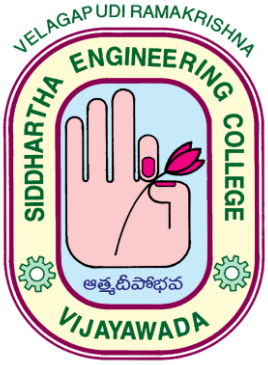
w.e.f. 2017-18

VR 17

B.Tech.

ELECTRICAL AND ELECTRONICS ENGINEERING

(Scheme of Instruction & Detailed Syllabus)



Department of Electricaland Electronics Engineering

Velagapudi Ramakrishna SiddharthaEngineeringCollege

Kanuru,Vijayawada

AndhraPradesh- 520007,INDIA.

www.vrsiddhartha.ac.in

V.R.SIDDHARTHA ENGINEERING COLLEGE: VIJAYAWADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

INSTITUTE VISION

To nurture excellence in various fields of engineering by imparting timeless core values to the learners and to mould the institution into a centre of academic excellence and advanced research.

INSTITUTE MISSION

To impart high quality technical education in order to mould the learners into globally competitive technocrats who are professionally deft, intellectually adept and socially responsible. The institution strives to make the learners inculcate and imbibe pragmatic perception and proactive nature so as to enable them to acquire a vision for exploration and an insight for advanced enquiry.

DEPARTMENT VISION

To impart quality education and strive for centre of excellence in research**.**

DEPARTMENT MISSION

To prepare future technocrats for a global workplace through excellence in teaching and research. The department endeavors to prepare the students professionally skillful, intellectually proficient and socially responsible

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Excel in chosen career and/or higher education.

PEO2: Exhibit professionalism, ethical, attitude, communication skills, teamwork and adapt to current trends by engaging in lifelong learning.

PEO3: Demonstrate technical competence in solving engineering problemsthat are economically feasible and socially acceptable.

PROGRAMME OUTCOMES

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineeringfundamentals, and an engineering specialization to the solution of complex engineeringproblems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics,natural sciences and engineering sciences.

PO3. Design/Development of solutions: Design solutions for complex engineering problems anddesignsystem components or processes that meet the specified needs with appropriateconsiderationfor thepublic health andsafety, and the cultural, societal, and environmentalconsiderations.

PO4.Conduct investigations of complex problems: Use research-basedknowledge and researchmethods including design of experiments, analysisand interpretation of data, and synthesis oftheinformation to provide validconclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, andmodern engineering and IT tools including prediction andmodeling to complex engineeringactivities with an understanding of thelimitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assesssocietal, health, safety, legal and cultural issues and theconsequent responsibilities relevant to theprofessional engineeringpractice.

PO7. Environment and sustainability: Understand the impact of theprofessional engineeringsolutions in societal and environmental contextsand demonstrate the knowledge of, and needforsustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics andresponsibilities andnorms ofthe engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader indiverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineeringactivities with theengineering community and with society at large, suchas, being able to comprehend and writeeffective reports and designdocumentation, make effective presentations, and give and receive clearinstructions.

PO11. Project Management and finance: Demonstrate knowledge andunderstanding of theengineeringand management principles and applythese to one's own work, as a member and leaderin a team, tomanageprojects and in multidisciplinary environments.

PO12. Life-long Learning: Recognize the need for, and have the preparation and ability toengage in independent and lifelong learning in the broadestcontext of technological change.

PROGRAMMESPECIFIC OUTCOMES

PSO1:Understand,analyzeanddesignsystemsthatefficientlygenerate,transmit,distribute and utilize electric power.

PSO2: Toexpertiseinthetechnologyassociatedwithefficientconversionandcontrolof electrical power to the requiredform.

V.R.SIDDHARTHA ENGINEERING COLLEGE: VIJAYAWADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VR17 SCHEME OF INSTRUCTION FOR B.TECH (EEE)

SEMESTER-I

S.No	CourseCode	Course	L	T	P	Credits
1.	17MA1101	Matrices andDifferential Calculus	3	1	0	4
2.	17CH1102A	EngineeringChemistry	3	0	0	3
3.	17CS1103	Problem SolvingMethods	2	1	0	3
4.	17ME1104A/ 17ME1104B	EngineeringMechanics–I (ME and CE) Mechanics for Engineers(EEE)	3	0	0	3
5.	17ME1105	EngineeringGraphics	2	0	4	4
6.	17CH1151	EngineeringChemistry Laboratory	0	0	3	1.5
7.	17CS1152	Computingand Peripherals Laboratory	0	0	2	1
Total			**13**	**2**	**9**	**19.5**
8.	17MC1106	Professional Ethics &Human Values	2	0	0	-

SEMESTER-II

S.No	CourseCode	Course	L	T	P	Credits
1.	17MA1201	LaplaceTransforms and Integral Calculus	3	1	0	4
2.	17PH1202	EngineeringPhysics	3	0	0	3
3.	17CS1203	Programmingin C	3	0	0	3
4.	17ME1204 17EE1204	EngineeringMechanics–II (ME and CE) NetworkAnalysis-1(EEE)	3	0	0	3
5.	17HS1205	Technical English and Communication Skills	2	0	2	3
6.	17PH1251	EngineeringPhysicsLaboratory	0	0	3	1.5
7.	17CS1252	Computer Programming Laboratory	0	0	3	1.5
8.	17ME1253	Basic Workshop	0	0	3	1.5
Total			**14**	**1**	**11**	**20.5**
9.	17MC1206A	Technologyand Society	1	0	0	-

L–Lecture, **T**– Tutorial,**P** –Practical,**C**-Credits

SEMESTER– III

S.No	CourseCode	Course	L	T	P	Credits
1.	17MA1301/EE	Transformations& NumericalMethods	3	1	0	4
2.	17EE3302	Electronic Circuits	3	0	0	3
3.	17EE3303	Electrical Machines –I	3	1	0	4
4.	17EE3304	Network Analysis–II	3	1	0	4
5.	17EE3305	Digital Electronics	3	0	0	3
6.	17TP1306	Logic &Reasoning	0	0	2	1
7.	17EE3351	Networks &Electrical Machines-ILab	0	0	3	1.5
8.	17EE3352	Electronic Circuits Lab–I	0	0	3	1.5
Total			15	3	8	22
9.	17MC1307B	IndianConstitution (EIE/CE/ME/EEE)	2	0	0	-

SEMESTER-IV

S.No	CourseCode	Course	L	T	P	Credits
1.	17EE3401	LinearControl Systems	3	0	0	3
2.	17EE3402	Electrical Measurements	3	0	0	3
3.	17EE3403	ElectricalMachines–II	3	1	0	4
4.	17EE3404	Digital Signal Processing	3	1	0	4
5.	17TP1405	English forProfessionals	0	0	2	1
6.	17HS2406	Humanities Elective	1	0	0	1
7.	17EE3451	Electrical Machines–IILab	0	0	3	1.5
8.	17EE3452	ControlSystems &Measurements Lab	0	0	3	1.5
9.	17HS1453	Communication SkillsLab	0	0	2	1
Total			**13**	**2**	**10**	**20**
10	17MC1407A	Environmental Studies (EIE/CE/ME/EEE)	2	0	0	-

List of Humanities Electives

A:Yoga & Meditation
B: Music
C:Human Rights and Legislative Procedures
D:Philosophy
E:Development of societies
F:Visual Communication
G:Film Appreciation
H :Sanskrit Bhasa
I1:Foreign Languages (French)
I2:Foreign Languages (Germany)
J:Psychology

SEMESTER-V

S.No	Course Code	Course	L	T	P	Credits
1.	17EE3501	Power Systems – I	3	1	0	4
2.	17EE3502	Operational Amplifiers and Linear Integrated Circuits	3	1	0	4
3.	17EE3503	Microcontrollers	3	1	0	4
4.	17EE2504	Open Elective – I	3	0	0	3
	17EE2504A	Electrical Materials				
	17EE2504B	Waste to Energy Conversion Technology				
5.	17XX2505	Open Elective -II (Inter Disciplinary Elective)	3	0	0	3
	17EE2505A	Fundamentals of Power System				
	17EE2505B	Renewable Energy Systems				
6.	17EE2506	Open Elective-III* (Self-Learning Elective Course)	0	0	0	2
	17EE2506A	Illumination Engineering				
	17EE2506B	Introduction to Soft Computing				
	17EE2506C	NPTEL/SWAYAM/COURSE ERA/EDX/Spoken _Tutorial(IITB)				
7.	17TP1507	Personality Development	0	0	2	1
8.	17EE3551	Microcontrollers Lab	0	0	3	1.5
9.	17EE3552	Electronic Circuits Lab – II	0	0	3	1.5
Total			**15**	**3**	**8**	**24**

*Students can opt any one of the self-learning courses prescribed by the department. Students can register and complete the opted course in approved MOOCS platform either in IV or V semester such that they have to submit the certificate on or before the last instruction day of V semester.

SEMESTER-VI

S.No	CourseCode	Course	L	T	P	Credits
1.	17EE3601	Power Systems - II	3	1	0	4
2.	17EE3602	PowerElectronics	3	1	0	4
3.	17EE4603	Program Elective-1 A. Advanced Control Systems B. Digital Control Systems C. Programmable Logic Controller	3	0	0	3
4.	17HS1604	Engineering Economics and Finance	2	0	0	2
5.	17EE2605	Open Elective-IV	3	0	0	3
	17EE2605A	Industrial Electrical System				
	17EE2605B	Electrical Energy Conservation and Audit				
6.	17TP1606	Quantitative Aptitude	0	0	2	1
7.	17EE3651	PowerElectronics Lab	0	0	3	1.5
8.	17EE3652	Digital Signal Processing Lab	0	0	3	1.5
9.	17EE5653	Engineering Project for Community Services*	0	1	2	2
Total			**14**	**3**	**10**	**22**
10.	17MC1607	Biology forEngineers	2	0	0	---

SEMESTER-VII

S.No	Course Code	Course	L	T	P	Credits
1.	17EE3701	Power System Analysis	3	0	2	4
2.	17EE4702	Program Elective -2 A. Power System Operation &Control B. HVDC & FACTS C.High Voltage Engineering D. Optimization Techniques	3	0	0	3
3.	17EE4703	Program Elective -3 A. Utilization of Electrical Energy B. Power Quality C. Electrical Distribution Systems D. Power System Protection	3	0	0	3
4.	17EE4704 **17EE4755D**	Program Elective -4 A. Digital Communications B. VLSI Design C. Embedded Systems D. Digital Controllers Lab	3 1	0 0	0 4	3
5.	17EE4705 **17EE4756D**	Program Elective -5 A. Industrial Drives B. Advanced Power Electronics C. Modeling of Electrical Machines D. PLC And SCADA Lab	3 1	0 0	0 4	3
6.	17EE4751	Power Systems Lab	0	0	2	1
7.	17EE4752	Simulation of Electrical Systems Lab	0	0	2	1
8.	17EE5753	Mini Project *	0	0	4	2
9.	17EE6754	A. Internship B. Industry offered Course C. Global Professional Certification	-	-	-	2
Total			**15/11**	**0**	**10/18**	**22**

SEMESTER-VIII

S.No	Course Code	Course	L	T	P	Credits
1.	17EE4801 17EE4852D	Program Elective – 6 A. Solar Photovoltaics B. Fuel Cell and Ocean Energy Conversion Systems. C. Energy Management and Audit D. Industrial Drives Lab.	3 1	0 0	0 4	3
2.	17EE2802	Open Elective -V*	3	0	0	3
		A. Introduction to Smart Grid Technology				
		B. Electrical And Hybrid Vehicles				
3.	17EE5851	Major Project**	0	5	8	9
Total			**6/4**	**5**	**8/12**	**15**

*Open Elective- V may also opt as self-learning course. Students can register and complete the opted course in approved MOOCS platform on or before last instruction day of VIII semester. They have to submit the certificate before the last instruction day of VIII semester. Students who have not opted as a self-learning are required to attend for the class work and internal assessment as per the regular theory course.

**Major project involves continuation of Mini Project. The objective is to complete the work as per the prepared work plan and prepare a detailed project report.

V.R.SIDDHARTHA ENGINEERING COLLEGE: VIJAYAWADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION FOR B.TECH(EEE) FIRST YEAR

Semester-I **Contact Hours: 26**

S.No	CourseCode	Course	L	T	P	Credits
1.	17MA1101	Matrices andDifferential Calculus	3	1	0	4
2.	17CH1102	EngineeringChemistry	3	0	0	3
3.	17CS1103	Problem SolvingMethods	2	1	0	3
4.	17ME1104A/ 17ME1104B	EngineeringMechanics–I (ME and CE) Mechanics for Engineers(EEE)	3	0	0	3
5.	17ME1105	EngineeringGraphics	2	0	4	4
6.	17CH1151	EngineeringChemistry Laboratory	0	0	3	1.5
7.	17CS1152	Computingand Peripherals Laboratory	0	0	2	1
Total			**13**	**2**	**9**	**19.5**
8.	17MC1106	Professional Ethics &Human Values	2	0	0	-

L–Lecture, **T**– Tutorial,**P** –Practical,**C**-Credits

17MA1101-MATRICES AND DIFFERENTIAL CALCULUS

Course Category:	**Institutional core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Fundamentals of Matrices, Fundamentals of Calculus, Integration, Differentiation	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Determine** Eigen values, Eigen vectors of a matrix.
CO2	**Estimate** Maxima and Minima of Multi Variable Functions.
CO3	**Solve** the Linear differential equations with constant coefficients.
CO4	**Solve** the Linear differential equations with variable coefficients.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**H**			**M**				**L**		**H**			
CO2	**H**	**H**			**M**				**L**		**H**			
CO3	**H**	**H**			**M**				**L**		**H**			
CO4	**H**	**H**			**M**				**L**		**H**			

Course Content

UNIT-I **Text Book -1]**

Matrices: Rank of a matrix, elementary transformations, inverse of a matrix (Gauss Jordan Method),consistency of linear system of equations, linear transformations, vectors, Eigen values, properties of Eigen values, finding inverse and powers of a matrix by Cayley-Hamilton theorem, reduction to diagonal form, reduction of quadratic form to canonical form, nature of a quadratic form, complex matrices.

UNIT-II **[Text Book -1]**

Differential Calculus: Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's theorem, Maclaurin's series.

Application: Curvature, radius of curvature**.**

Functions of two or more Variables: Partial derivatives, change of variables, Jacobians, Taylor's theorem for function of two variables, maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.

UNIT-III **[Text Book -1]**

Differential Equations of First Order: Formation of a differential equation, solution of a differential equation, linear equations, Bernoulli's equation, exact differential equations, equations reducible to exact equations.

Applications: Orthogonal trajectories, Newton's law of cooling.
Linear Differential Equations of Higher Order: Definitions, Operator D, rules for finding the complementary function, inverse operator, rules for finding particular integral, working procedure to solve the equation.

UNIT-IV **[Text Book -1]**
Linear Dependence of Solutions: Method of variation of parameters, Method of undetermined coefficients, equations reducible to linear equations with constant coefficients, Cauchy's homogeneous linear equation, Legendre's linear equation, simultaneous linear differential equations with constantcoefficients.
Applications: L-C-R Circuits.

Text Book:

[1] B.S.Grewal , "*Higher Engineering Mathematics* ", Khanna Publishers ,43rd edition, 2014.

Reference Books:

[1] Pal Bhunia , "*Engineering Mathematics* ",Oxford University Press,2015.
[2] Erwin Kreyszig , " Advanced Engineering Mathematics", John Wiley & Sons, 10th edition, 2015.
[3] B.V.Ramana, "*Higher Engineering Mathematics*", Tata MC Graw Hill, 1st Edition, 2007.
[4] N.P.Bali, Dr.Manish Goyal, "*A Text Book of Engineering Mathematics*", Laxmi Publications, 9th edition, 2014.

E-resources and other digital material

[1] www.nptel videos.com/mathematics/ (Math Lectures fromT,Stanford,IIT's)
[2] www.nptel.ac.in/courses/122104017
[3] www.nptel.ac.in/courses/111105035
Engineering Mathematics Open Learning Project.
www.3.ul.ie/~mlc/support/Loughborough%20website/

17CH1102A-ENGINEEERING CHEMISTRY

Course Category:	**Institutional core**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Knowledge of Chemistry at Intermediate level	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Analyze** various water treatment methods and boiler troubles.
CO2	**Apply** the principles of spectroscopic techniques to analyze different materials and apply the knowledge of conventional fuels for their effective utilization.
CO3	**Apply** the knowledge of working principles of conducting polymers, electrodes and batteries for their application in various technological fields.
CO4	**Evaluate** corrosion processes as well as protection methods.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				H										
CO2	M													
CO3														
CO4			M									H		

Course Content

UNIT-I **[Text Book -1]**

Water Technology-I: WHO standards-Water treatment for drinking purpose-sedimentation, coagulation, filtration, disinfection by chlorination, breakpoint chlorination and its significance-Desalination of brackish water-principle and process of electro-dialysis and reverse osmosis, advantages and disadvantages.

Water Technology-II: Boiler troubles-scales-formation, disadvantages and internal conditioning methods-phosphate conditioning, Calgon conditioning and sodium aluminate, sludges-formation, disadvantages and prevention, caustic embrittlement-reasons, mechanism and its control, and boiler corrosion-causes and control.

UNIT-II **[Text Book -1]**

Spectroscopic Techniques and Applications: Interaction ofelectromagnetic radiation with matter–Ultraviolet-visible spectroscopy: Frank-Condon principle,types of electronic transitions, Lambert-Beer's law–definition and numerical problems, problems on interpretation of UV visible spectra of simple molecules of arenes, aldehydes and ketones. Infrared (IR) spectroscopy: Principle, types of vibrations, problems on interpretation of IR spectra of simple moleculesof amines, alcohols, aldehydes and ketones.

Fuel technology: Fuel-definition, calorific value- lower and higher calorific values, analysis

of coal-proximate analysis and ultimate analysis, refining of petroleum, flue gas analysis by Orsat's apparatus, numerical based on calculation of air required for combustion.

UNIT-III **[Text Book -1]**

Conducting polymers: Definition, examples, classification-intrinsically conducting polymers and extrinsically conducting polymers-mechanism of conduction of undoped poly-acetylene, doping of conducting polymers-mechanism of conduction of p-doped and n-doped poly-acetylenes-applications of conducting polymers, fiber reinforced plastics.

