Unit: II

Projection of points, lines and planes: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the Projection of the objectives in four quadrants (L2)
2. Project the points, lines and planes (L6)

Unit: III

Projections of solids: Projections of regular solids inclined to one or both planes by rotational or auxiliaryviewsmethod.

Learning Outcomes:

At the end of this unit the student will be able to

1.Project the solids in both planes. (L6)
2. To draw the solids by auxiliary method. (L6)

Unit: IV

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

Learning Outcomes:

At the end of this unit the student will be able to

1.Project the sectional view of regular solids.(L6)
2. Understand how to draw the true shapes of the sections.(L2)

Unit:V

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

Learning Outcomes:

At the end of this unit the student will be able to

1. Draw the development of surfaces of the solids.(L6)
2. Understand to develop the sectional parts of the solids.(L2)

Text Books:

1. K.L.Narayana&P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers,2016.

Reference Books:

1. Dr K.Prahlada Rao, Dr. S. Krishnaiah, Prof.A.V.S. Prasad, Engineering Graphics, Amaravati publications. Copy right.2020
2. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right,2009
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers,2000
4. Shah and Rana, Engineering Drawing, 2/e, Pearson Education,2009
5. K.C.John, Engineering Graphics, 2/e, PHI,2013
6. Basant Agarwal &C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:

After completing the course, the student will be able to

- draw various curves applied in engineering.(L2)
- show projections of solids and sections graphically. (L2)
- draw the development of surfaces of solids.(L3)

Additional Sources

1. Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10302	Engineering Graphics Lab	0	0	2	1

(Common to ECE, EEE & CSE)

Course Objectives:

- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Instruct graphical representation of machinecomponents.

Computer Aided Drafting:
Introduction to Geometric Modeling: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets,arrays,dimensions.
Dimensioning principles and conventional representations.
Orthographic Projections: Systems of projections, conventions and application to orthographic projections - simple objects.
Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

Text Books:
1. K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad, PHI Learning, Eastern Economy editions.

Reference Books:
1. T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
2. K.L.Narayana&P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
3. Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
4. K.C.John, Engineering Graphics, 2/e, PHI,2013
5. Basant Agarwal &C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:
After completing the course, the student will be able to
- Use computers as a drafting tool.(L2)

- Draw isometric and orthographic drawings using CAD packages.(L3)

Additional Sources: 1. Youtube: http-sewor,Carleton.cag, kardos/88403/drawings.html conic sections-online, red woods.edu.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A15202	Applied Physics Lab	0	0	3	1.5

(Common to ECE, EEE & CSE)

Course Objectives:

- Understands the concepts of interference, diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
- Illustrates the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

Note: In the following list, out of 15 experiments, any 12 experiments (minimum 10) must be performed in a semester

List of Applied Physics Experiments

1. Determination of the thickness of the wire using wedge shape method
   Experimental outcomes:
   Operates optical instrument like travelling microscope. (L2)
   Estimate the thickness of the wire using wedge shape method (L2)
   Identifies the formation of interference fringes due to reflected light from non-uniform thin film. (L2)
2. Determination of the radius of curvature of the lens by Newton's ring method
   Experimental outcomes:
   Operates optical instrument like travelling microscope. (L2)
   Estimate the radius of curvature of the lens (L2)
   Identifies the formation of interference fringes due to reflected light from non-uniform thin film. (L2)
   Plots the square of the diameter of a ring with no. of rings (L3)
3. Determination of wavelength by plane diffraction grating method
   Experimental outcomes:
   Operates optical instrument like spectrometer. (L2)
   Estimate the wavelength of the given source (L2)
   Identifies the formation of grating spectrum due diffraction. (L2)
4. Determination of dispersive power of prism.
   Experimental outcomes:
   Operates optical instrument like spectrometer. (L2)
   Estimate the refractive index and dispersive power of the given prism (L2)
   Identifies the formation of spectrum due to dispersion. (L2)

5. Determination of wavelength of LASER source using diffraction grating.

   Experimental outcomes:
   Operates various instrument (L2)
   Estimate the wavelength of laser source (L2)
   Identifies the formation of grating spectrum due diffraction. (L2)

6. Determination of particle size using LASER.

   Experimental outcomes:
   Operates various instrument (L2)
   Estimate the Particles size using laser (L2)
   Identifies the application of laser (L2)

7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle

   Experimental outcomes:
   Operates various instruments and connect them as per the circuit. (L2)
   Estimate the numerical aperture and acceptance angle of a given optical fiber. (L2)
   Identifies the significance of numerical aperture and acceptance angle of an optical fiber in various engineering applications. (L2)

8. Determination of dielectric constant by charging and discharging method.

   Experimental outcomes:
   Operates various instruments and connect them as per the circuit. (L2)
   Estimatethedielectricconstantof the given substance. (L2)
   Identifies the significance of dielectric constant in various devices. (L2)

9. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.

   Experimental outcomes:
   Operates various instruments and connect them as per the circuit. (L2)
   Estimate the magnetic field along the axis of a circular coil carrying current. (L2)
   Plots the intensity of the magnetic field of circular coil carrying current with distance (L3)

10. Measurement of magnetic susceptibility by Gouy's method

    Experimental outcomes:
    Operates various instruments and connect them as per the circuit. (L2)
    Estimate the magnetic susceptibility of the given material. (L2)
    Identifies the significance of magnetic susceptibility in various engineering applications. (L2)

11. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)

    Experimental outcomes:
    Operates various instruments and connect them as per the circuit. (L2)
    Estimate the hysteresis loss, coercivity and retentivity of the ferromagnetic material. (L2)
    Classifies the soft and hard magnetic material based on B-H curve. (L2)
    Plots the magnetic field H and flux density B (L3)

12. To determine the resistivity of semiconductor by Four probe method

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)
Estimate the resistivity of a semiconductor. (L2)

Identifies the importance of four probe method in finding the resistivity of semiconductor. (L3)

13. To determine the energy gap of a semiconductor

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)
Estimate the energy gap of a semiconductor. (L2)
Illustrates the engineering applications of energy gap. (L3)
Plots1/T with log R (L3)

14. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)
Estimate the charge carrier concentration and mobility in a semiconductor. (L2)
Illustrates the applications of Hall Effect. (L3)
Plots the voltage with current and voltage with magnetic field (L3)

15. Measurement of temperature coefficient of resistance using thermostat.

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)
Estimate the resistance with varying temperature. (L2)
Plots resistance R with temperature T (L3)

Course Outcomes:

The students will be able to

- **Operate** optical instruments like microscope and spectrometer (L2)
- **Determine** thickness of a hair/paper with the concept of interference (L2)
- **Estimate** the wavelength of different colors using diffraction grating and resolving power (L2)
- **Plot** the intensity of the magnetic field of circular coil carrying current with distance (L3)
- **Evaluate** the acceptance angle of an optical fiber and numerical aperture (L3)
- **Determine** the resistivity of the given semiconductor using four probe method (L3)
- **Identify** the type of semiconductor i.e., n-type or p-type using hall effect (L3)
- **Calculate** the band gap of a given semiconductor (L3)

References: 1. S. Balasubramanian, M.N. Srinivasan “A Text book of Practical Physics”- S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A15502	COMMUNICATIVE ENGLISH LAB	0	0	3	1.5

(Common to ECE, EEE, CSE& CHEM)

Course Objectives

- students will be exposed to a variety of self instructional, learner friendly modes of language learning
- students will learn better pronunciation through stress, intonation and rhythm
- students will be trained to use language effectively to face interviews, group discussions, public speaking
- students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

Course Outcomes

- CO1: Listening and repeating the sounds of English Language
- CO2: Understand the different aspects of the English language proficiency with emphasis on LSRW skills
- CO3: Apply communication skills through various language learning activities
- CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
- CO5: Evaluate and exhibit acceptable etiquette essential in social and professional settings
- CO6: Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

Unit 1

1. Phonetics
2. Reading comprehension
3. Describing objects/places/persons

Learning Outcomes

At the end of the module, the learners will be able to

- understand different accents spoken by native speakers of English
- employ suitable strategies for skimming and scanning on monitor to get the general idea of a text and locate specific information
- learn different professional registers and specific vocabulary to describe different persons, places and objects

Unit 2

1. Role Play or Conversational Practice
2. JAM
3. Etiquettes of Telephonic Communication

Learning Outcomes
At the end of the module, the learners will be able to

- produce a structured talk extemporarily
- comprehend and produce short talks on general topics
- participate in debates and speak clearly on a specific topic using suitable discourse markers

Unit 3

1. Information Transfer
2. Note Making and Note Taking
3. E-mail Writing

Learning Outcomes
At the end of the module, the learners will be able to

- Learn different ways of greeting and introducing oneself/others
- summarize the content with clarity and precision and take notes while listening to a talk/lecture and make use of them to answer questions
- replenish vocabulary with one word substitutes, homonyms, homophones, homographs to reduce errors in speech and writing

Unit4

1. Group Discussions
2. Resume Writing
3. Debates

Learning Outcomes
At the end of the module, the learners will be able to

- Learn different ways of asking information and giving directions
- Able to transfer information effectively
- understand non-verbal features of communication

Unit 5

1. Oral Presentations
2. Poster Presentation
3. Interviews Skills

Learning Outcomes

At the end of the module, the learners will be able to

- make formal oral presentations using effective strategies
- learn different techniques of précis writing and paraphrasing strategies
- comprehend while reading different texts and edit short texts by correcting common errors

Suggested Software

- Orell
- Walden Infotech
- Young India Films

Reference Books

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
- A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

Web Links

- **www.esl-lab.com**
- **www.englishmedialab.com**
- **www.englishinteractive.net**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year I-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10202	FUNDAMENTALS OF ELECTRICAL CIRCUITS LAB	0	0	3	1.5

Course Objectives: Students will be able to

- remember, understand and apply various theorems for circuit analysis and verify practically
- understand and experimentally verify self, mutual inductances and coefficient of coupling
- understand and analyze power measurements in single phase and three phase circuits

Note: From the following list experiments minimum 10 experiments are required to be conducted:

List of Experiments:
1. Verification of KCL and KVL
2. Determination of Self, Mutual Inductances and Coefficient of Coupling
3. Verification of Mesh Analysis
4. Verification of Nodal analysis
5. Verification of Thevenin's and Norton's Theorems
6. Verification of Superposition Theorem for average and rms values
7. Maximum Power Transfer Theorem
8. Verification of Compensation Theorem
9. Verification of Reciprocity, Millmann's Theorems
10. Measurement of Active, Reactive and Apparent Power for Single Phase AC Circuits
11. Measurement of 3-Phase Active Power by One Wattmeter Method
12. Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads

Course Outcomes: At the end of the course, students should be able to

- verify basic laws of electrical circuits experimentally
- calculate self inductance, mutual inductances and coefficient of coupling of given circuit
- apply various theorems for circuit analysis
- verify active, reactive and apparent power for single phase A.C circuit
- measure active power for a three phase A.C circuit by using one and two wattmeter method

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COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
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B. Tech (E.E.E) I-Year II-sem – R20 exRegulation

Subject Code	Title of the Subject	L	T	P	C
20A15102	**Differential Equations and Vector Calculus**	**3**	**0**	**0**	**3**

(Common to All Branches of Engineers except CSE)

Course Objectives:

1) To enlighten the learners in the concept of differential equations and multivariable calculus.
2) To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

UNIT 1: Linear differential equations of higher order (Constant Coefficients)
10hrs

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, method of variation of parameters.Simultaneous linear equations, Applications to L-C-R Circuit problems and Mass spring system.

Learning Outcomes:

At the end of this unit, the student will be able to

- identify the essential characteristics of linear differential equations with constant coefficients (L3)
- solve the linear differential equations with constant coefficients by appropriate method (L3)
- classify and interpret the solutions of linear differential equations (L3)
- formulate and solve the higher order differential equation by analyzing physical situations (L3)

UNIT 2:Partial Differential Equations
8hrs

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's methodand non-linear PDEs (Standard Forms)

Learning Outcomes:
At the end of this unit, the student will be able to

- apply a range of techniques to find solutions of standard PDEs (L3)
- outline the basic properties of standard PDEs (L2)

UNIT 3: Applications of Partial Differential Equations 10hrs

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation.

Learning Outcomes:
At the end of this unit, the student will be able to

- calcify the PDE (L3)
- learn the applications of PDEs(L2)

UNIT4: Vector differentiation 6hrs
Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes:
At the end of this unit, the student will be able to

- apply del to Scalar and vector point functions (L3)
- illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

UNIT 5: Vector integration 8hrs
Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Learning Outcomes:
At the end of this unit, the student will be able to

- find the work done in moving a particle along the path over a force field (L4)
- evaluate the rates of fluid flow along and across curves (L4)
- apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B.Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.

4. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
6. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
7. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
8. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
9. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
10. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.
11. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
12. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Course Outcomes:

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

- solve the differential equations related to various engineering fields (L6)
- Identify solution methods for partial differential equations that model physical processes (L3)
- interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L6)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A15303	**CHEMISTRY**	**3**	**0**	**0**	**3**

(common to EEE, ECE & CSE)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches

COURSE OUTCOMES	
CO1	**Apply** Schrodinger wave equation to hydrogen atom, **Illustrate** the molecular orbital energy level diagram of different molecular species, **Explain** the band theory of solids for conductors, semiconductors and insulators **Discuss** the magnetic behaviour and colour of complexes.
CO2	**Explain** splitting in octahedral and tetrahedral geometry of complexes **Discuss** the

	magnetic behaviour and colour of coordination compounds **Explain** the band theory of solids for conductors, semiconductors and insulators **Demonstrate** the application of Fullerenes, carbon nano tubes and Graphines nanoparticles
CO3	**Apply** Nernst equation for calculating electrode and cell potentials, **Differentiate** between pH metry, potentiometric and conductometric titrations, **Explain** the theory of construction of battery and fuel cells, **Solve** problems based on cell potential
CO4	**Explain** the different types of polymers and their applications, **Explain** the preparation, properties and applications of PVC, Bakelite**Describe** the mechanism of conduction in conducting polymers, **Discuss** Buna-S and Buna-N elastomers and their applications
CO5	**Explain** the different types of spectral series in electromagnetic spectrum, **Understand** the principles of different analytical instruments, **Explain** the different applications of analytical instruments

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Unit 1: Structure and Bonding Models: (10 hrs)
Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, applications to hydrogen, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

Learning Outcomes:
At the end of this unit, the students will be able to

- **apply** Schrodinger wave equation to hydrogen atom (L3)
- **illustrate** the molecular orbital energy level diagram of different molecular species (L2)
- **explain** the calculation of bond order of O2 and CO molecules (L2)

iscussthe basic concept of molecular orbital theory (L3)

Unit 2: Modern Engineering materials: (10 hrs)

i). Coordination compounds: Crystal field theory – salient features – splitting in octahedral and tetrahedral geometry. Properties of coordination compounds-Oxidation state, coordination, magnetic and colour.
ii). Semiconductor materials, super conductors- basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures.
iii). Nanochemistry: Introduction, classification of nanometerials, properties and applications of Fullerenes, carbon nanotubes and Graphenes nanoparticles
iv). Super capacitors: Introduction, Basic concept-Classification – Applications.

Learning Outcomes:
At the end of this unit, the students will be able to

- **Explain** splitting in octahedral and tetrahedral geometry of complexes (L2).
- **Discuss** the magnetic behaviour and colour of coordination compounds (L3).
- **Explain** the band theory of solids for conductors, semiconductors and insulators (L2)
- **Demonstrate** the application of Fullerenes, carbon nanotubes and Graphines nanoparticles (L2).

Unit 3: Electrochemistry and Applications: (10 hrs)

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode); Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (Ni-Cad),and lithium ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Learning Outcomes:

At the end of this unit, the students will be able to

- **apply** Nernst equation for calculating electrode and cell potentials (L3)
- **differentiate** between pH metry, potentiometric and conductometric titrations (L2)
- **explain** the theory of construction of battery and fuel cells (L2)
- **solve** problems based on cell potential (L3)

Unit 4: Polymer Chemistry: (10 hrs)

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastic and Thermosetting plastic, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

Learning Outcomes:

At the end of this unit, the students will be able to

- **explain** the different types of polymers and their applications (L2)
- **explain** the preparation, properties and applications of Bakelite, Nylon-6,6, and carbon fibres (L2)
- **describe** the mechanism of conduction in conducting polymers (L2)
- **discuss** Buna-S and Buna-N elastomers and their applications (L2)

Unit 5: Instrumental Methods and Applications (10 hrs)

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law, Principle and applications of UV-Visibleand IR Spectroscopies. Solid-Liquid Chromatography–TLC, retention time and pH metry.

Learning outcomes:

After completion of Unit IV, students will be able to:

- **explain** the different types of spectral series in electromagnetic spectrum (L2)
- **understand** the principles of different analytical instruments (L2)
- **explain** the different applications of analytical instruments (L2)

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
4. J.M.Lehn, Supra Molecular Chemistry, VCH Publications

Course Outcomes:

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

- **compare**the materials of construction for battery and electrochemical sensors (L2)
- **explain**the preparation, properties, and applications of thermoplastics &thermosetting, elastomers& conducting polymers. (L2)
- **explain** the principles of spectrometry, SLC in separation of solid and liquid mixtures (L2)
- **apply** the principle of Band diagrams in application of conductors and semiconductors (L3)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10506	**C-PROGRAMMING & DATA STRUCTURES**	**3**	**0**	**0**	**3**

Common to EEE &ECE

Course Objectives:

- To illustrate the basic concepts of C programming language.
- To discuss the concepts of Functions, Arrays, Pointers and Structures.
- To familiarize with Stack, Queue and Linked lists data structures.
- To explain the concepts of non-linear data structures like graphs and trees.
- To learn different types of searching and sorting techniques.

Unit-1

Introduction to C Language - C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements, arrays.

At the end of the Unit, students should be able to:

- Use C basic concepts to write simple C programs. (L3)
- Use iterative statements for writing the C programs (L3)
- Use arrays to process multiple homogeneous data. (L3)
- Test and execute the programs and correct syntax and logical errors. (L4)
- Translate algorithms into programs. (L4)
- Implement conditional branching, iteration and recursion. (L2)

Unit – 2

Functions, types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures, Unions, Strings, string handling functions, and Command line arguments.

At the end of the Unit, students should be able to:

- Writing structured programs using C Functions. (L5)
- Writing C programs using various storage classes to control variable access. (L5)
- Apply String handling functions and pointers. (L3)
- Use arrays, pointers and structures to formulate algorithms and write programs.(L3)

Unit-3

Data Structures, Overview of data structures, stacks and queues, representation of a stack, stack related terms, operations on a stack, implementation of a stack, evaluation of arithmetic expressions, infix, prefix, and postfix notations, evaluation of postfix expression, conversion of expression from infix to postfix, recursion, queues - various positions of queue, representation of queue, insertion, deletion, searching operations.

At the end of the Unit, students should be able to:

- Describe the operations of Stack. (L2)
- Explain the different notations of arithmetic expression. (L5)
- Develop various operations on Queues. (L6)

Unit – 4

Linked Lists – Singly linked list, dynamically linked stacks and queues, polynomials using singly linked lists, using circularly linked lists, insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations.

At the end of the Unit, students should be able to:

- Analyze various operations on singly linked list. (L4)
- Interpret operations of doubly linked lists. (L2)
- Apply various operations on Circular linked lists. (L6)

Unit-5

Trees - Tree terminology, representation, Binary trees, representation, binary tree traversals. binary tree operations, **Graphs** - graph terminology, graph representation, elementary graph operations, Breadth First Search (BFS) and Depth First Search (DFS), connected components, spanning trees. **Searching and Sorting** – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

At the end of the Unit, students should be able to:

- Develop the representation of Tress. (L3)
- Identify the various Binary tree traversals. (L3)

- Illustrate different Graph traversals like BFS and DFS. (L2)
- Design the different sorting techniques (L6)
- Apply programming to solve searching and sorting problems. (L3)

Text Books:

1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.
2. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.
4. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
5. Richard F. Gilberg& Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E. Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T. Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

Course Outcomes:

1. Analyse the basicconcepts of C Programming language. (L4)
2. Design applications in C, using functions, arrays, pointers and structures. (L6)
3. Apply the concepts of Stacks and Queues in solving the problems. (L3)
4. Explore various operations on Linked lists. (L5)
5. Demonstrate various tree traversals and graph traversal techniques. (L2)
6. Design searching and sorting methods (L3)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10402	Electronic Devices and Circuits	0	0	3	1.5

(Common for ECE and EEE branches)

Course Objectives:

- To understand the basic principles of all semiconductor devices.
- To be able to solve problems related to diode circuits, and amplifier circuits.
- To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
- To be able to compare the performance of BJTs and MOSFETs
- To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

Unit – 1
Review of Semiconductors:
Intrinsic semiconductors, Doped Semiconductors, Current Flow in Semiconductors, PN Junction with Open Circuit, PN Junction with Applied Voltage, Capacitive Effects in PN Junction.
Diodes: Introduction, The Ideal Diode – current voltage characteristic, rectifier, diode logic gates, Terminal Characteristics of Junction Diodes– forward bias, reverse bias, and breakdown regions, Modeling the Diode Forward Characteristics- exponential model, graphical analysis and Iterative analysis using the exponential model, constant voltage drop model, the small signal model.

Learning outcomes:

1. Remember and understand the basic characteristics of semiconductor diode (L1)
2. Understand iterative and graphical analysis of simple diode circuits (L1)

Unit – 2
Zener Diodes– Zener diode Characteristics, Voltage shunt regulator, Temperature Effects, Rectifier Circuits– half-wave, full-wave and bridge rectifier circuits, rectifier with a filter capacitor, C-L-C filter, Clipping and Clamping Circuits– limiter circuit, the clamped capacitor, voltage doubler, Special Diode Types– UJT, Schottky barrier diode, Varactor diode, photo diode, light emitting diode(LED).
Bipolar Junction Transistors(BJTs): Physical Operation - simplified structure and modes of operation, Operation of the npn, and pnp transistors: cutoff, active, and saturation modes, V-I Characteristics- of different configurations - graphical representation of transistor characteristics, dependence of collector current on collector voltage, the Early Effect.

Learning outcomes:

1. Understand principle of operation of Zener diode and other special semiconductor diodes (L1)

2. Understand the V-I characteristics of BJT and its different configurations (L1)
3. Analyze various applications of diode and special purpose diodes (L3)
4. Design rectifier and voltage regulator circuits (L4)

Unit- 3

BJT circuits at DC, Applying the BJT in Amplifier Design- Voltage Amplifier, Voltage Transfer Characteristic (VTC), Small-Signal Voltage Gain, determining the VTC by Graphical Analysis, Q-point, Small-signal operation and models- the trans conductance, input resistance at the base, input resistance at the emitter, Voltage gain, separating the Signal and the DC Quantities, The Hybrid-π Model, the T Model, Basic BJT Amplifier Configurations - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Biasing in BJT Amplifier Circuits- Fixed bias, Self bias, voltage divider bias circuits, biasing using a Constant-Current Source, CE amplifier – Small signal analysis and design, Transistor breakdown and Temperature Effects.

Learning outcomes:

1. Solve problems on various biasing circuits using BJT (L2)
2. Analyze BJT based biasing circuits (L3)
3. Design an amplifier using BJT based on the given specifications (L4)

Unit – 4

MOS Field-Effect Transistors (MOSFETs): Introduction, Device Structure and Physical Operation – device structure, operation with zero gate voltage, creating a channel for current flow, operation for different drain to source voltages, the P-channel MOSFET,CMOS, V-I characteristics– i_D - v_{DS}characteristics, i_D – v_{GS}characteristics, finite output resistance in saturation, characteristics of the p-Channel MOSFET, MOSFET Circuits at DC, Applying the MOSFET in Amplifier Design – voltage transfer characteristics, biasing the MOSFET to obtain linear amplification, the small signal voltage gain, graphical analysis, the Q-point.

Learning outcomes:

1. Understand principle of operation of various types of MOSFET devices (L1)
2. Understand the V-I characteristics of MOSFET devices and their configurations (L1)

Unit – 5

MOSFET Small Signal Operation Models– the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Basic MOSFET Amplifier Configurations– three basic configurations, characterizing amplifiers, common source(CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, the amplifier frequency response, Biasing in MOSFET Amplifier Circuits– biasing by fixing V_{GS} with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, Common Source Amplifier using MOSFETs – Small signal analysis and design, Body Effect.

Learning outcomes:

1. Solve problems on small signal equivalent of MOSFET devices (L2)
2. Analyze various biasing circuits based on different types of MOSFETs (L3)

3. Design an amplifier using BJT based on the given specifications (L4)

Text Books:

1. Adel S. Sedra and KennethC. Smith, “Microelectronic Circuits – Theory and Applications”, 6th Edition, Oxford Press, 2013.
2. Donald A Neamen, “Electronic Circuits – analysis and design”, 3rdEdition, McGraw Hill (India), 2019.

References:

1. J. Milliman and C Halkias, “Integrated electronics”, 2nd Edition, Tata McGraw Hill, 1991.
2. BehzadRazavi, “Microelectronics”, Second Edition, Wiley, 2013.
3. R.L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuits,” 9thEdition, Pearson, 2006.
4. Jimmie J Cathey, “Electronic Devices and Circuits,” Schaum’s outlines series, 3rd Edition, McGraw-Hill (India), 2010.

COURSE OUTCOMES:

After the completion of the course students will able to

CO1: Understand principle of operation, characteristics and applications of Semiconductor diodes, Bipolar Junction Transistor and MOSFETs.
CO2: Applying the basic principles solving the problems related to Semiconductor diodes, BJTs, and MOSFETs.
CO3: Analyze diode circuits for different applications such as rectifiers, clippers and clampers also analyze biasing circuits of BJTs, and MOSFETs.
CO4: Design of diode circuits and amplifiers using BJTs, and MOSFETs.
CO5: Compare the performance of various semiconductor devices.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10303	Engineering Workshop	0	0	3	1.5

(Common to ECE, EEE & CSE)

Course Objective:
To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Wood Working:
Familiarity with different types of woods and tools used in wood working and make following joints
a) Half – Lapjoint
b) Mortise and Tenonjoint
c) Corner Dovetail joint or Bridlejoint

Sheet Metal Working:
Familiarity with different types of tools used in sheet metal working,
Developments of following sheet metal job from GI sheets
a)Taperedtray b)Conicalfunnel
c)Elbowpipe d)Brazing

Fitting:
Familiarity with different types of tools used in fitting and do the following fitting exercises
a) V-fit b)Dovetailfit c) Semi-circularfit
d) Bicycle tyre puncture and change of two wheelertyre

Electrical Wiring:
Familiarities with different types of basic electrical circuits and make the following connections
a) Parallelandseries b) Twowayswitch c)Godownlighting d) Tubelight
e) Threephasemotor f) Soldering ofwires

Power tools:
Demonstration of a)Circular Sa w b) Power Planer
c) Zig Saw d) Buffing Machine

Course Outcomes:
After completion of this lab the student will be able to
1. apply wood working skills in real world applications.(L3)
2. build different objects with metal sheets in real world applications.(L3)

3. apply fitting operations in various applications.(L3)
4. apply different types of basic electric circuit connections.(L3)
5. use soldering and brazing techniques.(L2)

Note: In each section a minimum of three exercises are to be carried out.

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10508	IT WORKSHOP	0	0	3	1.5

(Common to , EEE, ECE)

Note: Use open source tools for implementation of the following exercises.

Course Objectives:

- To make the students know about the internal parts of a computer, assembling and dissembling a computer from the parts, preparing a computer for use by installing the operating system
- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations and LAteX
- To learn about Networking of computers and use Internet facility for Browsing and Searching
- To learn about Google Forms and Google Sites

Preparing your Computer

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: **Operating system features**: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

Networking and Internet

Task 5: Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc. should be done by the student. The entire process has to be documented.

Task 6: Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating e-mail account.

Task 7: Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

Productivity tools

Task 8: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered, Image Manipulation tools.

Task 9: Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.

Task 10: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet

Task 11: LateX: Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

References:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, Powerpoint& Outlook Exams, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH
6. Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.

Course Outcomes:

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
- Prepare the Documents using Word processors and Prepare spread sheets for calculations .using excel and also the documents using LAteX.
- Prepare Slide presentations using the presentation tool.
- Interconnect two or more computers for information sharing.
- Access the Internet and Browse it to obtain the required information.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10507	C-PROGRAMMING & DATA STRUCTURES LAB	**0**	**0**	**3**	**1.5**

Common to EEE,& ECE

Course Objectives:

- To get familiar with the basic concepts of C programming.
- To design programs using arrays, strings, pointers and structures.
- To illustrate the use of Stacks and Queues
- To apply different operations on linked lists.
- To demonstrate Binary search tree traversal techniques.
- To design searching and sorting techniques.

Week l

Write C programs that use both recursive and non-recursive functions

i) To find the factorial of a given integer.
ii) To find the GCD (greatest common divisor) of two given integers.
iii) To solve Towers of Hanoi problem.

Week 2

a) Write a C program to find both the largest and smallest number in a list of integers.
b) Write a C program that uses functions to perform the following:
i) Addition of Two Matrices ii) Multiplication of Two Matrices

Week 3

a) Write a C program that uses functions to perform the following operations:
i) To insert a sub-string in to a given main string from a given position.
ii) To delete n characters from a given position in a given string.

Week 4

a) Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn‘t contain T.

b) Write a C program to count the lines, words and characters in a given text.

Week 5

a) Write a C Program to perform various arithmetic operations on pointer variables.

b) Write a C Program to demonstrate the following parameter passing mechanisms:

i) call-by-value ii) call-by-reference

Week 6

Write a C program that uses functions to perform the following operations:

i) Reading a complex number
ii) Writing a complex number
iii) Addition of two complex numbers
iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 7

Write C programs that implement stack (its operations) using

i) Arrays
ii) Pointers

Week 8

Write C programs that implement Queue (its operations) using

i) Arrays
ii) Pointers

Week 9

Write a C program that uses Stack operations to perform the following:

i) Converting infix expression into postfix expression
ii) Evaluating the postfix expression

Week 10

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 11

Write a C program that uses functions to perform the following operations on Doubly linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on circular linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following:

i) Creating a Binary Tree of integers

ii) Traversing the above binary tree in preorder, inorder and postorder.

Week 14

Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:

i) Linear search
ii) Binary search

Week 15

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order

i) Bubble sort
ii) Selection sort

iii) Insertion sort

Text Books:

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.

2. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.

3. Richard F. Gilberg& Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E.Balaguruswamy, "C and Data Structures", 4^{th} Edition, Tata Mc Graw Hill.
3. A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T.Somashekara, "Problem Solving Using C", PHI, 2^{nd} Edition 2009.

Course Outcomes

- Demonstrate basic concepts of C programming language. (L2)
- Develop C programs using functions, arrays, structures and pointers. (L6)
- Illustrate the concepts Stacks and Queues. (L2)
- Design operations on Linked lists. (L6)
- Apply various Binary tree traversal techniques. (L3)
- Develop searching and sorting methods. (L6)

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A15304	CHEMISTRY LAB	0	0	3	1.5

Common to (CE, EEE, ME)

COURSE OBJECTIVES	
1	Verify the fundamental concepts with experiments

COURSE OUTCOMES	
CO1	**determine** the cell constant and conductance of solutions (L3)
CO2	**prepare** advanced polymer materials (L2)
CO3	**determine** the physical properties like surface tension, adsorption and viscosity (L3)
CO4	**estimate** the Iron and Calcium in cement (L3)
CO5	**calculate** the hardness of water (L4)

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

List of Experiments:

1. Conductometric titration of strong acid vs. strong base
2. Conductometric titration of weak acid vs. strong base
3. Estimation of Ferrous Iron by Dichrometry.
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite and measurement of its mechanical properties (strength.).
8. Verify Lambert-Beer's law
9. Thin layer chromatography
10. Identification of simple organic compounds by IR.
11. Preparation of nanomaterial's by precipitation
12. Measurement of 10Dq by spectrophotometric method

Course Outcomes:
At the end of the course, the students will be able to

- **determine** the cell constant and conductance of solutions (L3)
- **prepare** advanced polymer Bakelite materials (L2)
- **measure** the strength of an acid present in secondary batteries (L3)
- **analyse** the IR of some organic compounds (L3)

TEXT BOOKS:

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – J. Mendham et al, Pearson Education.
2. Chemistry Practical – Lab Manual by Chandra Sekhar, GV Subba Reddy and Jayaveera

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
B. Tech (E.E.E) I-Year II-sem – R20 Regulation

Subject Code	Title of the Subject	L	T	P	C
20A10403	Electronic Devices and Circuits Lab	0	0	3	1.5

(Common for ECE and EEE branches)

COURSE OBJECTIVES:

1. To verify the theoretical concepts practically from all the experiments.
2. To analyse the characteristics of Diodes, BJT, MOSFET, UJT.
3. To design the amplifier circuits from the given specifications.
4. To Model the electronic circuits using tools such as PSPICE/Multisim.

LIST OF EXPERIMENTS: (**Execute any 12 experiments**).

Note: All the experiments shall be implemented using both Hardware and Software.

1. Verification of Volt- Ampere characteristics of a PN junction diode and find static, dynamic and reverse resistances of the diode from the graphs obtained.
2. Design a full wave rectifier for the given specifications with and without filters, and verify the given specifications experimentally. Vary the load and find ripple factor. Draw suitable graphs.
3. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs.
4. Design a Zener diode-based ***voltage regulator*** against variations of supply and load. Verify the same from the experiment.
5. Verification of the input and output characteristics of BJT in **Common Emitter** configuration experimentally and find required ***h – parameters*** from the graphs.
6. Study and draw the input and output characteristics of BJT in **Common Base** configuration experimentally, and determine required ***h – parameters*** from the graphs.
7. Study and draw the ***output*** and ***transfer*** characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find ***Threshold voltage*** (V_T), g_m, & K from the graphs.
8. Study and draw the ***output*** and ***transfer*** characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find I_{DSS}, g_m, & V_P from the graphs.

9. Study and draw the Volt Ampere characteristics of UJT and determine $\boldsymbol{\eta}$, $\boldsymbol{I_P}$, $\boldsymbol{I_v}$, $\boldsymbol{V_P}$, **&** $\boldsymbol{V_v}$ from the experiment.
10. Design and analysis of voltage- divider bias/self-bias circuit using BJT.
11. Design and analysis of voltage- divider bias/self-bias circuit using JFET.
12. Design and analysis of self-bias circuit using MOSFET.
13. Design a suitable circuit for switch using CMOSFET/JFET/BJT.
14. Design a small signal amplifier using MOSFET (common source) for the given specifications. Draw the frequency response and find the bandwidth.
15. Design a small signal amplifier using BJT(common emitter) for the given specifications. Draw the frequency response and find the bandwidth.

Tools / Equipment Required: Software Tool like Multisim/ Pspice or Equivalent,
DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

COURSE OUTCOMES:

After the completion of the course students will able to

CO1: Understand the basic characteristics and applications of basic electronic devices. (L1)

CO2: Observe the characteristics of electronic devices by plotting graphs. (L2)

CO3: Analyze the Characteristics of UJT, BJT, MOSFET. (L3)

CO4: Design MOSFET / BJT based amplifiers for the given specifications. (L4)

CO5: Simulate all circuits in PSPICE /Multisim. (L5)

Subject Code	Title of the Subject	L	T	P	C
20A10803	ENVIRONMENTAL SCIENCE	0	0	3	1.5

(Common to ECE, EEE & CSE)

COURSE OBJECTIVES: To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

UNIT – I:

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: – Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II:

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III:

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

SOLID WASTE MANAGEMENT : Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV:

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V:

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK : Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

TEXT BOOKS :

(1) Text book of Environmental Studies for Undergraduate Courses by ErachBharucha for University Grants Commission, Universities Press.
(2) Environmental Studies by Palani Swamy – Pearson education
(3) Environmental Studies by Dr.S.AzeemUnnisa, Academic Publishing Company

REFERENCES :

(1) Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Pubilications.
(2) Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
(3) Comprehensive Environmental studies byJ.P.Sharma, Laxmi publications.
(4) Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
(5) A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Pubilishing House

(6) Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MATHEMATICS
II Year B.Tech. I-Sem (R20)

COMPLEX VARIABLES AND TRANSFORM TECHNIQUES (20A35102)
(Common to MECH, EEE & ECE)

L	T	P	C
3	0	0	3

20A35102

Course Objective:

This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The student develops the idea of using continuous/discrete transforms.