Electrochemistry: Construction and working of Calomel electrode, silver-silver chloride electrode and principle, construction and working of glass electrode, determination of pH using glass electrode-Chemistry of modern batteries - $Li/SOCl_2$ battery and $Li_xC/LiCoO_2$ battery-construction, working and advantages,Chemistry of H_2-O_2 fuel cell-advantages.

UNIT-IV **[Text Book -1]**

Corrosion principles: Introduction, definition, reason for corrosion, examples-electrochemical theory of corrosion, types of electrochemical corrosion-hydrogen evolution and oxygen absorption-corrosion due to dissimilar metals, galvanic series-differential aeration corrosion- pitting corrosion and concept of passivity.

Corrosion control methods: Cathodic protection-principle and types, impressed current method and sacrificial anode method, anodic protection-principle and method, corrosion inhibitors-types and mechanism of inhibition- principle, process and advantages of electroplating and electroless plating.

Text Book:

[1] Shikha Agarwal, "*Engineering Chemistry-Fundamentals and Applications*", Cambridge University Press, New Delhi, 1st edition, 2015.

Reference Books:

[1] Sunita Rattan, "*A Textbook of Engineering Chemistry*", S.K. Kataria & Sons,New Delhi, 1st edition,2012.

[2] P.C. Jain, "*Engineering Chemistry*", Dhanpat Rai Publishing Company (P)Limited, New Delhi, 15th edition.

[3] B.S. Bahl, G. D. Tuli and Arun Bahl, "*Essentials of Physical Chemistry*", S. Chand & Company Limited, NewDelhi.

[4] O. G. Palanna, " *Engineering Chemistry*", Tata McGraw Hill Education Pvt.Ltd., New Delhi.

[5] Y.Anjaneyulu, K. Chandrasekhar and Valli Manickam, "*Text book of Analytical Chemistry",* Pharma Book Syndicate, Hyderabad.

[6] H. Kaur, "*Spectroscopy*", Pragati Prakashan, Meerut ,1stedition, 2001.

E-resources and other digital material

[1] http://www.cip.ukcentre.com/steam.htm

[2] http://corrosion-doctors.org/Modi;es/mod-basics.htm

[3] http://nopr.niscair.res.in/bitstream/123456789/5475/1/JSIR20715-728.pdf

[4] https://chem.libretexts.org/core/Analytical_Chemistry/ Electrochemistry/ Basics_of _Electrochemistry

[5] http: //www.filtronics.com/blog/tertiary-treatment/stages-in-typical-municipal-water-treatment/

[6] https://www.khanacademy.org/test-prep/mcat/physical-processes/infrared-and-ultraviolet-visible-spectroscopy/e/infrared-and-ultraviolet-visible-spectroscopy-questions

[7] NPTEL online course, "Analytical Chemistry", offered by MHRD and instructed by Prof. Debashis Ray of IIT Kharagpur.
[8] NPTEL online course, "Corrosion Part-I" offered by MHRD and instructed by Prof. Kallol Mondal of IIT Kanpur

17CS1103-PROBLEM SOLVING METHODS

Course Category:	**Institutional core**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-1-0
Prerequisites:		**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the Computer problem solving approaches, efficiency and analysis of algorithms
CO2	**Apply** the factoring methods to solve the given problem
CO3	**Apply** the array techniques to find the solution for the given problem
CO4	**Solve** the problems using MATLAB

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H			M								M		
CO2	L		H											
CO3	L		H									L		
CO4	L			L								H		

Course Content

UNIT-I **[Text Book-1]**

Introduction to Computer Problem Solving: Programs and Algorithms, characteristics of an algorithm, Requirements for solving problems by computer; Flowchart, pseudo-code. The Problem-Solving Aspect-Problem definition phase, Getting started on a problem, Similarities among problems, Working backwards from the solution, General problem- solving strategies, Top-Down design-Breaking a problem into sub-problems, Construction of loops, Establishing initial conditions for loops, Finding the iterative construct, Termination of loops.

The Efficiency of Algorithms: Redundant Computations, Referencing array elements, Inefficiency due to late termination, Early detection of desired output conditions, Trading storage for efficiency gains;

Analysis of Algorithms-Computational complexity, The order notation, Worst and average case behavior.

UNIT-II **[Text Book-1]**

Fundamental Algorithms: Problem, algorithm development, algorithm description - exchanging values of two variables, counting, summation of a set of numbers, factorial computation, generation of Fibonacci sequence, reversing the digits of an integer-using pseudo-codes and flowcharts to represent fundamental algorithms.

Factoring Methods: Finding the square root of a number-smallest divisor of an integer, GCD

of two integers, generating prime numbers, computing the prime factors of an integer, raising a number to a large power, pseudo random number generation, computing n^{th} Fibonacci number.

UNIT-III **[Text Book-1]**

Array Techniques: Introduction, array order reversal, array counting, finding the maximum number in a set, removal of duplicates from an ordered array, partitioning an array, finding the k^{th} smallest element.

Merging, Sorting and Searching: sorting by selection, sorting by exchange, linear search and binary search.

UNIT-IV **[Text Book-2]**

Introduction to MATLAB: MATLAB environment, constants,variables and expressions-data types, constants and variables, operators, built-in functions, vectors and matrices-introduction, scalars and vectors, matrix manipulations, control structures-loops, branches.

Input-Output Statements: Reading/Storing file data, MATLAB graphics-Introduction, two-dimensional plots.

Text Books:

[1] R.G. Dromey , "*How to Solve it By Computer*", Prentice-Hall InternationalSeries in ComputerScience,1982.

[2] Bansal.R.K, Goel.A.K, Sharma.M.K, "*MATLAB and its Applications in Engineering*", Pearson Education,2012.

Reference Books:

[1] Michael Schneider, Steven W. Weingart, David M. Perlman, "*An Introduction to Programming and Problem Solving With Pascal*", John Wiley and SonsInc,1984.

[2] David Gries, "*The Science of Programming*", Springer Verlag,1981.

[3] ReemaThareja, "*Computer Fundamentals and C Programming*", Oxford, 2012

E-resources and other digital material

https://www.mathworks.com/help/pdf_doc/

17ME1104B-MECHANICS FOR ENGINEERS

Course Category:	**Engineering Sciences**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Basic Mathematics, Physics	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes

	Upon successful completion of the course, the student will be able to:
CO1	**Understand** free body diagrams, develop appropriate equilibrium equations and simplify the system of forces and moments to equivalent systems
CO2	**Determine** the axial forces in the members of determinate truss and analyze systems with friction.
CO3	**Locate** centroids and **determine** area moment of inertia of rigid bodies
CO4	**Determine** the mass moment of inertia of rigid bodies and **analyze** the motion of rigid bodies

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**M**												
CO2	**H**	**H**												
CO3	**H**													
CO4	**H**	**H**												

Course Content

UNIT-I **[Text Book-1&2]**

Concurrent forces in a plane: Principles of statics, force, addition of two forces-parallelogram law-composition and resolution of forces-constraint, action and reaction, types of supports and support reactions, free body diagram, equilibrium of concurrent forces in a plane-method of projections-moment of a force, theorem of varignon, method of moments.

Parallel forces in a plane: Introduction, types of parallel forces, resultant, couple, resolution of force into force and a couple, general case of parallel forces in a plane.

UNIT-II **[Text Book-1&2]**

General case of forces in a plane: Composition of forces in a plane-equilibrium of forces in a plane, plane trusses-method of joints.

Friction: Introduction, classification of friction, laws of dry friction, co-efficient of friction, angle of friction, angle of repose, cone of friction, wedge friction.

UNIT-III **[Text Book-1]**

Centroids: Determination of centroids by integration method, centroids of composite plane figures.

Area moment of inertia of plane figures: Moment of Inertia of a plane figure with respect to an axis in its plane, Moment of Inertia with respect to an axis perpendicular to the plane of the figure, Parallel axis theorem, Moment of inertia for composite areas

UNIT-IV **[Text Book-1&2]**

Moment of inertia of material bodies: Moment of inertia of a rigid body-moment of inertia of laminas-slender bar, rectangular plate, circular plate, circular ring, moment of inertia of 3D bodies-cone, solid cylinder, sphere & parallelepiped.

Kinematics of a rigid body in rotation about a fixed axis: Kinematics of rotation.

Kinetics of a rigid body in rotation about a fixed axis: Equation of motion for a rigid body rotating about a fixed axis-rotation under the action of a constant moment.

Text Books:

[1] S.Timoshenko, D.H.Young, J.V.Rao & Sukumar Pati, " *Engineering Mechanics*", Tata Mc. Graw Hill Pvt. Ltd, 5th edition, 2013(For Concepts and symbolic Problems).

[2] A.K.Tayal , " *Engineering Mechanics Statics and dynamics* ", Umesh Publications , 13th edition, 2006 (For numerical Problems using S.I.System ofUnits).

Reference books:

[1] Andrew pytel & Jaan Kiwsalaas , " *Engineering Mechanics: Statics and Dynamics* ", Cenage Learning, 3rd edition, 2013.

[2] SS Bhavikatti and KG Rajasekharappa, "*Engineering Mechanics*", New Age International Private Limited, 4th edition, 2012.

[3] Beer and Johnston, "*Vector Mechanics for Engineers Statics andDynamics*", Tata Mc. Graw Hill Pvt Ltd, 3rd edition, 2010.

E-resources and other digital material

http://emweb.unl.edu

17ME1105-ENGINEERING GRAPHICS

Course Category:	**Institutional Core**	**Credits:**	4
Course Type:	Theory and practice	**Lecture-Tutorial-Practice:**	2-0-4
Prerequisites:		**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the Scales, conics and Cycloidal curves.
CO2	**Draw** Orthographic projections of points, Lines, Planes and Solids.
CO3	**Understand** Sectional views of Solids, **Development** of surfaces and their representation.
CO4	**Construct** isometric scale, isometric projections, isometric views and convert pictorial views to orthographicprojections.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**				**L**				**H**					
CO2	**M**				**M**				**H**					
CO3	**M**				**M**				**M**					
CO4	**L**				**M**				**H**					

Course Content

UNIT-I **[Text Book-1]**

Introduction to Engineering Drawing: Principles of engineering graphics and their significance.

Scales: Construction of plain and diagonal Scales.

Conic Sections: Construction of ellipse, parabola and hyperbola (Treatment is limited to Eccentricity or General method only).

Engineering Curves: Cycloidal curves-cycloid, epicycloid and hypocycloid.

UNIT-II **[Text Book-1]**

Orthographic Projections: Principles of orthographic projections-projections of points, lines (treatment is limited to first angle projection) and projections of plane regular geometric figures (up to plane inclined to both of the reference planes).

UNIT-III **[Text Book-2]**

Projections of Solids: Projections of simple solids such as cubes, prisms, pyramids, cylinders and cones with varying positions (limited to solid inclined to one of the reference planes).

Sections of Solids: Sections of solids such as cubes, prisms, pyramids, cylinders and cones. true shapes of sections (limited to the solids perpendicular to one of the principal planes).

UNIT-IV **[Text Book-1&2]**

Development of Surfaces: Lateral development of cut sections of cubes, prisms, pyramids, cylinders and cones.

Isometric Projections: Isometric Projection and conversion of isometric views into Orthographic Projections (Treatment is limited to simple objects only).

Conventions Auto CAD: Basic principles only (Internal assessment only).

Text Books:

[1] N.D. Bhatt & V.M. Panchal, "*Elementary Engineering Drawing*", Charotar Publishing House, 49th edition, 2006.

[2] Basanth Agrawal & C M Agrawal, " *Engineering Drawing*", McGraw Hill Education Private Limited, New Delhi , Latest edition.

Reference Books:

[1] K. L. Narayana & P. Kannaiah, "*Text Book on Engineering Drawing*", Scitech publications (India) Pvt. Ltd., Chennai, 2nd edition, 2006.

[2] K. Venugopal, "*Engineering Drawing and Graphics plus Auto CAD*", New Age International, NewDelhi, Latest edition.

[3] D M Kulkarni, AP Rastogi, AK Sarkar, "*Engineering Graphics with Auto CAD*", Prentice Hall of India Pvt. Ltd., Delhi, Latest edition, 2013.

E-resources and other digital material

[1] http://www.youtube.com/watch?v=XCWJ XrkWco, Accessed On 01-06-2017.

[2] http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html# isodrawing, Accessed On 01-06-2017.

[3] http://www.slideshare.net, Accessed On 01-06-2017

[4] http://edpstuff.blogspot.in, Accessed On 01-06-2017

17CH1151-ENGINEERING CHEMISTRY LABORATORY

Course Category:	**Institutional Core**	**Credits:**	1.5
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	Knowledge of chemistry practical at intermediate level.	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Analyze** quality parameters of water samples from different sources
CO2	**Perform** quantitative analysis using instrumental methods.
CO3	**Apply** the knowledge of mechanism of corrosion inhibition, metallic coatings and photochemical reactions.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				**H**										
CO2					**M**									
CO3		**M**												

Course Content

List of Experiments:

1. Determination of total alkalinity of water sample
2. Determination of chlorides in water sample
3. Determination of hardness of water sample
4. Determination of available chlorine in bleaching powder
5. Determination of copper in a given sample
6. Determination of Mohr‟s salt -Dichrometry
7. Determination of Mohr‟s salt -Permanganometry
8. Determination of purity of boric acid sample.
9. Conductometric determination of a strong acid using a strong base
10. pH metric titration of a strong acid vs. a strong base
11. Determination of corrosion inhibition efficiency of an inhibitor for mild steel.
12. Chemistry of Blue Printings
13. Preparation of Urea-Formaldehyde resin

Text Books:

[1] S.K. Bhasin and Sudha Rani, “Laboratory Manual on Engineering Chemistry”, Dhanpat Rai Publishing Company, New Delhi, 2nd edition.

[2] Sunitha Rattan, “Experiments in Applied Chemistry”, S.K. Kataria & Sons, New Delhi, 2nd edition

17CS1152-COMPUTING AND PERIPHERALS LABORATORY

Course Category:	**Institutional Core**	**Credits:**	1
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:		**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** and **Apply** MS Office tools
CO2	**Configure** the components on the motherboard and install different operating systems
CO3	**Understand** and **configure** different storage media
CO4	**Perform** networking, troubleshooting and system administration tasks

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**				**M**							**L**		
CO2			**M**	**M**								**L**		
CO3	**H**													
CO4			**M**	**L**								**M**		

Course Content

CYCLE - I

1. WordProcessing:

a) Create personal letter using MSWord.
b) Create a resume using MSWord.
c) Creating project abstract-Features to be covered-table of content, list of tables, formatting styles, inserting table, bullets and numbering, changing text direction, cell alignment, footnote, hyperlink, symbols, spell check, track changes.
d) Creating newsletter-Features to be covered-table of content, list of figures, newspaper columns, images from files and clipart, drawing toolbar and word art, formatting images, textboxes, paragraphs and mail merge in word.

2. SpreadSheets:

a) Create worksheet containing pay details of theemployees.
b) Creating a scheduler features to be covered-gridlines, format cells, summation, auto fill, formatting text.
c) Create a worksheet which contains student results-features to be covered-cell referencing, formulae in excel-average, charts, renaming and inserting worksheets, hyper linking, count function, Lookup/VLookup,sorting, conditional formatting.
d) Create a worksheet importing data from database and calculate sum of all the columns.

3. Presentations:

a) Create a presentation usingthemes.
b) Save, edit, print and import images/videos to apresentation.
c) Create a power Point presentation on business by using master layouts, adding animation to a presentation and see the presentation in different.

4. MSAccess:

a) Create simple table in MS Access for resultsprocessing.
b) Create a query table for the results processingtable.
c) Create a form to update/modify the results processingtable.
d) Create a report to print the result sheet and marks card for theresult.

CYCLE - II:

Hardware Experiments

a) Identification of system layout-front panel indicators & switches and front side & rear side connectors. Familiarize the computer system layout-marking positions of SMPS, motherboard, FDD,HDD, CD, DVD and add on cards, install hard disk, configure CMOS-setup, partition and format harddisk.
b) Install and Configure a DVD Writer or a Blu-ray Discwriter.
c) Install windows operating system and check if all the device (graphics, sound, network etc.) drivers are installed.
d) Install Linux operating system and check the working of all devices (graphics, sound, network etc.) in thecomputer.
e) Assemble a Pentium IV or Pentium Dual Core Pentium Core2 Duo system with necessary peripherals and check the working condition of thePC.
f) PC system layout: Draw a Computer system layout and Mark the positions of SMPS, Mother Board, FDD, HDD, and CD-Drive/DVD-Drive add on cards in table top / tower modelsystems.
g) Mother Board Layout: Draw the layout of Pentium IV or Pentium Dual core or Pentium Core2 DUO mother board and mark Processor, Chip set ICs. RAM, Cache, cooling fan, input/output slots and input/output ports and various jumpersettings.
h) Configure BIOS setup program to change standard and advanced settings to troubleshoot typicalproblems.
i) Install and configure Printer/Scanner/Web cam/Cell phone/bio-metric device with system. Troubleshoot the problems

CYCLE–III

Networking

a) Prepare an Ethernet/UTP cable to connect a computer to network switch. Crimp the 4 pair cable with RJ45 connector and with appropriate colorcode.
b) Manually configure TCP/IP parameters (Host IP, Subnet Mask andDefault Gateway) for a computer and verify them using IPCONFIG command. Test connectivity to a server system using PINGcommand.
c) Creating a shared folder in the computer and connecting to that folder using Universal Naming Convention (UNC) format. (Ex: Computer nameshare name)
d) Connects computers together via Switch/Hub
e) Connect different devices viaSwitch/Hub
f) Statically configure IP address and subnet mask for eachcomputer
g) Examine non-existent IP address and subnetconflicts

h) Configure a computer to connect to internet (using college internet settings) and troubleshoot the problems using PING, TRACERT and NETSTATcommands.
i) Using scan disk, disk cleanup, disk defragmenter, virus detection and rectifying software to troubleshoot typical computerproblems.
j) Configure DNS to establish interconnection between systems and describe how a name is mapped to IP Address.
k) Remote desktop connections and filesharing.
l) Installation Antivirus and configure theantivirus.
m) Introducing Ethereal , a packet capturetool.

Text Books:

[1] B.Sunil Kumar, "*Numerical Methods and Programing* ", Mc. Graw Hill, Latest edition.
[2] Mitchell Peabody , "*Introduction to Coding Concepts*".

E-resources and other digital material

[1] https://www.youtube.com/ watch?v=zjyR9e-#1D4&list=PLC5DC6AD60D798FB7
[2] http://ocw.mit.edu/6-00SCS11

17MC1106-PROFESSIONAL ETHICS & HUMAN VALUES

Course Category:	**Mandatory Learning**	**Credits:**	0
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:		**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Know** the moral autonomy and uses of ethical theories.
CO2	**Understand** morals, Honesty and character.
CO3	**Understand** about safety, risk and professional rights.
CO4	**Know** the ethics regarding Global issues related to Environment, Computers and weapon's development.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**													
CO2							**L**							
CO3								**M**						
CO4												**M**		

Course Content

UNIT-I **[Text Book-I]**

Engineering Ethics: Senses of "Engineering Ethics"-variety of moral issues, types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, consensus and controversy, Models of Professional Roles, theories about right action, self-interest-customs and religion-uses of ethicaltheories.

UNIT-II **[Text Book-1]**

Human Values: Morals, values and ethics, integrity, work ethic, service learning, civic virtue, respect for others, living peacefully, caring, sharing, honesty, courage, valuing time, co-operation, commitment, empathy, self-confidence, character, and spirituality.

UNIT-III **[Text Book-1]**

Engineering as Social Experimentation: Engineering as experimentation-engineers as responsible experimenters, codes of ethics, a balanced outlook on law, the challenger case study, safety.

Responsibilities and Rights: Safety and risk, assessment of safety and risk, risk benefit analysis and reducing risk, the three mile island and Chernobyl case studies. Collegiality and loyalty, respect for authority, collective bargaining, confidentiality, conflicts of interest, occupational crime, professional rights, employee rights, Intellectual Property Rights (IPR) –

discrimination.

UNIT-IV **[Text Book-1]**

Global Issues: Multinational corporations, environmental ethics, computer ethics, weapons development, engineers as managers, consulting engineers, engineers as expert witnesses and advisors, moral leadership, sample code of ethics (Specific to a particular Engineering Discipline).

Text Books:

[1] Mike Martin and Roland Schinzinger, " Ethics in Engineering," McGraw Hill Ltd , New York , Latest edition, 1996.

Reference Books:

[1] Baum, R.J. and Flores, A., " Ethical Problems in Engineering, Center for the study of the Human Dimensions of Science and Technology", Rensellae Polytechnic Institute, Troy, New York , 1978..

[2] Beabout, G.R., Wennemann, D.J., "Applied Professional Ethics:A Developmental Approach for Use with Case Studies", University Press of America Lanham, MD, 175 pp (1994).

[3] Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, Latest edition,2004.

V.R.SIDDHARTHA ENGINEERING COLLEGE: VIJAYAWADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION FOR B.TECH(EEE) FIRST YEAR

Semester-II **Contact Hours: 27**

S.No	CourseCode	Course	L	T	P	Credits
1.	17MA1201	LaplaceTransforms and Integral Calculus	3	1	0	4
2.	17PH1202	EngineeringPhysics	3	0	0	3
3.	17CS1203	Programmingin C	3	0	0	3
4.	17ME1204 17EE1204	EngineeringMechanics–II (ME and CE) NetworkAnalysis-1(EEE)	3	0	0	3
5.	17HS1205	Technical English and Communication Skills	2	0	2	3
6.	17PH1251	EngineeringPhysicsLaboratory	0	0	3	1.5
7.	17CS1252	Computer Programming Laboratory	0	0	3	1.5
8.	17ME1253	Basic Workshop	0	0	3	1.5
Total			**14**	**1**	**11**	**20.5**
9.	17MC1206A	Technologyand Society	1	0	0	-

L–Lecture, **T**– Tutorial,**P** –Practical,**C**-Credits

17MA1201-LAPLACE TRANSFORMS AND INTEGRAL CALCULUS

Course Category:	**Institutional core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Vectors and Curve Tracing.	**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Solve** linear differential equations using Laplace Transforms.
CO2	**Examine** the nature of the Infinite series.
CO3	**Evaluate** areas and volumes using double, triple integrals.
CO4	**Convert** line integrals to area integrals and surface integrals to volume integrals.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**M**			**L**									
CO2	**H**	**M**			**L**									
CO3	**H**	**M**			**L**									
CO4	**H**	**M**			**L**									

Course Content

UNIT-I **[Text Book-1]**

Laplace transforms: Introduction, definition, conditions for existence, transforms of elementary functions, properties of Laplace transforms, transforms of periodic functions, transforms of derivatives, transforms of integrals, multiplication by t^n, division by t, Inverse transforms-method of partial fractions, other methods of finding inverse transform, convolution theorem, unit step and unit impulse functions.

Applications: Evaluation of improper integrals, solving differential equations by Laplace transform.

UNIT-II **[Text Book-1]**

Partial differential equations: Introduction, formation of partial differential equations, solutions of a partial differential equations, equations solvable by direct integration, linear equations of first order.

Sequence and series: convergence of series, comparison test, integral test, D'Alembert's Ratio test, Cauchy's root test, alternating series test, absolute and conditional convergence.

UNIT-III **[Text Book-1]**

Integral calculus: Double integrals, change of order of integration, double integrals in polar coordinates, triple integrals, change of variables.

Applications: Area enclosed by plane curves, volumes ofsolids.
Special functions: Beta function, gamma function, relation between beta and gamma function, error function.

UNIT-IV **[Text Book-1]**

Vector calculus: Scalar and vector point functions, del applied to scalar point functions, del applied to vector point functions, physical interpretation of divergence, del applied twice to point functions, del applied to products of point functions. integration of vectors, line integral, surface integral, green's theorem in a plane, stokes's theorem, volume integral, gauss divergence theorem, irrotationalfields.

Text Book:

[1] B.S.Grewal, "*Higher Engineering Mathematics*", Khanna Publishers, 43rd edition, 2014.

Reference Books:

[1] Erwin Kreyszig , "*Advanced Engineering Mathematics*" , John Wiley & Sons, 10th edition, 2015
[2] B.V.Ramana, "*Higher Engineering Mathematics*", Tata MC Graw Hill, 1st edition,2007
[3] N.P.Bali, Dr.Manish Goyal, "*A Text Book of Engineering Mathematics*", Laxmi Publications, 9th edition, 2014.

E-resources and other digital material

[1] www.nptel videos.com/mathematics/ (Math Lectures fromMIT,Stanford,IIT"S)
[2] www.nptel.ac.in/courses/122104017
[3] www.nptel.ac.in/courses/111105035
[4] Engineering Mathematics Open Learning Project.: www.3.ul.ie/~mlc/support/Loughborough%20website/

17PH1202-ENGINEERING PHYSICS

Course Category:	**Institutional core**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:		**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Analyze** the importance of dual nature of matter and study the classification of materials.
CO2	**Classify** various properties of magnetic and dielectric materials and their applications.
CO3	**Apply** the concepts of light in optical fibers and lasers and learn various types of superconductors.
CO4	**Understand**the nano-scale and characterization of nano-materials and their applications in variousfields.

Contribution of Course Outcomes towards achievement of Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**													
CO2	**H**			**M**										
CO3	**H**	**M**	**M**	**H**	**M**									
CO4	**H**		**L**			**M**								

Course Content

UNIT-I **[Text Book-1]**

Quantum Mechanics: Dual nature of light, matter waves and De-broglie's hypothesis, G.P.Thomson experiment, Heisenberg's uncertainty principle and its applications (non existence of electron in nucleus, finite width of spectral lines), one dimensional time independent Schrödinger's wave equation, physical significance of wave function, particle in a box (one dimension).

Semiconductor Physics: Classification of materials based on energy diagram, Fermi level in intrinsic and extrinsic semiconductors ,carrier drift and carrier diffusion, generation and recombination process (qualitative), hall effect.

UNIT-II **[Text Book-1]**

Magnetic properties: Magnetic permeability, magnetization, origin of magnetic moment, classification of magnetic materials-dia, para, ferro magnetic materials, hysteresis curve, soft and hard magnetic materials.

Dielectric properties: Fundamental definitions-dielectric constant, electric polarization, polarizability, polarization vector, electric displacement, electric susceptibility, types of polarization-electronic, ionic, orientation, space charge polarization, internal fields in solids

(Lorentz method), Clausius- Rossetti equation, ferroelectrics and their applications.

UNIT-III **[Text Book-1]**

Superconductivity: Introduction, critical parameters, flux quantization, Meissner effect, types of superconductors, BCS theory, Cooper pairs, London's equation- penetration depth, high temperature super conductors, applications of superconductors.

Lasers: Spontaneous emission, stimulated emission, population inversion, solid state (Ruby) laser, Gas (He–Ne) laser, semiconductor (Ga-As) laser, applications of lasers.

Fiber optics: Propagation of light through optical fiber, types of optical fibers, numerical aperture, fiber optics in communication and its advantages.

UNIT-IV **[Text Book-1]**

Nanotechnology: Basic concepts of nanotechnology, nanoscale, introduction to nanomaterials, surface to volume ratio, general properties of nano materials, fabrication of nano materials-plasma arcing, sol-gel, chemical vapour deposition, characterization of nano materials- AFM, SEM, TEM, STM, carbon nanotubes-SWNT, MWNT, formation of carbon nanotubes-arc discharge, laser ablation, properties of carbon nanotubes, applications of CNT's & nanotechnology.

Text Book:

[1] M.N. Avadhanulu & P.G. Kshirsagar, "*Engineering Physics*", S.Chand Publications, 9th edition, 2014.

Reference Books:

[1] R.K.Gaur and S.L.Gupta,"Engineering Physics", Dhanpatrai publishers, 8thedition, 2012.
[2] S.O. Pillai, "Solid State Physics", New age international publishers,7th edition, 2015.
[3] M.R. Srinivasan, "Engineering Physics", New age international publishers,2ndedition, 2017.

E-resources and other digital material

[1] https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring- 2013/lecture-video
[2] https://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/laser-fundamentals-i/
[3] http://nptel.ac.in/courses.php?disciplineId=115
[4] http://www.light and matter.com/bk4.pdf
[5] http://freevideolectures.com/Course/3048/Physics-of-Materials/36
[6] http://www.electronics-tutorials.ws/diode/diode_1.html
[7] http://www.chm.bris.ac.uk/webprojects2000/igrant/main.html
[8] https://www.peterindia.net/NanoTechnologyResources.html

17CS1203-PROGRAMMING IN C

Course Category:	**Institutional core**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:		**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the fundamentals and structure of a C programming language
CO2	**Apply** the loops, arrays, functions and string concepts in C to **solve** the given problem.
CO3	**Apply** the pointers and text input output files concept to **find** the solution for the given applications.
CO4	**Use** enumerated data types, structures and unions.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**L**	L			**L**									
CO2	**L**	L			**L**									
CO3	**H**	M			**M**		**L**					**H**		
CO4	**H**	H			**H**		**L**					**H**		

Course Content

UNIT-I **[Text Book-1]**

Introduction to the C Language: Background, C programs, identifiers, types, variables, constants, input/output, programming examples.

Structure of a C Program: Expressions, precedence and associatively, evaluating expressions, type conversion, statements, sample programs.

Selection: Storage class, logical data and operators, two -way selection, multi way selection, more standard functions.

UNIT-II **[Text Book-1]**

Repetition: Concept of a Loop, loops in C, loop examples, recursion, the calculator program.

Arrays: Concepts, using array in C, inter-function communication, array applications, two dimensional arrays, multi-dimensional arrays.

Functions: Functions in C, user defined functions, inter function communication, standard functions, scope.

Strings: String concepts, C strings, string input/output functions, arrays of strings, string manipulation functions, and string- dataconversion.

UNIT- III **[Text Book-1]**

Pointers: Introduction, pointers for inter function communications, pointers to pointers, compatibility, L-value and R-value.

Pointer Applications: Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocations functions, array of pointers.

Text Input/output: Files, streams, standard library input/output functions, formatting input/output functions and character input/output functions, command-line arguments.

UNIT-IV **[Text Book-1]**

Enumerations: The type definition(type def), enumerated types-declaring an enumerated type, operations on enumerated types, enumeration type conversion, initializing enumerated constants, anonymous enumeration-constants, input/output operators.

Structures: Structure type declaration, initialization, accessing structures, operations on structures, complex structures, structures and functions, sending the whole structure, passing structures through pointers.

Unions: Referencing unions, initializers, unions and structures, internet address, programming applications.

Text Book:

[1] Behrouz A. Forouzan & Richard F.Gilberg, "*Computer Science A Structured Programming Approach using C*", CENGAGE Learning, 3rd edition.

Reference Books:

[1] Kernighan and Ritchie, "*The C programming language*", Prentice Hall of India Pvt Ltd, 2nd edition, 2004.
[2] Yashwant Kanetkar, "*Let us C* ", BPB Publications , 2nd edition, 2001.
[3] Paul J. Dietel and Dr. Harvey M. Deitel ," *C: How to Program*", Prentice Hall of India Pvt Ltd, 7th edition,2012.
[4] Herbert Schildt "*C:The Complete reference*", Mc.Graw Hill Ltd, 4th edition,2002.
[5] K R Venugopal, Sundeep RPrasad,"*Mastering C*", McGraw Hill Ltd, 2nd edition,2015.

E-resources and other digital material

17EE1204-NETWORK ANALYSIS-I

Course Category:	**Programme Core**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Physics	**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes

	Upon successful completion of the course, the student will be able to:
CO1	**Understand** DC and AC circuit concepts.
CO2	**Apply** network theorems for circuit analysis.
CO3	**Understand** series and parallel resonance concepts and **analyze** coupled circuits.
CO4	**Analyze** poly-phase circuits and apply different power measurement techniques.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**M**		**H**										
CO2	**H**			**H**										
CO3	**M**	**M**												
CO4	**M**													

Course Content

UNIT-I **[Text Book-1]**

Basic components and electric circuits: Charge, current, voltage and power, voltage and current sources-independent and dependent sources, ohm's law, series and parallel connected sources, circuit elements-resistance, inductance and capacitance, series and parallel combination of circuit elements, star-delta transformations, voltage and current division, source transformations, power & energycalculations.

Sinusoidal steady state analysis: Introduction, characteristics of sinusoids, Steady state response to sinusoidal functions, complex forcing functions, phasor, phasor relationship for R, L and C series RL circuit, RC circuit and RLC circuit, parallel AC circuits, impedance, admittance, Kirchhoff's voltage and current laws, basic mesh and super mesh analysis, basic nodal and super node analysis. Instantaneous power, average power, calculation of average power for periodic and non-periodical wave forms, effective values of current and voltage, complex power.

UNIT-II **[Text Book-1]**

Network Theorems to DC & AC Circuits: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Tellegen's theorem and Compensationtheorem.

UNIT-III **[Text Book-1]**

Series and Parallel Resonance: Series resonance, resonant frequency, voltages and currents in a series resonant circuit, bandwidth of an RLC series circuit, quality factor (Q) and its effect on bandwidth, magnificationin series resonance. parallel resonance, resonant frequency of parallel RLC circuit, reactance curves in parallel resonance, Q factor ofparallelresonance,bandwidth of parallel RLC circuit, resonant frequency for a tank circuit, magnification in parallelresonance.

Coupled Circuits: Introduction-self inductance, mutual inductance, coefficient of coupling, inductances in series and parallel, dot convention, coupled circuits, conductively coupled equivalentcircuits.

UNIT-IV **[Text Book-1&2]**

Poly-phase Circuits: Poly-phase system, advantages of three-phase system, generation of three-phase voltages, phase sequence, inter connection of three-phase sources and loads, voltage, current and power in a star connected system, voltage, current and power in a delta connected system, three-phase balanced and unbalancedcircuits.

Power Measurement in Three-Phase Circuits: Power in three phase circuits-two wattmeter and three wattmeter methods, power factor of balanced circuits by two wattmeter method, variation in wattmeter readings with load power factor (lag and lead p.f. loads), measurement of reactive power with two watt meter and single wattmeter, power factor of an unbalancedsystem.

Text Books:

[1] W.H.Hayt, J.E.kemmerly and S.M.Durbin, "*Engineering Circuit Analysis*", Tata Mc.Graw-Hill, New Delhi 8th edition,2012.

[2] A.Chakrabarti., " *Circuit Theory (Analysis and Synthesis*", Dhanpat Rai & Co. Delhi,6th edition,2010.

Reference Books:

[1] Charles K. Alexander, Matthew N. O. Sadiku , "*Fundamentals of. Electric Circuits"*, McGraw-Hill,New York, 5th edition, 2013.

[2] Ravish R Singh, "*Network Analysis and Synthesis"*, Mc Graw-Hill Education (India) Pvt. Ltd., 1st edition, 2013.

[3] A.Sudhakar and Shyammohan S.Palli , "*Circuits & Networks Analysis and Synthesis"*Tata McGraw-Hill, New Delhi , 3rd edition,2007.

[4] Van valeken berg, "*Network Analysis and Synthesis",*Prentice Hall of India,3rd edition.

E-resources and other digital material

[1] http://nptel.ac.in/courses.php?branch=eee

[2] http://ocw.mit.edu/courses/audio-video-courses/#electrical-engineering-and-computer-science.

17HS1205- TECHNICAL ENGLISH &COMMUNICATION SKILLS

Course Category:	**Institutional Core**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	Basic understanding of the language skills,viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Develop** administrative and professional compilations including web related (On-line) communication with felicity ofexpression.
CO2	**Demonstrate** proficiency in interpersonal communication, in addition to standard patterns ofpronunciation.
CO3	**Apply** the elements of functional English with sustained understanding for authentic use of language in any given academic and/or professional environment.
CO4	**Execute** tasks in technical communication withcompetence.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1					**L**	**H**	**H**	**H**	**H**	**H**	**M**	**H**		
CO2						**H**	**H**	**H**	**H**	**H**	**M**	**H**		
CO3	**M**				**L**	**H**	**H**	**H**	**H**	**H**	**M**	**H**		
CO4	**L**			**M**	**L**	**H**	**H**	**H**	**H**	**H**	**M**	**H**		

Course Content

UNIT-I

Professional Writing Skills

a) Professional Letter-business, complaint andtransmittal
b) Essay Writing-descriptive andanalytical
c) Administrative and On-line drafting skills–minutes and web notes includinge-mail.

UNIT-II

Interpersonal Communication Skills

a) **Communicative Facet**- Speech acts-extending invitation, reciprocation, acceptance concurrence, disagreeing without beingdisagreeable.
b) **Articulation-oriented Facet**- Transcription using international phonetic alphabet, primarystress.

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UNIT-III

Vocabulary and Functional English

a) A basic List of 500 words –Overview
b) Verbal analogies, confusables, idiomatic expressions and phrasalcollocations
c) Exposure through reading comprehension- skimming, scanning and understanding the textual patterns for tackling different kinds ofquestions
d) Functional grammar with special reference to concord, prepositions, uses of gerund a parallelism.