COURST OUTCOMES: After completion of the course a successful student is able to

CO 1: Acquire knowledge in

a. Fourier series.
b. Laplace transforms and their applications.
c. Find the derivatives of complex functions.

CO 2: To Develop skills in analyzing the

a. Properties of Fourier series for a given function.
b. Understand the analyticity of complex functions and conformal mapping.
c. Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.

CO 3: To develop skills in designing mathematical models for

a. Understand the usage of Laplace transforms.
b. Apply Cauchy's integral theorem.
c. Understand singularities of complex functions.

CO 4: To develop analytical tools in solving the problems involving

a. Fourier series
b. Laplace transforms
c. Evaluate the Fourier series expansion of periodic functions.

CO 5: Use relevant mathematical technique for evaluating

a. Evaluate improper integrals of complex functions using Residue theorem.
b. Laplace transforms

Course Outcome	Program Outcomes												Program Specific Outcomes				
	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**3**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**2**	**1**	**-**	**-**					
CO2	**1**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**2**	**2**	**-**	**-**					
CO3	**1**	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**2**	**2**	**-**	**-**					
CO4	**1**	**1**	**1**	**3**	**-**	**1**	**-**	**-**	**2**	**1**	**-**	**-**					
CO5	**1**	**1**	**1**	**1**	**-**	**1**	**-**	**-**	**2**	**1**	**-**	**-**					

Correlation Levels: High - 3 Medium – 2 Low - 1

Unit-I: Complex Variable – Differentiation:

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions(exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations(sin z, ez, cos z, z2) Mobius transformations (bilinear) and their properties.

Learning Outcomes:

Students will be able to

1. understand functions of Complex variable and its properties.
2. find derivatives of complex functions.
3. understand the analyticity of complex functions .
4. understand the conformal mappings of complex functions.

Unit-II: Complex Variable – Integration:

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof);power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi circle with f(z) not having poles on real axis).

Learning Outcomes:

Students will be able to

1. understand the integration of complex functions.

2. apply Cauchy's integral theorem and Cauchy's integral formula.

3. understand singularities of complex functions.

4. evaluate improper integrals of complex functions using Residue theorem.

Unit-III:Laplace Transforms

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function.Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

Learning Outcomes:

Studentswill be able to

1. understand the concept of Laplace transforms and find the Laplace transforms of elementary functions.

2. find the Laplace transforms of general functions using its properties.

3. understand Laplace transforms of special functions(Unit step function, Unit Impulse & Periodic).

4. apply Laplace transforms to solve Differential Equations.

Unit-IV:Fourier series

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms - Parseval's formula- Complex form of Fourier series.

Learning Outcomes:

Students will be able to

1. understand finding Fourier series expression of the given function.
2. determine Fourier coefficients (Euler's) and identify existence of fourier series of the given function.
3. expand the given function in Fourier series given in Half range interval.
4. apply Fourier series to establish Identities among Euler coefficients.
5. find Fourier series of wave forms.

Unit-V: Fourier transforms& Z Transforms:

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem.

Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.

Learning Outcomes:

Students will be able to

1. find Fourier Sine and cosine integrals.
2. understand Fourier transforms.
3. apply properties of Fourier transforms.
4. understand Z transforms.
5. apply properties of Z transforms.
6. apply Z transforms to solve difference equations.

Text Books:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India

Reference Books:

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">ELECTRICAL CIRCUIT ANALYSIS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A30201</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Fundamentals of Electrical Circuits</td><td>Semester</td><td colspan="4">III</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">
• To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
• Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.
• To know the applications of Fourier transforms to electrical circuits excited by non sinusoidal sources.
• Study of Different types of filters, equalizers.
</td></tr>
<tr><td colspan="7">Course Outcomes (CO):</td></tr>
<tr><td colspan="7">At the end of the course, students will be able to

• Remember and understand the basics of locus diagrams and concept of resonance, Band factor and Q-factor; two- port network parameters, inter conversion of parameters, transformed variables in two-port networks and transient analysis.
• Apply the concepts two port network parameters on electrical circuits, Fourier transforms to electrical circuits excited by non-sinusoidal sources and to determine the transient response of R-L, R-C, R-L-C series circuits for d.c and a.c excitations.
• Analyse locus diagrams when R, L, C connected in series and parallel combinations, the three-phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
• Design circuit for filters and equalizers.
</td></tr>
<tr><td>UNIT - I</td><td colspan="2">Locus Diagrams & Resonance</td><td colspan="4">8 Hrs</td></tr>
<tr><td colspan="7">Series and Parallel R -L, R-C, R-L-C Combination with Variation of Various Parameters and its locus diagrams – Resonance - Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.</td></tr>
</table>

Unit Outcomes:

The student will be able to

• Learn about basic concepts of Locus diagrams with different parameter variations of Electrical circuit elements

• Learn about occurrence of resonance with the presence of electrical circuit elements under certain operating conditions

UNIT - II	**Two Port Networks**	9 Hrs

Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations - Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables – Interconnection of two port networks.

Unit Outcomes:

The student will be able to

• Understand and estimate the network parameters of T & π configurations of DC circuits or resistive elements

• Understand how Laplace transforms studied in mathematics courses, can be applied to identifying energy storage elements in electrical circuits

UNIT - III	**Transient Analysis**	12 Hrs

D.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Initial Conditions of elements and network - Solution Method Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation.

A.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations - Initial Conditions of elements and network - Solution Method Using Differential Equations and Laplace Transforms.

Unit Outcomes:

The student will be able to

• Distinguish between classical method and Laplace transform approach in analysing transient phenomenon in DC excitations

• Distinguish between classical method and Laplace transform approach in analysing transient phenomenon in sinusoidal excitations

UNIT - IV	**Fourier Transforms**	10 Hrs

Fourier Theorem - Trigonometric Form and Exponential Form of Fourier series – Conditions of Symmetry - Line Spectra and Phase Angle Spectra - Analysis of Electrical Circuits to Non Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms - Application to Electrical Circuits.

Unit Outcomes:

The student will be able to

• Know how to apply Fourier transforms studied in Mathematics to Electrical circuits for non-sinusoidal periodic and non-periodic input waves

• Understand properties of Fourier series and Transforms

UNIT - V	**Filters**	9 Hrs

Filters – Low Pass – High Pass, Band Pass and Band Stop – RC, RL filters– Derived filters and composite filters design – Attenuators – Principle of Equalizers – Series and Shunt Equalizers – L Type - T type and Bridged – T and Lattice Equalizers.

Unit Outcomes:

The student will be able to

• Understand about what is a Filter, Classification, where they can be used, etc.

• Understand about attenuators and equalizers used in electronic high frequency circuits

Textbooks:

1. William Hayt, Jack E. Kemmerly and Jamie Phillips, “Engineering Circuit Analysis”, Mc Graw Hill, 9th Edition, 2019. 2. A. Chakrabarti, “Circuit Theory: Analysis & Synthesis”, Dhanpat Rai & Sons, 2008.
Reference Books:
1. M.E. Van Valkenberg, “Network Analysis”, 3rd Edition, Prentice Hall (India), 1980. 2. V. Del Toro, “Electrical Engineering Fundamentals”, Prentice Hall International, 2009. 3. Charles K. Alexander and Matthew. N. O. Sadiku, “Fundamentals of Electric Circuits” Mc Graw Hill, 5th Edition, 2013. 4. MahamoodNahvi and Joseph Edminister, “Electric Circuits” Schaum’s Series, 6th Edition, 2013. 5. John Bird, Routledge, “Electrical Circuit Theory and Technology”, Taylor & Francis, 5th Edition, 2014.
Online Learning Resources:
• https://onlinecourses.nptel.ac.in/noc21_ee99/preview • https://onlinecourses.nptel.ac.in/noc21_ee14/preview

Course Code	DC MACHINES & TRANSFORMERS		L	T	P	C
20A30202			3	0	0	3
Pre-requisite	Fundamentals of Electrical circuits and Magnetic circuits	Semester	III			

Course Objectives:

Student will be able to

- Study magnetic materials, electromechanical energy conversions, principle and operation of DC machines and transformers and starters.
- understand the constructional details of DC machines and Transformers
- Analyze the performance characteristics of DC machines and transformer
- Evaluate efficiency, regulation and load sharing of DC machines and transformers, Design of Equivalent circuit of transformer

Course Outcomes (CO):

At the end of this course, students will demonstrate the ability to

- Understand the concepts of magnetic circuits, principle and operations of DC machines, starters, single and three phase transformers
- Analyze armature reaction, parallel operation, speed control and characteristics of DC machines. Also analyze the performance characteristics with the help of OC and SC tests of transformer
- Evaluate generated EMF, back EMF, speed, efficiency and regulations of DC machines and efficiency and regulation of transformer, load sharing of parallel connected transformers
- Design winding diagrams of DC machines and equivalent circuit of transformer.

UNIT - I	**Principles of electromechanical energy conversion**	10 Hrs

Energy in magnetic system - Field energy and mechanical force - Multi-excited magnetic field systems - Forces/torques in systems with permanent magnets - Energy conversion via electric field - Dynamical equations of electro mechanical systems

Unit Outcomes:

<table>
<tr><td colspan="3">• Able to understand the electromechanical energy conversion system

• To understand about various magnetic materials, properties and Applications</td></tr>
<tr><td>UNIT - II</td><td>DC Generators</td><td>9Hrs</td></tr>
<tr><td colspan="3">Constructional details of DC machine - Principle of operation of DC generator - Armature windings and its types - EMF equation - Armature reaction - Effect of brush lead - Demagnetizing and Cross magnetizing ampere turns - Compensating windings – Commutation – EMF induced in a coil undergoing commutation - Methods of improving commutation - OCC and load characteristics of different types of generators - Parallel operation of DC Generators - DC shunt and series generators in parallel - Equalizing connections

Unit Outcomes:

• Able to understand the construction, operation and armature windings of a DC generator

• Able to analyze the characteristics of DC generators</td></tr>
<tr><td>UNIT - III</td><td>DC Motors</td><td>10 Hrs</td></tr>
<tr><td colspan="3">Force on conductor carrying current - Back emf and its significance – Types of motors -Torque and power developed by armature - Speed control of DC motors (Armature control and Flux control methods) - Necessity of starters - Constructional details of 3-point and 4-point starters - Characteristics of DC motors, Losses in DC machines - Condition for maximum efficiency.

Testing of DC machines:

Brake test, Swinburne’s test, Hopkinson's test, Fields test, Retardation test.

Unit Outcomes:

• Able to analyze speed control of DC motors, testing methods and parallel operation of DC machines

• Analyze the characteristics of DC motors</td></tr>
</table>

UNIT - IV	**Single Phase Transformers**	10 Hrs
Principle, construction and operation of single-phase transformers - Equivalent circuit - Phasor diagrams(no load and on load) - Magnetizing current - Effect of nonlinear B-H curve of magnetic core material - Harmonics in magnetization current - Losses and efficiency - Open circuit and short circuit tests - Voltage regulation - Sumpner's test -Separation of hysteresis and eddy current losses - Parallel operation of single-phase transformers - Autotransformers - construction, principle, applications and comparison with two winding transformer. **Unit Outcomes:** • Able to understand the construction, operation and parallel operation of transformer • To predetermine the efficiency and regulation of a transformer		
UNIT - V	**Three Phase Transformers**	9 Hrs
Three-phase transformer – construction, types of connection and their comparative features, Phase conversion - Scott connection - Tap-changing transformers - No-load and on-load tap changing of transformers - Three-winding transformers - Cooling of transformers. **Unit Outcomes:** • Able to understand and analyze the phase conversions • Analyze the tap changing of transformers		
Textbooks:		
1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 7th Edition, 2011. 2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2010.		
Reference Books:		
1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 7th Edition, 2020. 2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 3rd Edition, 2004.		

3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 3rd Edition, 2002.
Online Learning Resources:
• https://onlinecourses.nptel.ac.in/noc21_ee71/preview • https://onlinecourses.nptel.ac.in/noc21_ee24/preview

II B.Tech I Sem (E.E.E) **L T P C**

3 0 0 3

DIGITAL LOGIC DESIGN (20A30404)

Course Objectives:

- To familiarize with the concepts of different number systems and Boolean algebra.
- To introduce the design techniques of combinational, sequential logic circuits.
- To model combinational and sequential circuits using HDLs.

Course Outcomes (CO):

CO1: Understand the properties of Boolean algebra, other logic operations, and minimization of Boolean functions using Karnaugh map.
CO2: Make use of the concepts to solve the problems related to the logic circuits.
CO3: Analyze the combinational and sequential logic circuits.
CO4: Develop digital circuits using HDL, and Compare various Programmable logic devices
CO5: Design various logic circuits using Boolean algebra, combinational and sequential logic circuits.

UNIT - I

Number Systems, Boolean algebra and Logic Gates

Number systems - binary numbers, octal, hexadecimal, other binary codes; complements, signed binary numbers, digital logic operations and gates, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, complements of Boolean functions, two-level NAND and NOR Implementation of Boolean functions.

UNIT - II

Minimization of Boolean functions and Combinational Logic Circuits

The Karnaugh map method (up to five variables), product of sums simplifications, don’t care conditions, Tabular method, Introduction, Combinational circuits, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, decoders and encoders, multiplexers, demultiplexers.

UNIT - III

Sequential Logic Circuits

Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, design of counters, ripple counters, synchronous counters, ring counter, Johnson counter, registers, shift registers, universal shift register.

UNIT - IV

Finite State Machines and Programmable Logic Devices

Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flipflops, Mealy to Moore conversion and vice-versa, reduction of state tables using partition technique, Design of sequence detector.

UNIT - V

Hardware Description Language

Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs, Design of sequential circuits using ROMs, PLAs, CPLDs and FPGAs, Introduction to Verilog - structural Specification of logic circuits, behavioural specification of logic circuits, hierarchical Verilog Code, Verilog for combinational circuits - conditional operator, if-else statement, case statement, for loop; using storage elements with CAD tools-using Verilog constructs for storage elements, flip-flop with clear capability, using Verilog constructs for registers and counters.

Textbooks:

1. M. Morris Mano, "Digital Design", 3rd Edition, PHI. (Unit I to IV)
2. Stephen Brown and ZvonkoVranesic, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition, McGraw-Hill

Reference Books:

1. Charles H. Roth, Jr, "Fundamentals of Logic Design", 4th Edition, Jaico Publishers.
2. ZviKohavi and Niraj K.Jha, "Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2010.
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2ndEdition, Prentice Hall PTR.
4. D.P. Leach, A.P. Malvino, "Digital Principles and Applications", TMH, 7th Edition.

(Humanities Elective-I)

Subject Code	Title of the Subject	L	T	P	C
20A39101 a	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**	3	0	0	3

Common to All Branches

COURSE OBJECTIVES: The objective of this course is	
1	To inculcate the basic knowledge of micro economics and financial accounting
2	To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
3	To know the various types of Market Structures & pricing methods and its strategies
4	To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
5	To provide fundamental skills on Accounting and to explain the process of preparing Financial statements

SYLLABUS

UNIT-I: Managerial Economics

Introduction – Nature, meaning, significance, functions and advantages. Demand-Concept, Function, Law of Demand - DemandElasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

State the Nature of Managerial Economics and its importance
- Understand the concept of demand andits determinants
- Analyze the Elasticity and degree of elasticity
- EvaluateDemand forecasting methods
- Design the process of demand estimation for different types of demand

UNIT-II: Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination–Shortrun and longrun Production Function- Isoquants andIsocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale.Cost&Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) -Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Define the production function, Input-Output relationship and different cost concepts
- Apply the least-cost combination of inputs
- Analyze the behavior of various cost concepts
- Evaluate BEA for real time business decisions
- Develop profit appropriation for different levels of business activity

UNIT-III: Business Organizations and Markets

Introduction – Nature, meaning, significance, functions and advantages.Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises.Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly-Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Explain the structure of markets, features of different markets and forms of business organizations
- Apply the price output relationship in different markets
- Analyze the optimum output levels to maximize profit in different markets
- Evaluate price-output relationship to optimize cost,revenue and profit

UNIT- IV: Capital Budgeting

Introduction – Nature, meaning, significance, functions and advantages. Typesof Working Capital,Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals,Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Explain the concept of capital budgeting and its importance in business
- Contrast and compare different investment appraisal methods
- Analyze the process of selection of investment alternatives using different appraisal methods
- Evaluate methods of capital budgeting for investment decision making and for maximizing returns
- Design different investment appraisals and make wise investments

UNIT-V: Financial Accounting and Analysis

Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). ***Financial Analysis -*** Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Discuss the concept,convention and significance of accounting
- Apply the fundamental knowledge of accounting while posting the journal entries
- Analyze the process and preparation of final accounts and financial ratios
- Evaluate the financial performance of an enterprise by using financial statements

Text Books:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

References:

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

Data Books Required:

Present Value Factors table

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the concepts related to Managerial Economics, financial accounting and management.
CO2	Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets
CO3	Apply the concepts of production, cost and revenues for effective business decisions
CO4	Analyze how to invest their capital and maximize returns
CO5	Evaluate the capital budgeting techniques
CO6	Develop theaccounting statements and evaluate the financial performance of

	business entity.

(Humanities Elective –I)

Subject Code	Title of the Subject	L	T	P	C
20A39101b	**ENTREPRENEURSHIP& INCUBATION**	3	0	0	3

Common to All Branches

COURSE OBJECTIVES: The objective of this course is	
1	To make the student understand about Entrepreneurship
2	To enable the student in knowing various sources of generating new ideas in setting up ofnew enterprise
3	To facilitate the student in knowing various sources of finance in starting up of a business
4	To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
5	To encourage the student in creating and designing business plans

Syllabus

UNIT-I: Entrepreneurship

Introduction-Nature, meaning, significance, functions and advantages. concept, characteristics-knowledge and skills requirement - process - Factors supporting entrepreneurship - Differences between Entrepreneur and Intrapreneur - entrepreneurial mindset and personality - Recent trends.

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Understand theconcept of Entrepreneur and Entrepreneurship in India
- Analyzerecent trends in Entrepreneurship across the globe
- Develop a creative mind set and personality in starting a business.

UNIT-II: Women Entrepreneurship

Introduction – Nature, meaning, significance, functions and advantages. Growth of women entrepreneurship in India. - Issues & Challenges - Entrepreneurial motivations.Entrepreneurship Development and Government. Role, of Central and State Government - incentives, subsidies and grants – Export-oriented Units - Fiscal and Tax concessions.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the role of government in promoting women entrepreneurship
- Analyze the role of export-oriented units
- Evaluate the tax concessions available for Women entrepreneurs

.

UNIT-III:Product Development

Introduction – Nature, meaning, significance, functions and advantages. Startup Initiatives - Generating business/ Service idea – Sources and methods –Identifying opportunities - Feasibility study - Market feasibility, technical/operational feasibility, Financial feasibility. Developing business plan, Preparing project report, Presenting business plan to investors.

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Analyze the sources of new methods in generating business idea
- Evaluate market feasibility, financial feasibility and technical feasibility
- Design and draw business plansin project preparation and prepare project reports

UNIT-IV:Startups

Introduction – Nature, meaning, significance, functions and advantages. Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence theType/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to:

- Understand the importance of business incubation
- Apply brilliant ideas in the process of business incubation
- Analyze the process of business incubation/incubators.
- Design their own business incubation/incubators as viable-business unit.

UNIT-V: Finance

Introduction – Nature, meaning, significance, functions and advantages. Sources - Long term and Short term - Institutional Finance – Commercial Banks, SFC's and NBFC's in India, Role in small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions supporting entrepreneurship development.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the various sources of finance in Starting the new venture
- Analyze the role of banks and other financial institutions in promoting entrepreneurship in India
- Evaluatethe need and importance of MSMEs in the growth of country

TEXT BOOKS

1. D F Kuratko and T V Rao, **Entrepreneurship** - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit :login.cengage.com)
2 .Nandan H, Fundamentals of Entrepreneurship, PHI, 2013

REFERENCES

1.Vasant Desai,Small Scale Industries and Entrepreneurship, Himalaya Publishing 2012.
2. Rajeev Roy Entrepreneurship, 2^{nd} Edition, Oxford, 2012.
3.B.JanakiramandM.Rizwana‖ Entrepreneurship Development: Text & Cases, Excel Books, 2011.
4.Stuart Read, Effectual Entrepreneurship, Routledge, 2013.

E-RESOURCES

1. Entrepreneurship-Through-the-Lens-of-enture Capital

2.http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship

3.http://nptel.ac.in/courses/122106032/Pdf/7_4.pd

4.http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Concepts related to the Entrepreneurship and Incubators
CO2	Understand the concept of Entrepreneurship and challenges in the world of competition.
CO3	Apply the Knowledge in generating ideas for New Ventures.
CO4	Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
CO5	Evaluate the role of central government and state government in promoting Entrepreneurship.

CO6	Create and design business plan structure through incubations.

(Humanities Elective-I)
(w.e.f Academic Year 2020-21)

Subject Code	Title of the Subject	L	T	P	C
20A39101 c	**BUSINESS ETHICS AND CORPORATE GOVERNANCE**	3	0	0	3

Common to All Branches

COURSE OBJECTIVES: The objectives of this course are	
1	To make the student understand the principles of business ethics
2	To enable them in knowing the ethics in management
3	To facilitate the student's role in corporate culture
4	To impart knowledge about the fair-trade practices
5	To encourage the student in creating knowingabout the corporate governance

SYLLABUS
UNIT-I:ETHICS

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior - Value systems - Business Ethics,Types, Characteristics, Factors, Contradictions and Ethical Practices inManagement- Corporate Social Responsibility – Issues of Management – Crisis Management.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the meaning of loyalty and ethical Behavior
- Explain various types of ethics
- Analyze the corporate social responsibility of management

UNIT-II: ETHICS IN MANAGEMENT

Introduction Ethics in production, finance, Human Resource Managementand,MarketingManagement - Technology Ethics and Professional ethics - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the meaning of Marketing Ethics
- Compare and contrasttechnical ethics and professional ethics
- Develop ethical values

UNIT-III: CORPORATE CULTURE

Introduction, Meaning,definition,Nature, Scope, Functions,andsignificance– Cross cultural issues in Ethics - - Emotional Honesty – Virtue of humility – Promote happiness – karma yoga – proactive – flexibility and purity of mind. The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

LEARNING OUTCOMES: -After completion of this unit student will

- Define UniversalismUtilitarianism, Distributive
- Understand the corporate culture in business
- Analyze Ethical Value System Ethical Values in different Cultures

UNIT- IV:LEGAL FRAME WORK

Law and Ethics, Agencies enforcing Ethical Business Behavior, Legal Impact– Environmental Protection, Fair Trade Practices,legal Compliances, Safeguarding Health and wellbeing of Customers.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand Law and Ethics
- Analyze Different fair-trade practices
- Make use of Environmental Protection andFair-Trade Practices

UNIT -V: CORPORATE GOVERNANCE

Introduction, meaning – scope Nature - Issues, need, corporate governance code, transparency & disclosure, role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work, corporate scams, committees in India and abroad, corporate social responsibility. of BoDs composition, Cadbury Committee - various committees - reports - Benefits and Limitations.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand corporate governance code
- Analyze role ofauditors, board of directors and shareholders in corporate governance
- Implementing corporate socialresponsibility in India.

Text books.

1. Murthy CSV: Business Ethics and Corporate Governance, HPH
2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH.

Reference books

1. Dr. K. Nirmala, KarunakaraReddy: Business Ethics and Corporate Governance, HPH
2. H.R.Machiraju: Corporate Governance
3. K. Venkataramana, Corporate Governance, SHBP.
4. N.M.Khandelwal : Indian Ethos and Values for Managers

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Ethics and Types of Ethics.
CO2	Understand business ethics and ethical practices in management
CO3	Understand the role of ethics in management
CO4	Apply the knowledge in cross cultural ethics
CO5	Analyze law and ethics
CO6	Evaluate corporate governance

Course Code	ELECTRICAL CIRCUIT ANALYSIS LAB		L	T	P	C
20A30203			**0**	**0**	**3**	**1.5**
Pre-requisite	**Electrical circuits**	**Semester**	**III**			

Course Objectives:

- Understand and experimentally verify various resonance phenomenon.
- Understand and analyze various current locus diagrams.
- Apply and experimentally analyze two port network parameters

Course Outcomes (CO):

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

CO1: Remember, understand and apply various theorems for circuits' analysis and verify practically.

CO2: Understand and experimentally verify various resonance phenomenon.

CO3: Understand and analyze various current locus diagrams and active, reactive power measurements in three phase circuits.

CO4: Apply and experimentally analyze two port network parameters

List of Experiments:

From the following list all the ten experiments are required to be conducted as compulsory experiments:

1. Locus Diagram of RL Series Circuits: a) Variable 'R' and Fixed 'L' b) Variable 'L' and Fixed 'R'

2. Locus Diagram of RC Series Circuits: a) Variable 'R' and Fixed 'C' b) Variable 'C' and Fixed 'R'

3. Series & Parallel Resonance

4. Determination of Z & Y Parameters

5. Determination of Transmission & Hybrid Parameters

6. Series and Parallel connection of two port networks

7. Cascaded Connection of two port networks 8. Determination of Coefficient of coupling 9. Transient Response of RL an RC series circuits 10. Transient Response in R-L-C Series & Parallel circuits. 11. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). 12. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits. 13. Frequency response of LP and HP filters 14. Frequency response of BP and BR filters 15. Evaluation of convolution integral, Discrete Fourier transform for periodic & non-periodic signals.
References:
David A. Bell, Fundamentals of Electric Circuits: Lab Manual, OUP Canada, 7th Edition, 2009.
Online Learning Resources/Virtual Labs:
• **http://vlabs.iitkgp.ernet.in/asnm/index.html** • **https://vlab.amrita.edu/?sub=1&brch=75** • **http://vlabs.iitb.ac.in/vlabs-dev/labs/network_lab/labs/explist.php**

<table>
<tr><td>Course Code</td><td rowspan="2">DC MACHINES & TRANSFORMERS LAB</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A30204</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Pre-requisite</td><td>DC Machines and Transformer</td><td>Semester</td><td colspan="3">III</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Course Objectives:</td></tr>
<tr><td colspan="6">To conduct various experiments on
• DC motors and DC Generators
• The speed control techniques of DC motors.
• To conduct various experiments for testing on 1-phase transformers</td></tr>
<tr><td colspan="6">Course Outcomes (CO):</td></tr>
<tr><td colspan="6">• Remember, understand various basic tests like brake test, load test, Swinburne test, separation of losses, open circuit and short circuit tests.
• Apply the above tests on transformers, DC shunt motors and DC long and short compound generators.
• Analyze the magnetization characteristics of DC shunt generator, parallel operation of single phase transformers
• Evaluate various characteristics for the tests performed.</td></tr>
<tr><td colspan="6">List of Experiments:</td></tr>
<tr><td colspan="6">From the following list all the ten experiments are required to be conducted as compulsory experiments:
1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and</td></tr>
</table>

critical speed.

2. Load test on DC shunt generator. Determination of characteristics.

3. Brake test on DC shunt motor. Determination of performance curves.

4. Swinburne's test on DC shunt motor, Predetermination of efficiency.

5. Speed control of DC shunt motor (Armature control and Field control method).

6. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.

7. OC and SC test on single phase transformer

8. Parallel operation of single phase transformers.

9. Sumpner's test on single phase transformers.

10. Load test on DC long shunt compound generator. Determination of characteristics.

11. Load test on DC short shunt compound generator. Determination of characteristics.

12. Separation of losses in DC shunt motor.

13. Separation of losses of single phase transformer.

References:

D. P. Kothari and B. S. Umre, Laboratory Manual for Electrical Machines, I.K International Publishing House Pvt. Ltd., 2017

Online Learning Resources/Virtual Labs:

- http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering
- http://vlabs.iitb.ac.in/vlabs/dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
ELECTRICAL AND ELECTRONICS ENGINEERING

II B.Tech I Sem (E.E.E)

L T P C

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DIGITAL LOGIC DESIGN LAB (20A30405)

Course Objectives:

- To understand various pin configurations of the Digital ICs used in the laboratory
- To conduct the experiments and verify the truth tables of various logic circuits.
- To analyze the logic circuits
- To design sequential and combinational logic circuits and verify their properties.
- To design of any sequential/combinational circuit using Hardware Description Language.

Course Outcomes (CO):

CO1: Understand the pin configuration of various digital ICs used in the lab
CO2: Conduct the experiment and verify the properties of various logic circuits.
CO3: Analyze the sequential and combinational circuits.
CO4: Design of any sequential/combinational circuit using Hardware/ HDL.

List of Experiments:

1. Verification of truth tables of the following Logic gates
   Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive-OR (vi) Exclusive-NOR
2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.
3. Verification of functional table of 3 to 8-line Decoder /De-multiplexer
4. 4-variable logic function verification using 8 to1 multiplexer.
5. Design full adder circuit and verify its functional table.
6. Verification of functional tables of (i) JK Edge triggered Flip–Flop (ii) JK Master Slav Flip–Flop (iii) D Flip-Flop
7. Design a four-bit ring counter using D Flip–Flops/JK Flip Flop and verify output
8. Design a four bit Johnson’s counter using D Flip-Flops/JK Flip Flops and verify output
9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.
10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms.
11. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms.
12. (a) Draw the circuit diagram of a single bit comparator and test the output
    (b) Construct 7 Segment Display Circuit Using Decoder and7 Segment LED and test it.

Add on Experiments:

1. Design BCD Adder Circuit and Test the Same using Relevant IC
2. Design Excess-3 to 9- Complement convertor using only four Full Adders and test the Circuit.
3. Design an Experimental model to demonstrate the operation of 74154 De-Multiplexer using LEDs for outputs.
4. Design of any combinational circuit using Hardware Description Language
5. Design of any sequential circuit using Hardware Description Language

References:

M. Morris Mano, “Digital Design”, 3rd Edition, PHI

Course Code	**Python Programming**		**L**	**T**	**P**	**C**
20A30205			**1**	**0**	**2**	**2**
Pre-requisite		**Semester**	**III**			

Course Objectives:

- To learn the basic concepts of software engineering and life cycle models
- To explore the importance of Databases in application Development
- Acquire programming skills in core Python
- To understand the importance of Object-oriented Programming

Course Outcomes (CO):

After completion of the course students should be able to

- Understand the python programming basic concepts like: structure, data types, files, strings etc.
- Apply the above basic concepts to create user defined functions or make use of the built in functions to solve various problems
- Design various computational algorithms to solve algebraic, arithmetic and scientific problems.
- Evaluation of real time issues with the help of special functions, tuples and fruitful functions etc.

List of Experiments:

The student is expected to do the following exercises through Python Programming.

1. Install Python Interpreter and use it to perform different Mathematical Computations. Try to do all the operations present in a Scientific Calculator
2. Write a function that draws a grid like the following:

```
+ - - - -  + - - - - +
 |         |         |
|         |         |
|         |         |
|         |         |
+ - - - -  + - - - - +
 |         |         |
 |         |         |
 |         |         |
 |         |         |
+ - - - - + - - - - +
```

3. Write a function that draws a Pyramid with # symbols

```
            #
          # # #
        # # # # #
      # # # # # # #
            .
```

Up to 15 hashes at the bottom

4. The letters of the alphabet can be constructed from a moderate number of basic elements, like vertical and horizontal lines and a few curves. Design an alphabet that can be drawn with a minimal number of basic elements and then write functions that draw the letters. The alphabet can belong to any Natural language excluding English. You should consider at least 'ten' letters of the alphabet.
5. Write program which performs the following operations on lists. Don't use built-in functions
    a) Updating elements of a list
    b) Concatenation of list's
    c) Check for member in the list
    d) Insert into the list
    e) Sum the elements of the list
    f) Push and pop element of list
    g) Sorting of list
    h) Finding biggest and smallest elements in the list
    i) Finding common elements in the list
6. Write a program that reads a file, breaks each line into words, strips whitespace and punctuation from the words, and converts them to lowercase.
7. The time module provides a function, also named time that returns the current Greenwich

Mean Time in “the epoch”, which is an arbitrary time used as a reference point. On UNIX systems, the epoch is 1 January 1970.

```
>>> import time
>>>time. time()
1437746094.5735958
```

Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.

8. Given n+r+1 <= 2^r .n is the input and r is to be determined. Write a program which computes minimum value of r that satisfies the above.
9. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions.
10. Write a program which counts number of vowels, consonants and special characters for a given text of characters.
11. Given a word which is a string of characters. Given an integer say ‘n’. Rotate each character by ‘n’ positions and print it. Note that ‘n’ can be positive or negative.
12. Write a program that takes a string and prints the letters in decreasing order of frequency.
13. Solving linear differential equations and optimization problems using Python programming.
14. Matrix operations.
15. Basic image processing.

References:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, “How to Think Like a Computer Scientist: Learning with Python 3”, 3rd edition, Available at http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
2. Paul Barry, “Head First Python a Brain Friendly Guide” 2nd Edition, O’Reilly, 2016
3. Dainel Y. Chen “Pandas for Everyone Python Data Analysis” Pearson Education, 1st Edition, 2018
4. “Python programming and numerical methods: A guide for engineers and scientists” by Qingkai Kong, Timmy Siauw and Alexandre M.Bayen, Elsevier Inc, 2020.
5. “Python Programming” by Reema Thareja, Oxford University Press, 2017

Online Learning Resources/Virtual Labs:

. https://nptel.ac.in/courses/106/106/106106182/

2. https://nptel.ac.in/courses/106/106/106106212/

UNIVERSAL HUMAN VALUES

(Mandatory Course -III/IV SEMESTER)

(w.e.f Academic Year 2020-21)

(Common to EEE, ECE & CSE)

Subject Code	Title of the Subject	L	T	P	C
20A19101	**Universal Human Values**	3	0	0	3

COURSE OBJECTIVES: The objectives of this course are	
1	Exposure to the value of life, society and harmony
2	Leading towards holistic perspective based on self-exploration about themselves (human being), family, and society andnature/existence.
3	Bringing transition from the present state to Universal Human Order
4	Instill commitment and courage toact.
5	Know about appropriate technologies and management patterns

SYLLABUS

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Universal Human Values-I - Self-Exploration - content and process; 'Natural Acceptance' and Experiential Validation - self-exploration - Continuous Happiness and

Prosperity - Human Aspirations - current scenario - Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit 2: Understanding Harmony among Human Beings & Self Harmony!

human being as a co-existence of the sentient 'I' and the material' Body' - the needs - happiness and physical facility -the Body as an instrument of 'I' -the characteristics and activities of 'I' and harmony in 'I' -the harmony of I with the Body

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

Values in human relationship; meaning of Justice; Trust and Respect; Difference between intention and competence; the other salient values in relationship - the harmony in the society: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

the harmony in the Nature - Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature - Understanding Existence as Co-existence of mutually interacting units in all- pervasive space - Holistic perception of harmony at all levels of existence.