UNIT-IV

Technical Communication skills

a) Technical proposalwriting.
b) Technical vocabulary-a representative collection will behandled.
c) Introduction to executivesummary.
d) Technical report writing (informational reports and feasibilityreport).

Text Books:

[1] Martin Cutts, "*Oxford guide to Plain English*", Oxford University Press, 7th edition, 2011.
[2] TM Farhathullah,"*Communication skills for Technical Students",* OrientLongman, 1st edition, 2002.
[3] John Langan,"*College Writing Skills*", McGraw Hill, 9th edition, 2014.
[4] "Eclectic Learning materials offered by theDepartment".

Reference Books:

[1] Randolph Quirk, "*Use of English*", Longman, 1st edition, (1968) reprinted2004.
[2] Thomson A.J & A.V, Martinet, "*Practical English Grammar*", Oxford University Press, 3rd edition , 2001.
[3] V.Sethi and P.V. Dhamija, "*A Course in Phonetics and Spoken English*", Prentice Hall of India, 2nd edition, 2006

E-resources and other digital material

[1] https://www.britishcouncil.org/english *Accessed on 15th June2017.*
[2] www.natcorp.ox.ac.uk/Wkshops/Materials/specialising.xml?ID=online *Accessed on 15th June2017.*
[3] https://www.uni-marburg.de/sprachenzentrum/selbstlernzentrum/.../apps_for_esl.pdf *Accessed on 15th June 2017.*

17MC1206A-TECHNOLOGY AND SOCIETY

Course Category:	**Institutional Core**	**Credits:**	-
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1-0-0
Prerequisites:		**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the origins of technology and its role in the history of human progress.
CO2	**Know** the industrial revolution and its impact on society.
CO3	**Interpret** the developments in various fields of technology till twentieth century.
CO4	**Distinguish** the impacts of technology on the environment and achievements of great scientists.

Contribution of Course Outcomes towards achievement of Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**											**L**		
CO2	**H**						**M**							
CO3	**H**											**L**		
CO4	**H**						**M**							

Course Content

UNIT-I **[Text Book-1]**

Introduction: Origins of technology, the agriculture revolution, technological contributions of ancient civilizations- Mesopotamian, Egyptians, Greeks, Romans, Indians and Chinese.

UNIT-II **[Text Book-1]**

Industrial revolution: The social and political background, the technical background, steam-the power behind the industrial revolution, the revolution in textile industry, the impact of industrial revolution onsociety.

UNIT-III **[Text Book-1]**

The Flowering of modern technology: Manufacturing technologies, prime movers, and internal combustion engines, production of metals and alloys, the birth of electrical technology, twentieth century-the flowering of modern technology.

UNIT-IV **[Text Book-1]**

Technology, Science and Society: Impact of technology on society, the impacts of technology on the environment, sustainable development.

Achievements of famous scientists:

(**World**): Einstein, Newton, Faraday, Graham Bell, Edison, S.Hawking.

(**India**): CV Raman, S.Chandrasekhar, Aryabhatta, Homi J Bhabha, Vikram Sarabhai, APJ Abdulkalam, S.Ramanujan, M.Visweswarayya.

Text Book:

[1] Dr. R.V.G Menon, "*Technology and Society*", Pearson Education, Second edition, 2011.

Reference Book:

[1] Quan-Haase, A., "*Technology and Society: Inequality, Power, and Social Networks*", Oxford University Press, 2013.

17PH1251-ENGINEERING PHYSICS LABORATORY

Course Category:	**Institutional Core**	**Credits:**	1.5
Course Type:	**Practice**	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:		**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Use** function generator, spectrometer, travelling microscope and CRO in various experiments
CO2	**Test** optical components using principles of interference and diffraction of light
CO3	**Determine** the V-I characteristics of solar cell and photo cell and appreciate the accuracy in measurements

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**			**M**										
CO2	**H**													
CO3	**H**			**M**		**M**								

Course Content

List of Experiments

1. AC Sonometer –Verification of vibrating laws (VirtualLab)
2. Measurement of thickness of a foil using wedgemethod
3. Photo tube-Study of V-I Characteristics, determination of work function (VirtualLab)
4. Torsional Pendulum-Rigidity moduluscalculation
5. Variation of magnetic field along the axis of current-carrying circularcoil
6. Compound pendulum-Measurement of"g"
7. LCRcircuit-Resonance
8. Solar cell –Determination of FillFactor
9. Hall effect –Study of B & I Variation (VirtualLab)
10. B-H Curve Unit- Determination of hysteresisloss
11. Newton"s Rings-Radius of curvature of plano convexlens
12. Diffraction grating-Measurement of wavelength
13. Fibre Optics-Numerical aperturecalculation
14. Lissajous figures- calibration of an audiooscillator
15. Figure of merit of agalvanometer

Text Books:

[1] Madhusudhan Rao, "*Engineering Physics Lab Manual*", Scitech Publications, 1st edition, 2015

[2] Ramarao Sri, Choudary Nityanand and Prasad Daruka, "Lab *Manual ofEngineering Physics*", Excell Books, 5th edition, 2010.

E-resources and other digital material

[1] http://plato.stanford.edu/entries/physics-experiment

[2] http://www.physicsclassroom.com/The-Laboratory

[3] http://facstaff.cbu.edu/~jvarrian/physlabs.html

17CS1252-COMPUTER PROGRAMMING LABORATORY

Course Category:	**Institutional Core**	**Credits:**	1.5
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:		**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Implement** the use of programming constructs in a structured oriented programminglanguage
CO2	**Implement** conditional and iterative statements through C Language
CO3	**Analyze** and implement user defined functions to solve real time problems
CO4	**Implement** the usage of pointers and file operations on data
CO5	**Implement** the user defined data types via structures and unions to solve real life problems

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**													
CO2	**L**													
CO3	**M**	**M**			**M**		**L**					**M**		
CO4	**M**				**L**							**M**		
CO5	**H**	**M**			**L**							**M**		

Course Content

CYCLE – I :
PROGRAMMING CONSTRUCTION AND CONTROL STRUCTURES

1. Introduction to C Pogramming:
   a) Use of Turbo CIDE
   b) The Structure of C Program with Sample program
2. Data Types andVariables:
   a) Programs to usage of keywords and identifiers inc
   b) Programs on declaration of variables, rules for naming a variable, constants and different type of constants, datatypes
   c) Programs to perform on various operators in C
3. Branching andSelection:
   a) To specify the conditions under which a statement or group of statements should be executed.
   b) To choose exactly one out of two statements (possibly compound statements) to be

executed; specifies the conditions under which the first statement is to be executed and provides an alternative statement to execute if these conditions are notmet.

c) To choose one statement (possibly compound) to be executed from among a group of statements (possibly compound); specifies the conditions under which each statement may be executed and may contain a default statement (in an else clause at the end) to be executed if none of these conditions are met. Note that in the absence of a final else clause, it may be the case that none of the statements areexecuted.

4. Unconditional control Transfer statements inC:
   a) Design and develop programs that use of go toStatement
   b) Design and develop programs that the use of BreakStatement
   c) Design and develop programs that use of ContinueStatement

5. Loopingconstructs:
   Design and develop programs based on
   a) Iterative loops using While, Do While, For, NestedFor
   b) Selection Statement using the switch-caseStatement
   c) Multiple way selections that will branch into different code segments based on the value of a variable orexpression

6. Arrays
   a) Design and develop programs which illustrates the implementation of single-dimensional arrays and Multi dimensionalarrays

7. Strings
   a) Create programs to initialize strings and usage of them for various input, output operations.
   b) Design and develop programs to handle Stringfunctions

CYCLE - II:
ADVANCED PROGRAMMING CONSTRUCTS

1. Concept of user definedfunctions
   a) Design and develop programs depending on functions both user defined and standard library functions in C with differentapproaches.
2. File handlingoperations
   a) FILEstructure
   b) Opening and closing a file, file openmodes
   c) Reading and writing operations performed on a file
   d) File Pointers: stdin, stdout andstderr
   e) FILE handling functions: fgetc(), fputc(), fgets() and fputs()Functions
3. Pointers:
   a) Programs on declaration of pointers and their usage inC
   b) Programs to relate between arrays and pointers and use them efficiently in aprogram
   c) To pass pointers as an argument to a function, and use it efficiently inprogram
4. Command Line Arguments
   a) Design and develop programs that accept arguments from command line to perform different kinds ofoperations
5. Structures andUnions
   a) Programs to define, declare and access structure and unionvariables.
   b) Design and develop programs to work with pointers to access data within a structure programs to pass structure as an argument to afunction.

Text Books:

[1] P.C.Krause, O.Wasynezuk and S.D.Sudhoff, "*Analysis of Electric Machinery and Drive Systems*", John Wiley-2010.
[2] P.S.Bimbhra, "*Generalized Machine Theory*", Khanna Publishers 2008.

Reference Books:

[1] A.E.Fitzgerald, Jr.Ch.Kingsley and D.Stephan, Umans, "*Electric Machinery*", TataMcGraw Hill, 6th edition,2009.
[2] R.Krishnan, *"Electric Motor and Drives: Modelling, Analysis and Control*", Prentice-Hall of India Pvt. Limited, 2008.
[3] Ch.M.Ong," *Dynamic and Simulation of Electrical Machinery using MATLAB/Simulink*," Prentice Hall of India Publications.

E-resources and other digital material

[1] https://nptel.ac.in/courses/108106023/

17ME1253-BASIC WORKSHOP

Course Category:	**Engineering Sciences**	**Credits:**	1.5
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:		**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO 1	**Model** and **develop** various basic prototypes in the Carpentry trade.
CO 2	**Develop** various basic prototypes in the trade of Welding.
CO 3	**Model** and **develop** various basic prototypes in the trade of Tin Smithy.
CO 4	**Familiarize** with various fundamental aspects of house wiring.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	**H**			**H**	**L**									
CO 2	**M**			**H**	**L**									
CO 3	**M**			**H**	**L**									
CO 4	**L**			**H**	**L**									

Course Content

UNIT-I
Carpentry:

a. Study of tools & operations and various carpentryjoints.
b. Practice of open bridle joint, Cross half lap joint, Half Lap T Joint, and Dove tailjoint
c. Simple group exercise like preparation of single widowframe.

UNIT-II
Welding:

a. Study of tools and operations of Gas welding and arcwelding.
b. Practice of various joints like weld layer practice, V- Butt Joint, Double parallel

fillet joint, T-Joint, and Corner Joint

UNIT-III

Tin Smithy:

a. Study of tools &operations
b. Practice of various joints like Saw Edge, Wired Edge, Lap Seam, and GroovedSeam.
c. Simple exercise like Fabrication of squaretray.

UNIT-IV

House Wiring:

a. To connect one lamp with oneswitch.
b. To connect two lamps with oneswitch.
c. To connect a fluorescentTube.
d. Stair casewiring.
e. Godownwiring.
f. Study of single phase wiring for a officeroom.
g. Nomenclature & measurement of wire gauges andcables.
h. Estimation of cost of indoor wiring for a wiring diagram (plan of abuilding).
i. Test procedure for continuity of wiring in a electricinstallation.
Measurement of electric energy by usingmeter.

Text Books:

[1] KannaiahP.&NarayanaK.C.,"*ManualonWorkshopPractice*",ScitechPublications, Chennai,1999.
[2] Venkatachalapathy, V. S., "*First year Engineering Workshop Practice*", Ramalinga Publications, Madurai,1999

Reference Book:

[1] Gopal, T.V., Kumar, T., and Murali, G., "*A first course on workshop practice-Theory, Practice and Work Book*", Suma Publications, Chennai, 2005

V.R.SIDDHARTHA ENGINEERING COLLEGE: VIJAYAWADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION FOR B.TECH(EEE) SECOND YEAR

Semester-III **Contact Hours: 28**

S.No	Course Code	Course	L	T	P	Credits
1.	17MA1301/EE	Transformations & Numerical Methods	3	1	0	4
2.	17EE3302	Electronic Circuits	3	0	0	3
3.	17EE3303	Electrical Machines - I	3	1	0	4
4.	17EE3304	Network Analysis - II	3	1	0	4
5.	17EE3305	Digital Electronics	3	0	0	3
6.	17TP1306	Logic & Reasoning	0	0	2	1
7.	17EE3351	Networks & Electrical Machines-I Lab	0	0	3	1.5
8.	17EE3352	Electronic Circuits Lab - I	0	0	3	1.5
Total			**15**	**3**	**8**	**22**
9.	**17MC1307B**	**Indian Constitution (EIE/CE/ME/EEE)**	**2**	**0**	**0**	**-**

17MA1301/EE-TRANSFORMATIONS & NUMERICAL METHODS

Course Category:	**Institutional Core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Basic concepts of Trigonometry and Theory of equations.	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Analyze** general periodic functions in the form of an infinite convergence series of sines and cosines.
CO2	**Apply** Fourier Transforms to evaluate indefinite integrals and engineering problems.
CO3	**Solve** algebraic and transcendental, system of equations and understand the concept of polynomial interpolation.
CO4	**Understand** the concept of Numerical differentiation and integration. Solve initial and boundary value problems

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M			L							L	L	
CO2	H	M			L							L	L	
CO3	H	M			L							L	L	
CO4	H	M			L							L	L	

Course Content

UNIT-I **[Text Book-1]**

Fourier Series: Introduction, Euler's formulae, conditions for a Fourier expansion, functions having points of discontinuity, change of interval, odd and even functions, expansions of odd and even periodic functions, half-range series, Parseval's formula, complex form of Fourier series. Practical harmonic analysis.

UNIT-II **[Text Book-1]**

Fourier Transforms: Introduction, definition, Fourier integrals, Fourier sine and cosine integrals-complex form of Fourier integrals, Fourier transforms Fourier sine and cosine transforms-Finite Fourier sine and cosine transforms, Fourier transforms of the derivatives of a function, Parseval's identity for Fourier transforms.

UNIT-III **[Text Book-1]**

Numerical Methods: Solution of algebraic and transcendental equations. Introduction,

Newton-Raphson method, solution of simultaneous linear equations, Gauss elimination method, Gauss-Seidel iterative method.

Interpolation: Introduction, finite differences, forward, backward, central differences, symbolic relations, differences of a polynomial, Newton's formulae for interpolation, central difference interpolation formulae, Gauss's, Sterling's, Bessel's formulae interpolation with unequal intervals, Lagrange's and Newton's interpolation formulae.

UNIT-IV **[Text Book-1]**

Numerical Differentiation and Integration: Finding first and second order differentials using Newton's formulae, Trapezoidal rule,Simpsons 1/3 rule and Simpsons 3/8 rule.

Numerical Solutions of Differential Equations: Taylor's series method, Picard's method, Euler's method, Runge-Kutta method of 4^{th} order, boundary value problems, solution of Laplace's and Poisson's equations by iteration.

Text Book:

[1] B.S.Grewal, "*Higher Engineering Mathematics*", Khanna Publishers, 43^{rd}edition, 2014.

Reference Books:

[1] Krezig, "*AdvancedEngineering Mathematics*", JohnWiley & sons, 8^{th} edition, 2007.

[2] H.K.Das, Er. RajnishVerma, "*Higher Engineering Mathematics*" S.Chand, 1^{st}edition,2011.

[3] R.K.Jain&S.R.K.Iyengar, "*Advanced Engineering Mathematics*", 3^{rd}edition, Narosa Publishers.

[4] N.P.Bali, Manish Goyal, "*A Text book of Engineering Mathematics*", Lakshmi Publications (P) Limited, 1^{st}edition, 2011.

[5] S. S. Sastry, "*Introductory Methods of Numerical Analysis*", Printice Hall of India, 2005.

E-resources and other digital material

[1] mathworld.wolfram.com/fourierseries.html

[2] www.thefouriertransform.com

17EE3302-ELECTRONIC CIRCUITS

Course Category:	**ProgramCore**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Network Analysis-I(17EE1204)	**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Analyze and design** basic diode circuits related to various applications.
CO2	**Analyze and design**differenttransistorbiasingcircuits, stabilization and compensationcircuits.
CO3	**Analyze** the behavior of BJT and FET at low frequencies.
CO4	**Analyze** the behavior of BJT and FET at high frequencies.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		M	H	M									M	
CO2		M	H	M									M	
CO3		M	H	M									M	
CO4		M	H	M									M	

Course Content

UNIT-I **[Text Book-1& 2]**

Semiconductor-Diode and its Applications: Overview of P-N junction diode, diode approximations, diode as a rectifier, half wave, full wave (center-tapped) and bridge rectifiers without filter and with inductor filter, capacitor filter, L-section and π-section filters, multiple L-section, multiple π-section filters, clippers and clampers.

Special-purpose diodes: Light emitting diodes, laser diodes, photodiodes, solar cells, varactor diode, PIN diode, tunnel diode, zener diodes, zener diode as voltage regulator.

UNIT-II **[Text Book-1]**

Transistor & FET Biasing: Introduction**,** over view of Common Base, Common Emitter, Common Collector configurations, operating point, biasing circuits- fixed bias, collector to base bias, self-bias, stability factors, bias compensation circuits, diode compensation for V_{BE} and $I_{CO,}$ Thermistor and Sensistor compensation, thermal runaway and thermal stability.

FET Biasing: Fixed bias, self-bias, voltage divider bias.

UNIT-III **[Text Book-1]**

Transistor Amplifiers at Low Frequencies:

BJT Amplifiers: Hybrid parameter model of transistor, measurement of h-parameters,

analysis of transistor amplifier using h- parameter exact and approximate model of CE, CB and CC.

FET Amplifiers*:* FET Amplifiers at low frequencies, CS/CD/CG configurations at low frequencies.

UNIT-IV **[Text Book-1]**

Transistor Amplifiers at High Frequencies:

BJT Amplifiers:BJT at high frequencies, hybrid π-model, CE short circuit current gain without load, CE short circuit current gain with resistive load, single stage CE transistor amplifier response, emitter follower at high frequencies, gain bandwidth product.

FET Amplifiers:FET amplifier at high frequencies – CS/CD amplifiers.

Text Books:

[1] JacobMillman, Christos C Halkias&Satyabrata JIT, "*Millman's Electronic Devices and Circuits*", 3rd edition, Tata McGraw Hill Ltd, 2007.

[2] Robert LBoylested and Louis Nashelsky, "*Electronic Devices and Circuit Theory*", PHI, 8th edition,2003.

Reference Books:

[1] David A Bell., "*Electronic Devices and Circuits*", Oxford University press, 5th Edition, (2008).

[2] Jacob Millman and Christos C Halkias, *"Integrated Electronics: Analog and Digital Circuits and Systems"*, Tata McGraw Hill Ltd, 2003.

[3] G .K. Mithal*"Electronic Devices and Circuits"* Khanna Publishers

[4] SSalivahana*"Electronic Devices and Circuits"* Tata McGraw Hill Ltd, 2nd Edition.

[5] David A Bell *"Electronic Devices and Circuits"* Printice Hall of India, 4th edition, 2003

Note: Special purpose diodes content available in e-book.

E-resources and other digital material

[1] TonyR.Kuphaldt, "*Electric Circuits, Volume III-Semiconductors*",5th edition, 2009 (e-book).

[2] http://nptel.iitm.ac.in/courses.php?branch=Ece

[3] www.ibiblio.org/obp/electricCircuits

17EE3303-ELECTRICAL MACHINES-I

Course Category:	**ProgramCore**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Network Analysis-I (17EE1204)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Analyze** the concepts of electro-mechanical energy conversion, construction, operation and performance of dc generators.
CO2	**Discuss** and **analyze** the operation and performance of dc motors.
CO3	**Analyze** and **evaluate** the performance of single phase transformers.
CO4	**Analyze** and **evaluate** the performance of three phase transformers

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	H	H	H						H			H	H
CO2	M	H	H	H						H			H	
CO3	M	H	H	H						H			M	H
CO4	M	L	H	H						H			M	H

Course Content

UNIT- I **[Text Book-1]**

Electromechanical Energy Conversion: Energy in magnetic systems, field energy and mechanical force, singly and doubly excited magnetic field systems, forces and torques in systems with electromagnets.

DC Generators: Construction,principle of operation, types of DC Machine, EMF equation, armature reaction, methods of excitation, commutation and inter poles, compensating windings, characteristics of DC generators.

UNIT-II **[Text Book-2]**

DC Motors: Principle of working, significance of back EMF, torque equation, characteristics, starting methods, speed control, losses and efficiency, braking methods, DC machines applications. Testing of DC machines-Brake test, Swinburne's test, Hopkinson test, retardation test, field test.

UNIT-III **[Text Book-2]**

Single Phase Transformer: Transformer construction, principle of operation, EMF equation, ideal transformer, equivalent circuit, phasor diagram, transformer losses, regulation and efficiency, all day efficiency, polarity test, open circuit and short circuit tests, sumpner'stest, parallel operation of single phase transformer, auto transformer, applications of

transformers.

UNIT-IV **[Text Book-2]**

Three-Phase Transformer: Three phase transformer construction, cooling methods, connections, phase groups, open delta connection, scott connection, three winding transformers (Tertiary winding), parallel operation of three phase transformers, tap changing of transformers.

Text Books:

[1] I.J.Nagrath and D.P. Kothari, "*Electric Machines*", Tata McGraw-Hill Education Private Limited Publishing Company Ltd, 4th edition, 2010.
[2] Ashfaq Husain, "*Electric Machines*", DhanpatRai& Co.(Pvt.) Ltd, 2nd edition, 2009.

Reference Books:

[1] Dr. P. S. Bhimbra, "*Electrical Machinery*", Khanna Publications, 7th edition, 2007.
[2] A.E.Clayton, "*The Performance & design of DCMachines*", CBS publisher& Distributors,1st edition, 2003.
[3] A.E Fitzgerald and Charles Kinsley, "*Electric Machinery*", Tata McGraw-Hill Education Publications, 6th edition, 2002.
[4] J.B Gupta, "*Theory & Performance of Electrical Machines*", S.K.Kataria& Sons, 15th edition,2015

E-resources and other digital material

[1] http://nptel.ac.in/courses/108105017/

17EE3304-NETWORK ANALYSIS-II

Course Category:	**Program Core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Linear Algebra and differentialEquations(17MA1101) Network Analysis-I (17EE1204)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks::**	30M 70M 100M

Course outcomes

	Upon successful completion of the course, the student will be able to:
CO1	**Analyze** transient response of electric circuits.
CO2	**Find** network functions and two-port parameters.
CO3	**Apply** Fourier analysis to analyze electric circuits and design the filters.
CO4	**Synthesize** one port and two port networks.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H		M	M						H		H	
CO2	H	H	L	M							H		M	
CO3	H	H			L						H		M	
CO4	H	H	H								H		L	

Course Content

UNIT-I **[Text Book-1&2]**

Transients: Review of Laplace transforms, Introduction, direct current transients, RL transient, RC transient, RLC transient, two mesh transients. Alternating current transients-RL, RC, and RLC circuits, two mesh transients (Both differential equation and Laplace transform approaches), response of RL,RC and RLC circuits to periodic functions.

UNIT-II **[Text Book-1]**

Network Function: Introduction, driving point functions, transfer functions, analysis of ladder and non-ladder networks, Poles and Zeros of network functions, restrictions on poles and zeros for driving- point and transfer functions, time domain behavior from pole zero plot, graphical method for determination of residue.

Two Port Networks: Introduction, open circuit impedance parameters, short circuit admittance parameters, transmission (ABCD) parameters, inverse transmission parameters, hybrid parameters, inverse hybrid parameters, condition of symmetry and reciprocity in two port parameter representation, inter-relation between parameters of two port networks, inter connection of 2-port networks.

UNIT-III **[Text Book-1]**

Fourier Circuit Analysis: Introduction, trigonometric form of the Fourier series, wave form symmetry, exponential form of the Fourier series, average value and RMS value of a periodic complex wave, power supplied by complex wave.

Filters: Introduction, classification of filters, characteristics of filters, low pass, high pass, band pass and band stop filters, analysis and design of filter networks of both T and π configurations(constant k type filters only).

UNIT-IV **[Text Book-1]**

Network Synthesis: Introduction, Hurwitz polynomials and properties, positive real functions and its properties, elementary synthesis concepts, realization of LC, RC and RL functions of one port and two port networks using Foster form and Cauer form.

Text Books:

[1] Ravish R Singh,"*Network Analysis and Synthesis*", McGraw-Hill Education (India) Pvt.Ltd., 1st edition, New Delhi.

[2] A. Chakrabarthi, "*Circuit Theory (Analysis and Synthesis)*", Dhanpat Rai & Co. Pvt.Ltd., 6th edition, 2013.

Reference books:

[1] M.E Van Valkenburg, "*Network Analysis*", Prentice Hall of India Pvt. Ltd, 3rd edition New Delhi.

[2] W. H. Hayt, J.E. kemmerly and S. M. Durbin, "*Engineering Circuit Analysis*", Tata McGraw-Hill, New Delhi, 8th edition, 2012 .

[3] Charles K. Alexander, Matthew N. O. Sadiku, "*Fundamentals of Electric Circuits*", McGraw-Hill, 5th edition, 2012.

[4] A. Sudhakar and P.Shyam Mohan, "*Circuits and Networks Analysis and Synthesis*", Tata McGraw-Hill, New Delhi, 3rd edition, 2007

E-resources and other digital material

[1] http://nptel.ac.in/courses/108102042/

17EE3305-DIGITAL ELECTRONICS

Course Category:	**ProgramCore**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:		**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Construct** the binary codes and **Elucidate** various logic families.
CO2	**Design** and **Implement** combinational logic circuits.
CO3	**Elucidate** Flip-Flops, Registers and Counters..
CO4	**Design** and **Implement** Sequential Logic Circuits and Programmable Logic Devices.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M		H										M
CO2	M	H	H	H										M
CO3	M	H	H	H		L								M
CO4	M	M	H	H		H								M

Course Content

UNIT-I **[Text Book-1& 2]**

Number Systems: Number systems and codes, error detection and correction codes**.**

Digital Logic Families: Introduction to RTL, DTL,I^2L, TTL, ECL and MOS Logic families, wired AND operation, characteristics of digital logic family, comparison of different logic families**.**

UNIT-II **[Text Book-1& 2]**

Minimization of Switching Functions: SOP and POS forms, K-map representations, minimization using K-maps, simplification**,** don't care conditions**,** Quine–Mccluskey method.

Combinational Logic Design: Adders, subtractors, multiplexers and de-multiplexers, decoders and encoders, code converters, 1bit ALU.

UNIT-III **[Text Book-1 &2]**

Sequential Logic: 1-bit memory cell, SR, JK, D and T flip-flops level triggering and edge triggering, conversions of Flip-Flop**.**

Registers and Counters: Shift registers, asynchronous and synchronous type, modulo counters, ring counters.

UNIT-IV **[Text Book-1&2]**

Synchronous Sequential Logic Circuits: Moore and Mealy models, state diagrams, state assignment, state table and excitation tables, state reduction, design of counters**.**

Programmable Logic Devices: Read Only Memory, ROM organization, design of a combinational circuit using a ROM, Programmable Logic Array (PLA), PLA Programming table and Programmable Array Logic (PAL).

Text Books:

[1] R P Jain, "*Modern Digital Electronics*", Tata Mc. Graw Hill Publication.4th Edition.
[2] M. Morris Mano, "*Digital Logic and ComputerDesign*". Printice Hall of India, 2003.

Reference Books:

[1] Taub& Schilling, "*Digital integrated Electronics"*, McGraw-Hill
[2] AnandKumar, "*Fundamentals of Digital Circuits*" Printice Hall of India, 2nd edition.
[3] Gordon J Deboo & Clifford N. Burrous, "*Integrated Circuits and Semiconductor Devices*", International Student Edition, Tata McGraw-Hill,.2nd edition.

E-resources and other digital material

[1] http://www.nptel.ac.in/courses/117106086/
[2] http://www.docstoc.com/docs/14901337/Fundamentals-of-Digital-Electronics
[3] http://www.ebookee.com/Fundamentals-of-Digital-Electronics_313329.

17TP1306-LOGIC &REASONING

Course Category:	**Institutional Core**	**Credits:**	1
Course Type:	Learning by doing	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:		**Continuous Evaluation:**	100M
		Semester End Evaluation:	0M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Think** reason logically in any critical situation.
CO2	**Analyze** given information to find correct solution.
CO3	**Reduce** the mistakes in day to day activities in practical life.
CO4	**Develop** time-management skills by approaching different shortcut methods.
CO5	**Use** mathematical based reasoning to make decisions.
CO6	**Apply** logical thinking to solve problems and puzzles in qualifying exams in any competitive exam.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								M						
CO2				M										
CO3								M						
CO4											M			
CO5									M					
CO6								M						

Course Content

UNIT-I **[Text Book-1]**

1. Series completion
2. Coding-Decoding
3. Blood relation
4. Puzzles test

UNIT-II **[Text Book-1]**

1. Direction sense test
2. Logical Venn diagrams
3. Number test, ranking test
4. Mathematical operations

UNIT-III **[Text Book-1]**

1. Arithmetical reasoning
2. Inserting missing character
3. Syllogism.

UNIT-IV **[Text Book-1]**

Non-Verbal:

1. Water images
2. Mirror images
3. Paper folding
4. Paper cutting
5. Embedded figures
6. Dot situation
7. Cubes & Dice

Text Books:

[1] R. S. Aggarwal, "*Verbal and non-verbal reasoning*", S Chand publication, revised edition,2017. ISBN:81-219-0551.

Reference Books:

E-resources and other digital material

17EE3351-NETWORKS&ELECTRICALMACHINES-I LAB

Course Category:	**Program Core**	**Credits:**	1.5
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	Network Analysis-I(17EE1204) Electrical Machines-I(17EE3303)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Design** and conduct experiment.
CO2	**Analyze** and present experimental results.
CO3	**Exhibit** professional behavior

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			M	H					H	L			H	H
CO2				M					H	H			H	H
CO3				M					H	H				

Course Content

PART-A: Electric Networks:

1. Verification of KCL & KVL.
2. Verification of Thevenin's& maximum power transfer theorems.
3. Verification of superposition & reciprocity theorems.
4. Estimation of self & mutual inductance of coupled circuits.
5. Determination of Z, Y parameters of a given two port network.
6. Series and parallel resonance.
7. Measurement of voltage and current in RLC circuit.
8. Voltage, current and power measurements in balanced and unbalanced three phase circuits using resistors.

PART-B: DC Machines:

9. No load & load characteristics of separately excited DC generator.
10. Load characteristics of DC compound generatorwith differential and cumulative connections.
11. Speed control of DC shunt motor.

12. Brake test on DC shunt and compound motor.
13. Load test on DC Series Motor.
14. Swinburne's Test on DC shunt motor.
15. Hopkinson's test on DC motor-generator set.
16. Retardation test on DC shunt motor.
17. Field test on DC Series Motors.

PART-C: Transformers:

18. Open circuit and short circuit tests on single phase transformer.
19. Load test on single phase transformer.
20. Sumpner's test on single phase transformers.
21. Separation of no-load losses in single phase transformer.
22. Parallel operation of single phase transformers.
23. Load test on three phase transformer.
24. Scott connection of three phase transformers.
25. Open circuit and short circuit tests on three phase transformer.

Note: In all laboratories a minimum of 10 experiments are to be completed. (Minimum three experiments from each Part)

17EE3352-ELECTRONICCIRCUITSLAB-I

Course category:	**ProgramCore**	**Credits:**	1.5
Course type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	Electronic Circuits(17EE3302)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes

	Upon successful completion of the course, the student will be able to:
CO1	**Design** and conduct experiment.
CO2	**Analyze**and present experiment results.
CO3	**Exhibit** Professional behaviour.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	L		H	M									M
CO2	H			H			L							M
CO3				H				L						M

Course Content

LIST OF EXPERIMENTS

1. Electronic components testing (Diode, Transistors, LED, Photo- Diode, Capacitor nomenclature, ICs, colour coding of resistors) and CRO Basics.
2. Demo of making PCB using screen printing.
3. PCB Design –I (Schematic).
4. PCB Design –II (Rooting).
5. PCB Design –III (Etching Process).

PART-A: Electronics Devices Lab

6. Characteristics of PN junction diode.
7. Characteristics of Zener diode.
8. Characteristics of LED and photo diode.
9. Analysis of half wave rectifiers with and without filter.
10. Analysis of full wave rectifiers with and without filter.
11. Characteristics of transistor in Common Base configuration.
12. Characteristics of transistor in Common Emitter configuration.

13. Verification of transistor self-bias circuit.
14. Characteristics of Junction Field Effect Transistor.
15. Characteristics of Uni-Junction Transistor.

PART – B: Digital Electronics Lab

16. Realization of logic gates using discrete components and universal gates.
17. Implementation of the given Boolean function using logic gates in both SOP and POS forms.
18. Design of binary to gray and gray to binary converters.
19. Verification of flip-flops using logic gates.
20. Implementation of 4-bit parallel Adder/ Subtract or using IC 7483.
21. Design of BCD to 7-segment display driver.
22. Design and Verification of Shift registers.
23. Design of modulo – N counter.
24. Design of 1-bit Arithmetic Logic Unit (ALU).
25. Design and verification of synchronous and asynchronous counters using flip flops and IC 74163.

NOTE:Minimum Five from **PART-A** and **PART-B** are to be completed.

17MC1307B-INDIAN CONSTITUTION

Course Category:	**InstitutionalCore**	**Credits:**	-
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:		**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the spirit and origin of the fundamental law of the land.
CO2	**Understand** how fundamental rights can be protected.
CO3	**Understand** the structure and formation of the Indian Government at center as well as state.
CO4	**Understand** when and how an emergency can be imposed and its consequences.

Contribution of Course Outcomes towards achievementof Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						M								
CO2						M								
CO3						M								
CO4						M								

Course Content

UNIT-I

Introduction to Constitution of India: Meaning of the constitution law and constitutionalism, historical perspective of the constitution of India, salient features and characteristics of the constitution of India.

UNIT-II

Fundamental rights: Scheme of the fundamental rights, scheme of the fundamental right to equality, scheme of the fundamental right to certain freedoms under article 19,scope of the right to life and personal liberty under article 21.

UNIT-III

Nature of the Indian constitution: Federal structure and distribution of legislative and financial powers between the union and the states.

Parliamentary form of government in India: The constitution powers and status of the President of India, amendment of the constitutional powers and procedure, the historical perspectives of the constitutional amendments in India.

Local self-government: Constitutional scheme in India.

UNIT-IV **[Text Book-1]**

Emergency provisions: National emergency, president rule, financial emergency.

Text Book(s):

[1]. Dr. J.N. Pandey, "*Constitutional Law of India*", Central law Agency, Allahabad,2018

Reference Books:

[1] "The Constitution of India", 1950 (Bare Act), Government Publication.

[2] Dr. S. N. Busi, Dr. B. R. Ambedkar, "*Framing of Indian Constitution*", 1st edition, 2015.

[3] M. P. Jain, "*Indian Constitution Law*", Lexis Nexis, 7thedition,2014.

[4] D.D. Basu, "*Introduction to the Constitution of India*", Lexis Nexis, 2015.

V.R.SIDDHARTHA ENGINEERING COLLEGE: VIJAYAWADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION FOR B.TECH(EEE) SECOND YEAR

Semester- IV **Contact Hours: 27**

S.No	Course Code	Course	L	T	P	Credits
1.	17EE3401	Linear Control Systems	3	0	0	3
2.	17EE3402	Electrical Measurements	3	0	0	3
3.	17EE3403	Electrical Machines-II	3	1	0	4
4.	17EE3404	Digital Signal Processing	3	1	0	4
5.	17TP1405	English for Professionals	0	0	2	1
6.	17HS2406	Humanities Elective	1	0	0	1
7.	17EE3451	Electrical Machines-II Lab	0	0	3	1.5
8.	17EE3452	Control Systems & Measurements Lab	0	0	3	1.5
9.	17HS1453	Communication Skills Lab	0	0	2	1
Total			13	2	10	20
10.	**17MC1407A**	**Environmental Studies (EIE/CE/ME/EEE)**	2	0	0	-

List of Humanities Electives

A: Yoga & Meditation

B: Music

C: Human Rights and Legislative Procedures

D: Philosophy

E: Development of societies

F: Visual Communication

G: Film Appreciation

H: Sanskrit Bhasa

I1: Foreign Languages (French)

I2: Foreign Languages (Germany)

J: Psychology

17EE3401-LINEAR CONTROL SYSTEMS

Course Category:	**Program Core**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Network Analysis-I (17EE1204)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Determine** transfer function models of electrical, and mechanical systems
CO2	**Analyze** the behavior of the system under time domain approach and graphical method.
CO3	**Apply** various plots to analyze the behavior of the system under frequency domain approach.
CO4	**Analyze**State space models of various systems

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H		H	L								L		L
CO2	H		H	L								L		H
CO3	H		H	L								L		H
CO4	H		H	L								L		H

Course Content

UNIT-I **[Text Book-1&2]**

Introduction: Control system terminology, examples of simple control systems, open loop and closed loop control systems, effect of feedback on overall gain, stability, sensitivity, external noise, types of feedback control systems – linear, nonlinear, time invariant and time varying systems.