Unit 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

Humanistic Education - Competence in professional ethics: professional competence - people friendly and eco-friendly production systems - appropriate technologies and management patterns for above production systems. Individuals as socially and ecologically responsible engineers, technologists and managers

Prescribed Text Book

A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

Teachers' Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

ReferenceBooks

.JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999

1. HumanValues,A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.
2. The Story of Stuff(Book).
3. Economy of Permanence - J C Kumarappa 8.
   Bharat Mein Angreji Raj - PanditSunderlal 9.
   Rediscovering India - byDharampal
4. Hind Swaraj or Indian Home Rule - by Mohandas K.Gandhi
5. India Wins Freedom - Maulana Abdul Kalam Azad 12.
   Vivekananda - Romain Rolland(English)

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define terms like Natural Acceptance, Happiness and Prosperity
CO2	**Understand awareness of oneself, and one's surroundings (family, society nature)**
CO3	**Apply what they have learnt to their own self in different day-to-daysettings in real life**
CO4	Relate human values with human relationship and human society.
CO5	Justify the need for universal human values and harmonious existence
CO6	**Develop as socially and ecologically responsible engineers**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU
DEPARTMENT OF MATHEMATICS

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">Numerical Methods &Probability theory-
(EEE & MECH)
B.Tech II Year II Sem (R20)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A45101</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Basic Equations and Basic Probability</td><td>Semester</td><td colspan="4">IV</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.The theory of Probability and random variables.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): Student will be able to</td></tr>
<tr><td colspan="7">• apply numerical methods to solve algebraic and transcendental equations
• derive interpolating polynomials using interpolation formulae
• Solve differential and integral equations numerically
• apply Probability theory to find the chances of happening of events.
• understand various probability distributions and calculate their statistical constants.</td></tr>
<tr><td>UNIT – I</td><td colspan="2">Solution of Algebraic & Transcendental Equations:</td><td colspan="4">8 Hrs</td></tr>
<tr><td colspan="7">Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method

System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.</td></tr>
<tr><td>UNIT – II</td><td colspan="2">Interpolation</td><td colspan="4">8 Hrs</td></tr>
<tr><td colspan="7">Finite differences-Newton’s forward and backward interpolation formulae – Lagrange’s formulae. Gauss forward and backward formula, Stirling’s formula, Bessel’s formula.</td></tr>
<tr><td>UNIT - III</td><td colspan="2">Numerical Integration & Solution of Initial value</td><td colspan="4">9 Hrs</td></tr>
</table>

	problems to Ordinary differential equations	
Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.		
UNIT - IV	**Probability theory:**	9 Hrs
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.		
UNIT - V	**Random variables & Distributions:**	9 Hrs
Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution		
Textbooks:		
1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE. 3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.		
Reference Books:		
1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. 2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview 2. nptel.ac.in/courses/117101056/17 3. http://nptel.ac.in/courses/111105090		

II. B.Tech II Sem

Course Code	ANALOG ELECTRONICS		L	T	P	C
20A40409			**3**	**0**	**0**	**3**
Pre-requisite	**Electronic Devices & Circuits**	**Semester**	**IV**			

Course Objectives:

- List various types of feedback amplifiers, oscillators and large signal Amplifiers.
- Explain the operation of various electronic circuits and linear ICs.
- Apply various types of electronic circuits to solve engineering problems
- Analyse various electronic circuits and regulated power supplies for proper understanding
- Justify choice of transistor configuration in a cascade amplifier.
- Design electronic circuits for a given specification.

Course Outcomes (CO):

CO1: List various types of feedback amplifiers, oscillators and large signal amplifiers
CO2: Explain the operation of various electronic circuits and linear ICs
CO3: Apply various types of electronic circuits to solve engineering problems
CO4: Analyze various electronic circuits and regulated power supplies for proper understanding
CO5: Justify choice of transistor configuration in a cascade amplifier
CO6: Design electronic circuits for a given specification

UNIT - I
Multistage Amplifiers
Classification of amplifiers, different coupling schemes used in amplifiers, general analysis of cascade amplifiers, Choice of transistor configuration in a cascade amplifier, frequency response and analysis of two stage RC coupled and direct coupled amplifiers, principles of Darlington amplifier, Cascode amplifier.

UNIT - II
Feedback Amplifiers and Oscillators
Concepts of Feedback, Classification of Feedback Amplifiers, Transfer Gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Effect of Feedback on Amplifier characteristics, Analysis of a feedback Amplifiers - Voltage – Series, Current-Series, Current-shunt and Voltage–shunt.
Oscillators: Sinusoidal Oscillators, Conditions for oscillations, Phase-shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).

UNIT - III

Large Signal Amplifiers
Introduction, Classification, Class A large signal amplifiers, Second - Harmonic Distortion, Higher - Order Harmonic Generations, Transformer Coupled Class A Audio Power Amplifier, Efficiency of Class A, Class B, Class AB Amplifiers, Distortion in Power Amplifiers, Class C Power Amplifier.

UNIT - IV
Operational Amplifier
Introduction, Block diagram, Characteristics and Equivalent circuits of an ideal op-amp, Various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, Inverting and non-inverting amplifier configurations.
The Practical op-amp: Introduction, Input offset voltage, Offset current, Thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and Gain–bandwidth product, frequency limitations and compensations, transient response.

UNIT - V
Applications of OP-AMPs and Special ICs
Adder, Integrator, Differentiator, Difference amplifier and Instrumentation amplifier.
Converters: Current to voltage and voltage to current converters.
Active Filters: First order filters, second order low pass, high pass, band pass and band reject filters, **Oscillators:** RC phase shift oscillator, Wien bridge oscillator, Square wave generator.
Special Purpose Integrated Circuits: Functional block diagram, working, design and applications of Timer 555 (Monostable & Astable), Functional block diagram, working and applications of VCO566, PLL565, Fixed and variable Voltage regulators.

Textbooks:

1. Millman, Halkias and Jit , “Electronic Devices and Circuits” , 4th Edition , McGraw Hill Education (India) Private Ltd.,2015.
2. Ramakanth A. Gayakwad, “Op-Amps& LinearICs”,4thEdition, Pearson, 2017.

Reference Books:

1. Millman and Taub, Pulse, Digital and Switching Waveforms, 3rdEdition, TataMcGraw-Hill Education, 2011.
2. J. Milliman, C.C. Halkias and Chetan Parikh, “Integrated Electronics”, 2ndEdition, McGraw Hill, 2010.
3. David A. Bell, “ Electronic Devices and Circuits”, 5thedition,OxfordPress,2008.
4. D. Roy Choudhury, “LinearIntegratedCircuits”,2ndEdition, New Age International (p)Ltd,2003
5. Salivahanan and N. Suresh Kumar, “ Electronic Devices and Circuits”,4thEdition,McGrawHill Education (India) Private Ltd.,2017.

II. B.Tech II Sem

Course Code	**POWER ELECTRONICS**		**L**	**T**	**P**	**C**
20A40201			**3**	**0**	**0**	**3**
Pre-requisite	**Electrical circuits and semiconductor devices**	**Semester**	**IV**			

Course Objectives:

The student will be able to:

- Understand the differences between signal level and power level devices.
- Analyze the construction, operation, characteristics and usage of various converters.
- Analyze the voltage and current waveforms at various elements in the designed converter in different conduction modes of operation
- Apply concepts of converters to solve numerical problems

Course Outcomes (CO):

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

- Understand and remember the construction, operation, characteristics and usage of basic Power Semiconductor Devices.
- Analyze the operation of various converters when different types of loads are connected.
- Analyze the voltage and current waveforms at various elements in the designed converter in different conduction modes of operation.
- Apply voltage and current equations derived to solve numerical problems.

UNIT - I	**Power Switching Devices**	9 Hrs

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO. Introduction to Galium Nitride and Silicon Carbide Devices.

Unit Outcomes:

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

• Understand the basic power semiconductor devices their construction, principle of working and their characteristics.

• Understand in detail about SCR i.e., its characteristics, series and parallel connection of SCR’s, specification, its ratings and various commutation methods.

• Apply the above concepts to solve numerical problems.

UNIT - II	**Rectifiers**	10 Hrs

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance; Analysis of rectifiers with filter capacitance, Dual Converter -Numerical problems.

Unit Outcomes:

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

• Understand the concepts of phase control technique, midpoint and bridge connections of half and full controlled converters with various loads for both 1Ø and 3Ø phase converters, effect of source inductance and dual converters.

• Analyze and evaluate voltages and currents, active and reactive power inputs to converter with and without freewheeling diode for 1Ø and 3Ø converters.

• Apply the above concepts to solve numerical problems.

UNIT - III	**DC-DC CONVERTERS**	9 Hrs

Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

Unit Outcomes:

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

• Understand the concepts of various control strategies, types of choppers and analyze their principle operation, waveforms of voltages and currents at different loads. • Apply the above concepts to solve numerical problems.		
UNIT - IV	**INVERTERS**	10 Hrs
Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems. **Unit Outcomes:** At the end of the unit, students will be able to • Understand the construction, working of single phase and three phase voltage inverters with their waveforms in various operating modes when different loads. • Understand the concept of harmonic components and the different modulating techniques. • Apply the above concepts to solve numerical problems.		
UNIT - V	**AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS:**	10 Hrs
AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation. **Unit Outcomes:** At the end of the unit, students will be able to		

• Understand the concept of AC voltage controllers and analyse its output waveforms • Understand the concept of Cyclo Converters and its applications
Textbooks:
M. H. Rashid, "Power Electronics: Circuits, Devices and Applications", 2nd edition, Prentice Hall of India, 1998 2. P.S.Bimbhra,"Power Electronics", 4th Edition, Khanna Publishers, 2010. 3. M. D. Singh & K. B. Kanchandhani, "Power Electronics", Tata Mc Graw Hill Publishing Company, 1998.
Reference Books:
Ned Mohan, "Power Electronics", Wiley, 2011. 2. Robert W. Erickson and Dragan Maksimovic, "Fundamentals of Power Electronics" 2nd Edition, Kluwer Academic Publishers, 2004. 3. Vedam Subramanyam, "Power Electronics", New Age International (P) Limited, 1996. 4. V.R.Murthy, "Power Electronics", 1st Edition, Oxford University Press, 2005. 5. P.C.Sen, "Power Electronics", Tata Mc Graw-Hill Education, 1987. 5. "Power Electronic Control of Alternating Current Motors" by J.M.D.Murphy
Online Learning Resources:
• **https://www.classcentral.com/course/youtube-electrical-power-electronics-47667/classroom** • **https://onlinecourses.nptel.ac.in/noc21_ee01/preview**

II. B.Tech II Sem

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">AC MACHINES</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A40202</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Electrical circuits, Magnetic circuits, DC machines and transformers</td><td>Semester</td><td colspan="4">IV</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">The students will be able to:
Understand the principle, construction and operation of AC machines and Special Machines.
Analyze the concept of circle diagram, starting methods and speed control of inductor motor
Analyse the concept of parallel operation, power circles and starting methods of synchronous machines.</td></tr>
<tr><td colspan="7">Course Outcomes (CO):</td></tr>
<tr><td colspan="7">At the end of this course, students will be able to:
Understand and remember principle, construction, operation and winding concepts of AC machines, synchronous condenser and special machines.
Analyze the concept of circle diagram, starting methods and speed control of inductor motor, parallel operation, power circles and starting methods of synchronous machines
Obtain and draw the equivalent circuit, phasor diagrams, various voltage regulation methods and V and inverted V curves of synchronous machine.
Apply the concepts to evaluate the performance characteristics of AC machines.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">Induction Machines - I</td><td colspan="4">9Hrs</td></tr>
<tr><td colspan="7">Poly phase Induction Motors - Construction Details of Cage and Wound Rotor Machines- Production of a Rotating Magnetic Field - Principle of Operation - Rotor EMF and Rotor</td></tr>
</table>

Frequency - Rotor Reactance, Rotor Current and Power factor at Standstill and During Operation. Rotor Power Input, Rotor Copper Loss and Mechanical Power Developed and their inter relation-Torque Equation-Deduction From Torque Equation - Expressions for Maximum Torque and Starting Torque - Torque Slip Characteristics.

Learning Outcomes:

By the end of the unit, student will be able to:

- Understand the principle, construction and types of induction motors.
- Analyze the change of parameters with respect to slip, various types of powers, torque equations and their characteristics.
- Apply the above concepts to solve numerical problems.

UNIT - II	**Induction Machines - II**	10 Hrs

Equivalent Circuit - Phasor Diagram - Crawling and Cogging –Circle Diagram-No Load and Blocked Rotor Tests-Predetermination of Performance - Generator Operation - Double Cage and Deep Bar Rotors - Starting Methods and Starting Current and Torque Calculations, Speed Control methods -Change of Frequency, Pole Changing and Methods of Consequent Poles, Cascade Connection, Injection of an EMF.

Learning Outcomes:

By the end of the unit, student will be able to:

- Understand the concepts of crawling, cogging, generator operation and types of rotors and circle diagrams.
- Analyze various starting methods and speed control of induction motors.
- Apply the above concepts to solve numerical problems

UNIT - III	**Synchronous Machines - I**	10 Hrs

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings, Distributed and concentrated windings – Distribution, Pitch and Winding factors – E.M.F Equation - Harmonics in generated e.m.f. – suppression of harmonics – armature reaction – leakage reactance – synchronous reactance and

impedance – Experimental determination - phasor diagram – load characteristics. Predetermination of Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods –two reaction analysis – experimental determination of Xd and Xq (Slip test) Phasor diagrams – Regulation. **Learning Outcomes:** By the end of the unit, student will be able to: • Understand the types of windings, different winding factors, principle, construction, operation and armature reaction of synchronous generator. • Analyze various regulation methods of synchronous machine. • Apply the above concepts to solve numerical problems.		
UNIT - IV	**Synchronous Machines - II**	10 Hrs
Synchronization of alternators with infinite bus bar – Synchronizing power, synchronizing torque –parallel operation and load sharing - Effect of change of excitation and mechanical power input - Analysis of short circuit current wave form – Determination of sub-transient, transient and steady state reactances. Principle of operation, methods of starting, Phasor diagram of synchronous motor, variation of current and power factor with excitation, V and inverted V curves, Hunting and use of damper bars, Synchronous condenser and power factor correction, Excitation and power circles. **Learning Outcomes:** By the end of the unit, student will be able to: • Understand the concept of parallel operation of synchronous machines, principle and operation of synchronous motor. • Analyze various staring methods, phasor diagram, power factor correction, excitation and power circles • Apply the above concepts to solve numerical problems.		
UNIT - V	**Special Machines**	9 Hrs
Single Phase Motors: Single phase induction motor – Constructional features - Double		

revolving field theory – Elementary idea of cross-field theory – split-phase motors – shaded pole motor.

Special Motors: Construction, working principle and performance of- Stepper Motors, Reluctance motors, A.C. Series motors, Universal motors, BLDC motor.

Learning Outcomes:

By the end of the unit, student will be able to:

- Understand the principle and construction of special machines.
- Analyze the operation of special machines.

Textbooks:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.

2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

Reference Books:

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Online Learning Resources:

- **https://onlinecourses.nptel.ac.in/noc21_ee13/preview**

<table>
<tr><td>Course Code</td><td rowspan="2">ELECTROMAGNETIC FIELD THEORY</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A40203</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
</table>

Pre-requisite	**Magnetic circuits**	**Semester**	**IV**

Course Objectives:

- To understand the basic principles of electrostatics
- To understand and apply the basic principles of magneto statics for time invariant and time varying fields
- To apply the principles of dielectrics, conductors and magnetic potentials to numerical problems

Course Outcomes (CO):

After completion of the course, the student will be able to:

- Remember and understand the basics concepts and fundamental laws of electrostatics, magneto statics.
- Apply the concepts and laws in different charges in electrostatics, magneto statics and Time varying fields.
- Analyze the physical quantities of electromagnetic and time varying fields using the fundamental laws.
- Determine potential, charge, capacitance and inductance of electric field

UNIT - I	**ELECTROSTATICS**	9 Hrs

Electrostatic Fields - Coulomb’s Law - Electric Field Intensity (EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field - Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss Law Application of Gauss Law-Maxwell’s First Law – Numerical Problems. Laplace and Poisson Equations - Solution of Laplace Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.

Unit Outcomes:

• Able to determine electric field and potentials using Coulomb's law & Gauss law.

• Analyze potential differences for different configurations.

• Able to classify static electric magnetic fields in different engineering situations.

• Able to determine the Concepts of Electric dipole, Electrostatic Energy and Energy density

UNIT - II	**CONDUCTORS AND DIELECTRICS**	9 Hrs

Behaviour of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.

Unit Outcomes:

• Analyze the Concepts of Conduction and Convection currents.

•Understand the concept of capacitance for parallel plates, spherical & co-axial capacitors.

• Able to Calculate Energy stored and energy density in a static electric fields.

UNIT - III	**MAGNETO STATICS**	11 Hrs

Static Magnetic Fields – Biot-Savart Law – Oersted's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular &Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems. Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.

Unit Outcomes: • Analyze the Concepts of Magnetic field intensity using Biot-Savart Law & Ampere Law. • Able to understand Maxwell's equations. • Determine MFI due to an infinite sheet of current and a long filament carrying conductor in Different loops.		
UNIT - IV	**MAGNETIC POTENTIAL**	9 Hrs
Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations. Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems. **Unit Outcomes:** • Understand scalar magnetic potential and vector magnetic potential and its applications. • Able to calculate the magnetic forces and torque produced by currents in Magnetic Field. • Ability to calculate self and mutual Inductances. • Analyze the Concepts of Magnetic boundary conditions & Energy stored in the Magnetic field.		
UNIT - V	**TIME VARYING FIELDS and WAVES**	10 Hrs
Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current. Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedence and Skin Depth – Poynting Theorem – Poynting Vector and its Significance. **Unit Outcomes:** • Acquires knowledge on time varying fields & Faraday's law for Electromagnetic induction		

• Analyze the Concepts Maxwell's Equations in Different Forms. • Understand the Concepts Calculation of Poynting vector & Theorem. • Analyze the Concepts of Wave Theory
Textbooks:
1. Sadiku, Kulkarni, "Principles of Electromagnetics", 6th Edition, Oxford University Press, 2015 2. William.H.Hayt, "Engineering Electromagnetics", Mc Graw Hill, 2010.
Reference Books:
1.J.D.Kraus, "Electromagnetics", 5th Edition, Mc Graw Hill Inc, 1999. 2. David K. Cheng, "Field & Electromagnetic Waves", 2nd Edition, 1989. 3. Joseph A. Edminister, "Electromagnetics", 2nd Edition, Schaum's Outline, Mc Graw Hill, 2017. 4. K.A. Gangadhar and P.M. Ramanathan, "Electomagnetic Field Theory", 8th Reprint, Khanna Publications, 2015.
Online Learning Resources:
• **https://www.classcentral.com/course/youtube-electrical-electro-magnetic-fields-47689/classroom** • **https://onlinecourses.nptel.ac.in/noc21_ee83/preview**

II B.Tech II Sem (E.E.E) **L T P C**

0 0 3 1.5

ANALOG ELECTRONICS LAB (20A40410)

Course Objectives:

- To learn basic techniques for the design of analog circuits and fundamental concepts used in the design of systems.
- To design and analyze multistage amplifiers, feedback amplifiers and OP AMP based circuits.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.

Course Outcomes (CO):

CO1: Analyze various amplifier circuits.
CO2: Design multistage amplifiers.
CO3: Design OPAMP based analog circuits.
CO4: Understand working of logic gates.
CO5: Design and implement Combinational and Sequential logic circuits.

List of Experiments:

1. Design and simulate two stage RC coupled amplifier for given specifications. Determine Gain and Band width from its frequent cure sponse curve.
2. Design and simulate Darlington amplifier. Determine Gain and Bandwidth from its frequency response curve.
3. Design and simulate voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.
4. Design RC Phase shift oscillator/Wien bridge oscillator and square wave generator for the given specifications. Determine the frequency of oscillation.
5. Analyze a Class B complementary symmetry power amplifier and observe the waveforms with and without crossover distortion. Determine maximum output power and efficiency.
6. Design a class AB amplifier to remove the cross over distortion using MOSFETs.
7. Design inverting and non-inverting amplifiers for the given specifications using OP AMP and verify the same experimentally.
8. Design practical differentiator and integrator circuits using OP AMP for the given specifications and verify the same practically.
9. Design a second order low pass and high pass active filters using OP-AMP using the given specifications. Verify them practically.
10. Design a square waveform generator using OP-AMP for the given specifications.
11. Design an astable multivibrator circuit for the given specifications using 555 timer. Observe ON & OFF states of transistor in an astable multi-vibrator. Plot output waveforms.
12. Design a Mono stable Multi-Vibrator circuit for the given specifications using 555 Timer. Plot output waveforms.
13. Verify one application of PLL (IC 565) by choosing appropriate circuit.
14. Conduct experiment to generate multiple functions using IC 566.

Course Code	POWER ELECTRONICS LAB		L	T	P	C
20A40204			**0**	**0**	**3**	**1.5**
Pre-requisite	**Power Electronics**	**Semester**	**IV**			

Course Objectives:

- Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
- Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
- Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cycloconverters with different loads.
- Create and analyze various power electronic converters using PSPICE software.

Course Outcomes (CO):

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

- Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
- Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
- Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, Cycloconverters with different loads.
- Design various power electronic converters.

List of Experiments:

From the following list all the ten experiments are required to be conducted as compulsory experiments:

1. Study of Characteristics of SCR, MOSFET & IGBT

2. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering

3. Single Phase AC Voltage Controller with R and RL Loads

4. Single Phase fully controlled bridge converter with R and RL loads

5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)

6. DC Jones chopper with R and RL Loads

7. Single Phase Parallel inverter with R and RL loads

8. Single Phase Cycloconverter with R and RL loads

9. Single Phase Half controlled converter with R and RL load

10. Single Phase Fully controlled converter with R and RL load

10. Three Phase half controlled bridge converter with R,RL-load

11. Three Phase fully controlled bridge converter with R,RL-load

11. Single Phase series inverter with R and RL loads

12. Single Phase Bridge converter with R and RL loads

13. Single Phase dual converter with RL loads

References:

1. O.P. Arora, "Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)", Alpha Science International Ltd., 2007.

2. M.H.Rashid, "Simulation of Electric and Electronic circuits using PSPICE", M/s PHI Publications.

3. PSPICE A/D user's manual – Microsim, USA.

4. PSPICE reference guide – Microsim, USA. 5. MATLAB and its Tool Books user's manual and – Math works, USA.

Online Learning Resources/Virtual Labs:

http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php

II. B.Tech II Sem

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">AC MACHINES LAB</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A40205</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Pre-requisite</td><td>AC MAchines</td><td>Semester</td><td colspan="4">IV</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">To perform load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
To Predetermine regulation of a three-phase alternator by synchronous impedance, m.m.f method and Zero Power Factor method.
To determine Xd and Xq salient pole synchronous machine.
To evaluate and analyze V and inverted V curves of 3 phase synchronous motor</td></tr>
<tr><td colspan="7">Course Outcomes (CO):</td></tr>
<tr><td colspan="7">By the end of the course, the student will be able to:
Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
Predetermine regulation of a three-phase alternator by various methods.
Analyse Xd and Xq of salient pole synchronous machine.
Evaluate and analyze V and inverted V curves of 3 phase synchronous motor</td></tr>
<tr><td colspan="7">List of Experiments:</td></tr>
</table>

From the following list all the ten experiments are required to be conducted as compulsory experiments: 1. No-load & Blocked-rotor tests on Squirrel cage Induction motor. 2. Load test on three phase slip ring Induction motor. 3. Speed control of three phase induction motor 4. Rotor resistance starter for slip ring induction motor 5. Load test on single phase induction motor. 6. Determination of Equivalent circuit of a single phase induction motor. 7. Predetermination of Regulation of a three phase alternator by synchronous impedance &m.m.f methods. 8. Predetermination of Regulation of three-phase alternator by Z.P.F. method. 9. Determination of Xd and Xq of a salient pole synchronous machine by slip test. 10. V and inverted V curves of a 3-phase synchronous motor. 11. Speed control of wound rotor induction motor using rotor resistance control
References:
1. D. P.Kothari and B. S. Umre, “Laboratory Manual for Electrical Machines” I.K International Publishing House Pvt. Ltd, 2017. 2. D.R. Kohli and S.K. Jain, “A Laboratory Course in Electrical Machines” NEM Chand & Bros.
Online Learning Resources/Virtual Labs:
• **http://vem-iitg.vlabs.ac.in/** • http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering • http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html

II. B.Tech II Sem

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">CIRCUITS SIMULATION AND ANALYSIS USING PSPICE</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A40206</td><td>1</td><td>0</td><td>2</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td>Electrical Circuits, Power Electronics</td><td>Semester</td><td colspan="4">IV</td></tr>
</table>

Course Objectives:

- To simulate of various circuits using PSPICE software.
- To analyze the operation of single-phase half & fully-controlled converters and inverters
- To apply and analyze single-phase AC Voltage controllers for different loading conditions.

Course Outcomes (CO):

By the end of the course, the student will be able to:

- Understand and remember the basics of PSPICE software.
- Apply PSPICE on various power electronic circuits to analyze voltages, currents through the load and total harmonic distortion in the circuits.
- Analyze various AC and DC circuits using PSPICE to obtain voltages and currents at various nodes and branches.

List of Experiments:

I Simulation of Electrical Circuits

a) DC & AC Circuits
b) Mesh Analysis
c) Nodal Analysis
d) Transient Response

II Simulation of Power Electronic Circuits

a) Single-phase half wave, Semi and full converters with RLE loads.
b) Three-phase half wave, Semi and full converters with RLE loads.
c) Buck, Boost and Buck-Boost Converters
d) Single-phase AC voltage controller
e) Single and Three phase Quasi Square wave and PWM Inverters.

References:

Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009. 2. Simulation of Electric and Electronic circuits using PSPICE – by M.H.Rashid, M/s PHI Publications. 3. PSPICE A/D user's manual – Microsim, USA. 4. PSPICE reference guide – Microsim, USA. 5. MATLAB and its Tool Books user's manual and – Mathworks, USA.
Online Learning Resources/Virtual Labs:
• **http://vlabs.iitb.ac.in/vlabs- ev/labs/mit_bootcamp/power_electronics/labs/index.php**

II. B.Tech II Sem

Course Code	Design Thinking for Innovation (Common to All Branches)		L	T	P	C
20A49102			3	0	0	0
Pre-requisite	NIL	Semester	IV			

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes (CO):

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation
- Apply the design thinking techniques for solving problems in various sectors.
- Analyse to work in a multidisciplinary environment
- Evaluate the value of creativity
- Formulate specific problem statements of real time issues

UNIT - I	Introduction to Design Thinking	10 Hrs

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II	Design Thinking Process	10 Hrs

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III	Innovation	8 Hrs

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV	Product Design	8 Hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies. **Activity:** Importance of modelling, how to set specifications, Explaining their own product design.		
UNIT - V	**Design Thinking in Business Processes**	**10 Hrs**
Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. **Activity:** How to market our own product, About maintenance, Relibility and plan for startup.		
Textbooks:		
1. Change by design, Tim Brown, Harper Bollins (2009) 2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.		
Reference Books: 1. Design Thinking in the Classroom by David Lee, Ulysses press 2. Design the Future, by Shrrutin N Shetty, Norton Press 3. Universal principles of design- William Lidwell, Kritinaholden, Jill Butter. 4. The era of open innovation – Chesbrough.H		
Online Learning Resources:		
https://nptel.ac.in/courses/110/106/110106124/ https://nptel.ac.in/courses/109/104/109104109/ https://swayam.gov.in/nd1_noc19_mg60/preview		

Course Code	POWER SYSTEM ARCHITECTURE		L	T	P	C
20A50201			**3**	**0**	**0**	**3**
Pre-requisite		**Semester**	**V**			

Course Objectives: To make the student learn about:

- The Block Diagram and Operation of Conventional Power Generating Systems and their Components.
- The role of non-conventional Power Generating Systems and their operation and economic aspects.
- Calculation of different transmission line parameters and their use.
- Modeling of transmission line and evaluation of constants.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO1	Remember and understand the concepts of conventional and nonconventional power generating systems.
CO2	Apply the economic aspects to the power generating systems.
CO3	Analyse the transmission lines and obtain the transmission line parameters and constants.
CO4	Design and Develop the schemes to improve the generation and capability of transmission line to meet the day to day power requirements.

UNIT - I	**POWER GENERATING SYSTEMS**	Lecture Hrs: 8

Thermal Power: Block Diagram of Thermal Power Station (TPS), Brief Description of TPS Components

Hydro Power: Selection of Site, Classification, Layout, Description of Main Components.

Nuclear Power: Nuclear Fission and Chain Reaction-Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants- Radiation Hazards: Shielding and Safety Precautions- Types of Nuclear Reactors.

Solar Power Generation: Role and Potential of Solar Energy Options, Principles of Solar Radiation, Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.

Wind Power Generation: Role and Potential of Wind Energy Options, Horizontal and Vertical Axis Wind Mills- Performance Characteristics-Pitch & Yaw Controls – Economic Aspects.

UNIT - II	**TRANSMISSION LINE PARAMETERS**	Lecture Hrs: 10

Types of Conductors - Calculation of Resistance for Solid Conductors, Bundle Conductors, Skin effect, Proximity effect, Concept of GMR & GMD- Transposition of Power lines- Calculation of inductance for single phase and three phase, Single and Double circuit lines, Symmetrical and asymmetrical conductor configurations with and without transposition. Calculation of Capacitance for 2 wire and 3 wire systems, effect of ground on Capacitance, Capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT - III	MODELING OF TRANSMISSION LINES	Lecture Hrs: 10
Classification of Transmission Lines - Short, Medium and Long lines and their models - Representations - Nominal-T, Nominal-π and A, B, C, D Constants. Mathematical Solutions to estimate regulation and efficiency of all types of lines- Long Transmission Line-Rigorous Solution, Evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent – π, Numerical Problems – Surge Impedance and Surge Impedance Loading - Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients-Termination of lines with different types of conditions-wavelengths and Velocity of Propagation – Ferranti effect, Charging current, Need of Shunt Compensation.		
UNIT - IV	**INSULATORS, CORONA AND MECHANICAL DESIGN OF LINES AND CABLES**	Lecture Hrs: 10
Types of Insulators, String efficiency and Methods for improvement, Numerical Problems – Voltage Distribution, Calculation of String Efficiency, Capacitance Grading and Static Shielding. Corona - Description of the phenomenon, Factors affecting Corona, Critical Voltages and Power Loss, Radio Interference. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing Chart and Sag template and its Applications. Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation Resistance and Stress in Insulation, Numerical Problems.		
UNIT - V	**GENERAL ASPECTS OF DISTRIBUTION SYSTEMS**	Lecture Hrs: 10
Classification of Distribution Systems - Comparison of DC & AC and Under-Ground & Over - Head Distribution Systems. Voltage Drop and power loss in D.C Distributors for the following cases: Radial D.C Distributors fed at one end and at ends (equal/unequal Voltages), Uniform loading and Ring Main Distributor, LVDC Distribution Network. Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, feeder loading; basic design of secondary distribution. Voltage Drop and power loss in A.C. Distributors.		
Textbooks:		
1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 1999. 2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.		
Reference Books:		
1. Non-Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000. 2. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006. 3. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003. 4. Principles of Power Systems by V.K. Mehta and Rohit Mehta, S.CHAND& COMPANY LTD., New Delhi 2004. 5. Wind Electrical Systems by S. N. Bhadra, D. Kastha& S. Banerjee – Oxford University Press, 2013.		
Online Learning Resources:		

1. https://onlinecourses.nptel.ac.in/noc22_ee17/preview

Course Code	CONTROL SYSTEMS		L	T	P	C
20A50202			3	0	0	3
Pre-requisite		Semester	V			

Course Objectives: To make the students learn about:

- Merits and demerits of open loop and closed loop systems; the effect of feedback.
- The use of block diagram algebra and Mason's gain formula to find the overall transfer function.
- Transient and steady state response, time domain specifications and the concept of Root loci.
- Frequency domain specifications, Bode and Nyquist plots.
- State space modelling of Control system.

Course Outcomes (CO): After completing the course, the student should be able to:

CO1	Understand the concepts of control systems classification, feedback effect, mathematical modelling, time response and frequency response characteristics and state space analysis.
CO2	Apply the concepts of Block diagram reduction, Signal flow graph method and state space formulation for obtaining mathematical model, Root locus, Bode, Nyquist and Polar plots for stability calculations, controllability and observability and demonstrate the use of these techniques.
CO3	Analyse time response analysis, error constants, and stability characteristics of a given mathematical model using different methods.
CO4	Design and develop different compensators, controllers and their performance evaluation for various conditions. Implement them for various engineering applications.

UNIT - I	***CONTROL SYSTEMS CONCEPTS***	Lecture Hrs: 12

Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle and operation of DC and AC Servo motors, Transfer function of DC servo motor - AC servo motor and Synchros.

UNIT - II	**TIME RESPONSE ANALYSIS**	Lecture Hrs: 8

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

UNIT - III	***STABILITY ANALYSIS IN TIME DOMAIN***	Lecture Hrs: 10

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci- Design of Lag, Lead, Lag-Lead Compensators using Root Locus.

UNIT - IV	**STABILITY ANALYSIS INFREQUENCY DOMAIN**	Lecture Hrs: 12

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency

domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis. Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.		
UNIT - V	**STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS**	Lecture Hrs: 8
Concepts of state, state variables, state model-state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability - Duality between controllability and observability.		
Textbooks:		
1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5^{th} edition, 2010. 2. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5^{th} edition, 2007.		
Reference Books:		
1. Control Systems Principles & Design by M.Gopal, 4^{th} Edition, Mc Graw Hill Education, 2012. 2. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003. 3. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud& Ivan J Williams, 2^{nd} Edition, Schaum's outlines, Mc Graw Hill Education, 2013. 4. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000. 5. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6^{th} Edition, Pearson, 2010.		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee31/preview		

Course Code	DIGITAL COMPUTER PLATFORMS		L	T	P	C
20A50203			3	0	0	3
Pre-requisite	Signals and Systems	Semester	V			

Course Objectives:

- Architecture and designing of 8086 Microprocessor with Assembling language programming and interfacing with various modules
- Understand the Interfacing of 8086 with various advanced communication devices
- Designing of 8051 Microcontroller with Assembling language programming and interfacing with various modules
- To know about Assembly Language Programs for the Digital Signal Processors and usage of Interrupts
- To understand Xilinx programming and understanding of Spartan FPGA board

Course Outcomes (CO):

CO1 Understand the basic architecture & pin diagram of 8086 microprocessor, 8051 Microcontroller, DSP Processor and FPGA Processors
CO2 Apply the concepts to design Assembly language programming to perform a given task, Interrupt service routines for all interrupt types
CO3 Design Real time applications by writing Assembly Language Programs for the Digital Signal Processors, Xilinx programming for Spartan FPGA boards and use Interrupts for real-time control applications
CO4 Analyse various real time systems by using various controllers

UNIT - I	INTRODUCTION TO MICROPROCESSORS	Lecture Hrs: 10

Historical background- Evolution of microprocessors up to 64-bit. Architecture of 8086 microprocessor, special function of general purpose registers. 8086 flag registers and functions of 8086 flags – Addressing modes of 8086 – Instruction set of 8086 – Assembler directives - Pin diagram 8086 – Minimum mode and maximum mode of operation - Timing diagrams - CISC and ARM Processors- Introduction to Multicore Processors- GPU.

UNIT - II	ASSEMBLY LANGUAGE PROGRAMMING & I/O INTERFACE	Lecture Hrs: 10

Macros – simple programs involving logical – branch instructions – sorting – evaluating arithmetic expressions - string manipulations – 8255 PPI - various modes of operation - A/D - D/A converter interfacing, Memory interfacing to 8086 – interrupt structure of 8086 – vector interrupt table – interrupt service routine – interfacing interrupt controller 8259 - Need of DMA – serial communication standards – serial data transfer schemes.

UNIT - III	8051 MICRO CONTROLLER PROGRAMMING AND APPLICATIONS	Lecture Hrs: 10

Introduction to micro controllers, Functional block diagram, Instruction sets and addressing modes, interrupt structure – Timer – I/O ports – serial communication. Data transfer, manipulation, Control and I/O instructions – simple programming exercises key board and display interface – Closed loop control of servo motor – stepper motor control.