Mathematical Models of Physical Systems: Formulation of differential equations for Electrical and Mechanical systems, transfer functions of systems,analogous systems, characteristic equation of feedback systems, poles and zeros, block diagram representation of control systems, block diagram algebra, signal flow graph, Mason's gain formula.

UNIT-II **[Text Book-1]**

Time Domain Analysis: Standard test signals-step, ramp, parabolic and impulse time response of first-order system to standard test signals, step response of second order system, time domain specifications, steady state error and static error constants, P, I, PI, PD and PID control actions.

Stability Analysis in Complex Plane: Stability definitions, stability study based on poles of

closed-loop transfer function, Routh–Hurwitz criterion, root locus concept, magnitude and angle conditions, properties and construction of the root loci (for positive values of K only).

UNIT-III **[Text Book-1]**

Frequency Domain Analysis: Introduction, frequency domain specifications, correlation between time and frequency response, polar plot, Bode plot, phase margin and gain margin - Principle of argument, Nyquist stability criterion.

UNIT-IV **[Text Book-1]**

State Space Analysis: Concepts of state variables. State space model, diagonalization of state matrix, solution of state equations, eigen values and stability analysis, concept of controllability and observability.

Text Books:

[1] A. Ananda Kumar, "*Control Systems*", Printice Hall of India publishers, 2nd edition, 2014.

[2] I.J. Nagrath & M.Gopal, "*Control Systems Engineering*", New Age publisher, 5th edition,

Reference Books:

[1] K. Ogata, "*Modern Control Engineering*", Printice Hall of India, publishers, 5th edition, 2010.

[2] B.C. Kuo, "*Automatic Control Systems with MATLAB programming*", Printice Hall of India publishers, 7th edition,

[3] Schaum's Series, "*Feedback and control systems*", Tata McGraw Hill(Pvt.) Ltd., 2nd edition,

E-resources and other digital material

[1]www.nptel.ac.in/courses/108101037/

[2] www.dis.uniroma1.it/~lanai/controlsystems/cs_lectures_enhtml

17EE3402-ELECTRICAL MEASUREMENTS

Course Category:	**Program Core**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Engineering Physics(17PH1202) Network Analysis-I(17EE1204)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Elucidate** the basic laws governing the operation of electrical measuring instruments and measure electrical quantities like Voltage and Current, error analysis.
CO2	**Understand** the concepts used in measurement of Power, energy, phase and frequency.
CO3	**Understand** the significance and working of instrument transformers and bridges used for electrical measurements
CO4	**Elucidate** the concepts of digital voltmeters and Cathode Ray Oscilloscope used for electrical measurements.

Contribution of Course Outcomes towards achievement of Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H		M	L									M	
CO2	M			H								L	M	
CO3	H		M	H										M
CO4	M		M	M								L	M	

Course Content

UNIT-I **[Text Book-1]**

Analog Instruments: Classification of analog Instruments, principles of operation. Electro-Mechanical indicating instruments, operating forces, control systems, damping systems.

Analog Ammeters and Voltmeters: Permanent magnet moving coil instruments, moving iron instruments, electrodynamometer instruments, (construction, general torque equation, shape of scale, advantages, disadvantages and errors).

Error Analysis: Classification, combination of quantities.

UNIT-II **[Text Book-1]**

Measurement of Power & Energy: Electrodynamometer wattmeter-Construction, theory, shape of scale, errors. Low power factor dynamometer wattmeter, measurement of reactive power. Single phase Induction type Watt-hour meters (Construction, theory of operation and adjustments), testing of Energy meters by direct loading and phantom loading arrangements.

Measurement of Phase and Frequency: Power Factor meters, electrodynamometer,

frequency meters, mechanical resonance and electrical resonance frequency meters, synchro scopes, moving iron synchro scopes.

UNIT-III **[Text Book-1]**

Instrument Transformers: Current transformers-theory, ratio error and phase angle errors, reduction of errors, effect of secondary open circuit, testing of current transformers using mutual inductance method. Potential transformers-Theory, ratio error and phase angle errors, reduction of errors.

DC & AC Bridges: Measurement of resistance-Wheatstone bridge, Kelvin double bridge. Measurement of Self Inductance-Maxwell's bridge, Anderson's bridge. Measurement of Capacitance-Schering bridge.

UNIT-IV **[Text Book-1]**

Digital Voltmeters: Ramp, Integrating and potentio-metric digital voltmeters.

Cathode Ray Oscilloscopes: Basic CRO circuits, observation of waveform on CRO, measurement of voltages and currents, measurement of phase and frequency(Lissajouspatterns), multi input oscilloscopes, dual trace oscilloscopes, and dual beam oscilloscope.

Text Books:

[1]. A.K.Sawhney, "*A course in Electrical & Electronic Measurements and Instrumentation*", DhanapthRai& Co., New Delhi, 19th edition, 2013.

Reference Books:

[1]. J.B.Gupta, "*A course in Electronic & Electrical Measurements and Instrumentation*", S. K. Kataria& Sons, New Delhi, 2009.

[2]. E.W.Golding and F.C.Widdis, "*Electrical Measurements and measuring instruments"*, Wheeler Publishers, New Delhi, 5th edition,2009.

E-resources and other digital material

[4] http://nptel.ac.in/syllabus/108106070/

17EE3403-ELECTRICAL MACHINES-II

Course Category:	**Program Core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Electrical Machines-I (17EE3305)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the constructional details and principle of operationof synchronous generators.
CO2	**Analyze** the performance of the synchronous motor and its applications
CO3	**Understand** the constructional details and principle of operation of three phase AC induction motor and speed control methods
CO4	**Analyze** the starting methods of single phase AC induction motor and performance of special electrical machines

Contribution of Course Outcomes towards achievement of Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	H	H	H						H			H	
CO2	M	H		H						H			H	
CO3	M	H	H	H						H			H	
CO4	L	H	H	H						H			H	

Course Content

UNIT–I **[Text Book-2]**

Synchronous Generators: Construction, types of rotors, winding factors, EMF equation, armature reaction, phasor diagram of non-salient pole synchronous generator, synchronizing with infinite bus, parallel operation, synchronizing torque, effect of variation of excitation and mechanical input, losses and efficiency, voltage regulation, direct load, EMF, MMF, and ZPF methods, two reaction theory of salient pole machine, phasor diagram, slip test.

UNIT–II **[Text Book-2]**

Synchronous Motor: Principle of operation, torque equation, phasor diagram, different torques, effects of varying excitation, minimum and maximum power for a given excitation, Vand inverted V curves, hunting and its suppression, measurement of X_d and X_q, efficiency, synchronous condenser, starting of synchronous motors, application of synchronous motors.

UNIT–III **[Text Book-1]**

Three Phase Induction Motor and Speed Control Methods: Construction, rotating magnetic field, operation of squirrel cage and slip ring 3-phase induction motors**,** torque equation, torque-slip characteristics, equivalent circuit, losses and efficiency, testing of induction motors and circle diagram, separation of losses, induction generators and their applications, types of starters, speed control of induction motors, stator voltage control, frequency control, V/f control, pole changing, injection of EMF into rotor circuit.

UNIT-IV **[Text Book-1]**

Single Phase Induction Motors: Construction, double field revolving theory, equivalent circuit, No-load and blocked rotor test, starting methods, split phase, capacitor start and run motor.

Special Electrical Machines: Shaded pole motors and their characteristic, applications, linear induction motor, repulsion motor, hysteresis motor, BLDC motor, stepper motors.

Text Books:

[1] I.J.Nagrath and D.P. Kothari, "*Electric Machines*", Tata McGraw- Hill Education Private Limited Publishing Company Ltd, 4th edition, 2010.

[2] Ashfaq Husain, "*Electric Machines*", DhanpatRai& Co. (Pvt.) Ltd, 2nd edition, 2009.

Reference Books:

[1] Dr. P. S. Bhimbra, "*Electrical Machinery*", Khanna Publications, 7th edition, 2007.

[2] A.E Fitzgerald and Charles Kinsley, "*Electric Machinery*", TataMcGrawHill Education Publications, 6th edition, 2002.

[3] Alexander S.Langsdorf, "*Theory of Alternating- Current Machinery"* Tata McGraw-Hill Publications, 2001.

[4] J.B Gupta, "*Theory & Performance of Electrical Machines*", S.K.Kataria& Sons, 15th edition,2015.

E-resources and other digital material

[1] http://nptel.ac.in/courses/108105017/

17EE3404-DIGITAL SIGNAL PROCESSING

Course Category:	**Program Core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Transformations and Numerical Methods(17MA1301C)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Identify** and categorize discrete time systems.
CO2	**Analyze** discrete systems using Z transforms.
CO3	**Apply** DFT to discrete systems and evaluate DFT using fast Fourier and transforms.
CO4	**Design** FIR and IIR filters and realize digital filters.

Contribution of Course Outcomes towards achievementof Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H								H				H
CO2	H									H				H
CO3	H	H								H				H
CO4	H	H								H				H

Course Content

UNIT-I **[Text Book-1]**

Discrete Signals and Systems: Introduction to digital signal processing, advantages and applications, discrete time signals, LTI system: stability and causality, frequency domain representation of discrete time signals and systems.

Z-Transforms: Z-transforms, Region of convergence, Z-transform theorems and properties, Relation between Z-transform and Fourier transform of a sequence, Inverse Z-transform using Cauchy's integration theorem, Partial fraction method, Long division method, Solution of difference equations using one sided Z-transform, Frequency response of a stable system.

UNIT-II **[Text Book-2]**

DFT and FFT: Discrete Fourier series, properties of DFS, discrete Fourier transform, properties of DFT, linear convolution using DFT, computations for evaluating DFT, decimation in time FFT algorithms, decimation in frequency FFT algorithm, computation of inverse DFT.

UNIT-III **[Text Book-2]**

IIR Filter Design Techniques: Introduction, properties of IIR filters, IIR filter design using bilinear transformation and impulse Invariance methods, design of digital butterworth and Chebyshev filters using bilinear transformation, impulse invariance transformation methods,

and design of digital filters using frequency transformation method.

UNIT-IV **[Text Book-2]**

FIR Filter Design Techniques: Introduction to characteristics of linear phase FIR filters, frequency response, designing FIR filters using windowing methods, rectangular window, hanning window, hamming window, generalized hamming window, bartlett triangular window, comparison of IIR and FIR filters.

Realization of Digital Filters: Direct, canonic, cascade, transposed, parallel and ladder realizations.

Text Books:

[1] Alan V Oppenheim and Ronald W Schafer, "*Digital Signal Processing"* Pearson Education/Printice Hall of India, 2004.

[2] Proakis, J. Gard and D. G. Manolakis, "*Digital Signal Processing: Principals, Algorithms and applications*", 3rd edition, Printice Hall of India, 2003.

Reference Books:

[1] M.H.Hayes, "*Digital Signal Processing*", Tata Mc. Graw Hill Publication.

[2] P.RameshBabu, "*Digital Signal Processing*", Scitech Publications, 2nd edition, 2004.

[3] S K Mitra, "*Digital Signal Processing: A Computer Based Approach*", Tata Mc. Graw Hill Publication, 2nd edition, 2003

[4] S.Salivahanan ,"*Digital Signal Processing",* Tata Mc. Graw Hill Publication, 2000.

E-resources and other digital material

[1] www.dsptutor.freeuk.com

[2] https://nptel.iitm.ac.in/courses/Webcourse contents/ IITKANPUR/ Digi_Sign_Pro/ui/ About-Faculty.html

17TP1405-ENGLISH FOR PROFESSIONALS

Course Category:	**Institutional Core**	**Credits:**	1
Course Type:	Learning by Doing	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:		**Continuous Evaluation:**	100M
		Semester End Evaluation:	0M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Present** themselves effectively in the professional world by shedding off their inhibitions about communicating in English
CO2	**Introduce** themselves as well as others appropriately.
CO3	**Use** vocabulary to form sentences and narrate stories by using creative thinking skills
CO4	**Involve** in practical activity oriented sessions.
CO5	**Learn** about various expressions to be used in different situations.
CO6	**Respond** positively by developing their analytical thinking skills.

Contribution of Course Outcomes towards achievementof Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										H	H			
CO2									H	H	H			
CO3										H	H			
CO4								M		H	H			
CO5										H	H			
CO6										H	H			

Course Content

UNIT-I

1. Beginners, functional, situational conversations.
2. Practicing on functional conversations.

UNIT-II

1. Errors in usage of parts of speech with a thrust on verbs, adjectives and conjunctions, idioms/phrases.
2. Introducing basic grammar.
3. Practicing on functional conversations.

UNIT-III

1. Introducing self &others.
2. Structures and forming sentences.
3. Telephonic etiquette, social etiquette and table manners.
4. Practicing on functional conversations.

UNIT-IV

1. Direct, indirect/ reporting speech
2. Public speaking basics
3. Versant test preparation
4. Practicing on situational conversations.

Text Books:

[1] SwaroopaPolineni, "*Strengthen Your Communication Skills*", Maruthi Publications, 1st edition, 2013.

[2] MamtaBhatnagar&NitinBhatnagar, **"***Communicative English***",**Pearson India, 1st edition,2010.

Reference Books:

E-resources and other digital material

17HS2406A-YOGA & MEDITATION

Course Category:	**Humanities Elective**	**Credits:**	1
Course Type:	Practice	**Lecture-Tutorial-Practice:**	1-0-0
Prerequisites:		**Continuous Evaluation:**	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Equip** better attitude and behavior.
CO2	**Imbibe** set of values enabling a balanced life focused on an ethical material life.
CO3	**Develop** levels of concentration through mediation.
CO4	**Apply** conscience for the missions of life.

Contribution of Course Outcomes towards achievementof Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						M								
CO2						M								
CO3						M								
CO4						M								

Course Content

UNIT-I
Understanding Yoga: Orientation, introduction to values, the positive impact of yoga, application of values in real life, universal values**.**
(Lecture-demo pattern with illustrations representing Yogic postures and value system related pictorial will be followed.)

UNIT-II
Yoga Practices: Yoga, self and ultimate goal of yoga, introduction to various types of yoga ,integration of values in yoga.
(Activity based processes with Assanas and pranayama are implemented)

UNIT-III
Practice of Meditation: Art of meditation, observation, introspection, contemplation meditation and concentration.
(Activity based processes with meditation sessions followed by demonstration are implemented.)

UNIT-IV
Towards Professional Excellence through Yoga and Meditation: Stress management, choices we make, excellence and integration.(Lecture-demo pattern is followed)

Text Book(s):

[1] *Common Yoga protocol*, Ministry of Ayush, Govt of India.

[2] O Journey of the Soul- Michael Newton, 2003, Llewellyn, 2010.

Reference Books:

[1]Lectures from Colombo to Almora, Swami Vivekananda, 2010 Ramakrishna mission.

[2] Essays of Ralph Waldo Emerson, 1982, Eastern press

E-resources and other digital material

[1] www.heartfulness.org

[2] www. ayush.gov.in

[3] www. belurmath.org

17HS2406D-PHILOSOPHY

Course Category:	**Humanities Elective**	**Credits:**	1
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1-0-0
Prerequisites:		**Continuous Evaluation:**	100M

Course outcomes

	Upon successful completion of the course, the student will be able to:
CO1	**Understand**major philosophical issues.
CO2	**Appreciate** the philosophical doctrines of western thinkers.
CO3	**Understand** the eminence of Indian classical thought.
CO4	**Appreciate** relation between science and values.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						M								
CO2						M								
CO3						M								
CO4								M						

Course Content

UNIT-I
What's Philosophy: Definition, nature, scope and branches.

UNIT-II
Introduction to Western Philosophy: Ancient Greek and modern philosophy

UNIT-III
Introduction to Indian Thought: Six systems–Modern philosophers.

UNIT-IV
Philosophy of Science &Technology: Human values and professional Ethics.

Text Books:

[1] Will Durant, Simon & Schuster aborti, *"The story of philosophy",*1926.
[2] O.O.Fletcher, *"An Introduction to philosophy"*, Word Public Library, 2010.

Reference Books:

[1] DH Dutta, *"Six systems of Indian Philosophy"*
[2] Will Duran, Simon & Schuster, "*The pleasures ofphilosophy*",1929.

E-resources and other digital material

17HS2406 (I2)-FOREIGN LANGUAGE (GERMAN)

Course Category:	**Humanities Elective**	**Credits:**	1
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1-0-0
Prerequisites:		**Continuous Evaluation:**	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	Learn basics of German Language.
CO2	Write German Writing.
CO3	Understand German Hearing.
CO4	Form sentence in present, past and future tense.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										M				
CO2										M				
CO3										M				
CO4										M				

Course Content

UNIT-I
Alphabets, numbers, exact articles and not exact articles.

UNIT-II
Prepositions**,** Present tense.

UNIT-III
Past tense and about family.

UNIT-IV
Future tense

Text Book(s):

[1] Studio d A1CornelsenGoyalaas Publications New Delhi.

E-resources and other digital material

17HS2406 (J)-PSYCHOLOGY

Course Category:	**Humanities Elective**	**Credits:**	1
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1-0-0
Prerequisites:		**Continuous Evaluation:**	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	Relate biological and socio-cultural factors in understanding human behavior
CO2	Understand the nature of sensory processes, types of attentions.
CO3	Explain different types of learning the procedures, distinguishes between different types of memory.
CO4	Demonstrate an understanding of some cognitive processes involved in problem solving and decision –making.

Contribution of Course Outcomes towards achievementof Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						M								
CO2						M								
CO3						M								
CO4						M								

Course Content

UNIT -I
Introduction: Psychology as a scientific study of behavior. Biological and socio-cultural bases of behavior, Fields of psychology.

UNIT- II
Sensory and perceptual processes: Sensation, Attention and perception.

UNIT- III
Cognition and affect: Learning and memory, emotion and motivation

UNIT IV
Thinking, problem solving and decision making, personality and intelligence.

Text Books:
[1] Zimbardo,P.G.,*"Psychology and Life", Pearson education,20th edition*,2013.

Reference Books:
[1] Baron, R.A.*"Psychology"Pearson Education, New Delhi,5th edition,2006.*
[2] Coon, D., & Mitterer, J.O, "*Introduction to Psychology: Gateway to Mind and Behaviour*", Cengage, New Delhi, 2007.

[3] Feldman, R.S. "Psychology and your life", Mc. Graw Hill, New York, 2nd edition, 2013
E-resources and other digital material

17EE3451-ELECTRICAL MACHINES-II LAB

Course Category:	**Program Core**	**Credits:**	1.5
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	Networks & Electrical Machines-I Lab (17EE3351)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes

	Upon successful completion of the course, the student will be able to:
CO1	**Design** and conduct experiment.
CO2	**Analyze** and present experimental results.
CO3	**Exhibit** professional behavior.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H		H	L	L						H			H
CO2			H							H	H			
CO3			H							H				

Course Content

Electrical Machines Lab

1. Regulation of 3-phase alternator by EMF& MMF methods.
2. Regulation of 3-phase alternator by ZPF method.
3. Regulation of 3-phase salient pole alternator by slip test.
4. Load test on 3-phase alternator.
5. Synchronization and parallel operation of three phase alternator.
6. Measurement of negative sequence and zero sequence impedance of alternator.
7. Slip test on a salient pole synchronous motor.
8. V and inverted V curves of three phase synchronous motor.
9. Load test on 3 - phase squirrel cage induction motor.
10. Load test on 3 - phase slip ring induction motor.
11. No load and blocked rotor test on 3 - phase induction motor.
12. Separation of losses in 3-phase induction motor.
13. Load test on Induction generator.
14. Brake test on single phase induction motor.
15. Determination of equivalent circuit of single phase induction motor.
16. Modeling and simulation of three phase Induction motor using MATLAB.

NOTE**: (A** minimum of **ten** experiments are to be completed.)

17EE3452-CONTROL SYSTEMS & MEASUREMENTS LAB

Course Category:	**Program Core**	**Credits:**	1.5
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	Linear Control Systems (17EE3401) Electrical Measurements(17EE3402)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Design** and conduct experiment.
CO2	**Analyze**and present experimental results.
CO3	**Exhibit** professional behaviour.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H			H				L		M				M
CO2	M	L		H						M				H
CO3								L						

Course Content

LIST OF EXPERIMENTS.

PART-A:Control systems

1. Characteristics of Synchros.
2. Transfer function of D.C generator.
3. Time response of second order system.
4. Characteristics of magnetic amplifier.
5. Characteristics of A.C servo motor.
6. Effect of PID controller.
7. State Space analysis using Simulation.
8. Stability studies of Mechanical System using Simulation.

PART – B: Measurements

1. Kelvin double bridge - Measurement of low resistance.
2. Anderson Bridge-Measurement of Inductance.
3. Schering Bridge -Measurement of Capacitance.
4. Calibration of Single-phase energy meter by direct loading.
5. Calibration of Single-phase energy meter by phantom loading.
6. Measurement of frequency using Lissajous patterns.
7. Measurement of Ratio error and Phase angle error of C.T.
8. Measurement of Earth resistance by Earth tester.

NOTE: In all laboratories a minimum of **ten** experiments are to be completed.

Minimum Five experiments from **PART-A** and **PART-B** are to be completed.

17HS1453-COMMUNICATION SKILLS LAB

Course Category:	**Institutional Core**	**Credits:**	1
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:	Technical English and Communication skills (17HS1205)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Be proficient** in pronunciation of speech sounds including accentuation.
CO2	**Enhance** the awareness of the elements of listening comprehension.
CO3	**Develop** the abilities of rational argumentation and skills of public speaking.
CO4	**Be aware** of the elements of professional communication
CO5	**Be exposed** to the items of various competitive exams.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							H			H	L	M		
CO2		M		M		H	H	M	H	H	M	M		
CO3	H		M	H	L	H	M	H	H	H	H	M		
CO4	M	L	M	M	L	H	H	H	H	H	H	H		
CO5		M	M	M	L	H	L	H	M	H	L	H		

Course Content

UNIT-I

Elements of Spoken Expression and processes of Listening comprehension:

- Speech Mechanism
- Articulation of vowels and consonants
- Patterns of accentuation
- Types and processes of listening comprehension

UNIT-II

Patterns of Substantiation and Refutation in Public Speaking:

- Group discussion (Open and Monitored)
- Pyramid discussion
- PNI
- Seminar talk and Power Point Presentation.

UNIT-III

Professional Communication:

- Self-Affirmation
- Textual Patterns
- Advanced Composition including Memo and e-mail
- Résumé Preparation
- Elements of Non-Verbal Communication.

UNIT-IV

Life Skills and Vocabulary for Competitive Examinations:

- Select Life Skills(50)
- Select Logies, Isms, Phobias and Manias (25 each)
- Sentence Completion and Double unit Verbal Analogies(50 items)
- Fundamentals of Syllogisms(Descriptive and Pictorial)

Text Book(s):

[1] Martin Cutts, "*Oxford Guide to Plain English*", OUP, 7th Impression, 2011

[2] Exercises in Spoken English, Prepared by Department of Phonetics and Spoken English, CIEFL, OUP, 21stImpression, 2003.

Reference Books:

[1] Stephen R Covey, "*The 7 Habits of Highly Effective people*", (Pocket Books) Simon and Schuster UK Ltd, 2nd edition, 2004.

[2] Eclectic Learning Materials offered by the Department.

E-resources and other digital material

[1] ODll Language Learner's Software, 27-6-2012 Orell Techno Systems.

[2] Visionet Spears Digital Language Lab software Advance Pro , 28-01-2015

[3] www.natcorp.ox.ac.uk, *British National Corpus, XML edition 2007.*

17MC1407A-ENVIRONMENTAL STUDIES
(Common for (EIE/CE/ME/EEE))

Course Category:	**Mandatory Course**	**Credits:**	-
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:	Conservation and Preservation of Environment	**Continuous Evaluation:** **Total Marks:**	100M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the various natural resources, analyze and explore.
CO2	**Understand** the ecosystems and need of biodiversity
CO3	**Realize** and **Explore** the problems related to environmental pollution
CO4	**Apply** the role of information technology and analyze social issues degradation management and its management acts associated with Environment.

Contribution of Course Outcomes towards achievementof Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L						H				L			
CO2			L				H			L				
CO3								H	L					
CO4							H		L			H		

Course Content

UNIT I **[Text Book-1]**

The 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.

a) **Forest resources:** Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forests and tribal people.
b) **Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources.
d) **Food resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
e) **Energy resources:** Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.
f) **Land resources:** Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT-II **[Text Book-1]**

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-Forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation: Introduction, 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-spots 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 **[Text Book-1]**

Environmental Pollution: Definition, causes, effects and control measures of, Air pollution Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards

Solid waste management-causes, effects and control measures of urban and industrial wastes, role of an individual in prevention of pollution, Disaster management-Floods, earthquake, cyclone and landslides.

UNIT-IV **[Text Book-1]**

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, environmental ethics issues and possible solutions.

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, wastel and 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.

Human Population and the Environment: Population growth, variation among nations, population explosion-family welfare program., environment and human health, human rights, value education, HIV/AIDS, women and child welfare, role of information technology in environment and human health.

Field Work/Case Studies: (<u>Not to be included in semester end exams</u>)

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, birds.
Study of simple ecosystems-pond, river, hill slopes, etc.

Text Book:

[1] Text book for "*Environmental Studies*" for under graduate courses of all branches of higher education – ErachBharucha -- For University Grants Commission.

Reference Book:

[1] AnjaneyuluY, "*Introduction to Environmental sciences",*B S Publications PVT Ltd, Hyderabad.

E-resources and other digital material

colleges@edu.ac.in/UG/Envinromental%20**Studies**_ebook.**pdf**

V.R.SIDDHARTHA ENGINEERING COLLEGE: VIJAYAWADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION FOR B.TECH(EEE) THIRD YEAR

Semester-V **Contact Hours: 27**

S.No	Course Code	Course	L	T	P	Credits
10.	17EE3501	Power Systems - I	3	1	0	4
11.	17EE3502	Operational Amplifiers and Linear Integrated Circuits	3	1	0	4
12.	17EE3503	Microcontrollers	3	1	0	4
13.	17EE2504	Open Elective – I	3	0	0	3
	17EE2504A	Electrical Materials				
	17EE2504B	Waste to Energy Conversion Technology				
14.	17XX2505	Open Elective -II (Inter Disciplinary Elective)	3	0	0	3
	17EE2505A	Fundamentals of Power System				
	17EE2505B	Renewable Energy Systems				
15.	17EE2506	Open Elective-III* (Self-Learning Elective Course)	0	0	0	2
	17EE2506A	Illumination Engineering				
	17EE2506B	Introduction to Soft Computing				
	17EE2506C	NPTEL/SWAYAM/COURSE ERA/EDX/Spoken _Tutorial(IITB)				
16.	17TP1507	Personality Development	0	0	2	1
17.	17EE3551	Microcontrollers Lab	0	0	3	1.5
18.	17EE3552	Electronic Circuits Lab - II	0	0	3	1.5
Total			**15**	**3**	**8**	**24**

*Students can opt any one of the self-learning courses prescribed by the department students can register and complete the opted course in approved MOOCS platform either in IV or V semester such that they have to submit the certificate on or before the last instruction day of V semester.

17EE3501-POWER SYSTEMS-I

Course Category:	**Program Core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Engineering Physics (17PH1202) Network Analysis-I (17EE1204)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the layout of power system and **Elucidate** conventional power generating plants.
CO2	**Analyze** the performance of transmission lines.
CO3	**Evaluate** the performance ofAC and DC distribution systems.
CO4	**Understand** the economical aspects of power generation.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**		**H**				**H**			**H**			**H**	
CO2	**H**	**H**		**H**						**H**			**H**	
CO3	**M**	**H**								**H**			**H**	
CO4	**M**	**H**		**M**			**M**			**H**			**H**	

Course Content

UNIT-I [Text Book–1&2]

Introduction: Evolution of power systems and present day scenario-power system layout-bulk power grids and micro-grids.

Thermal and Hydroelectric power stations: Introduction - selection of site for thermal station -layout -main parts and working; factors for site selection of hydroelectric station - hydrology - classification of hydroelectric plants - general arrangement and operation of hydroelectric plants and its function.

Nuclear power stations: Introduction-nuclear reactions-nuclear materials-feasibility of nuclear power station-main parts of reactors and their functions-types of reactors-Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR)-working of nuclear power stations.

UNIT-II [Text Book–1&2]

Constants of overhead transmission lines: Introduction-inductance of a conductor due to internal & external fluxes-inductance of a single phase two wire line-inductance of composite conductor lines-inductance of 3 phase lines-capacitance of a two wire line-capacitance of 3 phase lines-effect of earth on capacitance of line.

Performance of transmission lines: Introduction - Representation of short, medium and long

length transmission lines- ABCD constants for short and medium lines–Ferranti effect-surge impedance and surge impedance loading- corona.

UNIT-III[Text Book-1]

DC Distribution: Introduction and classification of distribution systems,Voltage drop calculations in DC distributors-radial distributor fed at one end and at both ends-equal/unequal voltages with concentrated loads and ring main distributor.

AC Distribution: Voltage drop calculations in AC distributors - power factors referred to receiving end voltage and with respect to load voltages.

UNIT-IV[Text Book-1]

Economical aspects: Economics of generation-significance of load curve-load duration curve-load factor, diversity factor, plant use factor, cost of electrical energy, choice of size and number of generator units, methods of determining depreciation-tariffs.

Power factor considerations: Causes of low power factor-methods of improving power factor, most economical power factor for constant KW load and constant KVA type loads.

Text Books:

[1] M.L. Soni, P.V. Gupta, U.S. Bhatnagar and A. Chakraborti, "*Power System Engineering*", DhanpatRai& Co. Pvt. Ltd., 2016.

[2] C.L. Wadhwa, "*Generation Distribution and utilization of Electrical Energy*", New age International 4th Edition.

Reference Books:

[1] John J.Grainger and William D. Stevenson, *"Power System Analysis*", Mc.Graw Hill, 4th Edition 1994.

[2] V.K. Mehta, Rohit Mehta, "*Principles of Power Systems*", S. Chand, 4th Revised Edition.

[3] J.B. Gupta, "*Transmission & Distribution of Electrical Power*", S. K. Kataria& Sons, 2013.

Kothari and Nagrath, "Power System Engineering", Tata Mc.Graw Hill, 2nd Edition 2008.

E-resources and other digital material:

[1] https://nptel.ac.in/courses/108105104

[2] https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-061-introduction-to-electric-power-systems-spring-2011

EE3502– OPERATIONAL AMPLIFIERS AND LINEAR INTEGRATED CIRCUITS

Course Category:	**Program Core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Electronic Circuits-(17EE3302) Network Theory-I (17EE1204)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the concepts ofop-amps and its applications.
CO2	**Design** different non-linear op-amp circuits and waveform generators.
CO3	**Design** active filters, DACs and ADCs.
CO4	**Design** of timer circuits, PLL and voltage regulators.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**L**			**M**					**H**					**M**
CO2				**H**					**H**					**M**
CO3				**M**					**H**					**M**
CO4	**L**			**M**										**M**

Course Content

UNIT-I[Text Book-1&2]

Operational amplifiers: Integrated circuits-types, classification, package types and temperature ranges, power supplies; operational-amplifier block diagram, ideal and practical operational-amplifier Specifications, 741 operational-amplifier features and specifications. Operational-amplifier characteristics-DC and AC characteristics.

Linear applications of operational amplifiers: Negative feedback concept in operational-amplifiers, inverting and non-inverting amplifier, voltage follower, differential amplifier, summing amplifier, instrumentation amplifier, V-I, I-V converters, integrator and differentiator.

UNIT-II[Text Book-1&2]

Non Linear applications of operational amplifiers: Sample and hold circuit, log and antilog amplifiers, precision diode, applications- precision rectifier, peak value detector, clipper and clamper circuit.

Comparators and waveform generators: Introduction to comparator, basic comparator, applications-zero-crossing detector, window detector, voltage limiters; waveform generators- oscillators, Schmitt trigger, square-wave generator, triangular wave generator, saw tooth wave generator.

UNIT-III[Text Book–1&2]

Active filters: Active low pass and high pass filters, Sallen key low pass and high pass filters, band pass filters – wide band pass and multiple feedback band pass filters, band stop filters-wide band stop and notch filter, all pass filters.

D/A and A/D converters: Introduction, basic digital to analog converter techniques - weighted resistor digital to analog converter, R-2R ladder D/A converter; A/D conversion–parallel comparator type analog to digital converter, tracking type A/D converters, successive approximation analog to digital converter and dual slope analog to digital converter, digital to analog converter and analog to digital converter specifications.

UNIT-IV[Text Book-1&2]

Applications of special ICS: 555 Timer- 555 as mono-stable and astable multi-vibrator and applications; voltage controlled oscillator; phase locked loops- operating principles, monolithic PLLs, 565 PLL applications; IC voltage regulators, 723 IC voltage regulator.

Text books:

[1] Roy and Chowdhary, "Linear Integrated Circuits", New Age International Latest Edition.
[2] Rama Kant A. Gayakwad, "Operational amplifiers and Linear Integrated Circuits", Prentice Hall India Pvt. Ltd. Latest Edition.

Reference Books:

[1] Jacob, "*Applications and Design with Analog Integrated Circuits*", Prentice Hall India Pvt. Ltd. Latest Edition.
[2] Denton J Dailey, "*Operational Amplifiers and Linear Integrated Circuits: Theory and Applications*", McGraw Hill Ltd, latest Edition.

E-resources and other digital material:

[1] https://nptel.ac.in/courses/117101106

17EE3503– MICROCONTROLLERS

Course Category:	**Program Core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Digital Circuits and Systems (17EE3305)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Illustrate** the concept of embedded systems and architecture of 8051 microcontroller.
CO2	**Composition** of different features on 8051 microcontroller.
CO3	**Illustrate** the architecture and programming of AVR microcontroller.
CO4	**Interfacing** of basic I/O devices.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			**M**		**H**							**H**		**M**
CO2		**L**	**M**	**M**	**M**							**M**		**M**
CO3			**M**		**H**							**H**		**M**
CO4	**L**	**H**	**H**	**H**	**H**						**H**	**H**		**H**

Course Content

UNIT-I **[Text Book-1&2]**

Introduction to Embedded Technology: Introduction to microprocessors and microcontrollers, differences between microprocessor & microcontrollers, types of microcontrollers based on architecture.

8051 Microcontroller Hardware: Features of 8051, block and pin diagram of 8051 controller, register organization, memory organization, addressing modes.

UNIT-II **[Text Book-1&2]**

8051 On-chip Peripherals Interfacing [Using Embedded C]:

Timers-Register configuration, modes of operation, programming in mode1 and mode2.

Serial port (UART): Types of serial communications, Register configuration, modes of operation, programming in mode1.

Interrupts: Register configuration, programming of external hardware interrupts, timer and serial communication interrupts, interrupt priority and programming.

UNIT-III[Text Book-3]

AVR Microcontrollers [ATMEGA328P]: Introduction, features of microcontroller, pin-diagram and block-diagram of ATMEGA328P controller, register organization, memory organization.

Introduction to ATMEGA328P Programming using generic development board: Introduction to embedded C, basic I/O instructions, loop instructions, conditional jump instructions.

UNIT-IV **[Text Book–2&3]**

External Peripherals Interfacing [using Embedded C]: Interfacing of Pushbutton, 4X4Hex-keyboard, general purpose LED, seven segment LED, 16X2 LCD, relay using both 8051 and ATMEGA328P development board, ADC808, DAC800 programming using 8051.

Text Books:

[1] Ayala and Kenneth J., "*The 8051 Microcontroller: Architecture, Programming and Applications*", West Publishing Company, 2007.

[2] M.A. Mazidi, J.G. Mazidi and R.D.McKinlay, "*The 8051 Microcontroller and Embedded Systems using Assembly and C*", Pearson Education, 2nd Edition.

[3] Richard.H. Barnett, sarah Cox and Larry O'Cull*," Embedded C Programming and the Atmel AVR*", Delmar Cenage Learning, 2nd Edition.

Reference Books:

[1] SubrataGhoshal, "*8051 Microcontroller: Internals, Instructions, Programming and Interfacing*", Pearson Education, 2010.

[2] A.V. Deshmukh, "*Microcontrollers Theory and Applications*", Tata McGraw Hill, 2005.

[3] Kenneth Ayala and Kenneth J. Ayala, "The *8086 Microprocessor: Programming and Interfacing the PC*", West Publishing Company, 1995.