UNIT - IV	INTRODUCTION TO TMS320LF2407 DSP CONTROLLER	Lecture Hrs: 10

Basic architectural features - Physical Memory - Software Tools. Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers. C2xx DSP CPU and Instruction Set: Introduction & code Generation - Components of the C2xx DSP core - Mapping External Devices to the C2xx core - peripheral interface - system configuration registers - Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction set.

UNIT - V	FIELD PROGRAMMABLE GATE ARRAYS (FPGA)	Lecture Hrs: 8
Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA – Xilinx, XC3000 series - Configurable logic Blocks (CLB) – Input / Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming –overview of Spartan 3E and Virtex II pro FPGA boards- case study.		

Textbooks:

1. Ramesh S. Gaonkar, Microprocessor Architecture Programming and Applications with 8085, Penram Intl. Publishing, 6th Edition, 2013
2. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw-Hill Publications, 3rd Edition, 2013.

Reference Books:

1. Microprocessor and Interfacing by Douglas V Hall, 2nd Edition, Tata McGraw hill, 1992
2. Microprocessor, Nilesh B Bahadure, PHI, 2010.
3. The 8051 Micro Controller Architecture, Programming and Applications by Kenneth J Ayala, Pearson International publishing (India).
4. Hamid A. Tolyat, DSP Based Electro Mechanical Motion Control, CRC press, 2004.
5. Application Notes from the webpage of Texas Instruments.
6. XC 3000 series datasheets (version 3.1). Xilinx Inc., USA, 1998
7. XC 4000 series datasheets (version 1.6). Xilinx Inc., USA, 1999
8. Wayne Wolf, FPGA based system design, Prentice hall, 2004.

Online Learning Resources:

1. https://nptel.ac.in/courses/106108100
2. https://nptel.ac.in/courses/108105102
3. https://nptel.ac.in/courses/117108040

Course Code	PROGRAMMABLE LOGIC CONTROLLERS (PE-I)		L	T	P	C
20A50204a			3	0	0	3
Pre-requisite	Digital Circuits	Semester	V			

Course Objectives: The student will be able to:

- Understand the basic functions and types of PLCs, Easy Veep software.
- Understand Classification of PLCs and applications.
- Design PLC Programming for various applications.
- Analyze PLC troubleshooting aspects.

Course Outcomes (CO): At the end of the course, the student will be able to:

CO1 Understand different types of PLCs, Its classification and the usage of EasyVeep software.
CO2 Analyze the hardware details of Allen Bradley PLC.
CO3 Design PLC Programming for various applications.
CO4 Apply PLC programming concepts in different fields of Science and Technology.

UNIT - I	**BASIC CONCEPTS OF PLCs**	Lecture Hrs: 8

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards.

UNIT - II	**PLC COMPUTATIONAL TOOLS**	Lecture Hrs: 10

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500.

UNIT - III	**PLC DEVELOPMENT**	Lecture Hrs: 10

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.
Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.

UNIT - IV	**PLC PROGRAMMING**	Lecture Hrs: 10

Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring – Examples, Motor START and STOP Logic, Lube Oil Pump Ladder Logic, Star Delta Motor Starter using PLC Logic.

UNIT - V	**PLC APPLICATIONS**	Lecture Hrs: 10

Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO2), plastic wrapping machines etc.

Textbooks:

1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2. PLC Hand Book (Automation direct Siemens)

Reference Books:

1. Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers, 2002.
2. Programmable Logic Controllers by W. Bolton, 4th Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2nd Edition, Carolina Academic Press, 2006.

Online Learning Resources:

1. https://nptel.ac.in/courses/108105088

Course Code	LINEAR AND DIGITAL IC APPLICATIONS	L	T	P	C
20A50204b		3	0	0	3
Pre-requisite	Semester				

- Electronic Devices & Circuits
- Digital Logic Design

Course Objectives:

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of PLL.
- To introduce the concepts of waveform generation and introduce some special function
- ICs.

Course Outcomes (CO): At the end of this course, the students will be able to

- List out the characteristics of Linear and Digital ICs.
- Discuss the various applications of linear & Digital ICs.
- Solve the application-based problems related to linear and digital ICs.
- Analyze various applications-based circuits of linear and digital ICs.
- Design the circuits using either linear ICs or Digital ICs from the given specifications.

UNIT - I

Integrated Circuits and Operational Amplifier: Introduction, Classification ofIC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and itsfeatures, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics –DCand AC.

UNIT - II

Linear Applications of OP-AMP: Inverting and non-inverting amplifiers, adder, subtractor,Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

Non-Linear Applications of OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular andSquare waveform generators, Oscillators

UNIT - III

Active Filters: Introduction, Butterworth filters – 1st order, 2nd order low pass and high passfilters, band pass, band reject and all pass filters.

Timer And Phase Locked Loops: Introduction to IC 555 timer, description of functionaldiagram, monostable and Astable operations and applications, Schmitt trigger, PLL -introduction, basic principle, phase detector/comparator, voltage-controlled oscillator (IC 566),low pass filter, monolithic PLL and applications of PLL.

UNIT - IV

Voltage Regulator: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723general purpose regulators, Switching Regulator.

D to A and A to D Converters: Introduction, basic DAC techniques - weighted resistor

DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters - parallel comparator type ADC,counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADCSpecifications.

UNIT - V

Digital ICs: CMOS Logic: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NORgates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any functionusing CMOS logic.

Combinational Circuits using TTL 74XX ICs: Study of logic gates using 74XX ICs,

Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7-segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer(IC74154).

Sequential Circuits using TTL 74XX ICs: Flip Flops (IC 7474, IC 7473), Shift Registers,

Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).

Textbooks:

1. D. Roy Choudhury, Shail B. Jain, “Linear Integrated Circuit”, 4th edition (2012), New Age International Pvt.Ltd., New Delhi, India
2. Ramakant A. Gayakwad, “OP-AMP and Linear Integrated Circuits”, 4th edition (2012),Prentice Hall / Pearson Education, New Delhi.
3. Floyd, Jain, “Digital Fundamentals”, 8th edition (2009), Pearson Education, New Delhi

Reference Books:

1. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi.
2. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits,Wiley International, NewDelhi.

Online Learning Resources:

1. https://nptel.ac.in/courses/108108111

2. https://nptel.ac.in/courses/108106069

Course Code	EMBEDDED SYSTEM DESIGN	L	T	P	C
20A50204c		3	0	0	3
Pre-requisite	Semester				

- Digital Logic Design
- Microprocessors/ Microcontrollers and Interfacing

Course Objectives:

- To teach the basics of an embedded system and RTOS.
- To introduce the typical components of an embedded system & different communication interfaces.
- To provide knowledge on the design process of embedded system applications

Course Outcomes (CO): At the end of this course, the students will be able to

- Identify hardware and software components of an embedded system
- Learn the basics of OS and RTOS
- Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment
- Design simple embedded system-based applications

UNIT - I

Introduction To Embedded Systems: History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

UNIT - II

Typical Embedded System: Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.

UNIT - III

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM.

UNIT - IV

Embedded Firmware Design and Development:

Embedded firmware design approaches-super loop-based approach, operating system-based approach; embedded firmware development languages-assembly language-based development, high level language-based development.

UNIT - V

RTOS Based Embedded System Design: Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques

Textbooks:

1. Introduction to Embedded Systems - Shibu KV, Mc Graw Hill Education.
2. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).

Reference Books:

1. Embedded System Design -frank vahid, tony grivargis, john Wiley.
2. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012.
3. Embedded Systems – Raj Kamal, TMH

Online Learning Resources:

Open Elective Course -I

Course Code	**ELECTRIC VEHICLE ENGINEERING (OE-I) Common to All Branches**		**L**	**T**	**P**	**C**
20A50205			**3**	**0**	**0**	**3**
Pre-requisite	AC & DC Machines	**Semester**	**V**			
Course Objectives: The student will be able to:						
• Understand latest trends in Electric Vehicles; parameters used in EV and types of EVs. • Analyze various energy sources available to run EV like batteries, fuels cells etc. • Analyze the dynamics and the propulsion system used in EVs, working of fuel cells, battery charging concept. • Design a electromechanical system using various control techniques.						
Course Outcomes (CO): At the end of the course, the student will be able to:						
CO1: Understand the difference between conventional and latest trends in Electric Vehicles; understand the various parameters used in EV, types of HEVs.						

CO2: Analyze various energy sources available to run EV like batteries, fuels cells etc.

CO3: Analyze the propulsion system of EV, its dynamics and the concept of battery charging.

CO4: Design EV system with battery charger using various fundamental concepts.

UNIT - I	**INTRODUCTION TO EV SYSTEMS AND PARAMETERS**	**Lecture Hrs: 10**

Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

UNIT - II	**EV AND ENERGY SOURCES**	**Lecture Hrs: 08**

Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems

UNIT - III	**EV PROPULSION AND DYNAMICS**	**Lecture Hrs: 10**

Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration.

UNIT - IV	**FUEL CELLS**	**Lecture Hrs: 10**

Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples

UNIT - V	**BATTERY CHARGING AND VEHICLE CONTROL**	**Lecture Hrs: 10**

Battery charging: Battery Chemistry, Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Battery Management System: Introduction and BMS functionality, Battery pack topology, Voltage, Temperature and Current Sensing.

Control: Introduction, modelling of electro mechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle

Textbooks:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Reference Books:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005.
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015.
3. Tom Denton, "Electric and Hybrid Vehicles", TAYLOR & FRANCIS; 2nd edition, CBS PUBLISHERS, 2^{nd} Edition, 2020.
4. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.
5. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

Course Code	CONTROL SYSTEMS LAB		L	T	P	C
20A50206			**0**	**0**	**3**	**1.5**
		Semester	**V**			

Course Objectives: To make the students learn about:

- Determinations of transfer function of various systems and control of it by different methodologies.
- To provide knowledge in the design and analysis of controllers and compensators.
- The characteristics of servo mechanisms which are helpful in automatic control systems.
- To know the stability analysis using MATLAB.

Course Outcomes (CO): After completing the course, the student should be able to:

CO1: Understand the basic concept of feedback control and transfer function of DC servo motor and AC Servo motor, P, PD, PI, PID Controller and Compensators.
CO2: Analysis of control system stability using soft tools.
CO3: Apply programmable logic controllers to demonstrate industrial controls in the laboratory.
CO4: Demonstrate the time domain and frequency domain analysis for linear time invariant systems.

List of Experiments:

1. Time response of Second order system.
2. Characteristics of Synchros.
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor.
5. Transfer function of DC Machine.
6. Effect of P, PD, PI, PID Controller on a second order system.
7. Lag and lead compensation – Magnitude and phase plot.
8. Temperature controller using PID.
9. Characteristics of magnetic amplifiers.
10. Characteristics of AC servo motor.
11. Simulation of Op-Amp based Integrator and Differentiator circuits.
12. Linear system analysis (Time domain analysis, Error analysis) using Soft Tools.
13. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using Soft Tools.
14. State space model for classical transfer function using Soft Tools – Verification.
15. P, PI and PID Controller design for Temperature Control using Soft Tools.

References:

1. Simulation of Electrical and electronics Circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

Online Learning Resources/Virtual Labs:

1. http://iitb.vlab.co.in/?sub=8&brch=117

Course Code	DIGITAL COMPUTING PLATFORMS LAB		L	T	P	C
20A50207			**0**	**0**	**3**	**1.5**
		Semester	**VI**			

Course Objectives: To make the students learn about:

- Write Assembly language programming on 8086 Microprocessors
- To Interface various devices with 8086
- To develop MASAM Programming
- For Interfacing of 8051 Microcontroller with its peripheral devices.

Course Outcomes (CO): After completing the course, the student should be able to:

CO 1 Understand the basic concepts to write assembly language programming on 8086 Microprocessors.
CO 2 Analyze various device configurations and Interfacing of various devices with 8086.
CO 3 Apply the basic concepts to write programming on 8051 Microcontroller.
CO 4 Design various Interfacing circuitry with 8051 Microcontroller with its peripheral devices

List of Experiments:

1. Programs for 16 bit arithmetic operations for 8086 (using various addressing modes).
2. Program for sorting an array for 8086
3. Program for searching for a number or character in a string for 8086
4. Program for String manipulations for 8086
5. Interfacing ADC and DAC to 8086.
6. Parallel communication between two microprocessors using 8255.
7. Serial communication between two microprocessor kits using 8251.
8. Interfacing to 8086 and programming to control stepper motor.
9. Programming using arithmetic, logical and bit manipulation instructions of 8051
10. Program and verify Timer/Counter in 8051.
11. Program and verify interrupt handling in 8051.
12. UART operation in 8051.
13. Communication between 8051 kit and PC.
14. Interfacing LCD to 8051.
15. Interfacing matrix or keyboard to 8051.

References:

1. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw-Hill Publications, 3rd Edition, 2013.
2. Microprocessor and Interfacing by Douglas V Hall, 2nd Edition, Tata McGraw hill, 1992
3. Microprocessors and Microcontrollers Lab Manual: 8086 & 8051 by Srinivasa Murthy, Kindle Edition.

Online Learning Resources/Virtual Labs:

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Skill Oriented Course- III

Course Code	**Soft Skills**		**L**	**T**	**P**
20A55502	**Common to EEE, ECE, CSE**		**1**	**0**	**2**
Pre-requisite		**Semester v**			

Course Objectives:

- ➢ To encourage all round development of the students by focusing on soft skills
- ➢ To make the students aware of critical thinking and problem-solving skills
- ➢ To develop leadership skills and organizational skills through group activities
- ➢ To function effectively with heterogeneous teams

Course Outcomes (CO):

By the end of the program students should be able to

- Define various elements of effective communicative skills
- Understanding people using emotional intelligence
- apply critical thinking skills in problem solving
- analyse the needs of an organization for team building
- Assess the situation and take necessary decisions as a leader
- Creating a productive work place atmosphere using social and work-life skills ensuring personal and emotional well-being

UNIT – I	**Soft Skills & Communication Skills**	Lecture Hrs

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Inter personal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leade presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify nor verbal clues and remedy the lapses on observation

UNIT – II	**Critical Thinking**	Lecture Hrs
Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking **Activities** : Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others Case Study, Story Analysis		
UNIT – III	**Problem Solving & Decision Making**	Lecture Hrs
Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles **Activities:** Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initia debate on the appropriateness of the decision. Case Study & Group Discussion		
UNIT – IV	**Emotional Intelligence & Stress Management**	Lecture Hrs
Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips **Activities**: Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, an confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates		
UNIT – V	**Leadership Skills**	Lecture Hrs
Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management **Activities** Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodatin nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making , Group discussion et **NOTE-:** 1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdote epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill. 2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.		

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra BarunK.)Publisher : Oxford Universit Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha KapoorPublisher : I K International Publishing House; 0 edition (February 28, 2018)

1. Reference Books: **Soft skills: personality development for life success by prashantsharma, BPB publications 2018.**
2. **Soft Skills By Alex K. Published by S.Chand**
3. **Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeeth Sharma Published by Wiley.**
4. **Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books**
5. **SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press**
6. **Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher : Vayu Education C India**

Online Learning Resources:

1. **https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q**
2. **https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ**
3. **https://youtu.be/-Y-R9hDl7lU**
4. **https://youtu.be/gkLsn4ddmTs**
5. **https://youtu.be/2bf9K2rRWwo**
6. **https://youtu.be/FchfE3c2jzc**

Common to EEE, ECE, CSE

INTELLECTUAL PROPERTY RIGHTS & PATENTS

Course Code	**L**	**T**	**P**	**C**
20A69901	**2**	**0**	**0**	**0**

Course Objectives:·

1. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
2. To help them in knowing the significance of real life practice and procedure of Patents.
3. To make the students to understand the statutory provisions of different forms of IPRs in simple forms.
4. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks
5. To enable the students to keep their IP rights alive.

Course Outcomes: On successful completion of this course, the students will be able to:

CO1:Identify different types of intellectual properties (IPS), the right of ownership, scope of protection
CO2: Understand and defining various types of intellectual properties and their roles in contributing to organizational competitiveness.
CO3: Apply statutory provisions to protect particular form of IPRs.
CO 4: Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc.
CO:5 Evaluate different forms of IPR available at national & international level
CO:6 Develop skill of making search of various of forms of IPR by using modern tools and techniques.

SYLLABUS

UNIT – I:
Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II:
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT – III:
Patents: Introduction to Patents – Laws Relating to Patents in India – Patent Requirements,Patent Registration and Granting of Patent – Exclusive Rights – Limitations – Ownership and Transfer –

– Revocation of Patent. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT – IV:
Trade Secrets: New developments in Patents – Software Protection and Computer related Innovations Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secrets litigation.Unfair competition: Misappropriation - Right of publicity, False advertising.

UNIT – V:
New development of intellectual property: New developments in trade mark law: copy right law, patent law, intellectual property audits.
International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

Textbooks:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013
2. P.Naryan, “Intellectual Property Law”, 3rd Ed ,Eastern Law House, 2007.

Reference Books:

R.Myneni, Law of Intellectual Property”, 9th Ed, Asia law House, 2019.
PrabuddhaGganguli, ,Intellectual Property Rights Tata Mcgraw Hill, 2001

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">POWER SYSTEM ANALYSIS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A60201</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Power System Architecture</td><td>Semester</td><td colspan="4">VI</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">To make the students learn about:
• The Use of per unit Values and Graph Theory Concepts, Solving a Problem using Computer.
• Formation of Y_{bus} And Z_{bus} of a Power System Network, Power Flow Studies by Various Methods.
• Different Types of Faults and Power System Analysis for Symmetrical and also Unsymmetrical Faults.
• Analysis of Power System for Steady State and Transient Stability and also Methods to Improve Stability</td></tr>
<tr><td colspan="7">Course Outcomes (CO):</td></tr>
<tr><td colspan="7">After completing the course, the student should be able to do the following:
CO 1 Remember and Understand the Concepts of per unit Values, Y_{Bus} And Z_{Bus} Formation, Load Flow Studies, Symmetrical and Unsymmetrical Fault Calculations.
CO 2 Apply the Concepts of Good Algorithm for the Given Power System Network and Obtain the Converged Load Flow Solution and Experiment Some of these Methods using Modern Tools and Examine the Results.
CO 3 Analyse the Symmetrical Faults and Unsymmetrical Faults and Done the Fault Calculations, Analyse the Stability of the System and Improve the Stability. Demonstrate the use of these Techniques through Good Communication Skills.
CO 4 Develop Accurate Algorithms for Different Networks and Determine Load Flow Studies and Zero, Positive and Negative Sequence Impedances to Find Fault Calculations.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">PER UNIT SYSTEM AND FORMATION OF Y_{bus}</td><td colspan="4">Lecture Hrs: 8</td></tr>
<tr><td colspan="7">Per-Unit Representation of Power System Elements - per-unit Equivalent Reactance Network of a Three Phase Power System - Graph Theory: Definitions, Bus Incidence Matrix, Y_{bus} Formation by Direct And Singular Transformation Methods, Numerical Problems.</td></tr>
<tr><td>UNIT - II</td><td colspan="2">FORMATION OF Z_{bus}</td><td colspan="4">Lecture Hrs: 10</td></tr>
</table>

Partial Network, Algorithm for the Modification of Z_{bus} Matrix for Addition Element for the Following Cases: Addition of Element from a New Bus to Reference, Addition of Element from a New Bus to an Old Bus, Addition of Element Between an Old Bus to Reference and Addition of Element Between Two Old Buses - Modification of Z_{bus} for the Changes in Network (Problems)		
UNIT - III	**POWER FLOW ANALYSIS**	Lecture Hrs: 10
Static Load Flow Equations – Load Flow Solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load Flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods.		
UNIT - IV	SHORT CIRCUIT ANALYSIS	Lecture Hrs: 10
Short Circuit Current and MVA Calculations, Selection of Ratings of Protective Equipments - Circuit Breaker, Fault Levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero Sequence Components, Positive, Negative and Zero Sequence Networks. Symmetrical Fault Analysis: LLLG Faults with and without Fault Impedance, Unsymmetrical Fault Analysis: LG, LL and LLG Faults with and without Fault Impedance, Numerical Problems.		
UNIT - V	STABILITY ANALYSIS	Lecture Hrs: 10
Elementary Concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical Methods for Solution of Swing Equation - Methods to Improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.		
Textbooks:		
1. Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006. 2. Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.		
Reference Books:		
1. Power System Analysis by Grainger and Stevenson, McGraw Hill, 1994. 2. Power System Analysis by Hadi Saadat, McGraw Hill, 1998. 3. Power System Analysis and Design by B.R.Gupta, S. Chand & Company, 2005.		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee120/preview		

Course Code	MEASUREMENTS & SENSORS		L	T	P	C
20A60202			**3**	**0**	**0**	**3**
Pre-requisite		**Semester**	**VI**			

Course Objectives: To make the students learn about:

- The basic principles of different types of electrical instruments for the measurement of voltage, current, power factor, power and energy.
- The measurements of RLC parameters using bridge principles.
- The principles of magnetic measurements
- The principle of working of CRO and its applications

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand the working of various instruments and equipment used for the measurement of various electrical engineering parameters like voltage, current, power, phase etc in industry as well as in power generation, transmission and distribution sectors

CO 2 Analyze and solve the varieties of problems and issues coming up in the vast field of electrical measurements.

CO 3 Analyse the different operation of extension range ammeters and voltmeters, DC and AC bridge for measurement of parameters and different characteristics of periodic and aperiodic signals using CRO.

CO 4 Design and development of various voltage and current measuring meters and the varieties of issues coming up in the field of electrical measurements.

UNIT - I	MEASURING INSTRUMENTS & DIGITAL METERS	Lecture Hrs: 8

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range – Numerical examples.

Digital Voltmeters-Successive Approximation, Ramp, and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer.

UNIT - II	MEASUREMENT OF POWER, POWER FACTOR AND ENERGY	Lecture Hrs: 10

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type – 1-ph and 3-ph Power factor Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and their Compensation, Three Phase Energy Meter – Numerical examples.

UNIT - III	*INSTRUEMENT TRANSFORMERS, POTENTIOMETERS, AND MAGNETIC MEASUREMENTS*	Lecture Hrs: 10

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations. DC Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications. Determination of B-H Loop Methods of Reversals - Six Point magnetic measurement Method – A.C. Testing – Iron Loss of Bar Samples –Numerical Examples		
UNIT - IV	***D.C & A.C BRIDGES***	Lecture Hrs: 10
Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge – Schering Bridge – Numerical Examples		
UNIT - V	***CRO AND SENSORS***	Lecture Hrs: 10
Cathode Ray Oscilloscope- Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase, Frequency, Current and Voltage-Lissajious Patterns. Capacitive and Inductive displacement sensors, Electromagnetism in sensing, Flow, Level sensors, Position and Motion sensors, Pressure sensors and Temperature sensors		
Textbooks:		
1. Electrical & Electronic Measurement & Instruments by A.K.SawhneyDhanpat Rai & Co. Publications, 2007. **2. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition, Reem Publications, 2011.**		
Reference Books:		
1. Electronic Instrumentation by H. S. Kalsi, Tata Mcgrawhill, 3rd Edition, 2011. 2. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, 2010. **3. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.** **4. Sensor Technology: Hand Book by Jon S. Wilson, ELSEVIER publications, 2005**		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee112/preview		

Course Code	DIGITAL SIGNAL PROCESSING		L	T	P	C
20A60203			3	0	0	3
Pre-requisite	Mathematics and Signals & Systems	Semester	VI			

Course Objectives: To make the students learn about:

- Understanding the fundamental characteristics of signals and systems.
- Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling
- Knowledge of frequency-domain representation and analysis concepts using Fourier Analysis tools, Z-transform
- Realization of FIR and IIR digital filters

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand different transformation techniques.

CO 2 Analyze the techniques, skills, and modern engineering tools necessary for analysis of different electrical signals and filtering out noise signals in engineering practice.

CO 3 Apply Fourier transform to analyse the operations on signals and acquire knowledge about Systems.

CO 4 Design FIR Digital Filters Using Window Techniques.

UNIT - I	INTRODUCTION TO DIGITAL SIGNAL PROCESSING	Lecture Hrs: 8

Discrete Time Signals and Sequences, Linear Shift Invariant Systems, Stability and Causality, Linear Constant Coefficient Difference Equations. Frequency Domain Representation of Discrete Time Signals and Systems.

UNIT - II	DISCRETE FOURIER SERIES AND FAST FOURIER TRANSFORMS	Lecture Hrs: 10

Properties of Discrete Fourier Series, DFS Representation of Periodic Sequences, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences Using DFT, Computation of DFT. Relation between Z-Transform and DFS, Fast Fourier Transforms (FFT)-Radix2 Decimation in Time and Decimation in Frequency FFT Algorithms, Inverse FFT and FFT for Composite N.

UNIT - III	REALIZATION OF DIGITAL FILTERS	Lecture Hrs: 10

Z-Transforms: Concept, Properties, Region of Convergence, and Applications; Solution of Difference Equations of Digital Filters, Block Diagram Representation of Linear Constant Coefficient Difference Equations, Basic Structures of IIR Systems, Transposed Forms, Basic Structures of FIR Systems, System Function.

UNIT - IV	IIR AND FIR DIGITAL FILTERS	Lecture Hrs: 10

Analog Filter Approximations-Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Design Examples: Analog-Digital Transformations, Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Digital Filters Using Window Techniques, Frequency Sampling Technique, Comparison of IIR and FIR Filters, Illustrative Problems.

UNIT - V	**MULTIRATE DIGITAL SIGNAL PROCESSING**	Lecture Hrs: 10
Basic Sample Rate Alteration Devices, Multirate Structures for Sampling Rate Converters, Multistage Design of Decimator and Interpolator, Polyphase Decomposition, Nyquist Filters. Spectral Analysis of Nonstationary Signals, Musical Sound Processing, Signal Compression, Transmultiplexers, Discrete Multitone Transmission of Digital Data.		
Textbooks:		
1. Digital signal processing, principles, Algorithms and applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 2007. **2. Digital signal processing , A computer base approach- Sanjit K Mitra, Tata McGraw Hill, 3rd edition, 2009.**		
Reference Books:		
1. Signals - Discrete Time Signal Processing – Allan V Oppenheim and Systems, Pearson. **2. Digital signal processing: Andreas Antoniou, TATA McGraw Hill, 2006.** **3. A Text book on Digital Signal processing – R S Kaler, M Kulkarni, Umesh Gupta, I K International Publishing House Pvt. Ltd., 2009.**		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee99/preview 2. https://nptel.ac.in/courses/108105055		

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">SWITCHGEAR AND PROTECTION
(PE-II)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A60204a</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td></td><td>Semester</td><td colspan="4">VI</td></tr>
<tr><td colspan="7">Course Objectives: To make the students learn about:</td></tr>
<tr><td colspan="7">• To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
• The study of different Circuit Breakers and Relays
• The protection of Generators and Transformers
• The protection of various feeder bus bars from abnormal conditions and over voltages & importance on Neutral grounding for overall protection.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): After completing the course, the student should be able to do the following:</td></tr>
<tr><td colspan="7">CO 1 Understand the operation of different circuit breakers.
CO 2 Analyze the concepts of different relays which are used in real time power system operation.
CO 3 Apply various protective schemes for Transformers, Rotating machines, Bus bars, Feeders.
CO 4 Develop the practical applications of power system operation and planning.</td></tr>
<tr><td>UNIT – I</td><td colspan="2">CIRCUIT BREAKERS</td><td colspan="4">Lecture Hrs: 8</td></tr>
<tr><td colspan="7">Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Auto reclosures. Description and Operation of- Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.</td></tr>
<tr><td>UNIT – II</td><td colspan="2">ELECTROMAGNETIC, STATIC AND NUMERICAL RELAYS</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Basic Requirements of Relays – Primary and Backup protection - Construction details of – Attracted armature, balanced beam, inductor type and differential relays – Universal Torque equation – Characteristics of over current, Direction and distance relays. Static Relays – Advantages and Disadvantages – Definite time, Inverse and IDMT static relays – Comparators – Amplitude and Phase comparators. Microprocessor based relays – Advantages and Disadvantages – Block diagram for over current (Definite, Inverse and IDMT) and Distance Relays and their Flow Charts.</td></tr>
<tr><td>UNIT - III</td><td colspan="2">PROTECTION OF GENERATORS AND TRANSFORMERS</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Protection of generators: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on percentage winding unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CTs Ratio, Buchholtz relay Protection.</td></tr>
<tr><td>UNIT - IV</td><td colspan="2">PROTECTION OF FEEDERS, TRANSMISSION LINES AND BUSBARS</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Protection of Feeders (Radial & Ring main) using over current Relays. Protection of Transmission lines – 3 Zone protection using Distance Relays. Carrier current protection. Protection of Bus bars -Differential protection.</td></tr>
</table>

UNIT - V	PROTECTION AGAINST OVER VOLTAGES	Lecture Hrs: 10

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL. Neutral Grounding, Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.

Textbooks:

1. Switchgear and Protection – by Sunil S Rao, Khanna Publishers.
2. Power System Protection and Switchgear by Badari Ram, D.N Viswakarma, TMH Publications.

Reference Books:

1. Protective Relaying Principles and Applications – J Lewis Blackburn, CRC Press.
2. Numerical Protective Relays, Final Report 2004 – 1009704 EPRI, USA.
3. Protective Relaying Theory and Applications - Walter A Elmore, Marcel Dekker.
4. Transmission network Protection by Y.G. Paithankar, Taylor and Francis, 2009.
5. Power System Protection- P. M. Anderson, Wiley Publishers.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee101/preview

Course Code	NONLINEAR SYSTEM ANALYSIS (PE-II)		L	T	P	C
20A60204b			3	0	0	3
Pre-requisite	Control Systems	Semester	VI			

Course Objectives: The student will be able to:

- Learn linear and nonlinear systems, overview of system analysis and Stability.
- Know Lyaponov stability functions to nonlinear systems.
- Understand the systems with Lyapunov stability theorems.
- Know about applications of nonlinear systems such as flight control, magnetic levitation and robotic manipulator.

Course Outcomes (CO): At the end of the course, the student will be able to:

CO1: Understand linear and nonlinear systems, describing function, overview of system analysis and Stability.

CO2: Apply Lyaponov functions to nonlinear systems.

CO3: Analyze the systems with Lyapunov stability theorem and Popov's stability criterion.

CO4: Design of nonlinear systems such as the ball and beam, flight control, magnetic levitation and robotic manipulator.

UNIT - I	SYSTEM NONLINEARITIES	Lecture Hrs: 10

Linear versus nonlinear systems - Describing function analysis: Fundamentals- common nonlinearities (saturation, dead – zone- on - off non – linearity- backlash- hysteresis) and their describing functions.

UNIT - II	DESCRIBING FUNCTION	Lecture Hrs: 10

Describing function analysis of nonlinear systems- - Phase plane analysis: Phase portraits-Singular points characterization- Analysis of non - linear systems using phase plane techniques-Existence of limit cycles.

UNIT - III	CONCEPT OF STABILITY AND THEOREMS	Lecture Hrs: 10

Concept of stability-Zero - input and BIBO stability- stability in the sense of Lyapunov and absolute stability- Lyapunov stability definitions-First method of Lyapunov- Second (or direct) method of Lyapunov stability theory for continuous and discrete time systems- Aids to generate Lyapunov function – Krasovskii's theorem.

UNIT - IV	*STABILITY ANALYSIS*	Lecture Hrs: 10

Aizerman's and Kalman's conjecture-Construction of Lyapunov function - Methods of Aizerman-Zubov- Variable gradient method- Lure problem. Popov's stability criterion- generalized circle criterion- Kalman - Yakubovich - Popov Lemma- Popov's hyper stability theorem.

UNIT - V	*APPLICATIONS OF NON-LINEAR CONTROLLER*	Lecture Hrs: 9

Concept of variable - structure controller and Basic feedback stabilization, Integrator Backstepping. Backstepping: More General Cases - reaching condition and reaching mode-Some design examples of nonlinear systems such as the ball and beam-flight control-magnetic levitation and robotic manipulator etc.

Textbooks:

1. J. E. Slotine and Weiping LI, Applied Nonlinear Control, Prentice Hall.
2. Hassan K. Khalil, Nonlinear Systems, Pearson India, Third Edition, 2014.

Reference Books:
1. Haracio J Marquez, Nonlinear Control Systems: Analysis and Design, John Wiley 1st Edition, 2002 2. Sankar Sastry, Nonlinear Systems Analysis, Stability and Control. 3. M. Vidyasagar, Nonlinear Systems Analysis, Prentice - Hall International editions,1993. 4. A. Isidori, Non linear Control Systems, Third Edition, Springer, 1999. 5. I. J. Nagrath and M. Gopal, Control Systems Engineering, New Age International (P) Limited Publishers, 5th edition, 2007. 6. B.N. sarkar, Advanced Control Systems, PHI Learning Pvt. Ltd., 2013.
Online Learning Resources:
https://nptel.ac.in/courses/108/102/108102113/

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">DESIGN OF PHOTOVOLTAIC SYSTEMS
(PE-II)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A60204c</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Electrical Circuits</td><td>Semester</td><td colspan="4">VI</td></tr>
</table>

Course Objectives: To get the student learn about:

- Basics of PV Cell and its Equivalent Circuit, Fill Factor and PV Cell Simulation.
- Energy Estimation and costing, Other Energy Storage Methods and PV System Design.
- Maximum Power Point Tracking, PV and DC-DC Interface and MPPT for Non-Resistive Loads.
- PV Interfacing and PV Models and Annual Payment and Present Worth Factor.

Course Outcomes (CO): The student will be able to:

CO 1 Understand the basic concepts of PV Cells
CO 2 Analyze the principles of Energy estimation and Sizing
CO 3 Apply the techniques of MPPT to obtain maximum power tracking
CO 4 Design of PV system and its interfacing with grid.

UNIT - I	**PV CELL**	Lecture Hrs: 10

A Historical Perspective, PV Cell Characteristics and Equivalent Circuit, Model of PV Cell, Short Circuit, Open Circuit and Peak Power Parameters, Datasheet Study, Cell Efficiency, Effect of Temperature, Temperature Effect Calculation Example, Fill Factor, PV Cell Simulation, Series and Parallel Interconnection

UNIT – II	**ENERGY ESTIMATION AND SIZING PV**	Lecture Hrs: 10

Energy from Sun, Insolation and Irradiance, Insolation Variation with Time Delay, Solar Geometry, Insolation On a Horizontal Flat Plate, Sunrise and Sunset Hour Angles, Energy Plots in Octave, Atmospheric Effects, Air Mass, Clearness Index, Sizing PV for Applications without Batteries, Examples, Batteries: Introduction, Capacity, C-Rate, Efficiency, Energy and Power Densities, Battery Selection, Other Energy Storage Methods, PV System Design.

UNIT – III	**MAXIMUM POWER POINT TRACKING**	Lecture Hrs: 10

MPPT Concept, Input Impedance of DC-DC Converters – Boost Converter, Buck Converter, Buck-Boost Converter, PV Module in SPICE, Simulation – PV and DC-DC Interface, Impedance Control Methods-Voltage Scaling, Current Scaling, Sampling Method, Power Slope Method 1, Power Slope Method 2, Hill Climbing Method, Practical Points – Housekeeping Power Supply, Gate Driver, MPPT for Non-Resistive Loads, Simulation.

UNIT – IV	***PV-BATTERY INTERFACE***	Lecture Hrs: 10

Direct PV-Battery Connection, Charge Controller, Battery Charger – Understanding Current Control, Slope Compensation, Simulation of Current Control, Batteries in Series – Charge Equalization, Batteries in Parallel Peltier Device – Principle, Peltier Element – Datasheet, Peltier Cooling, Thermal Aspects- Conduction, Convection, A Peltier Refrigeration Example, Radiation and Mass Transport, Demo of Peltier Cooling, PV and Water Pumping

UNIT – V	***PV AND GRID INTERFACE***	Lecture Hrs: 8
Grid Connection Principle, PV to Grid Topologies, 3ph D-Q Controlled Grid Connection-Introduction, dq-Axis Theory, AC to DC Transformation, DC to AC Transformation, Complete 3ph Grid Connection, 1ph D-Q Controlled Grid Connection, 3ph PV-Grid Interface Example, SVPWM – Discrete Implementation, Analog Implementation, Application of Integrated Magnetics, Life Cycle Costing Growth Models, Examples, Annual Payment and Present Worth Factor, Examples		

Textbooks:

1. Design of Photovoltaic Systems by L. Umanand
2. Chenming, H. and White, R.M., "Solar Cells from B to Advanced Systems", McGraw Hill Book Co, 1983

Reference Books:

1. Ruschenbach, HS, Reinhold, "Solar Cell Array Design Hand Varmostrand", NY, 1980
2. Dr. Sundaravadivelu S, Mr. Suresh R. Norman, Dr. Johnsi Stella I, Dr. Suresh Kumar A, ' Solar photo voltaic Power Systems", Notion press.
3. Suneel Deambi, Photovoltaic System Design, CRC Press 2020.

Online Learning Resources:

https://nptel.ac.in/courses/117108141
https://swayam.gov.in/nd1_noc20_ee57/preview

Open Elective Course -II

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">RENEWABLE ENERGY SYSTEMS
(OE-II) Common to All Branches</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A60205</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td></td><td>Semester</td><td colspan="4">VI</td></tr>
</table>

Course Objectives: To make the students learn about:

- Various sources of Energy and the need of Renewable Energy Systems.
- The concepts of Solar Radiation, Wind energy and its applications.
- Operation of Solar thermal and solar PV systems
- The concept of geo thermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

Course Outcomes (CO): At the end of the course the student will be able to:

CO 1 Understand various alternate sources of energy for different suitable application requirements.
CO 2 Analyze the concepts of solar energy generation strategies and wind energy system
CO 3 Design Solar and Wind energy systems.
CO 4 Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power.

UNIT - I	**SOLAR ENERGY**	Lecture Hrs: 10

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT - II	**PV ENERGY SYSTEMS**	Lecture Hrs: 10

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

UNIT - III	**WIND ENERGY**	Lecture Hrs: 10

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

UNIT - IV	**GEOTHERMAL ENERGY**	Lecture Hrs: 8

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT - V	**MISCELLANEOUS ENERGY TECHNOLOGIES**	Lecture Hrs: 10

Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.
Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration
Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Text books:

1. Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.
2. G. D. Rai, "Non-Conventional Energy Sources", 4^{th} Edition, Khanna Publishers, 2000.

Reference Books:

1. S. P. Sukhatme, "Solar Energy",3^{rd} Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
2. B H Khan , " Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
3. S. Hasan Saeed and D.K.Sharma,"Non-Conventional Energy Resources",3^{rd} Edition, S.K.Kataria& Sons, 2012.
4. G. N. Tiwari and M.K.Ghosal, "Renewable Energy Resource: Basic Principles and Applications", Narosa Publishing House, 2004.

Online Learning Resources:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

Course Code	POWER SYSTEMS LAB		L	T	P	C
20A60206			0	0	3	1.5
		Semester	VI			

Course Objectives: To make the students learn about:

- To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of subtransientreactances.
- To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
- To develop the MATLAB program for formation of Y and Z buses. To develop the MATLAB programs for Gauss-Seidel and fast decoupled load flow studies.
- To develop the SIMULINK model for single area load frequency problem.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand practical knowledge on calculation of sequence impedance, fault currents, voltages and sub transient reactance's.
CO 2 Analyze how to draw the equivalent circuit of three winding transformer.
CO 3 Develop a MATLAB program for formation of Y and Z buses, Gauss-Seidel and Fast Decouple Load Flow studies.
CO 4 Design of Simulink models for load frequency control problems.

List of Experiments:

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
2. Determination of Sequence Impedances of salient pole Synchronous Machine
3. LG Fault Analysis on an un loaded alternator
4. LL Fault Analysis on conventional phases
5. LLG Fault Analysis
6. LLLG Fault Analysis
7. Determination of Sub transient reactance of salient pole synchronous machine
8. Equivalent circuit of three winding transformer.
9. Y_{Bus} formation using Soft Tools
10. Z_{Bus} formation using Soft Tools
11. Gauss-Seidel load flow analysis using Soft Tools
12. Newton-Raphson load flow analysis using Soft Tools
13. Fast decoupled load flow analysis using Soft Tools
14. Solve the Swing equation and Plot the swing curve
15. Develop a model for a uncontrolled single area load frequency control problem and simulate the same using Soft Tools.
16. Develop a model for PI controlled single area load frequency control problem and simulate the same using Soft Tools.
17. Develop a model for a uncontrolled two area load frequency control problem and

simulate the same using Soft Tools. 18. Develop a model for PI controlled two area load frequency control problem and simulate the same using Soft Tools.
References:
1. Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006. 2. Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.
Online Learning Resources/Virtual Labs:
https://www.ee.iitb.ac.in/~vlabsync/template/vlab/index.html#

Course Code	MEASUREMENTS AND SENSORS LAB		L	T	P	C
20A60207			0	0	3	1.5
		Semester	VI			

Course Objectives: To make the students learn about:

- Calibration of various electrical measuring instruments
- Accurate determination of inductance and capacitance using AC Bridges
- Measurement of coefficient of coupling between two coupled coils
- Measurement of resistance for different range of resistors using bridges

Course Outcomes (CO): At the end of the course, the student will be able to:

CO 1 Understand various electrical measuring instruments.
CO 2 Analyze and determine the values of inductance and capacitance using AC bridges
CO 3 Compute the coefficient of coupling between two coupled coils.
CO 4 Determine the values of very low resistances using various bridges.

List of Experiments:

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and voltmeter
4. Kelvin's double Bridge – Measurement of low resistance – Determination of Tolerance
5. Determination of Coefficient of coupling between two mutually coupled coils
6. Determination of Capacitance using Schering Bridge
7. Determination of Inductance using Anderson bridge
8. Measurement of 3-phase reactive power with single-phase wattmeter
9. Measurement of parameters of a choke coil using 3-voltmeter and 3-ammeter methods
10. Determination of Inductance using Maxwell's bridge
11. Determination of Capacitance using DeSauty bridge
12. Calibration of LPF wattmeter – by Phantom loading
13. Wheatstone bridge – measurement of medium resistances
14. LVDT and capacitance pickup – characteristics and Calibration
15. Resistance strain gauge – strain measurement and Calibration
16. Transformer turns ratio measurement using AC Bridge
17. AC Potentiometer – Calibration of AC Voltmeter, Parameters of Choke coil

References:

1. **Electronic Instrumentation by H. S. Kalsi, Tata Mcgrawhill, 3rd Edition, 2011.**
2. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, 2010.
3. **Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.**
4. **Sensor Technology: Hand Book by Jon S. Wilson, ELSEVIER publications, 2005**

Online Learning Resources/Virtual Labs:

1. http://vlabs.iitkgp.ernet.in/asnm/#

Course Code	DIGITAL SIGNAL PROCESSING LAB		L	T	P	C
20A60208			**0**	**0**	**3**	**1.5**
		Semester	**VI**			

Course Objectives: To make the students learn about:

- Implement the processing techniques using the instructions of DSP Processor.
- Implement various filters using MATLAB Programming.
- Learn about discrete time systems and filters.
- Know about designing and implementation of various filters.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand Programming concepts to implement various digital filters.
CO 2 Analyze Generation of signals and their processing.
CO 3 Apply digital signal processing techniques to design discrete time systems and digital filters.
CO 4 Develop algorithms for designing and implementation of FIR and IIR filters.

List of Experiments:

1. Linear and circular convolution of two sequences using DSP Processor
2. Sampling and effect of aliasing using DSP Processor
3. Design of FIR filters using DSP Processor
4. Design of IIR filters using DSP Processor
5. Calculation of FFT of a signal using DSP Processor
6. Decimation by polyphase decomposition using DSP Processor
7. Implementation of Linear and Circular Convolution using soft tools.
8. Sampling of input signal and display using soft tools.
9. Waveform generation using soft tools.
10. Implementation of FIR filter using soft tools
11. Implementation of IIR filter using soft tools
12. FFT analysis using soft tools

References:

1. Digital Signal Processing: Alon V. Oppenhelm, PHI
2. Digital Signal processing(II-Edition): S.K. Mitra, TMH

Online Learning Resources/Virtual Labs:

1. http://vlabs.iitkgp.ac.in/dsp/#

Course Code	APPLICATIONS OF SOFT COMPUTING TOOLS IN ELECTRICAL ENGINEERING		L	T	P	C
20A60209			1	0	2	2
		Semester	VI			

Course Objectives: To make the students learn about:

1. Basic concepts of Electrical Engineering and tools.
2. The concepts to design various models in MATLAB.
3. Various Electrical engineering applications through MATLAB.
4. Designing various models in MATLAB enviroment.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand the basic concepts of Electrical Engineering.

CO 2 Apply the concepts to design MATLAB models.

CO 3 Analyse various Electrical engineering applications through MATLAB.

CO 4 Develop real time models using MATLAB.

List of Experiments:

Theory:

MATLAB-Introduction, different tool boxes, creation of program files, creation of simulink files, GUI, commonly used blocks, Simpower system toolbox, control system toolbox, Sim Drive lines, Creation of functions, Project implementation through MATLAB

List of Experiments:

1. Transient analysis of given electrical network
2. Simulation of 1-phase and 3-phase transformers
3. Study of the dynamics of second order system
4. Implementation of buck and boost dc-dc converters
5. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
6. Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters
7. Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional method
8. Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)
9. Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)
10. Fault studies using Z_{bus} matrix
11. Design of virtual PMU
12. Wide area control of Two area Kundur system

References:

1. **Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006.**
2. Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.
3. Power Electronics: Essentials and Applications by L. Umanand, Wiley, 2009.

Online Learning Resources/Virtual Labs:

1. **http://vem-iitg.vlabs.ac.in/**
2. **https://vp-dei.vlabs.ac.in/Dreamweaver/**

Subject Code	Title of the Subject	L	T	P	C
20A65901	**CONSTITUTION OF INDIA(Mandatory Non-Credit Course)**	2	0	0	0

Common to EEE, ECE,CSE

COURSE OBJECTIVES : The objective of this course is	
1	To Enable the student to understand the importance of constitution
2	To understand the structure of executive, legislature and judiciary
3	To understand philosophy of fundamental rights and duties
4	To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
5	To understand the central-state relation in financial and administrative control

Syllabus

UNIT-IIntroduction to Indian Constitution

Constitution -Meaning of the term - Indian Constitution- Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History and features of Indian constitution
- Learn about Preamble, Fundamental Rights and Duties

UNIT-II Union Government and its Administration

Structure of the Indian Union - Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

UNIT-III State Government and its Administration

Structure of the State Govt. - Governor - Role and Position -CM and Council of Ministers - State Secretariat- Organization Structure and Functions

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the structure of state government
- Analyze the role of Governor and Chief Minister
- Explain the role of State Secretariat
- Differentiate between structure and functions of state secretariat

UNIT-IV Local Administration

District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, ,ZillaParishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

LEARNING OUTCOMES: -After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration's role and importance
- Analyze the role of Mayor and elected representatives of Municipalities
- Learn about the role of Zilla Parishath block level organization

UNIT-V Election Commission

Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

LEARNING OUTCOMES: -After completion of this unit student will

- Know the role of Election Commission
- Contrast and compare the role of Chief Election commissioner and Commissionerate
- Analyze the role of state election commission
- Evaluate various commissions viz SC/ST/OBC and women

TEXT BOOKS

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt.Ltd.. New Delhi

2. Subash Kashyap, Indian Constitution, National Book Trust

REFERENCES:

1. J.A. Siwach, Dynamics of Indian Government & Politics,

2. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)

3. .J.C. Johari, Indian Government and Politics, Hans India

4. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

E-RESOURCES:

1.nptel.ac.in/courses/109104074/8
2.nptel.ac.in/courses/109104045/
3.nptel.ac.in/courses/101104065/
4.www.hss.iitb.ac.in/en/lecture-details
5.www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	State the historical background of the constitution making and its importance for building a democratic India.
CO2	Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
CO3	Demonstrate the value of the fundamental rights and duties for becoming good citizen of India.
CO4	Analyze the decentralization of power between central, state and local self-government
CO5	Appraise the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
CO6	Develop themselves as responsible citizens and pave way to build a democratic country.

Course Code	POWER SYSTEM OPERATION AND CONTROL (PE-III)		L	T	P	C
20A70201a			3	0	0	3
Pre-requisite		Semester	VII			

Course Objectives: To make the students learn about:

- To know about economic load dispatch problems with and without losses in Power Systems
- To distinguish between hydro-electric and thermal plants and coordination between them
- To understand about optimal power flow problems and solving using specified method
- To understand about Automatic Generation Control problems and solutions in Power Systems
- To understand necessity of reactive power control, compensation under no-load and load operation of transmission systems
- To understand about deregulation aspects in Power Systems

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand the concept of economic scheduling and automatic generation control.

CO 2 Analyze the coordination in hydro-thermal system and optimal power flow.

CO 3 Apply the compensation methods to control the reactive power and automatic generation control.

CO 4 Develop the techniques to find market power and transfer capabilities in power system deregulation.

UNIT - I	ECONOMIC OPERATION OF POWER SYSTEMS	Lecture Hrs: 10

Brief description about electrical power systems, introduction to power system operation and control, Characteristics of various steam units, combined cycle plants, cogeneration plants, Steam units economic dispatch problem with & without considering losses and its solutions, B Matrix loss formula – Numerical problems

UNIT - II	HYDRO-THERMAL COORDINATION AND OPTIMAL POWER FLOW	Lecture Hrs: 10

Hydro-thermal Coordination: Characteristics of various types of hydro-electric plants and their models, Introduction to hydro-thermal Coordination, Scheduling energy with hydro-thermal coordination, Short-term hydro-thermal scheduling.

Optimal Power Flow: Optimal power flow problem formulation for loss and cost minimisation,

Solution of optimal power flow problem using Newton's method and Linear Programming technique – Numerical problems		
UNIT - III	**AUTOMATIC GENERATION CONTROL**	Lecture Hrs: 10
Speed governing mechanism, modelling of speed governing mechanism, models of various types of thermal plants (first order), definitions of control area, Block diagram representation of an isolated power system, Automatic Load Frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system, Static response of two-area system – Numerical examples		
UNIT - IV	**REAL & REACTIVE POWER CONTROL**	Lecture Hrs: 10
Requirements in ac power transmission, factors affecting stability & voltage control, fundamental transmission line equation, surge impedance, Natural loading, uncompensated line on open circuit, uncompensated line under load, types of compensations on compensated transmission lines, passive and active compensators, uniformly distributed fixed and regulated shunt compensation, series compensation, compensation by sectioning – Numerical problems		
UNIT - V	**POWER SYSTEMS DEREGULATION**	Lecture Hrs: 8
Principle of economics, utility functions, power exchanges, electricity market models, market power indices, ancillary services, transmission and distribution charges, principles of transmission charges, transmission pricing methods, demand-side management, regulatory framework – Numerical problems		

Textbooks:

1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd edition, 1996.
2. Power System Engineering, D P Kothari and I J Nagrath, McGraw Hill Education India Pvt. Limited, Chennai, 3e, 2019.

Reference Books:

1. G. Srinivasan & S. Sivanagaraju, Power System Operation and Control, Pearson Education India, First Edition, 2009.
2. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2nd edition, 1983.
3. Reactive Power Control in Electric Systems, T J E Miller, John Wiley & Sons, New York, 1982.
4. K. Nisha, Power System Operation and Control, S.K. Kataria& Sons, 2014.
5. Uma Rao, Power System Operation and Control, Willey Publishers, 2012.

Online Learning Resources:

1. https://nptel.ac.in/courses/108104052
2. https://nptel.ac.in/courses/108101004

Course Code	SWITCHED MODE POWER CONVERTERS (PE-III)		L	T	P	C
20A70201b			3	0	0	3
Pre-requisite		**Semester**	**VII**			

Course Objectives:

- Understand the problems and to design of various DC-DC converters, advanced converters of SMPCs
- Evaluate the performance of resonant converters
- Analyze the performance characteristics of 1-ϕ and 3-ϕ inverters with single/multi levels, power conditioners, UPS and filters
- Design various applications of the above in Power Systems, EVE, Renewable Energy Systems, etc.

Course Outcomes (CO):

After completion of this course, student will be able to

CO1: Understand the basic concepts of DC-DC converters, DC-AC Converters, Resonant Converters and SMPCs.

CO2: Analyze the concepts of resonant converters and their classification, various types of multilevel inverters, power conditioners, UPS and filters.

CO3: Apply various modulation and harmonic elimination techniques over the converters.

CO4: Design inductor and transformer for various power electronic applications.

UNIT - I	DC-DC CONVERTERS	Lecture Hrs: 8

Principles of step-down and step-up converters – Analysis and state space modelling of Buck, Boost, Buck- Boost and Cuk converters – Numerical Examples

UNIT - II	SWITCHING MODE POWER CONVERTERS	Lecture Hrs: 10

Analysis and state space modelling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical Examples

UNIT - III	RESONANT CONVERTERS	Lecture Hrs: 10

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples

UNIT - IV	DC-AC CONVERTERS	Lecture Hrs: 10

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.		
UNIT - V	**POWER CONDITIONERS, UPS & FILTERS**	**Lecture Hrs: 10**
Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.		

Textbooks:

1. Power Electronics: Essentials and Applications by L. Umanand, Wiley, 2009
2. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
3. Course material on Switched Mode Power Conversion by V Ramanarayanan, Dept. of Electrical Engg. IISc. Bangalore.

Reference Books:

1. Philip T. Krein, "Elements of Power Electronics", Oxford University Press, 2012
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design, 3rd Edition, John Wiley and Sons, 2006
3. M.H. Rashid, Power Electronics circuits, devices and applications, 3rd Edition Prentice Hall of India New Delhi, 2007.
4. KengWu ,"Switched Mode Power Converters: Design and Analysis", Elseware academic press.
5. Dorin O. Neacsu, "Switching Power Converters Medium and High Power", CRC Press; 2nd edition, 2013.

Online Learning Resources:

1. https://nptel.ac.in/courses/108108036
2. https://nptel.ac.in/courses/108105180

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">ELECTRICAL & ELECTRONIC INSTRUMENTATION
(PE-III)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A70201c</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td></td><td>Semester</td><td colspan="4">VII</td></tr>
<tr><td colspan="7">Course Objectives: To make the students learn about:</td></tr>
<tr><td colspan="7">• Measuring system, Common errors, and Objectives of Measuring systems.
• Test signals and modulation phenomenon, Data acquisition system, various telemetry systems and various modulation systems.
• Measuring various meters and analysers.
• Basic transducers and their usage in various measurements.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): After completing the course, the student should be able to do the following:</td></tr>
<tr><td colspan="7">CO 1 Understand Measuring systems, error measurements, test signals, different types of data transmission and modulation techniques.
CO 2 Analyze various telemetry systems, basic operation of Data acquisition systems, measuring meters and signal analyzers.
CO 3 Apply Transducers and their measurement of electrical and non-electrical quantities in real time applications.
CO 4 Design various applications of the measuring instruments.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">INSTRUMENT ERRORS</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Measuring Systems, Objectives of Measuring Instruments, definition of terms-Spam & Range, Sensitivity, Threshold & Resolution, Accuracy, Precision & Reliability, Performance Characteristics - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical evaluation of measuring data – Numerical Problems</td></tr>
<tr><td>UNIT - II</td><td colspan="2">DATA TRANSMISSION AND TELEMETRY</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Signals and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation. Methods of Data Transmission – General Telemetry System. Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Acquisition Systems – Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram — Modern Digital DAS (Block Diagram).</td></tr>
<tr><td>UNIT - III</td><td colspan="2">SIGNAL ANALYZERS</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Wave Analyzers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters.</td></tr>
<tr><td>UNIT - IV</td><td colspan="2">TRANSDUCERS</td><td colspan="4">Lecture Hrs: 10</td></tr>
</table>

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor**,** Inductor andCapacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes.

UNIT - V	**MEASUREMENT OF NON-ELECTRICAL QUANTITIES**	Lecture Hrs: 8

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow, Liquid level

Textbooks:

1. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India,2004.
2. A course in Electrical and Electronic Measurements and Instrumentation, A.K.Sawhney, Dhanpat Rai & Co.,2012.

Reference Books:

1. Electronic Instrumentation-by H.S.Kalsi Tata MCGraw-Hill Edition, 3/e.,2010.
2. Modern Electronic Instrumentation and Measurement techniques – by A.DHelfrick and W.D.Cooper, Pearson/Prentice Hall of India.,1990.
3. Industrial Instrumentation – Principles and Design by T. R. Padmanabhan, Springer, 3rd re print, 2009.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee112/preview

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">ELECTRICAL DISTRIBUTION SYSTEM AUTOMATION
(PE-IV)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A70202a</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td></td><td>Semester</td><td colspan="4">VII</td></tr>
<tr><td colspan="7">Course Objectives: To make the students:</td></tr>
<tr><td colspan="7">

To know about fundamental aspects of distribution system, principle of distribution substations
To know about classification of various loads
To understand difference between conventional load flow studies of power system and distribution system load flow
To know about evaluation of voltage droop and power loss calculations, distribution automation and management system, SCADA

</td></tr>
<tr><td colspan="7">Course Outcomes (CO): After completing the course, the student should be able to do the following:</td></tr>
<tr><td colspan="7">CO 1 Understand basics of distribution systems and substations, modelling of various loads
CO 2 Analyze of load flow solutions in distribution system
CO 3 Apply the concepts of SCADA, Automation distribution system and management in real time problems.
CO 4 Evaluation of power loss and feeder cost.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">DISTRIBUTION SYSTEM FUNDAMENTALS</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Brief description about electrical power transmission and distribution systems, Different types of distribution sub-transmission systems, Substation bus schemes, Factors effecting the substation location, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors effecting the primary feeder loading.</td></tr>
<tr><td>UNIT - II</td><td colspan="2">DISTRIBUTION SYSTEM SUBSTATIONS AND LOADS</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Substations: Rating of a distribution substation for square and hexagonal shaped distribution substation service area, K constant, Radial feeder with uniformly and non-uniformly distributed loading. Benefits derived through optimal location of substations.

Classification of substations: Air insulated substations - Indoor & Outdoor substations: Substation layout showing the location of all the substation equipment – Gas Insulated Substation (GIS).

Loads: Various types of loads, Definitions of various terms related to system loading, detailed description of distribution transformer loading, feeder loading, Modelling of star and delta connected loads, two-phase and single-phase loads, shunt capacitors.</td></tr>
<tr><td>UNIT - III</td><td colspan="2">DISTRIBUTION SYSTEM LOAD FLOW</td><td colspan="4">Lecture Hrs: 10</td></tr>
</table>

Exact line segment model, Modified line model, approximate line segment model, Step-Voltage Regulators, Line drop compensator, Forward/Backward sweep distribution load flow algorithm – Numerical problems		
UNIT - IV	**VOLTAGE DROP AND POWER LOSS CALCULATION**	Lecture Hrs: 10
Analysis of non-three phase primary lines, concepts of four-wire multi-grounded common-neutral distribution system, Percent power loss calculation, Distribution feeder cost calculation methods, Capacitor installation types, types of three-phase capacitor-bank connections, Economic justification for capacitors – Numerical problems		
UNIT - V	**DISTRIBUTION AUTOMATION**	Lecture Hrs: 8
Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, outage management, decision support applications, substation automation, control feeder automation, database structures and interfaces. Standards: IEEE 1344, IEEE C37.118 (2005), IEEE Standard C37.111-1999 (COMTRADE), IEC61850 GOOSE		
Textbooks:		
1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002. 2. Electric Power Distribution System Engineering, TuranGonen, McGraw-Hill Inc., New Delhi, 1986.		
Reference Books:		
1. Control and automation of electrical power distribution systems, James Northcote-Green and Robert Wilson, CRC Press (Taylor & Francis), New York, 2007. 2. Biswarup Das, Power distribution Automation, IET publication, 2016. 3. Dr. M. K. Khedkar, Dr. G.M. Dhole, Electric Power Distribution Automation, Laxmi Publications, First edition, 2017.		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee126/preview		

Course Code	RESTRUCTUREDPOWERSYSTEMS (PE-IV)		L	T	P	C
20A70202b			3	0	0	3
Pre-requisite		Semester	VII			

Course Objectives: To make the student learn

- Basic concepts of therestructuringofpower industryandmarketmodels.
- About thefundamentalconceptsofcongestionmanagement, Transfer Capability issues and ancillary service management.
- The transmission cost allocation methods to evaluate the cost.
- The operational planning activities in different competitive environment.

Course Outcomes (CO): Student will be able to

CO1: Understandthedifferences betweentheconventionalpower systemoperationandtherestructuredone and basics concepts of market power, electricity pricing and competitive environment.

CO2: AnalyzetheconceptsofIndependent System Operator (ISO) and OpenAccessSame-TimeInformationSystem (OASIS).

CO3: Apply the methods to find Available Transfer Capability (ATC) and to allocate the Transmission cost.

CO4: Develop power marketsandmarketarchitecturalaspects and short time Price forecasting.

UNIT – I	KEYISSUESINELECTRICUTILITIES	Lecture Hrs: 9

Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange–Marketoperations– MarketPower–Standardcost–TransmissionPricing–Congestion Pricing –Management ofInter zonal/IntrazonalCongestion.

UNIT - II	OPENACCESSSAME-TIMEINFORMATIONSYSTEM(OASIS)&MARKETPOWER	Lecture Hrs: 8

Structure of OASIS – Posting of Information – Transfer capability on OASIS – Market Power:Introduction– Different typesof marketPower–MitigationofMarketPower– Examples.

UNIT - III	AVAILABLETRANSFERCAPABILITY(ATC) &ELECTRICITYPRICING	Lecture Hrs: 10

Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATCbased on power flow – Electricity Pricing: Introduction – Electricity Price Volatility ElectricityPrice Indexes – Challenges to Electricity Pricing –

Construction of Forward Price Curves –Short-time PriceForecasting.

UNIT - IV	POWERSYSTEMOPERATIONIN COMPETITIVEENVIRONMENT	Lecture Hrs: 9

Introduction – Operational Planning Activities of ISO – The ISO in Pool Markets – The ISO inBilateralMarkets– OperationalPlanningActivitiesofaGENCO.

UNIT - V	TRANSMISSION COST ALLOCATION METHODS &ANCILLARYSERVICESMANAGEMENT	Lecture Hrs: 10

Introduction –TransmissionCostAllocationMethods:PostageStampRateMethod – Contract PathMethod– MW-MileMethod– Unused TransmissionCapacity Method– MVA-Milemethod–Comparisonofcostallocationmethods – AncillaryServicesManagement:Introduction–Reactive Power as an Ancillary Service, a Review – Synchronous Generators as AncillaryService Providers.

Textbooks:

1. KankarBhattacharya, MathH.J.BollerandJaapE.Daalder, Operationof RestructuredPowerSystem,KulwerAcademicPublishers,1st Edition ,2001
2. MohammadShahidehpourandMuwaffaqAlomoush,RestructuredElectricalPowerSystems,MarcelDekker,Inc.,1st Edition ,2001.

Reference Books:

1. LoiLeiLai,PowerSystemRestructuring and Deregulation,John Wiley&SonsLtd.,England, 2001.
2. Pinni Srinivasa Varma, Sankar Velamuri, Power System Deregulation, Lambert Academic Publishing, First Edition, 2017.
3. P. Venkatesh, B. V. Manikandan, S.Charles Raja and A. Srinivasan, Electrical Power Systems Analysis Security and Deregulation, PHI Learning, 2012.
4. Dr. P. V. Rama Krishna, G. Srinivas and Dr. S.V. Padmavathi, Power System Deregulation, Namya press, 2014.

Online Learning Resources:

1. **https://nptel.ac.in/courses/108/101/108101005/**

<table>
<tr><td>Course Code</td><td rowspan="2" colspan="2">INTELLIGENT CONTROL TECHNIQUES
(PE-IV)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A70202c</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td></td><td>Semester</td><td colspan="4">VII</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:To make the students learn about:</td></tr>
<tr><td colspan="7">• To get exposed to a few Intelligent Control Techniques
• To learn about Artificial Neural Network based Estimators
• To learn about Fuzzy Logic Control System as one of the ICT
• To learn about a few evolutionary algorithms, implement the various ICTs for linear and non-linear systems as case studies</td></tr>
<tr><td colspan="7">Course Outcomes (CO):After completing the course, the student should be able to do the following:</td></tr>
<tr><td colspan="7">CO 1 Understand various Intelligent Control Techniques
CO 2 Design the controllers and estimators using ANN and Fuzzy Logic
CO 3 Apply Evolutionary algorithms suitable to optimize and design a given system specifications
CO 4 Develop various ICTs for system modeling, control schemes and to design estimators using MATLAB.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">FUNDAMENTALS OF AI</td><td colspan="4">Lecture Hrs: 8</td></tr>
<tr><td colspan="7">AI trend in Engineering applications, Need for AI, Approaches to intelligent control; Architectures for intelligent control; Symbolic reasoning system; rule-based systems; Knowledge representation; Expert systems.</td></tr>
<tr><td>UNIT - II</td><td colspan="2">ANN BASED CONTROLLERS AND ESTIMATORS</td><td colspan="4">Lecture Hrs: 12</td></tr>
<tr><td colspan="7">Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model; Learning and Training the neural network-Supervised and unsupervised learning concepts, simple Perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron – Back Propagation algorithm; BAM networks, Self-organizing network and Recurrent network; Neural Network based controllers and estimators design.</td></tr>
<tr><td>UNIT - III</td><td colspan="2">FUZZY LOGIC CONTROL SYSTEM</td><td colspan="4">Lecture Hrs: 10</td></tr>
<tr><td colspan="7">Motivation and basic definitions; Crisp sets, Fuzzy sets, difference between crisp and fuzzy sets, Fuzzy properties, operations and relations; Fuzzy logic system and its components; Membership functions and methods for assignment of membership function values, Fuzzy knowledge and rule</td></tr>
</table>

bases; Fuzzy modelling and control schemes for linear and nonlinear systems; Fuzzy estimators.		
UNIT - IV	**EVOLUTIONARY ALGORITHMS**	Lecture Hrs: 10
Genetic Algorithm: Introduction - basic concepts, application, Adaptive Neuro-fuzzy Inference System (ANFIS), Neuro-Genetic, Fuzzy-Genetic systems. Ant colony optimization, Particle swarm optimization (PSO) – basic concepts and design procedures.		
UNIT - V	**CASE STUDIES**	Lecture Hrs: 8
Identification and control of linear and nonlinear dynamic systems using Neural Networks, Power System Load Flow using Back Propagation algorithm; Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox, Single area Load Frequency Control using Fuzzy Logic; optimization for controller design in case of constrained and unconstrained optimization issues, Economic Load Dispatch using Genetic Algorithm/PSO.		

Textbooks:

1. Jacek. M. Zurada; "Introduction to Artificial Neural Systems", Jaico Publishing House, 1st Edition, 1994
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3rd Edition, WILEY Publications, 2011
3. S.N. Sivanandam and S.N. Deepa, Introduction to Genetic Algorithms, Springer Publications, 2008

Reference Books:

1. J.S.R. Jang, C.T.Sun and E. Mizutami, “Neuro-Fuzzy & Soft Computing”, Pearson India Education Services Pvt. Ltd.
2. LaurereFauselt, “Fundamentals of Neural Networks”, Pearson India Education Services Pvt. Ltd.
3. Padhy.N.P.; “Artificial Intelligence and Intelligent Systems”; Oxford University Press, 2005

Online Learning Resources:

1. https://nptel.ac.in/courses/108104049
2. https://nptel.ac.in/courses/112103301

Common to All Branches

Course Code	MANAGEMENT SCIENCE	L	T	P	C
	(HE-II) 20A75401a	3	0	0	3
Pre-requisite					

COURSE OBJECTIVES: The objectives of this course are

1	To provide fundamental knowledge on management, administration, organization & its concepts.
2	To make the students understand the role of management in Production process and marketing management
3	To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
4	To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
5	To make the students aware of the contemporary issues in management

Course Outcomes (CO): At the end of the course, students will be able to

1	Define the Management, and its Functions
2	Understand the concepts & principles of management and designs of organization in a practical world
3	Apply the knowledge of Work-study principles & Quality Control techniques in industry
4	Analyse the concepts of HRM in Recruitment, Selection and Training & Development.
5	Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyse the business through SWOT.
6	Create Modern technology in management science.

UNIT - I **INTRODUCTION TO MANAGEMENT**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Elton Mayo's Human relations - Systems Theory - **Organizational Designs** - Line organization - Line & Staff Organization - Functional Organization - Committee form of Organization - Social responsibilities of Management.

LEARNING OUTCOMES: At the end if the Unit, the learners will be able to

- Understand the concept of management and organization
- Analyze the organization chart & structure for an enterprise.
- Apply the concepts & principles of management in real life industry.
- Evaluate and interpret the theories and the modern organization theory.

UNIT - II **OPERATIONS & MARKETING MANAGEMENT**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), - Statistical Quality Control- **Materials Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Understand the core concepts of Management Science and Operations Management
- Apply the knowledge of Method of Production principles in real life industry.
- Analyze Marketing Mix Strategies for an enterprise
- Evaluate Materials departments & Determine EOQ
- Create and design advertising and sales promotion

UNIT - III **HUMAN RESOURCES MANAGEMENT (HRM)**

HRM - Evolution of HRM - Definition and Meaning – Nature - Managerial and Operative functions - - Job Analysis - Human Resource Planning (HRP) – Process of Recruitment & Selection - Training and Development - Performance Appraisal - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration.

LEARNING OUTCOMES: At the end if the Unit, the learners will

- Understand the concepts of HRM in Recruitment, Selection, Training & Development
- Apply Managerial and operative Functions of HRM
- Analyze the need of training
- Evaluate performance appraisal Techniques
- Design the basic structure of salaries and wages Administration.

UNIT - IV **STRATEGIC & PROJECT MANAGEMENT**

Strategy Definition & Meaning - Vision - Mission - Goals - Steps in Strategy Formulation and Implementation - SWOT Analysis **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Project Crashing (Simple problems).

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise
- Apply SWOT Analysis to strengthen the project
- Analyze Strategy formulation and implementation

- Evaluate PERT and CPM Techniques
- Creative in completing the projects within given time

UNIT - V **CONTEMPORARY ISSUES IN MANAGEMENT**

The concept of Management Information System (MIS) - Materials Requirement Planning (MRP) - Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Business Process Outsourcing (BPO) - Business Process Re-engineering - knowledge Management.

LEARNING OUTCOMES At the end if the Unit, the learners will be able to

- Understand modern management techniques
- Apply Knowledge in Understanding in modern management techniques
- Analyze Concept of CRM, MRP, TQM
- Evaluate Six Sigma concept and SCM

Textbooks:

1. A.R Aryasri, Management Science, TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

Reference Books:

1. Koontz &Weihrich, Essentials of Management, 6/e, TMH, 2005.
2. Thomas N.Duening& John M.Ivancevich, Management Principles and Guidelines, Biztantra.
3. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
4. Samuel C.Certo, Modern Management, 9/e, PHI, 2005

Online Learning Resources:

www.slideshare.net/jhayabesamis/chapter-1-the-nature-and-concept-of-management-122625641?
www.slideshare.net/vivekpratapsingh14/school-of-management-thoughts?
https://www.slideshare.net/89ajpaul/organizational-design-anf-structure
https://www.slideshare.net/sujeet2685/plant-layout-46555840#
https://www.slideshare.net/drmadhurverma/materials-38395397
https://www.slideshare.net/ShaliniShetty3/introduction-to-marketing-management-72210724?
https://www.slideshare.net/srinidhiraman/human-resource-management-ppt-43320777
https://www.slideshare.net/wicaksana/training-and-development-33535063
https://www.slideshare.net/ayushijain107/strategic-management-ppt-58012275

Course Code	BUSINESS ENVIRONMENT (HE-II)	L	T	P	C
20A75401b		3	0	0	3
Pre-requisite	Sem-VII Common to All Branches				

Course Objectives:

1.	To make the student understand about the business environment
2.	To enable them in knowing the importance of fiscal and monitory policy
3	To facilitate them in understanding the export policy of the country
4.	To Impart knowledge about the functioning and role of WTO
5.	To Encourage the student in knowing the structure of stock markets

Course Outcomes (CO): At the end of the course, students will be able to

1.	Define Business Environment and its Importance.
2.	Understand various types of business environment.
3	Apply the knowledge of Money markets in future investment
4	Analyse India's Trade Policy
5	Evaluate fiscal and monitory policy
6	Develop a personal synthesis and approach for identifying business opportunities

UNIT - I **Overview of Business Environment**

Introduction – meaning Nature, Scope, significance, functions and advantages. Types - Internal & External, Micro and Macro. Competitive structure of industries - Environmental analysis - advantages & limitations of environmental analysis & Characteristics of business.

Learning Outcomes: - After completion of this unit student will

- Understand the concept of Business environment
- Classify various types of business environment
- Evaluate the environmental analysis in business
- Discuss the Characteristics of Business.

UNIT - II **Fiscal Policy**

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Public debt - Development activities financed by public expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget - Monetary Policy - Demand and Supply of Money – RBI - Objectives of monetary and credit policy - Recent trends - Role of Finance Commission.

Learning Outcomes: - After completion of this unit student will

- Understand the concept of public revenue and public Expenditure
- Identify the functions of RBI and its role
- Analyze the Monitory policy in India
- Know the recent trends and the role of Finance Commission in the development of our country
- Differentiate between Fiscal and Monitory Policy

UNIT - III **India's Trade Policy**

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

Learning Outcomes: - After completion of this unit student will

- Understand the role of Indian international trade
- Understand and explain the need for Export and EXIM Policies
- Analyze causes for Disequilibrium and correction measure
- Differentiate between Bilateral and Multilateral Trade Agreements

UNIT - IV **World Trade Organization**

Introduction – Nature, meaning, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - Agreements in the Uruguay Round – TRIPS, TRIMS, and GATT - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

Learning Outcomes: - After completion of this unit student will

- Understand the role of WTO in trade
- Analyze Agreements on trade by WTO
- Understand the Dispute Settlement Mechanism
- Compare and contrast the Dumping and Anti-dumping Measures.

UNIT - V **Money Markets and Capital Markets**

Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI - Stock Exchanges - Investor protection and role of SEBI.

Learning Outcomes: - After completion of this unit student will

- Understand the components of Indian financial system
- Know the structure of Money markets and Capital markets
- Analyze the Stock Markets
- Apply the knowledge in future investments
- Understand the role of SEBI in investor protection.

Textbooks:

1.Business Environment Text & Cases: JUNE 2017

2. Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India.

3. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition.HPH2016

Reference Books:

1.K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.

2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.

3. Chari. S. N (2009), International Business, Wiley India.

4.E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

Online Learning Resources:
https://www.slideshare.net/ShompaDhali/business-environment-53111245
https://www.slideshare.net/jitenparmar313/fiscal-policy-65521889
https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt
https://www.slideshare.net/prateeknepal3/ppt-mo

Course Code	ORGANIZATIONAL BEHAVIOUR (HE-II)		L	T	P	C
20A75401c			**3**	**0**	**0**	**3**
Pre-requisite	**Common to All Branches**	**Sem-VII**				

Course Objectives:

1	To make them aware of concepts & analysis in organizational behaviour
2	To offer knowledge to students on self-motivation, leadership and management
3	To facilitate them to become powerful leaders
4	To Impart knowledge about group dynamics
5	To make them understand the importance of change and development

COURSE OUTCOMES: At the end of the course, students will be able to

1	Define the Organizational Behaviour, its nature and scope
2	Understand the nature and concept of Organizational behaviour
3	Apply theories of motivation to analyse the performance problems
4	Analyse the different theories of leadership
5	Evaluate group dynamics
6	Develop as powerful leader

UNIT - I **Introduction Of Organizational Behavior and Various Concepts**

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective - Understanding Individual Behavior – Attitude - Perception - Learning – Personality.

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the concept of Organizational Behavior
- Contrast and compare Individual & Group Behavior and attitude
- Evaluate personality types

UNIT - II **Motivation and Organization Outcome**

Theories of Motivation - Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy - McClelland's theory of needs – Mc Gregor's theory X and theory Y – Adam's equity theory – Locke's goal setting theory –

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the concept of Motivation
- Analyze the Theories of motivation
- Explain how employees are motivated according to Maslow's Needs Hierarchy

UNIT - III **Leadership**

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Alderfer's ERG theory – traits - Leaders Vs Managers.

Conflict Management - Evaluating Leader - Women and Corporate leadership.

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the concept of Leadership
- Contrast and compare Trait theory and Managerial Grid
- Distinguish the difference between Transactional and Transformational Leadership
- Evaluate the qualities of good leaders

UNIT - IV **Organizational Culture**

Introduction – Nature, Meaning, scope, definition and functions - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the importance of organizational change and development
- Apply change management in the organization
- Analyze work stress management
- Evaluate Managerial implications of organization

UNIT - V **Organizational Change and Development**

Introduction – Nature, Meaning, scope, definition and functions - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the importance of organizational change and development
- Apply change management in the organization
- Analyze work stress management
- Evaluate Managerial implications of organization

Textbooks:

1. Luthans, Fred, OrganisationalBehaviour, McGraw-Hill, 12 Th edition 2011
2. P Subba Rao, OrganisationalBehaviour, Himalya Publishing House 2017

Reference Books:

- McShane, Organizational Behaviour, TMH 2009
- Nelson, OrganisationalBehaviour, Thomson, 2009.
- Robbins, P.Stephen, Timothy A. Judge, OrganisationalBehaviour, Pearson 2009.
- Aswathappa, OrganisationalBehaviour, Himalaya, 2009

https://www.slideshare.net/payalrchhabra/organisational-behavior-15668552
https://www.slideshare.net/nilendrakumar7/motivation-and-team-building

https://www.slideshare.net/Knight1040/organizational-culture-9608857
https://www.slideshare.net/harshrastogi1/group-dynamics-159412405
https://www.slideshare.net/kohlisudeep18/organisational-developmet

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">BATTERY MANAGEMENT SYSTEMS
(OE-III) Common to All Branches</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A70204</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td>Basic Electrical Engineering</td><td>Semester</td><td colspan="4">VI</td></tr>
<tr><td colspan="7">Course Objectives: To make the students learn about:</td></tr>
<tr><td colspan="7">• Understand the role of battery management system and the requirements of BMS.
• Interpret the concept associated with battery charging / discharging process
• Analyze various parameters of battery and battery pack
• Design the model of battery pack</td></tr>
<tr><td colspan="7">Course Outcomes (CO): After completion of this course, student will be able to</td></tr>
<tr><td colspan="7">CO1: Understand and remember the basic concepts and terminologies of Cells and Batteries, charging, discharging methods, concept of cell balancing.

CO2: Analyze BMS functionality, various sensors used, control techniques, Sate of Charge estimation, cell total energy and cell total power.

CO3: Apply the equivalent circuits, physical models, empirical modelling of BMS.

CO4: Design of Battery management system considering various parameters and through simulation.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">INTRODUCTION</td><td colspan="4">Lecture Hrs: 14</td></tr>
<tr><td colspan="7">Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging</td></tr>
<tr><td>UNIT - II</td><td colspan="2">BATTERY MANAGEMENT SYSTEM</td><td colspan="4">Lecture Hrs: 14</td></tr>
<tr><td colspan="7">Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of charge estimation, Cell total energy and cell total power</td></tr>
<tr><td>UNIT - III</td><td colspan="2">BATTERY STATE OF CHARGE AND STATE</td><td colspan="4">Lecture Hrs: 12</td></tr>
</table>

	OF HEALTH ESTIMATION	
Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing		
UNIT - IV	**MODELLING AND SIMULATION**	Lecture Hrs: 12
Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs		
UNIT - V	**DESIGN OF BATTERY MANAGEMENT SYSTEMS**	Lecture Hrs: 12
Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system		
Textbooks:		
1. Plett, Gregory L. Battery management systems, Volume I: Battery modelling. Artech House, 2015. 2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.		
Reference Books:		
1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002. 2. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010 3. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008. 4. Rui Xiong, "Battery management Algorithm for Electric Vehicles", China Machine Press, Springer,2020. 5. Bergveid, Krujit, Notten, " Battery Management Systems: Design by Modelling", Philips Research Book Series, Kluwer Academic Publishers.		
Online Learning Resources:		
1. https://www.coursera.org/learn/battery-management-systems		

Course Code	IoT APPLICATIONS IN ELECTRICAL ENGINEERING (OE-IV)Common to All Branches		L	T	P	C
20A70205			3	0	0	3
Pre-requisite		Semester	VII			

Course Objectives: To make the students learn about:

- Basics of Internet of Things and Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process.
- The concept of motion less and motion detectors in IoT applications.
- Applications of IoT in smart grid.
- The concept of Internet of Energy for various applications.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand the concept of IoT in Electrical Engineering.
CO 2 Analyze various types of motionless sensors and various types of motion detectors
CO 3 Apply various applications of IoT in smart grid.
CO 4 Design future working environment with Energy internet.

UNIT - I	SENSORS	Lecture Hrs: 10

Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric

UNIT - II	OCCUPANCY AND MOTION DETECTORS	Lecture Hrs: 10

Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors

UNIT - III	MEMS	Lecture Hrs: 10

Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors

UNIT - IV	IoT FOR SMART GRID	Lecture Hrs: 8

Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home

UNIT - V	INTERNET of ENERGY (IoE)	Lecture Hrs: 10
Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid .		

Textbooks:

1. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004
2. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1st Edition, Mc Grawhill Education, 2017
3. Ersan Kabalci and Yasin Kabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019

Reference Books:

1. Raj Kumar Buyya and Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1st Edition, CRC Press, 2019
3. RMD Sundaram Shriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs96/preview
2. https://nptel.ac.in/courses/108108123
3. https://nptel.ac.in/courses/108108179

Course Code	ENERGY CONSERVATION AND AUDITING		L	T	P	C
20A70206	(Skill oriented course – V)		1	0	2	2
		Semester	VII			

Course Objectives: To make the students learn about:

The following industry relevant skills of the competency 'Undertake energy conservation and energy audit' are expected to be developed in the students by undertaking

- Identification of energy losses and opportunities of energy conservation.
- Implementation of energy conservation technique.
- Apply energy conservation techniques in electrical installations.
- Use Co-generation and relevant tariff for reducing losses in facilities.
- Carryout energy audit for electrical system.

Course Outcomes (CO): At the end of the course the student will be able to:

CO 1 Understand energy conservation policies in India.

CO 2 Analyze energy conservation techniques in electrical machines.

CO 3 Apply energy conservation techniques in electrical installations, Co-generation and relevant tariff for reducing losses in facilities.

CO 4 Design and analyse energy audit for electrical system.

List of Experiments:

Theory:
Different types of Electrical apparatus, ratings, units, Loads, efficiency calculations, power consumption calculations, improvement of p.f., lightening, fans, electricity tariff, need for energy saving, energy audit questionnaire

List of Experiments:

1. Analyze star labeled electrical apparatus and compare the data sheet (Pamphlet) of various star ratings.

2. Determine the '% loading' and the related efficiency of given Induction motor at different

loading

3. Determine the reduction in power consumption in star mode operation of Induction motor compared to delta mode at no load/ light loads.

4. Use APFC / PFC unit for improvement of p. f. of electrical load.

5. Compare power consumption of (Fluorescent and LED) lighting

6. Determine Net Energy Saving by Lamp replacements.

7. Determine Energy conservation in Fan by using Electronic Regulator

8. Analysis of electric bill based on tariff of Industrial consumer to reduce energy usage and electric bill

9. To analyze the energy bill of a commercial consumer and to suggest (if needed) suitable tariff to achieve energy conservation and reduction in energy bill

10. To interpret the energy bill of a residential consumer, suggest suitable tariff to achieve energy conservation and reduction in energy bill.

11. Estimate energy saving by improving power factor and load factor for given cases.

12. Prepare a sample energy audit questionnaire for the given industrial facility.

13. Prepare an energy audit report

14. Determination of rating of Inverter capacity for household applications

References:

1. Guide Books no. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors

2. Energy Management and Conservation By Sharma, K. V., Venkataseshaiah P.

Online Learning Resources/Virtual Labs:

1. https://nptel.ac.in/courses/108106022

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I Civil

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	Experimental Stress Analysis	L	T	P	C
20A50105		3	0	0	3
	Semester	V			

Course Objectives:

1. To understand different methods of experimental stress analysis
2. To understand the use of strain gauges for measurement of strain
3. To be exposed to different Non destructive methods of concrete
4. To understand the theory of photo elasticity and its applications in analysis of structures
5. To understand different methods of photo elasticity

Course Outcomes (CO):

1. Understand different methods of experimental stress analysis
2. Understand the use of strain gauges for measurement of strain
3. Expose to different Non destructive methods of concrete
4. Understand the theory of photo elasticity and its applications in analysis of structures
5. Understand different methods of photo elasticity

UNIT - I

PRINCIPLES OF EXPERIMENTAL APPROACH:Merits of Experimental Analysis Introduction, uses of experimental stress analysisAdvantages of experimental stress analysis, Different methods –Simplification of problems.

UNIT - II

STRAIN MEASUREMENT USING STRAIN GAUGES :Definition of strain and its relation of experimental Determinations Properties of Strain-

Gauge Systems-Types of Strain Gauges –Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges - Inductance strain gauges – LVDT – Resistance strain gauges – Various types –Gauge factor – Materials of adhesion base.

UNIT - III

STRAIN ROSSETTES AND NON – DESTRUCTIVE TESTING OF CONCRETE: Introduction – The three elements Rectangular Rosette – The Delta Rosette Corrections for Transverse Strain Gauge.

Ultrasonic Pulse Velocity method –Application to Concrete. Hammer Test – Application to Concrete.

UNIT - IV

THEORY OF PHOTOELASTICITY: Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polar scope for various arrangements – Fringe Sharpening. Brewster's Stress Optic law.

UNIT - V

TWO DIMENSIONAL PHOTOELASTICITY:Introduction – Isochramic Fringe patterns- Isoclinic Fringe patterns passage of light through plane Polariscope and Circular polariscope Isoclinic Fringe patterns – Compensation techniques – Calibration methods – Separation methods – Scaling Model to prototype Stresses – Materials for photo – Elasticity Properties of Photoelastic Materials.

Textbooks:

1. Experimental stress analysis by J.W.Dally and W.F.Riley, College House Enterprises2005
2. Experimental stress analysis by Dr.SadhuSingh.khanna Publishers 4th edition

Reference Books:

1. Experimental Stress analysis by U.C.Jindal, Pearson Pubilications 2012 edition
2. Experimental Stress Analysis by L.S.Srinath, MC.Graw Hill Company Publishers.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I EEE

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	ELECTRIC VEHICLE ENGINEERING (OE-I) EEE		L	T	P	C
20A50205			3	0	0	3
Pre-requisite	AC & DC Machines	**Semester**	V			

Course Objectives: The student will be able to:

- Understand latest trends in Electric Vehicles; parameters used in EV and types of EVs.
- Analyze various energy sources available to run EV like batteries, fuels cells etc.
- Analyze the dynamics and the propulsion system used in EVs, working of fuel cells, battery charging concept.
- Design a electromechanical system using various control techniques.

Course Outcomes (CO): At the end of the course, the student will be able to:

CO1: Understand the difference between conventional and latest trends in Electric Vehicles; understand the various parameters used in EV, types of HEVs.

CO2: Analyze various energy sources available to run EV like batteries, fuels cells etc.

CO3: Analyze the propulsion system of EV, its dynamics and the concept of battery charging.

CO4: Design EV system with battery charger using various fundamental concepts.

UNIT - I	INTRODUCTION TO EV SYSTEMS AND PARAMETERS	Lecture Hrs: 10

Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

UNIT - II	EV AND ENERGY SOURCES	Lecture Hrs: 08

Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems

UNIT - III	EV PROPULSION AND DYNAMICS	Lecture Hrs: 10

Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration.

UNIT - IV	FUEL CELLS	Lecture Hrs: 10
Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle. Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples		
UNIT - V	**BATTERY CHARGING AND VEHICLE CONTROL**	**Lecture Hrs: 10**
Battery charging: Battery Chemistry, Basic requirements, charger architecture, charger functions, wireless charging, power factor correction. **Battery Management System:** Introduction and BMS functionality, Battery pack topology, Voltage, Temperature and Current Sensing. **Control:** Introduction, modelling of electro mechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle		
Textbooks:C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001. 3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.		
Reference Books:		
6. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005. 7. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015. 8. Tom Denton, "Electric and Hybrid Vehicles", TAYLOR & FRANCIS; 2nd edition, CBS PUBLISHERS, 2^{nd} Edition, 2020. 9. MehrdadEhsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010. 10. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002.		
Online Learning Resources:		
1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview		

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I Mechanical

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Subject Code	Title of the Subject	L	T	P	C

2050305	**OPTIMIZATION TECHNIQUES**	3	0	0	3

Course Objectives:

To introduce various optimization techniques i.e classical, linear programming,

Transportation problem, simplex algorithm, dynamic programming Constrained and unconstrained optimization techniques for solving and optimizing.

Electrical and electronic engineering circuits design problems in real world situations.

To explain the concept of Dynamic programming and its applications to project

Learn the knowledge to formulate optimization problems

UNIT - I

Classical optimization techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints– method of Lagrange multipliers, Kuhn-Tucker conditions.

UNIT - II

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT - III

Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

Multi-Objective GA: Pareto's analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems

UNIT – IV

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam and general optimization model of a machining process.

Course Outcomes:

After completion of this course, the student will be able to explain the need of optimization of engineering systems

understand optimization of electrical and electronics engineering problems

apply classical optimization techniques, linear programming, simplex algorithm,

• transportation problem apply unconstrained optimization and constrained non-linear programming anddynamic programming Formulate optimization problems.

TEXT BOOKS:

Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers

Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers

Engineering Optimization – S.S.Rao, New Age Publishers

REFERENCES:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers

Genetic Programming- Koza

Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I ECE

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	**BASICS OF ELECTRONICS AND COMMUNICATION ENGINEERING**	**L**	**T**	**P**	**C**
20A50405		3	0	0	3
	Semester	**V**			

Pre-requisite

Applied Physics

Course Objectives:

- To study the basic principle, construction and operation of semiconductor devices.
- To learn the real time applications of semiconductor devices.
- To introduce binary number systems, logic gates and digital logic circuits.
- To get an idea about the basic principles of communication systems and their applications.
- To learn the measurement of physical parameters using Sensors and Transducers.

Course Outcomes (CO): At the end of this course, the students will be able to

- Understand the basic principle, construction and operation of semiconductor devices.
- Learn the real time applications of semiconductor devices.
- Comprehend the binary number systems, logic gates and digital logic circuits.
- Understand the basic principles of communication systems and their applications.
- Measure the physical parameters using Sensors and Transducers.

UNIT - I

Introduction to Electronics Engineering: Overview, scope and objective of studying Electronics Engineering. Introduction to semiconductor devices: Bond structure of semiconductors, intrinsic and extrinsic semiconductors; Basic principle and operation of semiconductor devices – diode, bipolar junction transistor, field effect transistors; Introduction to VLSI.

UNIT - II

Applications of semiconductor devices: Basic concepts of rectifiers, voltage regulators, amplifiers and oscillators; Basic concepts of operational amplifier and their applications.

UNIT - III

Introduction to digital systems: Binary number system, Boolean algebra, Logic gates, adders, one-bit memory, flip-flops (SR, JK), shift registers, Asynchronous counter.

UNIT - IV

Introduction to Communication Systems: Elements of a communication system – transmitter and receiver; Signal types in communication; FDM and TDM; Processing of signals for transmission – basic concepts of amplitude and frequency modulation; Examples of telecommunication systems – telephone, radio, television, mobile communication and satellite communication.

UNIT - V

Sensors and Transducers - Active and passive transducers: Measurement of displacement

(Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

Textbooks:

1. Millman J, Halkias C.C and Jit S, “Electronic Devices and Circuits”, Tata McGraw-Hill, 2nd 2007 Edition.
2. Mano M.M., “Digital Design”, Prentice-Hall, 3rd Edition. 2002
3. A.K. Sawhney, “A course in Electrical and Electronics Measurements and Instrumentation”, DhanpatRai& Co. 3rd edition Delhi, 2010.
4. Kennedy G. and Davis B., “Electronic Communication Systems”, Tata McGraw-Hill, 4th 2008 Edition.

Reference Books:

1. Tomasi W., “Advanced Electronic Communication Systems”, Pearson/Prentice-Hall, 6th 2004 Edition.
2. Boylstead R.L. and Nashelsky L., “Electronic Devices and Circuit Theory”, Pearson, 10th 2009 Edition.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I CSE

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

INTRODUCTION TO JAVA PROGRAMMING

Course Code:20A50505 **Semester V(R20)** **L T P C : 3 0 0 3**

Course Objectives:

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

Course Outcomes:

CO1: Solve real-world problems using OOP techniques.
CO2: Apply code reusability through inheritance, packages and interfaces
CO3: Solve problems using java collection framework and I/O classes.
CO4: Develop applications by using parallel streams for better performance and develop applets for web applications.
CO5: Build GUIs and handle events generated by user interactions and Use the JDBC API to access the database.

UNIT – I: **Introduction**

Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods.

UNIT – II: **Inheritance, Packages, Interfaces**

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,

Packages: Basics, Finding packages and CLASSPATH, Access Protection, Importing packages.
Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

UNIT – III: **Exception handling, Stream based I/O**

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception subclasses.

Stream based I/O (java.io) – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and Writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

UNIT – IV: **Multithreading, The Collections Framework**

Multithreading: The Java thread model, Creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collectionclasses- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hashtable, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

UNIT – V: **Applet, GUI Programming with Swings, Accessing Databases with JDBC**

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, show message dialog, show confirmdialog, show input dialog, show option dialog, jdialog, create a modeless dialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

Textbooks:

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.

2. Java How to Program, 10th Edition, Paul Dietel, Harvey Dietel, Pearson Education.

Reference Books:

1. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
2. Core Java Volume – 1 Fundamentals, Cay S. Horstmann, Pearson Education.
3. Java Programming for core and advanced learners, Sagayaraj, Dennis, KarthikandGajalakshmi, University Press
4. Introduction to Java programming, Y. Daniel Liang, Pearson Education

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I Chemical

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code		L	T	P	C
20A50805	**ENERGY CONVERSION AND STORAGE DEVICES**	**3**	**0**	**0**	**3**

Pre-requisite

Course Objectives:

1. Understand the fundamentals of fossil energy sources, solar, biomass and electrochemical energy etc
2. Understand the basics of photosynthetic, photocatalytic and photoelectrochemical systems and devices for the efficient energy and fuels production.
3. Learn the principles and operations of electrochemical energy storage devices,

Course Outcomes (CO):

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

CO1	Understand the need of energyconversion and the various methods of energy storage
CO2	Identify Winds energy as alternateform of energy and to know how itcan be tapped
CO3	Understand the nuclear and bio energy, its mechanism of production and its applications
CO4	Analyse chemical, electrochemical energy storage devices and interpret the conversion efficiencies
CO5	Explain bio gas generation and itsimpact on environment

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

UNIT - I

Outline of the course. Introduction and scope of energy conversion. World Energy Production and Balance. Motivations for studying future energy systems (e.g. pollution, climate change, energy security).

UNIT - II

Fossil Energy: Overview of fossil fuel resources and energy contents. Cycle analysis (Rankine, Brayton, combined cycles, cogeneration)

Nuclear Energy: nuclear reaction and energy conversion physics (fission and fusion), nuclear power systems

UNIT - III

Solar-thermal energy: solar thermal radiation physics, Active and passive solar-thermal energy collection and conversion systems

Photoelectric energy: Photoelectric physics. Solar photovoltaic cell materials and technology

Wind Energy: Wind interaction with objects fluid dynamics. Wind harvesting devices and systems

UNIT - IV

Biomass and Waste to Energy: Potential and resources of biomass and waste energy. Thermal-chemical and bio-chemical conversion methods

Overview of Climate Control, CO_2 Sequestration and Energy Sustainability

UNIT - V

Basic of Electrochemical energy conversion and storage, Fundamentals of Fuel Cells, Basics of Fusion power, Energy Storage Technologies, Mechanical storage, Chemical storage, Electrical storage

Textbooks:

Energy Systems Engineering, F.M. Vanek, L.D Albright, and LargusAngenent, Second Edition, McGraw-Hill, Inc., 2012,

Reference Books:

- AngèleReinders, Pierre Verlinden, Wilfried van Sark, Alexandre Freundlich, Photovoltaic Solar Energy:From Fundamentals to Applications, JOHN WILEY.
- Alexander P. Kirk, Solar Photovoltaic Cells: Photons to Electricity, ELSEVIER
- Francesco Dalena, Angelo Basile, Claudio Rossi, Bioenergy Systems For The Future: Prospects ForBiofuels And Biohydrogen, 1st Edition, ELSEVIER
- Jean-Marie Tarascon, Patrice Simon, ELECTROCHEMICAL ENERGY STORAGE,
- Electrochemistry by Carl H. Hamann, Andrew Hamnett and Wolf Vielstich, Wiley VCH, 1998.
- Modern Electrochemistry 1. Volume 1 and 2, by J. O'M. Bockris and A. K. N. Reddy, Kluwer Academic,2000.
- Electrochemical Methods, by A. J. Bard and L. R. Faulkner, John Willey, 1980
- John Love and John A. Bryant, Biofuels and Bioenergy, John Wiley
- Anju Dahiya, Bioenergy: Biomass to Biofuels, Elsevier

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I Mathematics

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">Optimization Methods
B.Tech III Year
(Common for all)
Open elective course -1</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A55101</td><td>0</td><td>3</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>--</td><td>Semester</td><td colspan="4">I</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">This course enables the students to classify and formulate real-life problem for modeling as optimization problem, solving and applying for decision making.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): Student will be able to</td></tr>
<tr><td colspan="7">formulate a linear programming problem and solve it by various methods.
give an optimal solution in assignment jobs, give transportation of items from sources to destinations.
identify strategies in a game for optimal profit.
implement project planning.</td></tr>
<tr><td>UNIT - I</td><td colspan="2"></td><td colspan="4">8 Hrs</td></tr>
<tr><td colspan="7">Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.</td></tr>
<tr><td>UNIT - II</td><td colspan="2"></td><td colspan="4">8 Hrs</td></tr>
</table>

Transportation problems- assignment problems-Game theory.		
UNIT - III		9 Hrs
CPM and PERT –Network diagram-Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations.		
UNIT - IV		8 Hrs
Sequencing Problems-Replacement problems-Capital equipment- Discounting costs-Group replacement .		
UNIT - V		9 Hrs
Inventory models-various costs- Deterministic inventory models-Economic lot size-Stochastic inventory models- Single period inventory models with shortage cost.		
Textbooks:		
1. Operations Research , S.D. Sharma. **2.** Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers. **3.** Operations Research, Nita H Shah, Ravi M Gor, HardikSoni, PHI publishers		
Reference Books:		
1. Problems on Operations Research, Er. Premkumargupta, Dr.D.S. Hira, Chand publishers 2. Operations Research, CB Gupta, PK Dwivedi, Sunil kumaryadav		
Online Learning Resources:		
https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L2slides.pdf https://slideplayer.com/slide/7790901/ https://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf		

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I Physics

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Subject Code	Title of the Subject	L	T	P	C
20A55201	**MATERIALS CHARACTERIZATION TECHNIQUES**	3		-	3

COURSE OBJECTIVES	
1	To provide an exposure to different characterization techniques.

2	To explain the basic principles and analysis of different spectroscopic techniques.
3	To elucidate the basic principle of Scanning electron microscope along with its limitations and applications.
4	To identify the Resolving power and Magnification of Transmission electron microscope and its applications.
5	To educate the uses of advanced electric and magnetic instruments for characterization.
COURSE OUTCOMES	
At the end of the course the student will be able	
CO1	To explain the structural analysis by X-ray diffraction.
CO2	To understand the morphology of different materials using SEM and TEM.
CO3	To recognize basic principles of various spectroscopic techniques.
CO4	To apprehend the electric and magnetic properties of the materials.
CO5	To make out which technique has to be used to analyse a material

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

Credit: 3 **Hours of teaching: - 45 H**

UNIT-I **9H**

Structure analysis by Powder X-Ray Diffraction: Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure,Crystallite size by Scherrer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT-II **9H**

Microscopy technique -1 –Scanning Electron Microscopy (SEM)

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (SecondaryElectron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT-III **9H**

Microscopy Technique -2 - Transmission Electron Microscopy (TEM): Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy,Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy.

UNIT-IV **9H**

Spectroscopy techniques – Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy(ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT-V **9H**

Electrical & Magnetic Characterization techniques: Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method,Vibrating sample Magnetometer (VSM) and SQUID.

TEXT BOOKS:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods –Yang

Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008

2. Hand book of Materials Characterization -by **Sharma** S. K. - S**pringer**

REFERENCES:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville BanwellandElaine M.

McCash, Tata McGraw-Hill, 2008.

2. Elements of X-ray diffraction – Bernard Dennis Cullity& Stuart R Stocks, PrenticeHall, 2001 – Science

3. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods- Yang

Leng- John Wiley & Sons

4. Characterization of Materials 2nd Edition, 3 Volumes-Kaufmann E N -John Wiley(Bp)

5. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan,John Wiley & Sons Ltd., 2008.

NPTEL courses

https://nptel.ac.in/courses/115/103/115103030/

https://nptel.ac.in/content/syllabus_pdf/113106034.pdf

https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I H & SS

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES

Course Code	E-Business	L	T	P	C
20A55401		3	0	0	3

Pre-requisite

Course Objectives:

1.	To provide knowledge on emerging concept on E-Business related aspect.
2.	To understand various electronic markets models which are trending in India
3.	To give detailed information about electronic payment systems net banking.
4.	To exact awareness on internet advertising, market research strategies and supply chain management.
5.	To understand about various internet protocols-security related concept.

Course Outcomes (CO):

1	They will be able to identify the priority of E-Commerce in the present globalised world.
2	Will be able to understand E-market-Models which are practicing by the organization
3.	Will be able to recognize various E-payment systems & importance of net banking.
4.	By knowing E-advertisement, market research strategies, they can identify the importance of customer role.
5.	By understanding about E-security, they can ensure better access control to secure the information
6	Develop a personal synthesis and approach towards E-Business

UNIT – I **Electronic Business**

Definition of Electronic Business - Functions of Electronic Commerce (EC) - Advantages of E-Commerce – E-Commerce and E-Business Internet Services Online Shopping-Commerce Opportunities for Industries.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the concept of E-Business
- Contrast and compare E-Commerce E-Business
- Analyze Advantages of E-Commerce
- Evaluate opportunities of E-commerce for industry

UNIT - II **Electronic Markets and Business Models**

E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals - Business Models-Business to Business(B2B)-Business to Customers(B2C)-Business to Government(B2G)-Auctions-B2B Portals in India

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals
- Analyze Advantages of portals
- Explain the B2B,B2C and B2G model

UNIT - III **III Electronic Payment Systems**

Digital Payment Requirements-Designing E-payment System- Electronic Fund Transfer (EFT)-Electronic Data Interchange (EDT)-Credit Cards-Debit Cards-E-Cash-Electronic Cheques -Smart Cards-Net Banking-Digital Signature.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and EDT
- Analyze debit card and credit card
- Explain the on Digital signature

UNIT - IV **E-Security**

Internet Protocols - Security on the Internet –Network and Website Security – Firewalls – Encryption – Access Control – Secure Electronic transactions.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand E-Security
- Contrast and compare security and network
- Analyze Encryption
- Evaluate electronic transitions

UNIT - V **E-Marketing**

Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Online Market Research– Data mining and Marketing Research Marketing Strategy On the Web – E-Customer Relationship Management(e-CRM) –E- Supply Chain Management.(e-SCM) –New Trends in Supply Chain Management.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the concept of online marketing
- Analyze advantages of online marketing
- Compare the e-CRM and e-SCM
- Explain the New trends in supply chain management

Textbooks:

1. **E-Commerce by C.S.V Murthy** Himalaya publication house, 2002.
2. **E-Commerce by** P.T.S Joseph, Fourth Edition, Prentice Hall of India 2011

Reference Books:

1. **E-Commerce: by** KamaleshKBajaj,DebjaniNa, Second Edition TataMcGrwHills 2005
2. **E-Commerce E-Management: by Dave Chaffey** – Second Edition, Pearson, 2012.
3. **E-Commerce Fundamentals and Application; by** Henry Chan, Raymond Lee,Tharm Wiley India 2007
4. **E-Commerce: by** S. Jaiswall Galgotia Publication Pvt Ltd 2003.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF CHEMISTRY

Subject Code	Title of the Subject	L	T	P	C
20A55301	**CHEMISTRY OF ENERGY MATERIALS**	2	1	-	3

COURSE OBJECTIVES	
1	To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2	To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
3	To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method
4	Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5	To understand and apply the basics of calculations related to material and energy flow in the processes.

COURSE OUTCOMES	
CO1	Solve the problems based on electrode potential,Describe the Galvanic Cell Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
CO2	Describe the working Principle of Fuel cell,Explain the efficiency of the fuel cell Discuss about the Basic design of fuel cells,Classify the fuel cell
CO3	Differentiate Chemical and Physical methods of hydrogen storage,Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures

	Describe the liquification methods
CO4	Apply the photo voltaic technology,Demonstrate about solar energy and prospects Illustrate the Solar cells,Discuss about concentrated solar power
CO5	Differentiate between Photo and Photo electrochemical Conversions,Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photoelectron catalytic conversion

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

UNIT-1: Electrochemical Systems: Galvanic cell, standard electrode potential, application of EMF, electrical double layer, dipole moments, polarization, Batteries-Lead-acid and Lithium ion batteries**.-**

UNIT-2: Fuel Cells: Fuel cell working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency, Basic design of fuel cell,

UNIT-3: Photo and Photo electrochemical Conversions: Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

UNIT-4:Solar Energy: Solar energy introduction and prospects, photo voltaic (PV) technology, concentrated solar power (CSP), Solar Fuels, Solar cells .

UNIT-5: Hydrogen Storage: Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures, metal oxide porous structures, hydrogel storage by high pressure methods. Liquifaction method.

References :

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins
4. Fuel Cell Hand Book 7^{th} Edition, by US Department of Energy (EG&G technical services and corporation)
5. Hand book of solar energy and applications by Arvind Tiwari and Shyam.
6. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
7. Hydrogen storage by Levine Klebonoff

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II Civil

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	Disaster Management	L	T	P	C

20A60105 **3 0 0 3**

Course Objectives:

1. To give knowledge types of disasters and stages in disaster rehabilitation process.
2. To make awareness on change in climates and their impacts on occurrence of environmental disasters.
3. To impart knowledge on Consideration of wind and water effects as per codal provisions to withstand disasters.
4. To familiarize the student with the Causes of earthquake and their effects and remedial methods to be adopted for buildings.
5. To illustrate the methodology in Planning and design considerations of various structures constructing in disaster prone areas.

Course Outcomes (CO):

1. About various types of disasters and stages in disaster rehabilitation process.
2. Impact of change in climates and their impacts on occurrence of environmental disasters.
3. Adopting suitable codal provisions to study the effect of wind and water effects on various structures constructed at disaster prone areas.
4. Causes of earthquake and their effects and remedial methods to be adopted for buildings.
5. Adopt suitable Planning and design considerations of various structures constructing in disaster prone areas.

UNIT - I

Brief introduction to different types of natural disaster, Occurrence of disaster in different climatic and geographical regions, hazard (earthquake and cyclone) map of the world and India, Regulations for disaster risk reduction, Post disaster recovery and rehabilitation (socioeconomic consequences)

UNIT - II

Climate change and its impact on tropical cyclone, Nature of cyclonic wind, velocities and pressure, Cyclone effects, Storm surge, Floods, Landslides. Behavior of structures in past cyclones and wind storms, case studies. Cyclonic retrofitting, strengthening of structures and adaptive sustainable reconstruction. Life–line structures such as temporary cyclone shelter.

UNIT - III

Basic wind engineering, aerodynamics of bluff bodies, vortex shedding and associated unsteadiness along and across wind forces. Lab: Wind tunnel testing, its salient features. Introduction to Computational fluid dynamics. General planning/design considerations under wind storms & cyclones; Wind effects on buildings, towers, glass panels etc, & wind resistant features in design. Codal Provisions, design wind speed, pressure coefficients; Coastal zoning regulation for construction & reconstruction phase in the coastal areas, innovative construction material & techniques, traditional construction techniques in coastal areas.

UNIT - IV

Causes of earthquake, plate tectonics, faults, seismic waves; magnitude, intensity, epicenter, energy release and ground motions. Earthquake effects – On ground, soil rupture, liquefaction, landslides. Performance of ground and building in past earthquakes: Behavior of various types of buildings, structures, and collapse patterns; Behavior of Non-structural elements like services, fixtures, mountings- case studies. Seismic retrofitting- Weakness in existing buildings, aging, concepts in repair, restoration and seismic strengthening.

UNIT - V

General Planning and design consideration; Building forms, horizontal and vertical eccentricities, mass and stiffness distribution, soft storey etc.; Seismic effects related to building configuration. Plan and vertical irregularities, redundancy and setbacks. Various Types and Construction details of: Foundations, soil stabilization, retaining walls, plinth fill, flooring, walls, openings, roofs, terraces, parapets, boundary walls, under-ground – overhead tanks, staircases and isolation of structures; innovative construction material and techniques; Local practices: traditional regional responses; Computational investigation techniques.

Textbooks:

1. Disaster Management by Rajib Shah, Universities Press, India, 2003
2. Disaster Management by R.B. Singh (Ed) Rawat Publication, New Delhi, 2000

Reference Books:

1. Natural disasters. By Abbott, L. P. (2013) 9th Ed. McGraw-Hill.
2. Earthquake Resistant Design of Structures. By Agarwal, P. and Shrikhande, M. (2009). New Delhi : PHI Learning.
3. Mapping Vulnerability: Disasters, Development and People. byBankoff, G., Frerks, G. and Hilhorst, D. (2004). London :Earthscan.
4. Improving Earthquakes and Cyclone Resistance of Structures:Guidelines for the Indian Subcontinent. TERI
5. Disaster Mitigation, preparedness, recovery and Response. By Sinha, P. C. (2006). New Delhi : SBS Publishers.
6. World Bank. (2009). Handbook for Reconstructingafter Natural Disasters.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II EEE

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	RENEWABLE ENERGY SYSTEMS (OE-II)		L	T	P	C
20A60205			3	0	0	3
Pre-requisite		Semester	VI			
Course Objectives: To make the students learn about:						
• Various sources of Energy and the need of Renewable Energy Systems. • The concepts of Solar Radiation, Wind energy and its applications. • Operation of Solar thermal and solar PV systems • The concept of geo thermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.						

Course Outcomes (CO): At the end of the course the student will be able to:

CO 1 Understand various alternate sources of energy for different suitable application requirements.
CO 2 Analyze the concepts of solar energy generation strategies and wind energy system
CO 3 Design Solar and Wind energy systems.
CO 4 Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power.

UNIT - I	**SOLAR ENERGY**	Lecture Hrs: 10

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT - II	**PV ENERGY SYSTEMS**	Lecture Hrs: 10

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

UNIT - III	**WIND ENERGY**	Lecture Hrs: 10

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

UNIT - IV	**GEOTHERMAL ENERGY**	Lecture Hrs: 8

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT - V	**MISCELLANEOUS ENERGY TECHNOLOGIES**	Lecture Hrs: 10

Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.
Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration
Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Text books:

3. Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.
4. G. D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2000.

Reference Books:

5. S. P. Sukhatme, "Solar Energy",3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
6. B H Khan , " Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
7. S. Hasan Saeed and D.K.Sharma,"Non-Conventional Energy Resources",3rd Edition, S.K.Kataria& Sons, 2012.
8. G. N. Tiwari and M.K.Ghosal, "Renewable Energy Resource: Basic Principles and Applications", Narosa Publishing House, 2004.

Online Learning Resources:
1. https://nptel.ac.in/courses/103103206 2. https://nptel.ac.in/courses/108108078

https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771

https://www.slideshare.net/VikramNani/e-commerce-business-models

https://www.slideshare.net/RiteshGoyal/electronic-payment-system

https://www.slideshare.net/WelingkarDLP/electronic-security

https://www.slideshare.net/Ankitha2404/emarketing-ppt

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II Mechanical

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Subject Code	Title of the Subject	L	T	P	C
20A60305	**SOLAR ENERGY SYSTEMS**	3	0	0	3

Course objectives

Learning the fundamental principles of solar radiation and geographic distribution of solar radiation.

Study of various solar energy technologies with different types of concentrating collectors.

Comparative study of different solar cells with respect to properties and applications of solar cells in nano technology.

Understanding the basics of economics involves in the solar system.

Learning the concepts and designing aspects in thermal power. 6. Study of solar pond and solar stills and their applications.

UNIT – I

SOLAR RADIATION:

Sources of radiation –sun earth relationship, Solar Time and angles, day length, angle of incidence on tilted surface; Sun path diagram, Solar Radiation: Extraterrestrial Radiation; Effect of earth atmosphere; Estimation of solar radiation on horizontal and tilted surfaces.

Geographic Distribution of solar radiation, Phyrellio, pyranometer, equation of time-estimation of average radiation falling on tilled.

UNIT-II

SOLAR ENERGY TECHNOLOGIES:

Performance analysis of a liquid Flat-plate collector, Total loss coefficient and heat losses: Top loss coefficient, Bottom loss coefficient, Side loss coefficient. Solar concentrating collectors, types of concentrating collectors, Parabolic Dish System, The central power tower system, The Parabolic Trough System, Tracking CPC and Solar Swing, Performance analysis of cylindrical parabolic collector, Compound parabolic concentrator (CPC).

UNIT-III

SOLAR CELLS:

Solar cell fundamentals, solar cell classification, solar cell, module, panel array construction, maximum power pint trackers(MPPT), solar PV applications, The Recent developments in Solar cells, Role of Nano-Technology in Solar cells.

UNIT – IV

ECONOMICS:

Discounted Cash Flow-light cycle, coasting of solar system, production function and optimization

UNIT – V

THERMAL POWER:

The power concepts- design aspects, thermo-chemical reactor.

SOLAR POND AND SOLAR STILLS:

Working Principle-Construction-operating difficulties and remedies, Agriculture and Domestic applications: Still, timber drying, crop drying, cooker.

Course Outcomes :

Illustrate the fundamental principles of solar radiation and geographic distribution of solar radiation.

Obtaining the performance analysis of liquid flat plate collector and cylindrical parabolic collector.

Developing solar cells in the field of nano technology.
Calculating the cash flow and costs involves in the solar energy systems.
Designing and developing of thermo chemical reactor with respect to thermal power.

Reference Books:

Solar Energy Thermal Process Diffice and Beckman
Solar Heating and Cooling by Kreith and Kreider
Solar Energy Utilization by G.D.Rai

Solar Energy Utilization by G.D.Rai , Khanna Publishers.
Renewable Energy Sources and Emerging Technologies- By D.P. Kothari, PHI Pub.,

Applied Solar Energy by Meinel and Meinel
Non-Conventional Energy Resources by B.H . Khan, Tata McGraw Hill
Energy Resources Utilization and Technologies ByAnjaneyulu, BS Pub.

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II ECE

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	BASICS OF INTEGRATED CIRCUITS APPLICATIONS	L	T	P	C
20A60405		3	0	0	3

\Pre-requisite

Basics of Electronics and Communication Engineering

Course Objectives:

- To introduce the basic building blocks of linear & digital integrated circuits.
- To learn the linear and non - linear applications of operational amplifiers.
- To introduce the theory and applications of 555 and PLL.
- To learn the theory of ADC and DAC
- To understand different families of digital integrated circuits and their characteristics.

Course Outcomes (CO): At the end of this course, the students will be able to

- Understand the basic concepts of Op -AMPs, characteristics and specifications.
- Design circuits using operational amplifiers for various applications.
- Develop, apply and analyze circuits for advanced applications using Op-Amps, PLL, VCO and Analog multipliers.
- Understand different families of digital integrated circuits and their characteristics
- Design various and sequential circuits using digital ICs.

UNIT - I

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation - Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT - II

Op-Amp, IC-555 & IC 565 Applications: Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL - Block Schematic, Description of Individual Blocks, Applications.

UNIT - III

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT - IV

Digital Integrated Circuits: Classification of Integrated Circuits, Comparison of Various Logic Families, CMOS Transmission Gate, IC interfacing- TTL Driving CMOS & CMOS Driving TTL

Combinational Logic ICs – Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT - V

Sequential Logic ICs and Memories: Familiarity with commonly available 74XX & CMOS 40XX Series ICs – All Types of Flip-flops, Synchronous Counters, Decade

Counters, Shift Registers. Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

Textbooks:

1. Ramakanth A. Gayakwad, “Op-Amps & Linear ICs”, PHI, 2003.
2. Floyd and Jain, “Digital Fundamentals”, Pearson Education, 8th Edition, 2005.

Reference Books:

1. D. Roy Chowdhury, “Linear Integrated Circuits”, New Age International (p) Ltd, Second Edition, 2003.
2. James M. Fiore, “Op Amps and Linear Integrated Circuits-Concepts and Applications”, Cengage Learning/ Jaico, 2009.
3. K.Lal Kishore, “Operational Amplifiers with Linear Integrated Circuits”, Pearson, 2009.
4. John. F. Wakerly, “Digital Design Principles and Practices”, Pearson, Third Edition, 2005.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II CSE

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Introduction to Linux Programming

Course Code:20A60505 **L T P C : 3 0 0 3**

Course Objectives:

- To study the commands according to user requirements.
- To utilize Shell scripts to perform the given task.
- To enable writing own programs in UNIX.
- To know AWK programs.

Course Outcomes:

CO1: Develop text data processing applications using Unix commands and filters.

CO2: Design and develop text based user interface components

CO3: Understand user management, network management and backup utilities

CO4: Use the system calls for file management

CO5: Understands the Concept of Process Threads and File Structure.

UNIT-I: Introduction,Unix File System,Unix Commands

Operating System, History of UNIX, Overview and Features of Unix System,Structure of Unix System, Unix Environment. **Unix File System**: Introduction of Files, Organization of File Systems, Accessing File Systems, Structure of File Systems. **Unix Commands**: Basic Commands, Advanced Unix Commands: File Access Permissions, Pipe Operator, cut, paste, wc, sort, head, tail, diff, cmp, uniq, comm, time, Conversions between DOS and Unix, man.

UNIT-II: File management and Compression Techniques,Manipulating Processes and Signals
Managing and Compressing Files, Computer Devices, Disk related Commands, Compression and Uncompressing Files, Important Unix System Files, Shell Variables, Export of Local and Global Shell Variables.
Manipulating Processes and Signals: Process Basics, Processes States and Transitions, Zombie Process, Context switching, Threads, ps-status of Process.
UNIT-III: System calls
Introduction, File-related System calls (open, create, read, write, lseek), File-related System calls (close, mknod, link and unlink, access, and chown, chmod), Directory Handling System calls (mkdir, rmdir, chdir, opendir, readdir, telldir, closedir), Process related System calls (exec, fork, wait,exit).
Editors in Unix: introduction, Stream editor, Emacs Editor.

UNIT-IV: AWK Script,Burne Shell

AWK Command, print, printf, Displaying Content of Specified Patterns, Comparison Operators, Compound Expressions, Arithmetic Operators, Begin and end Sections, User-defined Variables, if else Statement, Built-in Variables, Changing Input Filed Separator, Functions, Loops, Getting Input from User, Search and Substitute Functions, Copying results into Another file.

Bourne Shell: Introduction, beginning Bourne Shell Scripting, Writing Shell Scripts, Command Line Parameters, read, for Loop, While Loop, if Statement, Bourne Shell Commands.

UNIT-V: InterprocessCommunicaation, Unix System Administration and Networking

Interprocess Communication, Synchronization, Filters.

Unix System Administration and Networking: Unix Booting Procedure,Mounting Unix File System, Unmounting Unix File System, Managing User Accounts, Networking Tools, mail Command, Distributed File System, Firewalls, Backup and Restore.

TEXT BOOKS

1. "UNIX and SHELL Programming", B.M. HARWANI, OXFORD UNIVERSITY PRESS.

REFERENCES

1. "UNIX and Linux System Administration Handbook", Evi Nemeth, Garth Snyder, Trent R. Hein and Ben Whaley, PHI

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II Chemical

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	OE2. GREEN TECHNOLOGY	L	T	P	C
20A60805		**3**	**0**	**0**	**3**

Pre-requisite

Course Objectives:

Course Outcomes (CO):

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

CO1	Understand the basic knowledge of environmental issues and estimate the risk
CO2	Evaluate the exposures
CO3	To discuss the type of wastes and emissions that drive the environmental impacts
CO4	Estimation of the environmental properties, persistence, ecosystem risk,
CO5	To present approaches and methodologies for evaluating and improving the environmental performance of chemical processes and chemical products.

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

UNIT - I

An introduction to environmental issues: Role of chemical processes and chemical products, Global environmental issues, Air and water quality issues, Ecology.

Risk concept: Description of risk, Risk assessment concept, Dose-response, Exposure assessment.

UNIT - II

Evaluating exposures: Occupational exposures: recognition, evaluation, control, Exposure assessment for chemicals in the ambient environment, Designing safer chemicals.

Green chemistry:Green chemistry methodologies, Optimization based frameworks for the design of green chemical synthesis pathway.

UNIT - III

Evaluating environmental fate: Chemical and physical property estimation, estimating environmental persistence, estimating ecosystem risk, classifying environmental risk based on chemical structure.

UNIT - IV

Life-cycle concepts: Life-cycle assessment, Life-cycle impact assessment

UNIT - V

Material flows in chemical manufacturing, Assessing opportunities for waste exchanges and by-product synergies.

Textbooks:

SHONNARD, DALLEN, D. Green Engineering: Environmentally Conscious Design of Chemical Processes.

Reference Books:

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">Mathematical Modelling & Simulation
(Common for CIVIL,MECH&CHEM)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A65101</td><td>0</td><td>3</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td></td><td>Semester</td><td colspan="4">II</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">This course focuses on what is needed to build simulation software environments, and not just building simulations using preexisting packages.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): Student will be able to</td></tr>
<tr><td colspan="7">understand basic Model Forms.
understand basic Simulation Approaches.
evaluate handling Stepped and Event-based Time in Simulations.
distinguish Discrete versus Continuous Modeling.
apply Numerical Techniques.
calculate Sources and Propagation of Error.</td></tr>
<tr><td>UNIT - I</td><td colspan="2"></td><td colspan="4">8 Hrs</td></tr>
<tr><td colspan="7">Simulation Basics-Handling Stepped and Event-based Time in Simulations-Discrete versus Continuous Modelling-Numerical Techniques-Sources and Propagation of Error</td></tr>
<tr><td>UNIT - II</td><td colspan="2"></td><td colspan="4">9 Hrs</td></tr>
<tr><td colspan="7">Dynamical, Finite State, and Complex Model Simulations-Graph or Network Transitions Based Simulations-Actor Based Simulations-Mesh Based Simulations-Hybrid Simulations</td></tr>
<tr><td>UNIT - III</td><td colspan="2"></td><td colspan="4">8 Hrs</td></tr>
</table>

Converting to Parallel and Distributed Simulations-Partitioning the Data-Partitioning the Algorithms-Handling Inter-partition Dependencies		
UNIT - IV		8 Hrs
Probability and Statistics for Simulations and Analysis-Introduction to Queues and Random Noise-Random Variates Generation-Sensitivity Analysis		
UNIT - V		9 Hrs
Simulations Results Analysis and Viewing Tools-Display Forms: Tables, Graphs, and Multidimensional Visualization-Terminals, X and MS Windows, and Web Interfaces-Validation of Model Results.		
Textbooks:		
1. Mathematical modeling, JN Kapur, Newage publishers 2. Mathematical Modeling and Simulation: Introduction for Scientists and Engineers by Kai Velten, Wiley Publishers		
Reference Books:		
1. Introduction to Mathematical Modeling and Computer Simulations By Vladimir Mityushev,WojciechNawalaniecNataliaRylko Published by Chapman and Hall/CRC.		
Online Learning Resources:		
http://www.cse.chalmers.se/~dag/docs/matmodReport6.pdf https://www.slideshare.net/arupparia/introduction-to-mathematical-modelling-42588379 https://www.slideshare.net/mailrenuka/simulation-for-queuing-problems-using-random-numbers		

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">Wavelet transforms and its Applications

(Common for EEE&ECE)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A65102</td><td>0</td><td>3</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Fourier Series</td><td>Semester</td><td colspan="4">II</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">This course provides the students to understand Wavelet transforms and its applications.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): Student will be able to</td></tr>
<tr><td colspan="7">understand wavelets and wavelet expansion systems.
illustrate the multi resolution analysis ad scaling functions.
form fine scale to coarse scale analysis.
find the lattices and lifting.
perform numerical complexity of discrete wavelet transforms.</td></tr>
</table>

• find the frames and tight frames using Fourier series.		
UNIT - I	Wavelets	9 Hrs
Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems - Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform The Discrete-Time and Continuous Wavelet Transforms.		
UNIT - II	A Multiresolution Formulation of Wavelet Systems	8 Hrs
Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.		
UNIT - III	Filter Banks and the Discrete Wavelet Transform	9 Hrs
Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.		
UNIT - IV	Time-Frequency and Complexity	9 Hrs
Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.		
UNIT - V	Bases and Matrix Examples	8 Hrs
Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.		
Textbooks:		

1. C. Sidney Burrus, Ramesh A. Gopinath, “Introduction to Wavelets and Wavelets Transforms”,Prentice Hall, (1997). 2. James S. Walker, “A Primer on Wavelets and their Scientific Applications”, CRC Press, (1999).
Reference Books:
1. Raghuveer Rao, “Wavelet Transforms”, Pearson Education, Asia.
Online Learning Resources:
https://www.slideshare.net/RajEndiran1/introduction-to-wavelet-transform-51504915

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	Statistical Methods for Data Science	L	T	P	C

20A65103	CSE (Data Science)			3		3
Pre-requisite		**Semester**	**II**			
Course Objectives:						
This course aims at providing knowledge on basic concepts of Statistics, Estimation and testing of hypotheses for large and small samples.						
Course Outcomes (CO): Student will be able to						
• Understand the basic concepts of Statistics • Analyze data and draw conclusion about collection of data under study using Point estimation • Analyze data and draw conclusion about collection of data under study using Interval estimation • Analyzing the tests and types of errors for large samples • Apply testing of hypothesis for small samples.						
UNIT - I	**Basic Concepts**		**9 Hrs**			
Population, sample, parameter and statistic; characteristics of a good estimator; Consistency – Invariance property of Consistent estimator, Sufficient condition for consistency; Unbiasedness; Sufficiency – Factorization Theorem – Minimal sufficiency; Efficiency – Most efficient estimator, likelihood equivalence, Uniformly minimum variance unbiased estimator,applications of Lehmann-Scheffe's Theorem, Rao - Blackwell Theorem and applications						
UNIT - II	**Point Estimation**		**8 Hrs**			
Point Estimation- Estimator, Estimate, Methods of point estimation – Maximum likelihood method (the asymptotic properties of ML estimators are not included), Large sample properties of ML estimator(without proof)- applications , Method of moments, method of least squares, method of minimum chi-square and modified minimum chi-square-Asymptotic Maximum Likelihood Estimation and applications.						
UNIT - III	**Interval Estimation**		**8 Hrs**			
Confidence limits and confidence coefficient; Duality between acceptance region of a test and a confidence interval; Construction of confidence intervals for population proportion (small and large samples) and between two population proportions(large samples); Confidence intervals for mean and variance of a normal population; Difference between the mean and ratio of two normal populations.						

UNIT - IV	Testing of hypotheses	9 Hrs
Types of errors, power of a test, most powerful tests; Neyman-Pearson Fundamental Lemma and its applications; Notion of Uniformly most powerful tests; Likelihood Ratio tests: Description and property of LR tests - Application to standard distributions.		
UNIT - V	**Small sample tests**	**9 Hrs**
Student's t-test, test for a population mean, equality of two population means, paired t-test, F-test for equality of two population variances,CRD,RBD,LSD; Chi-square test for goodness of fit and test for independence of attributes, χ2 test for testing variance of a normal distribution Sign test, Signed rank test, Median test, Mann-Whitney test, Run test and One sample Kolmogorov –Smirnov test ,Kruskal – Wallis H test(Description, properties and applications only).		
Textbooks:		
1. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing of Hypotheses, Prentice Hall of India, 2014. 2. Robert V Hogg, Elliot A Tannis and Dale L.Zimmerman, Probability and Statistical Inference,9th edition,Pearson publishers,2013.		
Reference Books:		
1. S.P.Gupta, Statistical Methods, 33rd Edition, Sultan Chand & Sons. 2. Miller and John E Freund, Probability and Statistics for Engineers, 5th Edition.		
Online Learning Resources:		
1. https://www.statstutor.ac.uk/resources/uploaded/1introduction3.pdf 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996198/		

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

PHYSICS OFELECTRONICMATERIALS ANDDEVICES

COURSE OBJECTIVES

1 To impart the fundamental knowledge on various materials, their properties and

Applications.

2 To provide insight into various semiconducting materials and their properties.

3 To elucidate the characteristic behavior of various semiconductor devices.

4 To provide the basics of dielectric and piezoelectric materials and their properties.

5 To explain different categories of magnetic materials, mechanism and their

advanced applications.

COURSE OUTCOMES

At the end of the course the student will be able

CO1 To understand the fundamentals of various materials.

CO2 To exploit the physics of semiconducting materials

CO3 To familiarize with the working principles of semiconductor-based devices.

CO4 To understand the behavior of dielectric and piezoelectric materials.

CO5 To make use of the magnetic materials for advanced applications.

Mapping between Course Outcomes and Programme Outcomes

PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12

CO1

CO2

CO3

CO4

CO5

SYLLABUSCredit: 3 Hours of teaching: - 45 H

UNIT-1 Fundamentals of Materials Science: 9H

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. Basic idea of point, line and planar defects.Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT-2: Semiconductors: 9H

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT-3: Physics of Semiconductor Devices: 9H

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium.and under bias, Construction and working principles of: Light emitting diodes, Heterojunctions, Transistors, FET and MOSFETs.

UNIT-4: Dielectric Materials and their Applications: 9H

Introduction, Dielectric properties, Electronic polarizability and susceptibility, Dielectric constant and frequency dependence of polarization, Dielectric strength and dielectric loss, Piezoelectric properties- Ferroelectricity-Applications.

UNIT-5: Magnetic Materials and their Applications: 9H

Introduction, Magnetism & various contributions to para and dia magnetism, Ferro and Ferri magnetism and ferrites, Concepts of Spin waves and Magnons, Anti-ferromagnetism, Domains and domain walls, Coercive force, Hysteresis, Nano-magnetism, Super-paramagnetism – Properties and applications.

Text Books

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,3rd edition, 2007.

2. Electronic Components and Materials- Grover and Jamwal, DhanpatRai and Co.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition

2. Electronic Materials Science- Eugene A. Irene, , Wiley, 2005

3. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd., , 2nd Edition,2011

4. A First Course In Material Science- by Raghvan, McGraw Hill Pub.

5. The Science and Engineering of materials- Donald R.Askeland,Chapman& Hall Pub.

6. Electrical Engineering Materials-by A.J. Dekker, PHI Pub

NPTEL courses links

https://nptel.ac.in/courses/113/106/113106062/

https://onlinecourses.nptel.ac.in/noc20_mm02/preview

https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-mm07

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II H& SS

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	**Academic Writing and Public Speaking**		**L**	**T**	**P**	**C**
20A65501			**3**	**0**	**0**	**3**
Pre-requisite						

Course Objectives:

- ➢ To encourage all round development of the students by focusing on writing skills
- ➢ To make the students aware of non-verbal skills
- ➢ To develop analytical skills
- ➢ To deliver effective public speeches

Course Outcomes (CO):

By the end of the program students will be able to

- Define various elements of Academic Writing
- Understand how to paraphrase sources and avoid plagiarism
- Demonstrate the knowledge in writing a Research paper
- Analyse different types of essays
- Assess the speeches of others and know the positive strengths of speakers
- Build confidence in giving an impactful presentation to the audience

UNIT - I	Introduction to Academic Writing	Lecture Hrs

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing

UNIT - II	**Academic Journal Article**	Lecture Hrs

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing –

Conference Paper writing - Editing, Proof Reading - Plagiarism		
UNIT - III	**Essay & Writing Reviews**	Lecture Hrs
Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review-		
UNIT - IV	Public Speaking	Lecture Hrs
Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches-Speeches for Academic events		
UNIT - V	Public Speaking and Non-Verbal Delivery	Lecture Hrs
Body Language – Kinesics – Oculesics – Proxemics – Haptics – Paralanguage		
Textbooks:		
3. Critical Thinking, Academic Writing and Presentation Skills: Mg University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010) **4. A Course In Academic Writing Paperback – 1 January 2017Publisher : The Orient Blackswan; Second edition (1 January 2017)**		
Reference Books: 1. **A Handbook For Academic Writing and Composition Paperback – 1 January 2014** by Nzanmongi Jasmine PattonPublisher : Pinnacle Learning; 1st edition (1 January 2014) 2. Critical Thinking, Academic Writing and Presentation Skills: Mg University Edition Paperback – 1 January 2010Publisher : Pearson Education; First edition (1 January 2010) by Marilyn Anderson (Author) 3. Effective Academic Writing Second Edition: 1: Student Book: The Paragraph Paperback – Student Edition, 9 June 2014 by Alice Savage (Author), MasoudShafiei (Author)Publisher : Oxford University Press; Student, Workbook edition (9 June 2014) 4. A Course In Academic Writing Paperback – 1 January 2017 by Renu Gupta (Author) Publisher : The Orient Blackswan; Second edition (1 January 2017)		
Online Learning Resources:		
1. https://youtu.be/NNhTIT81nH8		

2. phttps://www.youtube.com/watch?v=478ccrWKY-A 3. https://www.youtube.com/watch?v=nzGo5ZC1gMw 4. https://www.youtube.com/watch?v=Qve0ZBmJMh4

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF CHEMISTRY

Subject Code	Title of the Subject	L	T	P	C
	CHEMISTRY OF POLYMERS AND ITS APPLICATIONS	2	1	-	3

COURSE OBJECTIVES	
1	To understand the basic principles of polymers
2	To synthesize the different polymeric materials and their characterization by various instrumental methods.
3	To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
4	To enumerate the applications of polymers in engineering

COURSE OUTCOMES	
CO1	Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
CO2	Differentiate Bulk, solution, Suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers, Characterize

	the properties of polymers by IR, NMR, XRD etc.
CO3	Describe the properties and applications of polymers, Interpret the properties of cellulose, lignin, starch, rosin, latex etc., Discuss the special plastics of PES, PAES, PEEK etc., Explain modified cellulosics
CO4	Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery, Demonstrate the advanced drug delivery systems and controlled release
CO5	Demonstrate electrical phenomena at interfaces including electrokinetics, miselles, reverse micelles etc., Explain photoelectron spectroscopy, Discuss ESCA and Auger spectroscopy to the study of surfaces, Differentiate micelles and reverse micelles

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

Unit – I: Polymers-Basics and Characterization :-

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, co polymerization and coordination. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: end group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit – II: Synthetic Polymers

Addition and condensation polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol – formaldehyde. Melamine Epoxy and Ion exchange resins. Characterization of polymers by IR, NMR, XRD

Unit – III : Natural Polymers & Modified cellulosics

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins. Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Unit-IV: Hydrogels of Polymer networks and Drug delivery

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels**,** Applications of hydrogels in drug delivery.

Introduction to drug systems including, drug development, regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release.

Unit – V: Surface phenomena

Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetics, micelles, reverse micelles, solubilization. Application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

References :

1. A Text book of Polymer science, Billmayer
2. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall

3. Advanced Organic Chemistry, B.Miller, Prentice Hall
4. Polymer Chemistry – G.S.Mishra
5. Polymer Chemistry – Gowarikar
6. Physical Chemistry –Galston
7. Drug Delivery- Ashim K. Misra

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III CIVIL

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	Building Technology for Engineers	L	T	P	C
20A70104		3	0	0	3

Course Objectives :

1. To make the student familiar with varioustypes of Buildings and its components
2. To teach the students about general requirements of building regarding safety and transportation
3. To impart knowledge on various special requirements of buildings regarding ventilation, insulation acoustics, etc,.
4. To make the student familiar with the concepts of various Prefabrication systems.
5. To Teach the students about various construction equipments used in building.

Course Outcomes:

By the end of this course the student will be able to

1. Classify various types of buildings and its components.
2. Understand the general requirements of building regarding safety and transportation.
3. Understand the Special requirements of buildings regarding ventilation, insulation acoustics, etc,.
4. Familiarize with the concepts of various Prefabrication systems.
5. Understand various construction equipments used in building.

UNIT-1

Building planning: Types of Buildings — components, definitions, economy and design, Principles and aspects of building planning, Definitions and importance of Grouping and circulation; Lighting and ventilation; Sustainability and Green Buildings.

UNIT-II

General requirements: Requirements for safety against fire, termite, damping, earthquakes, Vertical transportation in building — planning of vertical transportation, Stairs, different forms of stairs, Other modes of vertical transportation.

UNIT-III

Special Requirements: Air conditioning — process and classification of air conditioning, Dehumidification. Systems of air-conditioning, ventilation, functional requirements of ventilation. Thermal insulation. Acoustics, effect of noise, properties of noise and its measurements, Principles of acoustics of building. Sound insulation.

UNIT-IV
Prefabrication systems: Prefabricated walls, openings, cupboards, shelves etc., planning and modules and sizes of components in prefabrication. Plumbing services — water supply system, maintenance of building pipe line, Sanitary fittings, Design of building drainage.

UNIT-V
Construction Equipment: Introduction and Planning for construction Equipment, Earthmoving and Excavating equipment, Pile driving equipment, Lifting and Concreting Equipment.

Learning Resources:

Text Books:

1. Building Construction, Punmia B. C., Jain A.J., and Jain A.J., Laxmi Publication, 2016, Eleventh Edition.
2. The Text book for Building Construction, Arora S. P., and Bindra S. P., Dhanpat Rai Pubications, 2010.

Reference Books:

1. Building Construction, Varghese P.C., PHI Learning Pvt. Ltd., 2017, 2nd Edition.
2. Construction Planning, Equipment and Methods, Robert P., Clifford J. S., and Aviad S., McGrawHiIl Education, 2010

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III EEE

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">BATTERY MANAGEMENT SYSTEMS
(OE-III)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A70204</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td>Basic Electrical Engineering</td><td>Semester</td><td colspan="4">VI</td></tr>
<tr><td colspan="7">Course Objectives: To make the students learn about:</td></tr>
<tr><td colspan="7">• Understand the role of battery management system and the requirements of BMS.
• Interpret the concept associated with battery charging / discharging process
• Analyze various parameters of battery and battery pack
• Design the model of battery pack</td></tr>
<tr><td colspan="7">Course Outcomes (CO): After completion of this course, student will be able to</td></tr>
<tr><td colspan="7">CO1: Understand and remember the basic concepts and terminologies of Cells and Batteries,</td></tr>
</table>

charging, discharging methods, concept of cell balancing. **CO2:**Analyze BMS functionality, various sensors used, control techniques, Sate of Charge estimation, cell total energy and cell total power. **CO3:** Apply the equivalent circuits, physical models, empirical modelling of BMS. **CO4:** Design of Battery management system considering various parameters and through simulation.		
UNIT - I	**INTRODUCTION**	Lecture Hrs: 14
Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging		
UNIT - II	**BATTERY MANAGEMENT SYSTEM**	Lecture Hrs: 14
Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of charge estimation, Cell total energy and cell total power		
UNIT - III	**BATTERY STATE OF CHARGE AND STATE OF HEALTH ESTIMATION**	Lecture Hrs: 12
Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing		
UNIT - IV	**MODELLING AND SIMULATION**	Lecture Hrs: 12
Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs		
UNIT - V	**DESIGN OF BATTERY MANAGEMENT SYSTEMS**	Lecture Hrs: 12
Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system		
Textbooks:		
1. Plett, Gregory L. Battery management systems, Volume I: Battery modelling. Artech House, 2015. 2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech		

House, 2015.
Reference Books:
1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002. 2. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010 3. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008. 4. RuiXiong, "Battery management Algorithm for Electric Vehicles", China Machine Press, Springer,2020. 5. Bergveid, Krujit, Notten, " Battery Management Systems: Design by Modelling", Philips Research Book Series, Kluwer Academic Publishers.
Online Learning Resources:
1. https://www.coursera.org/learn/battery-management-systems

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MECHANICAL ENGINEERING

Subject Code	Title of the Subject	L	T	P	C
20A70304	**MODERN MANUFACTURING METHODS**	3	0	0	3

Course Objectives:

To learn the importance and basics of unconventional machining.
To understand the rapid prototyping processes.

To have the knowledge of different micro machining methods
To understand the working principles of various Non-traditional machining methods.
To learn about Non-traditional forming processes.

UNIT-I

Need for Modern Manufacturing Methods: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing. Classification of non-traditional processes - their selection for processing of different materials and the range of applications.

Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

UNIT-II

Ultrasonic machining – Elements of the process, mechanics of material removal, process parameters, applications and limitations, Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

UNIT-III

Electro –Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM.

Chemical Machining: Fundamentals of chemical machining- Principle of material removal- maskants – etchants- process variables, advantages and applications.

UNIT-IV

Thermal Metal Removal Processes: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved surface finish and machining accuracy - Applications of different processes and their limitations.

Plasma Machining: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

UNIT-V

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations.

Laser Beam Machining: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

Course Outcomes:

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

- Technical aspects of precision machining.
- Applications of rapid prototyping technologies.
- Tool selection for non traditional processes.
- Knowledge of economic aspects of Non traditional processes.
- Fabrication of microelectronic devices.

TEXT BOOKS:

- Manufacturing processes for engineering materials by SeropeKalpakjian and Steven R Schmid, 5edn, Pearson Pub.
- Advanced machining processes, VK Jain, Allied publishers.

REFERENCE:

- New Technology , Bhattacharya A, The Institution of Engineers, India 1984
- Manufacturing Technology, Kalpakzian, Pearson
- Modern Machining Process, Pandey P.C. and Shah H.S., TMH.

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Electronic & Communication Engineering

Course Code	**DIGITAL ELECTRONICS**		**L**	**T**	**P**	**C**
20A70404			3	0	0	3
Pre-requisite		**Semester**	**VII**			

Basics of Electronics and Communication Engineering

Course Objectives:

- To learn simplification methods for minimizing Boolean functions and their realization using logic gates.
- To understand and design various combinational logic circuits like adders and code converters.
- To know the design of various combinational circuits useful to implement logic

functions.

- To study the design of sequential logic circuits in synchronous and asynchronous modes.
- To introduce programmable logic devices.

Course Outcomes (CO): At the end of this course, the students will be able to

- Learn simplification methods for minimizing Boolean functions and their realization using logic gates.
- Understand and design various combinational logic circuits like adders and code converters.
- Know the design of various combinational circuits useful to implement logic functions.
- Gain knowledge on the design of sequential logic circuits in synchronous and asynchronous modes.
- Understand the operation and uses of programmable logic devices.

UNIT - I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Quine –McCluskey Tabular Minimization Method. Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT - II

Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT - III

Combinational Logic Design 2: Decoders (3 to 8, octal to decimal), Encoders, Priority Encoders, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT - IV

Sequential Logic Design: Latches, Flipflops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, flipflop conversions, set up and hold times, Ripple and Synchronous counters, Shift registers.

UNIT - V

Programmable Logic Devices:ROM, Programmable Logic Devices (PLDs), Introduction to logic families and their comparisons.

Textbooks:

1. Digital Design, M. Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, ZviKohavi and Nirah K. Jha, 2nd Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Fundamentals of Logic Design, Charles H Roth, Jr., 5th Edition, Brooks/coleCengage Learning, 2004.
2. Digital & State Machine Design, Comer, 3rd Edition, OXFORD.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – III
IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch
DEPARTMENT OF Compute Science & Engineering

Cyber Security

Course Code:20A70504 **L T P C : 3 0 0 3**

Course Objectives:

- To introduce the concepts of Java.
- To Practice object-oriented programs and build java applications.
- To implement java programs for establishing interfaces.
- To implement sample programs for developing reusable software components.
- To establish database connectivity in java and implement GUI applications.

Course Outcomes:

CO1: Recognize the Java programming environment.
CO2: Select appropriate programming constructs to solve a problem.
CO3: Develop efficient programs using multithreading.
CO4: Design reliable programs using Java exception handling features.
CO5: Extend the programming functionality supported by Java.

UNIT-I: Cybercrime

Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Need for Cyberlaws in Indian context, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Positive aspects and weak areas of ITA 2000, Amendments made in Indian ITA 2000 for admissibility of e- records, Amendments to the Indian IT Act, Global perspective on cybercrimes, Intellectual property in cyberspace, Ethical dimension of cybercrimes.

UNIT-II: Cyber Offenses

Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Need for Cyberlaws in Indian context, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Positive aspects and weak areas of ITA 2000, Amendments made in Indian ITA 2000 for admissibility of e- records, Amendments to the Indian IT Act, Global perspective on cybercrimes, Intellectual property in cyberspace, Ethical dimension of cybercrimes.

UNIT-III: Cybercrime in Mobile and Wireless Devices

Proliferation of mobile and wireless devices, Trends in mobility, Credit card frauds in mobile and wireless computing era, Security challenges posed by mobile devices, Registry settings for mobile devices, Authentication service security, Attacks on mobile/cell phones, Security implications of mobile devices for organizations, Organizational measures for handling mobile devices related security issues.

UNIT-VI: Tools and Methods Used in Cybercrime

Proxy servers and anonymizers, Password cracking, Keyloggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks

UNIT-V: Cyber Forensics, Cybercrime in Real-World

Forensics of Computer and Handheld Devices: Cyber forensics, Cyber forensics and digital evidence, Forensics analysis of e-mail, Forensics and social networking sites, Forensics of handheld devices – Smartphone forensics, EnCase, Device Seizure, MOBIL edit.

Cybercrime examples, mini-cases, online scams: Real-life examples - Official website of Maharashtra Government hacked, Indian banks lose millions of rupees, Game source code stolen; Mini-cases - Indian Case of online gambling, Indian case of intellectual property crime; Online scams - Cheque cashing scam, Charity scams.

References:

1. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424
2. Cyril Prasanna Raj P., “CMOS digital circuit design manual”, Volume 1, MSEC E-publication, Edition 2016

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemical Engineering

Course Code	INDUSTRIAL POLLUTION CONTROL ENGINEERING	L	T	P	C
20A70804		3	0	0	3

Pre-requisite

Course Objectives:

Course Outcomes (CO):

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

- CO1 Understand the different types of wastes generated in an industry, their effects on living and non-living things & environmental regulatory legislations and standards and climate changes.
- CO2 Quantify, analyse and treat wastewater
- CO3 Apply the different unit operations and unit processes involved in conversion of highly polluted water to potable standards
- CO4 Apply the operating principles, design calculations of particulate control devices.
- CO5 Estimate the different waste generated from the industries

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

UNIT - I

Types of emissions from chemical industries and effects of environment, environment legislation, Type of pollution, sources of wastewater, Effluent guidelines and standards. Characterization of effluent streams, oxygen demands and their determination (BOD, COD, and TOC), Oxygen sag curve, BOD curve mathematical, controlling of BOD curve, self purification of running streams, sources and characteristics of pollutants in fertilizer, paper and pulp industry, petroleum and petroleum industry.

UNIT - II

General methods of control and removal of sulfur dioxide, oxides of nitrogen and organic vapors from gaseous effluent, treatment of liquid and gaseous effluent in fertilizer industry. Air pollution sampling and measurement: Types of pollutant and sampling and measurement,ambient air sampling: collection of gaseous air pollutants, collection of particulate air pollutants. Stack sampling: sampling system, particulate sampling, and gaseous sampling. Analysis of air pollutants: Sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and ozones, hydrocarbons, particulate matter

UNIT - III

Air pollution control methods and equipments: Source collection methods: raw material changes, process changes, and equipment modification. Cleaning of gaseous equipments particulate emission control: collection efficiency, control equipment like gravitational settling chambers, Cyclone separators, fabric filters, ESP and their constructional details and design aspects. Scrubbers: wet scrubbers, spray towers, centrifugal scrubbers, packed beds and plate columns, venturi scrubbers, their design aspects. Control of gaseous emissions: absorption by liquids, absorption equipments, adsorption by solids, equipment and the design aspects

UNIT - IV

Introduction to waste water treatment, biological treatment of wastewater, bacterial and bacterial growth curve, aerobic processes, suspended growth processes, activated aerated lagoons and stabilization ponds, attached growth processes, trickling filters, rotary drum filters, anaerobic processes.

UNIT - V

Methods of primary treatments: screening, sedimentation, flotation, neutralization, and methods of tertiary treatment. A brief study of carbon absorption, ion exchange, reverse osmosis, ultra-filtration, chlorination, ozonation, treatment and disposal. Hazardous waste management: nuclear wastes: health and environment effects, sources and disposal methods. Chemical wastes: health and environmental effects, treatment and disposal: treatment and disposal by industry, off site treatment and disposal, treatment practices in various countries. Biomedical wastes: types of wastes and their control.

Textbooks:

1. Environmental Pollution and Control Engineering, C. S. Rao – Wiley Eastern Limited, India, New Delhi, 1993.

2. Pollution Control in Process Industries, S.P. Mahajan, Tata McGraw-Hill, New Delhi, 1985.

Reference Books:

1. Wastewater Treatment, M. Narayana Rao and A.K.Datta, Oxford and IHB publ. New Delhi.

Online Learning Resources:

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	**Numerical Methods for Engineers**		**L**	**T**	**P**	**C**
20A75101	**(Common for all Branches)**		**0**	**3**	**0**	**3**
Pre-requisite	**---**					
Course Objectives:						
This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.						
Course Outcomes (CO): Student will be able to						
• apply numerical methods to solve algebraic and transcendental equations. • understand fitting of several kinds of curves. • derive interpolating polynomials using interpolation formulae. • Solve differential and integral equations numerically.						
UNIT - I	**Solution of Algebraic & Transcendental Equations:**		8 Hrs			
Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.						
UNIT - II	**Curve Fitting**		8 Hrs			
Principle of Least squares- Fitting of curves- Fitting of linear, quadratic and exponential curves.						
UNIT - III	**Interpolation**		9 Hrs			
Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula						

UNIT - IV	**Numerical Integration**	8 Hrs
Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule		
UNIT - V	**Solution of Initial value problems to Ordinary differential equations**	9 Hrs
Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.		
Textbooks:		
4. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 5. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE. 6. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India		
Reference Books:		
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. 4. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.		
Online Learning Resources:		
https://slideplayer.com/slide/8588078/		

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Physics

Subject Code	Title of the Subject	L	T	P	C
20A75201	**SMART MATERIALS AND DEVICES**	3		-	3

COURSE OBJECTIVES	
1	To provide exposure to smart materials and their engineering applications.
2	To impart knowledge on the basics and phenomenon behind the working of smart materials
3	To explain theproperties exhibited by smart materials
4	To educate various techniques used to synthesize and characterize smart materials
5	To identify the required smart material for distinct applications/devices
COURSE OUTCOMES	
At the end of the course the student will be able	
CO1	To recognize the need of smart materials
CO2	To understand the working principles of smart materials
CO3	To know different techniques used to synthesize and characterize smart materials
CO4	To exploit the properties of smart materials
CO5	To make use of smart materials for different applications

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

Credit: 3 **Hours of teaching: - 45 H**

UNITI : Introduction to Smart Materials: 9H

Historical account of the discovery and development of smart materials, Two phases: Austenite and Martensite, Temperature induced phase changes, Shape memory effect, Pseudoelasticity, One-way shape memory effect, Two-way shape memory effect.

UNIT II: Properties of Smart Materials: 9H

Physical principles of optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT III: Synthesis of Smart materials: 9H

Solid state reaction technique, Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method,Co-precipitaiton.Green synthesis, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT IV: Characterization Techniques: 9H

X-ray diffraction, Raman spectroscopy (RS), Fourier-transform infrared reflection (FTIR), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy, Atomic force microscopy (AFM) and Differential Scanning Calorimetry (DSC).

UNIT V:Smart Materials and Devices: 9H

Characteristics of shape memory alloys, Magnetostrictive, Optoelectronic, Piezoelectric, Metamaterials, Electro-rheological and Magneto-rheological materials and Composite materials.

Devices based on smart materials: Sensors & Actuators, MEMS and intelligent devices, Future scope of the smart materials.

Text Books:

1.Encyclopaediaof Smart Materials- Mel Schwartz, John Wiley & Sons, Inc.2002

2. Smart Materials and Structures - M. V. Gandhi and B.S. Thompson, Champman and Hall, 1992

Texts/References:

1. Smart Materials and Technologies- M. Addington and D. L. Schodek, , Elsevier, 2005.

2. Characterization and Application of smart Materials -R. Rai, Synthesis, , Nova Science, 2011.
3. Electroceramics: Materials, Properties, Applications -A.J. Moulson and J.M. Herbert, , 2nd Edn., John Wiley & Sons, 2003.
4. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic 1. Emission Sensors, Materials and Amplifiers,G.Gautschi, Springer, 2002.
5. Optical Metamaterials: Fundamentals and Applications-W. Cai and V. Shalaev, ,springer,2010.
6. Smart Materials and Structures - P. L Reece, New Research, Nova Science, 2007

NPTEL courses links

https://nptel.ac.in/courses/112/104/112104173/
https://nptel.ac.in/courses/112/104/112104251/
https://nptel.ac.in/content/storage2/courses/112104173/Mod_1_smart_mat_lec_1.pdf

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF H &SS

Course Code	**Employability Skills**		**L**	**T**	**P**	**C**
20A75501			**3**	**0**	**0**	**3**
Pre-requisite		**Semester-VII**				

Course Objectives:

- ➢ To encourage all round development of the students by focusing on productive skills
- ➢ To make the students aware of Goal setting and writing skills
- ➢ To enable them to know the importance of presentation skills in achieving desired goals.
- ➢ To help them develop organizational skills through group activities

To function effectively with heterogeneous teams

Course Outcomes (CO):

CO1: Define goals and try to achieve them

CO2: Understand the significance of self-management

CO3: Apply the knowledge of writing skills in preparing eye-catchy resumes

CO4: Analyse various forms of Presentation skills

CO5: Judge the group behaviour

CO6: Develop skills required for employability.

UNIT - I	Goal Setting and Self-Management	Lecture Hrs

Definition, importance, types of Goal Setting – SMART Goal Setting – Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOT Analysis

UNIT - II	Writing Skills	Lecture Hrs
Definition, significance, types of writing skills – Resume writing, E-Mail writing, Cover Letters, - E-Mail Etiquettes		
UNIT - III	Technical Presentation Skills	Lecture Hrs
Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics – PPT & Poster Presentation		
UNIT - IV	Group Presentation Skills	Lecture Hrs
Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion		
UNIT - V	Job Cracking Skills	Lecture Hrs
Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success - Answering Strategies – Mock Interviews		
Textbooks:		
• 1. Soft Skills & Employability Skills (English, Paperback, SABINA PILLAI, AGNA FERNANDEZ)Publisher: Cambridge 2.Personality Development and Soft Skills (English, Paperback, MitraBarun K.)		
Reference Books:		
1. Learning How To Fly - Life Lessons for the Youth (English, Paperback, Kalam Abdul A. P. J.), Rupa& Co 2. Personality Development and Soft Skills - Preparing for Tomorrow 1 Edition (English, Paperback, Shikha Kapoor)Publisher: Dreamtech Press 3. Skills for Employability - Skills for Employability with 0 Disc (English, Paperback, Dr. M. Sen Gupta)Publisher: Innovative Publication		
Online Learning Resources:		
7. **https://youtu.be/gkLsn4ddmTs**		

8. https://youtu.be/2bf9K2rRWwo
9. https://youtu.be/FchfE3c2jzc
10. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemistry

Subject Code	Title of the Subject	L	T	P	C
20A75301	**GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT**	2	1	-	3

COURSE OBJECTIVES	
1	Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products.
2	Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

COURSE OUTCOMES	
CO1	Apply the Green chemistry Principles for day to day life as well as synthesis, Describe the sustainable development and green chemistry, Explain economic and un-economic reactions, Demonstrate Polymer recycling.
CO2	Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries, Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis, Discuss Transition metal and Phase transfer Catalysis
CO3	Demonstrate Organic solvents and importance of solvent free systems, Discuss Super critical carbondioxide, Explain Super critical water and water as a reaction solvent, Interpret Ionic Liquids as Catalyst and Solvent
CO4	Describe importance of Biomass and Solar Power, Illustrate Sonochemistry and Green Chemistry, Apply Green Chemistry for Sustainable Development , Discuss the importance of Renewable resources
CO5	Discuss green Chemistry Principles for practicing Green nano synthesis, Illustrate Microwave Assisted Synthesis, Differentiate Hydrothermal and Reflux synthesis, Demonstrate Green Chemistry applications of Inorganic nanomaterials

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

UNIT 1: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

UNIT 2: CATALYSIS AND GREEN CHEMISTRY

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogeneous and Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples,

UNIT 3: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent.

UNIT 4: EMERGING GREENER TECHNOLOGIES

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable Feedstocks, Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions)

UNIT 5:ALTERNATIVE ENERGY SOURCES

Photo redox catalysis, single electron transfer reactions (SET), Advantages and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis.

Text Books :

1. **M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.**
2. **Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition,**

   Oxford University Press, USA

References :

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and Ackmez Mudhoo, CRC Press, 2010.
2. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Civil Engineering

		L	T	P	C
20A70105	**Environmental Impact Assessment**	**3**	**0**	**0**	**3**

Course Objectives:

1. To impart knowledge on different concepts of Environmental Impact Assessment.
2. To teach procedures of risk assessment.
3. To teach the EIA methodologies and the criterion for selection of EIA methods.
4. To teach the procedures for environmental clearances and audit.
5. To know the impact quantification of various projects on the environment.

Course Outcomes (CO):

1. To prepare EMP, EIS, and EIA report.
2. To identify the risks and impacts of a project.
3. To choose an appropriate EIA methodology.
4. To evaluation the EIA report.
5. To Estimate the cost benefit ratio of a project.

UNIT - I

Concepts and methodologies of EIA :Initial environmental Examination, Elements of EIA, - Factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters- Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

UNIT - II

Impact of Developmental Activities and Land Use :Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.

UNIT - III

Assessment of Impact on Vegetation, Wildlife and Risk Assessment :Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation - Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment-Advantages of Environmental Risk Assessment

UNIT - IV Environmental audit

Introduction - Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report.

UNIT - V Environmental Acts and Notifications

The Environmental protection Act, The water preservation Act, The Air (Prevention &Control of pollution Act), Wild life Act - Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report-Evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO 14000.

Textbooks:

1. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)
2. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011

Reference Books:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G.Mc-Graw Hill International Editions, New York 1985
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers
3. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania& Sons Publication, New Delhi.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd,

Delhi.

Online Learning Resources:

https://nptel.ac.in/courses/124107160

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Electrical & Electronic & Engineering

<table>
<tr><td>Course Code</td><td rowspan="2" colspan="2">IoT APPLICATIONS IN ELECTRICAL ENGINEERING
(OE-IV)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A70205</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td></td><td></td><td colspan="4"></td></tr>
<tr><td colspan="7">Course Objectives: To make the students learn about:</td></tr>
<tr><td colspan="7">Basics of Internet of Things and Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process.
The concept of motion less and motion detectors in IoT applications.
Applications of IoT in smart grid.
The concept of Internet of Energy for various applications.</td></tr>
</table>

Course Outcomes (CO): After completing the course, the student should be able to do the following:		
CO 1 Understand the concept of IoT in Electrical Engineering. **CO 2**Analyze various types of motionless sensors and various types of motion detectors **CO 3** Apply various applications of IoT in smart grid. **CO 4** Design future working environment with Energy internet.		
UNIT - I	**SENSORS**	Lecture Hrs: 10
Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric		
UNIT - II	**OCCUPANCY AND MOTION DETECTORS**	Lecture Hrs: 10
Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors		
UNIT - III	**MEMS**	Lecture Hrs: 10
Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors		
UNIT - IV	**IoT FOR SMART GRID**	Lecture Hrs: 8
Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home		
UNIT - V	**INTERNET of ENERGY (IoE)**	Lecture Hrs: 10
Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid .		
Textbooks:		
4. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004 5. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1st Edition, Mc Grawhill Education, 2017 6. ErsanKabalci and YasinKabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019		

Reference Books:
4. Raj Kumar Buyya and Amir VahidDastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016 5. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1st Edition, CRC Press, 2019 6. RMD SundaramShriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019
Online Learning Resources:
1. https://onlinecourses.nptel.ac.in/noc22_cs96/preview 2. https://nptel.ac.in/courses/108108123 3. https://nptel.ac.in/courses/108108179

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Mechanical Engineering

Subject Code	Title of the Subject	L	T	P	C
20A70305	**MATERIAL HANDLING EQUIPMENTS**	3	0	0	3

Course Objectives:

To understand how the knowledge of materials management can be an advantage to logistics and supply chain operations.

To sensitize the students on the materials management functions – Planning, Purchase, Controlling, Storing, Handling, Packaging, Shipping and Distributing, and Standardizing.

To realize the importance of materials both in product and service.

planning/ production and plant layouts, studying about strategies of material handling and equipments, and selection of site locations.

It also aims to explore the layout planning by computer applications following different algorithms.

UNIT-I

Overview of Material Handling: Principles of Material Handling, Principal groups of Material Handling equipment – General Characteristics and application of Material Handling Equipment, Modern trends in material handling.

UNIT-II

Lifting Equipments: Hoist- Components of Hoist – Load Handling attachments hooks, grabs and clamps – Grabbing attachments for bulk material – Wire ropes and chains.

UNIT-II

Lifting tackle pulleys for gain of force and speed: Tension in drop parts – Drums, Shears and sprockets – Arresting gear and brakes – Block brakes, Band brakes, thrust brakes – Safety and hand cranks. Principle operation of EOT, Gantry and jib cranes Hoisting Mechanisms, Travelling mechanisms, lifting mechanisms – Slewing Mechanisms – Elevators and lifts.

UNIT-IV

CONVEYORS: Types - description -applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors

UNIT-V

ELEVATORS: Bucket elevators: Loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

Course Outcomes :

The students will be able to select appropriate location for establishing industrial plants by applying the concepts of location selection.

The students will be able to plan and design plant and production layouts through basic strategies and with computer applications.

The students will be able to identify and analyse the problems in the existing layout/ material handling system and shall be able to the optimize the layout/ material handling system

The students will be able to develop algorithms for new planning layouts for typical applications in the industries and Suggesting appropriate material handling strategies in the industries.

The students will be able to design of fork lift trucks.

REFERENCES

Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.

Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.

Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.

Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.

P.S.G. Tech., “Design Data Book”, KalaikathirAchchagam, Coimbatore, 2003.

Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol. 1 & 2, Suma Publishers, Bangalore, 1983

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Electronics & Communication Engineering

Course Code	PRINCIPLES OF DIGITAL SIGNAL	L	T	P	C

20A70405 **PROCESSING** 3 0 0 3

Pre-requisite

Basics of Electronics and Communication Engineering

Course Objectives:

- To understand the frequency domain analysis of discrete time signals.
- To learn the properties of discrete Fourier series and Fourier transforms.
- To design &analyzeIIR digital filters from analog filters.
- To know various structures used in implementation of FIR digital filters.
- To grasp the importance and applications of Multirate Digital signal processing.

Course Outcomes (CO): At the end of this course, the students will be able to

- Articulate the frequency domain analysis of discrete time signals.
- Understand the properties of discrete Fourier series and Fourier transforms.
- Design &analyzeIIR digital filters from analog filters.
- Design various structures used in implementation of FIR digital filters.
- Summarize the importance and applications of Multirate Digital signal processing.

UNIT - I

Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, LTI system Properties. Solution of Linear constant coefficient difference equations, frequency domain representation of discrete time signals and systems. Review of Z-transforms.

UNIT - II

Discrete Fourier Series and Fourier Transforms: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

UNIT - III

Design of IIR Digital Filters and Realizations: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.

UNIT - IV

Design of FIR Digital Filters and Realizations: Characteristics of FIR Digital Filters, frequency response. Design of FIR digital filters using window techniques and frequency sampling techniques, comparison of IIR & FIR filters, basic structures of FIR systems.

UNIT - V

DSP Applications: Introduction to programmable DSPs, Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a 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 using block diagram representation study only.

Textbooks:

1. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing, Principles, Algorithmsand Applications”, Pearson Education, 2007.
2. A.V. Oppenheim and R.W. Schaffer, “Discrete Time Signal Processing”, PHI.

Reference Books:

1. Andreas Antoniou, “Digital Signal Processing”, TATA McGraw Hill, 2006
2. MH Hayes, “Digital Signal Processing”, Schaum’s Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling and Sandra L. Harris, “Fundamentals of Digital Signal Processing using MATLAB”, Thomson, 2007.
4. B. Venkataramani and M. Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications”, TATA McGraw Hill, 2002.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – IV
IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch
DEPARTMENT OF Computer Science & Engineering

Introduction to Database Management Systems

Course Code:20A70505 **L T P C : 3 0 0 3**

Course Objectives:

- To introduce the concept of Internet of Things.
- To Practice programs and build real time applications.
- Students will be explored to the interconnection and integration of the physical world.
- Students will gain practical experience in the development of Cloud-based IoT systems.
- To get knowledge on cloud platforms

Course Outcomes (CO):

CO1: Design reliable real time applications using microcontrollers and microprocessors .
CO2: Extend the programming functionality and design new modules.
CO3: Able to design & develop IOT Devices.

UNIT-I: Introduction

Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database

system, approaches to building a database, data models, database management system, Data Independence, DBMS

system architecture, challenges in building a DBMS, various components of a DBMS

Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database

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UNIT-II: E/R Model

Conceptual Data Modeling – motivation, entities, entity types, various types of attributes, relationships, relationship

types, Entity set types, Participation constraints, E/R diagram notation, Extended E/R Model, Examples

Conceptual Data Modeling – motivation, entities, entity types, various types of attributes, relationships, relationship

types, Entity set types, Participation constraints, E/R diagram notation, Extended E/R Model, Examples

Conceptual Data Modeling - motivation, entities, entity types, various types of attributes, relationships, relationship types, Entity set types, Participation constraints, E/R diagram notation, Extended E/R Model, Examples.

UNIT-III: Relational Data Model

Concepts of relations, schema-instance distinction, keys, referential integrity & foreign keys, converting the database specification in ER notation to the relational schema, Relational algebra operators: selection, projection, cross product, various types of joins, division, set operations, example queries, tuple relational calculus, domain relational calculus, Fundamentals of SQL.

UNIT-VI: Relational Database Design

Importance of a good schema design, problems encountered with bad schema designs, motivation for normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, Normalization, Normal Forms - INF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, multi valued dependencies and 4NF, join dependencies and 5NF, Concept of Denormalization.

UNIT-V: Transaction Processing,Data Storage & Indexing

Transaction processing and Error recovery-Concepts of transaction processing, ACID properties, concurrency control, Serializability, locking based protocols, Timestamp based protocols, recovery and logging methods.

Data Storage and Indexes - File organizations, primary, secondary index structures, various index structures - hasb based, dynamic hashing techniques, multi-level indexes, B and B-trees.

References:

3. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424
4. Cyril Prasanna Raj P., “CMOS digital circuit design manual”, Volume 1, MSEC E-publication, Edition 2016

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemical Engineering

Course Code	SOLID WASTE MANAGEMENT	L	T	P	C
20A70805		**3**	**0**	**0**	**3**

Pre-requisite

Course Objectives:

- Material flow in society and generation of solid waste source
- Clarification of solid waste on characterization of the same
- Understand the sense of onsite handling storage and collection systems including transportation
- Understand processing technologies with mechanical volume reduction and thermal volume reduction corporate land filling, deep well injections.
- Learn to estimate material recovery energy recovery from a given waste data using case standing

Course Outcomes (CO):

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

CO1	Identify sources and relationship between various functional elements of solid waste management and methods of storage and collection and transport of solid wastes.
CO2	Know the importance of transfer station and suggest suitable methods of solid waste disposal based on the composition of solid waste.
CO3	Suggest suitable methods for the management of plastic and E-wastes
CO4	Identify hazardous wastes and suggest suitable management techniques for radioactive wastes and Bio-medical wastes.
CO5	Adopt the suitable management method for a given industry

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

UNIT - I

Introduction: Definition, characteristics and perspectives of solid waste. Types of solid waste. Physical and chemical characteristics. Variation of composition and characteristics. Municipal, industrial, special and hazardous wastes.

General aspects Overview of material flow in society. Reduction in raw material usage. Reduction in solid waste generation. Reuse and material recovery. General effects on health and environment. Legislations

UNIT - II

Engineered systems: Typical generation rates. Estimation and factors effecting generation rates. On site handling. Storage and processing. Collection systems and devices. Transfer and transport.

UNIT - III

Processing Techniques: Mechanical volume reduction. Thermal volume reduction. Component separation. Land filling and land forming. Deep well injection.

UNIT - IV

Material recovery: Mechanical size alteration. Electromagnetic separation. Drying and dewatering. Other material recovery systems. Recovery of biological conversion products. Recovery of thermal conversion products.

Energy recovery: Energy recovery systems and efficiency factors. Determination of output and efficiency. Details of energy recovery systems. Combustion incineration and heat recovery. Gasification and pyrolysis. Refuse derived fuels (RDF).

UNIT - V

Case studies: Major industries and management methods used in typical industries – Coal fired power stations, textile industry, oil refinery, distillery, sugar industry, and radioactive waste generation units.

Textbooks:

1. Howard S. Peavy, Environmental Engineering, McGraw Hill International Edition, 1986.
2. Dutta, Industrial Solid Water Management and Land Filling Practice, Narose Publishing House, 1999.

Reference Books:

1. Sastry C.A., Waste Treatment Plants, Narose Publishing House, 1995.
2. Lagrega, Hazardous Waste Management, McGraw Hill, 1994.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – IV
IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch
DEPARTMENT OF MATHEMATICS

Course Code	Number theory and its Applications		L	T	P	C
20A75102			0	3	0	3
Pre-requisite	-----	Semester	I			
Course Objectives:						
This course enables the students to learn the concepts of number theory and its applications to information security.						
Course Outcomes (CO): Student will be able to						
• understand number theory and its properties. • understand principles on congruences • develop the knowledge to apply various applications • develop various encryption methods and its applications.						

UNIT - I	**Integers, Greatest common divisors and prime Factorization**	8 Hrs
The well-ordering property-Divisibility-Representation of integers-Computer operations with integers-Prime numbers-Greatest common divisors-The Euclidean algorithm -The fundamental theorem of arithmetic-Factorization of integers and the Fermat numbers-Linear Diophantine equations		
UNIT - II	**Congruences**	8 Hrs
Introduction to congruences -Linear congruences-The Chinese remainder theorem-Systems of linear congruences		
UNIT - III	**Applications of Congruences**	9 Hrs
Divisibility tests-The perpetual calendar-Round-robin tournaments-Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem-Pseudo primes- Euler's theorem- Euler's p hi-function- The sum and number of divisors- Perfect numbers and Mersenne primes.		
UNIT - IV	**Finite fields & Primality, factoring**	8 Hrs
Finite fields- quadratic residues and reciprocity-Pseudo primes-rho method-fermat factorization and factor bases.		
UNIT - V	**Cryptology**	9 Hrs
Basic terminology-complexity theorem-Character ciphers-Block ciphers-Exponentiation ciphers- Public-key cryptography-Discrete logarithm-Knapsack ciphers- RSA algorithm-Some applications to computer science.		
Textbooks:		
1. Elementary number theory and its applications, Kenneth H Rosen, AT & T Information systems & Bell laboratories. 2. A course in Number theory & Cryptography, Neal Koblitz, Springer.		

Reference Books:
1. An Introduction To The Theory Of Numbers, Herbert S. Zuckerman, Hugh L. Montgomery, Ivan Niven, wiley publishers 2. Introduction to Analytic number theory-Tom M Apostol, springer 3. Elementary number theory, VK Krishnan, Universities press
Online Learning Resources:
https://www.slideshare.net/ItishreeDash3/a-study-on-number-theory-and-its-applications

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Physics

Subject Code	Title of the Subject	L	T	P	C
20A75202	**SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS**	3		-	3

COURSE OBJECTIVES	
1	To provide exposure to various kinds of sensors and actuators and their engineering

	applications.
2	To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
3	To explain the operating principles of various sensors and actuators
4	To educate the fabrication of sensors
5	To explain the required sensor and actuator for interdisciplinary application
COURSE OUTCOMES	
At the end of the course the student will be able	
CO1	To recognize the need of sensors and actuators
CO2	To understand working principles of various sensors and actuators
CO3	To identify different type of sensors and actuators used in real life applications
CO4	To exploit basics in common methods for converting a physical parameter into an electrical quantity
CO5	To make use of sensors and actuators for different applications

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

Credits: 3 **Hours of teaching:- 45 H**

UNIT – I: Introduction to Sensors and Actuators 9H

Sensors: Types of sensors:temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Materials used and their fabrication process: Deposition:ChemicalVapor Deposition, Pattern: photolithography and Etching: Dry and WetEtching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Hydraulic, Pneumatic, Mechanical, Electrical, Magnetic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT –II: Temperature and Mechanical Sensors 9H

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Resistance temperature sensors, Silicon resistive sensors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Semiconductor, Piezoresistive, capacitive, Variable Reluctance Sensor (VRP).

UNIT –III: Optical and Acoustic Sensors 9H

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo-resistors based sensors, Photomultipliers, Infrared sensors:thermal, Passive Infra Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones.

UNIT –IV: Magnetic, Electromagnetic Sensors and Actuators 9H

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magneto-strictive sensors and actuators, Voice coil actuators (speakers and speaker-like actuators).

UNIT –V: Chemical and Radiation Sensors 9H

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Geiger-Muller counters, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Text Books:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

Reference Books:

1.Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.
5. Principles of Industrial Instrumentation By D. Patranabhis

NPTEL courses links

https://onlinecourses.nptel.ac.in/noc21_ee32/preview

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF H & SS

Subject Code	Title of the Subject	L	T	P	C
20A79102	English Literary Spectrum	3		0	3

COURSE OBJECTIVES	
1	To develop aesthetic sense to appreciate the beauty of life
2	To introduce to Elizabethan drama and be able to appreciate the nuances of humour
3	To familiarize with Victorian novel and industrialization
4	To expose to the historical significance of ideas of different periods
5	To give exposure to the vicissitudes of life through short stories

COURSE OUTCOMES	
CO1	Awareness to lead a life of quality than quantity
CO2	Able to understand humour and Elizabethan culture
CO3	Enable to appreciate human relations in this mechanized world

CO4	Tolerant and receptive to different ideas
CO5	Be imaginative and understanding of human aspirations

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

UNIT I: Poetry

1. Ode to a Grecian Urn- John Keats
2. To a Skylark- P.B.Shelley
3. Satan's Speech from Paradise Lost Book I- 140-170 lines- John Milton
4. My Last Duchess- Robert Browning

UNIT II: Drama

1. Twelfth Night- William Shakespeare
   a) Elizabethan theatre
   b) Shakespearean tragedy
   c) Shakespearean Comedy
   d) Themes of Shakespearean Dramas

UNIT III: Novel

1. Hard Times- Charles Dickens

a) Rise of the English Novel
b) Victorian Novel
c) Utilitarianism
d) Humanism

UNIT IV: Prose

1. Of Studies – Francis Bacon
2. On Seeing People Off- A.G.Gardiner
3. Sweetness and Light- Mathew Arnold
4. I too have a Dream- Martin Luther King Junior

UNIT V: Short Stories

1. The Last Leaf- O.Henry
2. Useless Beauty- Guy de Maupassant
3. After the Dance – Leo Tolstoy
4. The Selfish Giant- Oscar Wilde

Text Books:

The Oxford Book of English Verse by Christopher Ricks (Editor)

Twelfth Night (2010 edition): Oxford School Shakespeare (Oxford School Shakespeare Series)

Dickens Charles, Hard Times (Penguin Classics)

The Art of the Personal Essay: An Anthology from the Classical Era to the Present, Anchor Books Publication

References:

Legois and Cazamian, *A History of English Literature*

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemistry

Subject Code	Title of the Subject	L	T	P	C
20A75302	**CHEMISTRY OF NANOMATERIALS AND APPLICATIONS**	2	1	-	3

COURSE OBJECTIVES	
1	To understand synthetic principles of Nanomaterials by various methods
2	And also characterisae the synthetic nanomaterials by various instrumental methods
3	To enumerate the applications of nanomaterials in engineering

COURSE OUTCOMES	
CO1	Classify the nanostructure materials, Describe scope of nano science and technology, Explain different synthetic methods of nano materials, Identify the synthetic methods of nanomaterial which is suitable for preparation of particular material

CO2	Describe the top down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapour deposition method and electrodeposition method, Discuss about high energy ball milling.
CO3	Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis, Apply different spectroscopic techniques for characterization
CO4	Explain synthesis and properties and applications of nanaomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, Describe liquid crystals
CO5	Illustrate applications of nanaomaterials, Discuss the magnetic applications of nanomaterials, list the applications of non-linear optical materials, Describe the applications fullerenes, carbon nanotubes

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

Unit – I

Basics and Characterization of Nanomaterials : Introduction**,** Scope of nanoscience and nanotecnology, nanoscience in nature, classification of nanostructured materials, importance of nano materials.

Unit – II

Synthesis of nanomaterials : Top-Down approach**,** Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling method.

Synthetic Methods**:** Bottom-Up approach**:-** Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT-III

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterilas, BET method for surface area analysis, dynamic light scattering for particle size determination-

UNIT-IV

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials, fullerenes, carbon nanotubes, core-shell nanoparticles, nanoshells, self- assembled monolayers, and monolayer protected metal nanoparticles, nanocrystalline materials, magnetic nanoparticles and important properties in relation to nanomagnetic materials, thermoelectric materials, non-linear optical materials and liquid crystals.

UNIT-V

Engineering Applications of Nanomaterials : Applications of Nano Particle, nano rods of nano wires, Fullerenes, carbon nano tubes, Graphines nanoparticles and other applications of nonmaterials and uses.

TEXT BOOKS:

1. **NANO: The Essentials:** T Pradeep, MaGraw-Hill, 2007.
2. **Textbook of Nanoscience and nanotechnology:** B S Murty, P Shankar, Baldev Rai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2. **Nanostructures & Nanomaterials; Synthesis, Properties & Applications:** Guozhong Cao, Imperial College Press, 2007.
3. **Nanomaterials Chemistry**, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.