E-resources and other digital material:

[1] www.8052.com under tutorial section

[2] Data sheet of ATMEGA328P: "http://ww1.microchip.com/downloads/en/DeviceDoc/ATmega48A-PA-88A-PA-168A-PA-328-P-DS-DS40002061A.pdf

[3] https://www.avr-tutorials.com/

17EE2504A–ELECTRICAL MATERIALS

Course Category:	**Open Elective-I (General Elective)**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Engineering Physics (17PH1202)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the basic structure of materials.
CO2	**Analyze** the properties of conductors & semiconductors.
CO3	**Analyze** the behaviour of dielectrics & insulators.
CO4	**Analyze** the properties of magnetic materials.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**L**				**L**				**M**			**M**	
CO2	**M**	**L**				**M**				**M**			**M**	
CO3	**H**	**L**				**M**				**M**			**M**	
CO4	**M**	**L**				**M**				**M**			**M**	

Course Content

UNIT-I [Text Book-1&2]

Introduction to Engineering Materials: Historical perspective of materials, classification of materials, properties of materials, bases of properties of materials, selection of materials.

Crystal structure of materials: Atomic model-Thomson's plum pudding model, Rutherford's nuclear model, Bohr's atomic model, important terms, concept of atom, electron configuration of atoms, crystal structure, bonds in solids.

UNIT-II [Text Book–1&2]

Conductors: Conductor, electric circuit, general properties of conductors, electrical conductors, specific resistance, factors affecting resistivity, temperature coefficient of resistance, variation of resistivity with temperature, electrical conducting materials, materials of low resistivity, high resistivity, materials for lamp filaments and transmission lines, stranded conductors, bimetals, carbon and graphite brushes, fuses, skin effect, proximity effect.

Semiconductors: Definition, characteristics, atomic structure, intrinsic and extrinsic semiconductors, atomic binding in semiconductors, formation of holes, Fermi level in an intrinsic semiconductor, electron conductivity of metal, current carriers in semiconductors, p-n junction diode, preparation of semiconductor materials, production of p-type and n-type

crystals, transistors, electrical characteristics of semiconductors.

UNIT-III **[Text Book–1&2]**

Dielectrics: Introduction, dielectric as an electric field medium, leakage currents, dielectric losses, break down voltage and dielectric strength, break down voltage in solid dielectrics, flashover and arc resistance, liquid dielectrics, gases as dielectrics, polarization, electrical conductivity - solid dielectrics, liquid dielectrics and gaseous dielectrics, applications.

Insulators: Introduction, characteristics of good insulating materials, classification of insulating materials-solid insulating materials, liquid insulating materials, insulating gases, properties of insulating materials, air spaces in insulation, effect of moisture on insulation.

UNIT-IV **[Text Book–1&2]**

Magnetic materials: Introduction, terms connected with magnetic materials, magnetic parameters, classification of magnetic materials, ferromagnetism, magnetic domains, magnetization, properties of ferromagnetic materials, magnetic anisotropy, magnetostriction, para-magnetism, diamagnetism, magnetically soft and hard materials B-H curves, description of magnetic materials, feebly magnetic materials, cast and cermet permanent magnets, ageing of permanent magnets, effect of temperature, effect of impurities and alloying elements on electro magnet materials, losses in magnetic materials, factors affecting permeability and hysteresis loss.

Text Books:

[1] R.K. Rajput, "*A Course in Electrical Engineering Materials*", University Science Press, 1st Edition 2010.

[2] Dr. C.S. Indulkar and Dr. S. Thiruvengadam, "*An Introduction to Electrical Engineering Materials*", S. Chand Publishers, 6th Edition, 2011.

Reference Books:

[1] A.J. Dekker, *"Electrical Engineering Materials*", Prentice Hall India Pvt. Ltd., Latest Edition.

E-resources and other digital material:

[1] https://nptel.ac.in/courses/122102008/

17EE2504B-WASTE TO ENERGY CONVERSION TECHNOLOGY

Course Category:	**Open Elective-I (General Elective)**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Environmental Studies (17HS1407A)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Explore** the usage of municipal solid waste, bio-medical waste and environmental aspects.
CO2	**Illustrate** the process for disposal of waste.
CO3	**Explore** the process of energy conversion from thermo-chemical waste.
CO4	**Explore** the process of energy conversion from bio-chemical waste.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**				**M**	**M**	**H**						**L**	
CO2	**M**					**M**	**H**						**L**	
CO3	**M**	**M**	**M**		**M**	**M**	**H**						**L**	
CO4	**L**		**M**			**M**	**H**						**L**	

Course Content

UNIT-I **[Text Book-1]**

Introduction to Waste & Waste Processing -Definitions, sources, types and composition of various types of wastes; Characterization of Municipal Solid Waste (MSW)-Industrial waste and Biomedical waste, waste collection and transportation; Waste processing-size reduction, separation; waste management hierarchy, waste minimization and recycling of MSW.

Environmental and Health Impacts-Case Studies: Environmental and health impacts of waste to energy conversion, case studies of commercial waste to energy plants, waste to energy- potentials and constraints in India, eco-technological alternatives for waste to energy conversions - Rules related to the handling, treatment and disposal of MSW and BMW in India.

UNIT-II **[Text Book-1]**

Waste Treatment and Disposal: Aerobic composting, incineration, different type of incineration; medical and pharmaceutical waste incinerations- land fill classification, types, methods and silting consideration, composition, characteristics, generation, movement and control of landfill leachate and gases, environmental monitoring system for land fill gases. **(Case study).**

UNIT-III **[Text Book-1]**

Energy from waste-thermo chemical conversion: Sources of energy generation, incineration, pyrolysis, gasification of waste using gasifies, briquetting, utilization and advantages of briquetting - environmental and health impacts of incineration; strategies for reducing environmental impacts.**(Case study).**

UNIT-IV **[Text Book-2]**

Energy from waste- Bio-chemical Conversion: Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, industrial waste, agro residues, anaerobic digestion biogas production, land fill gas generation and utilization. (**Case study)**

Note: Case studies not to be included for main examination.

Text Books:

[1] Nicholas P Cheremisinoff, "*Handbook of Solid Waste Management and Waste Minimization Technologies*", An Imprint of Elsevier, New Delhi, 2003.
[2] Paul Breeze, "*Energy from Waste*", An Imprint of Elsevier, New Delhi, 2018.

Reference Books:

[1] C.Parker and T.Roberts (Ed.), "Energy from Waste", *An Evaluation of Conversion Technologies*, Elsevier Applied Science, London, 1985.
[2] Shah, Kanti L, "*Basics of Solid and Hazardous Waste Management Technology*", Prentice Hall, 2000.
[3] Manoj Datta, "*Waste Disposal in Engineered Landfills*", Narosa Publishing House, Latest Edition.

E-resources and other digital material:

[1] https://nptel.ac.in/courses/103107125/
[2] https://swayam.gov.in/course/3562-waste-to-energy-conversion

17EE2505A– FUNDAMENTALS OF POWER SYSTEMS

Course Category:	**Open Elective-II (Inter Disciplinary Elective)**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Basic Electrical Engineering (17EE1104/17EE1204)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the concepts of basics of electrical energy system.
CO2	**Understand** the concepts of generation.
CO3	**Understand** the concepts of Transmission and Distribution.
CO4	**Understand** the concepts of switchgear and protection.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							**L**	**L**					**L**	**L**
CO2	**M**		**M**				**L**	**L**					**M**	
CO3	**M**	**M**	**L**				**L**	**L**					**M**	**L**
CO4							**M**	**L**						

Course Content

UNIT-I **[Text Book-1]**

Introduction to Power System Concepts: Fundamental concepts of DC and AC circuits, concept of phase difference, phase representation of alternating quantities, comparison of A.C. and D.C. systems, comparison of single phase and three phase systems, introduction to insulation materials and dielectrics calculation (simple problems), scenario of power systems in India-concept of regional and national grid.

UNIT-II **[Text Book-1]**

Generation: Conventional and Non-conventional sources of energy. Different types of conventional power stations (elementary treatment). Non-conventional sources of power generation types, merits and demerits of conventional and non-conventional sources of energy, concept of load estimation (simple calculation).

UNIT-III **[Text Book-2]**

Transmission System (Short and Medium): Selection of voltage, Electrical features of transmission line-A.C. Transmission lines (Two- port Network Model - T and Π models), efficiency and regulation, corona (definition only).

Distribution system: Layout of H.T. and L.T. distribution system. Comparison of overhead and underground distribution system, domestic and commercial tariff concepts.

UNIT-IV **[Text Book-2]**

Switchgear and Protection: Circuit breakers, types, ratings, comparison, protection-fuses, relays, types & characteristics, comparison, protection schemes of generators, transformers, bus bars, feeders (elementary treatment), difference between power and instrument transformers (C.Ts, P.Ts).

Text Books:

[1] E El-Hawary, "*Introduction to Electrical Power Systems*", John Wiley & Sons publication, IEEE, 2008.
[2] V.K Mehta and Rohit Mehta, "*Principles of Power Systems*", S. Chand publication.

Reference Books:

[1] Alexandra von Meier, "*Electric Power Systems: A Conceptual Introduction*", Wiley Survival Guides in Engineering and Science, Wiley-IEEE Press, 2006.

E-resources and other digital material:

[1] https://nptel.ac.in/courses/108102047/
[2] https://nptel.ac.in/courses/108105058/

17EE2505B -RENEWABLE ENERGY SYSTEMS

Course Category:	**Open Elective-II (Inter Disciplinary Elective)**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Basic Electrical Engineering (17EE1104/17EE1204)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the basics of various renewable energy systems.
CO2	**Understand** the concepts of solar energy and wind energy.
CO3	**Understand** the concepts of bio-energy.
CO4	**Understand** the concepts OTEC, tidal, geothermal and hydro.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**		**M**					**M**		**M**			**M**	
CO2	**M**	**L**	**M**					**M**		**M**			**M**	**L**
CO3	**M**		**M**					**M**		**M**			**M**	
CO4	**M**		**M**					**M**		**M**			**M**	**L**

Course Content

UNIT-I [Text Book-1]

Introduction: Introduction to energy sources, reserves and estimates, global energy scenario, renewable energy -environment implications, global warming and climate change, limitations of conventional energy sources, classification of non-conventional energy sources - solar energy, wind energy, bio-energy, *Ocean Thermal Energy Conversion* (OTEC), tidal, geothermal and hydro.

UNIT-II [Text Book-2&3]

Solar energy and Applications: Solar energy and its application, availability of solar radiation energy, collection and solar thermal storage, photovoltaic (PV) and solar thermal power generation, solar photovoltaic applications.

Wind energy: Wind energy and its application, types of wind mills and their characteristics, elementary design principles, wind energy conversation system, determination of torque coefficient, wind energy storage -applications -hybrid (wind & solar) systems.

UNIT-III [Text Book-4]

Bio-energy: Biomass and its sources, energy plantation, production of fuel wood, bio-conversion processes, bio-gas, bio-diesel and ethanol production and utilization, thermo-chemical processes, biomass gasification, process, types of reactors, utilization of producer

gas for thermal and electricity generation.

UNIT-IV **[Text Book-1]**

***Ocean thermal energy conversion*, tidal, geothermal and hydro:** Tidal energy, wave energy, data, technology options; open and closed *Ocean thermal energy conversion* cycles, small hydro turbines, geothermal energy sources, power plant and environmental issues.

Alternative energy sources: Hydrogen generation-storage, transport and utilization, applications, power generation. Fuel cells-Technologies, types, economics and power generation.

Text Books:

[1] G.D. Rai, "*Non-Conventional Energy Sources*", Khanna Publishers, New Delhi, Latest Edition.
[2] Duffie J.A. and Beckman W.A., "*Solar Engineering of Thermal Process*", John Wiley, 3rd Edition, 2013.
[3] Lysen E.H.A., "*Introduction to Wind Energy*", Franklin Institute Press.
[4] *Y.W.B. Charles* and *B.H. Essel*, "*Biomass Conversion and Technology*", John Wiley, Latest Edition.

Reference Books:

[1] Godfrey Boyle, "*Renewable Energy- Power for a Sustainable Future*", Oxford University Press, U.K.
[2] Twidell J.W. & Weir A., "*Renewable Energy Sources*", E.F.N Spon Ltd., UK.
[3] G.N. Tiwari, "*Solar Energy-Fundamentals Design, Modeling and Applications*", Narosa Publishing House, New Delhi, 2002.
[4] L.L. Freris, "*Wind Energy Conversion systems*", Prentice Hall, UK.

E-resources and other digital material:

[1] https://www.renewableenergyworld.com/index/tech.html
[2] https://nptel.ac.in/courses/121106014/
[3] http://web.mit.edu/renewable-iap09
[4] https://www.coursera.org/courses?query=renewable%20energy

17EE2506A - ILLUMINATION ENGINEERING

Course Category:	**Open Elective –III (Self-Learning Elective)**	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	0-0-0
Prerequisites:	Engineering Physics (17PH1202)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the principlesof illumination.
CO2	**Analyze** the performance of various light sources.
CO3	**Apply** the knowledge of illumination to the design of interior and exterior lighting.
CO4	**Apply** the knowledge about the measurements and protections.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**H**	**L**	**L**			**L**					**M**	**M**	
CO2	**H**	**H**	**L**	**L**			**L**					**M**	**M**	
CO3	**H**	**H**	**L**	**L**			**L**					**M**	**M**	
CO4	**H**	**H**	**L**	**L**			**L**					**M**	**M**	**L**

Course Content

UNIT-I [Text Book-1]
Introduction: Radiation, colour, eye and vision, different entities of illuminating systems, light sources, day light, incandescent, electric discharge, fluorescent, arc lamps and lasers.

UNIT-II [Text Book-1]
Illumination sources: Luminaries, wiring switching and control circuits, law of illumination, illumination from point, line and surface sources, photometry and spectrophotometry, photocells, environment and glare, general illumination and design.

UNIT-III [Text Book-2]
Lighting applications: Interior lighting- industrial, residential, office departmental stores, indoor stadium, theatre and hospitals Exterior lighting-flood, street, aviation and transport lighting, lighting for displays and signaling -neon signs, light emitting diode, liquid crystal diode displays, beacons and lighting for surveillance.

UNIT-IV[Text Book-3]
Measurement and Protections: Utility services for large building/office complex and layout of different meters and protection units, different type of loads and their individual protection,

selection of cable/wire sizes, potential sources of fire hazards and precautions, emergency supply-standby and un-interrupted power supply, specific design problem on this aspect.

Text Books:

[1] Joseph B. Murdoch, "*Illumination Engineering from Edison's Lamp to the Laser*", Visions Comm, Latest Edition.
[2] Ronald N. Helms and M. Clay Beicher, "*Lighting for Energy efficient Luminous Environments"*, Prentice Hall, Latest Edition.
[3] Jack L. Lindsey, "*Applied illumination Engineering*" The Fairmont Press Inc., Latest Edition.

Reference Books:

[1] Marc Schiler, "*Simplified Design of Building Lighting*" John Wiley and Sons, 1992.
[2] IES Lighting Handbook, 8th Edition, 1993.

E-resources and other digital material:

[1] http://www.nptel.ac.in
Prof N.K. Kishore, "Illumination Engineering (web Course)", IIT Kharagpur.

17EE2506B–INTRODUCTION TO SOFT COMPUTING

Course Category:	**Open Elective-III (Self-Learning Elective)**	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	0-0-0
Prerequisites:	Linear Algebra and Calculus	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Learn about** the basic concepts of Fuzzy logic.
CO2	**Learn about** the basic concepts of Genetic Algorithm.
CO3	**Learn about** the basic concepts of Evolutionary computing.
CO4	**Learn about** the basic concepts of Artificial Neural Networks.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**H**			**M**							**L**	**M**	**M**
CO2	**M**	**H**			**M**							**L**	**M**	**M**
CO3	**M**	**H**			**M**							**L**	**M**	**M**
CO4	**M**	**H**			**M**							**L**	**M**	**M**

Course Content

UNIT-I [Text Book-1]
Introduction to soft computing: Introduction to fuzzy logic, Fuzzy membership functions and defining Membership functions, Fuzzy operations, Fuzzy relations Fuzzy implications, interferences, De-fuzzification techniques-I & II, Fuzzy logic controller-I &II.

UNIT-II [Text Book-2]
Genetic Algorithm: Concept Genetic Algorithm, Genetic Algorithm Operators: Encoding, Selection, cross over techniques, mutation and others.

UNIT-III [Text Book-3]
Evolutionary computing: Introduction to Evolutionary computing-I**,** Introduction to Evolutionary computing-II, Multi Objective Evolutionary Algorithm (MOEA) Approaches: Non-Pareto, Pareto-I, Pareto-II.

UNIT-IV [Text Book-4]
Artificial Neural Networks: Introduction to Artificial Neural Networks, ANN Architecture, ANN Training-I, ANN Training-II, ANN Training-III, Applications of ANN operation.

Text Books:

[1] Timothy J. Ross,"*Fuzzy Logic with Engineering Applications*", John Wiley, Latest Edition.
[2] Melanic Mitchell, "*An Introduction to Genetic Algorithm*", MIT Press, Latest Edition.
[3] Collelo, Lament and Veldhnizer, "*Evolutionary Algorithm for Solving Multi-objective, Optimization Problems*", Springer, 2nd Edition.
[4] Simon Haykin, "*Neural Networks and Learning Machines*", Prentice Hall of India (PHI).

Reference Books:

[1] D. K. Chaturvedi, "*Introduction to Soft Computing-Techniques and its Applications in Electrical Engineering*", Springer link.

E-resources and other digital material:

[1] https://nptel.ac.in/courses/106105173/26

17TP1507–PERSONALITY DEVELOPMENT

Course Category:	**Institutional Core**	**Credits:**	1
Course Type:	Learning by doing	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:	Course title/course code	**Continuous Evaluation:**	100M
		Semester End Evaluation:	--
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the corporate etiquette.
CO2	**Make** presentations effectively with appropriate body language.
CO3	**Composed** with positive attitude.
CO4	**Understand** the core competencies to succeed in professional and personal life.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								**M**		**H**				
CO2									**M**	**H**				
CO3										**H**				
CO4									**M**	**H**				

Course Content

UNIT-I

Analytical Thinking & Listening Skills: Self-Introduction, shaping young minds - A Talk by AzimPremji (Listening Activity), self – analysis, developing positive attitude, perception.

Communication Skills: Verbal communication; non-verbal communication (Body Language).

UNIT-II

Self-Management Skills: Anger Management, stress management, time management, six thinking hats, team building, leadership qualities.

Etiquette: Social etiquette, business etiquette, telephone etiquette, dining etiquette.

UNIT-III

Standard Operation methods: Note making, note taking, minute's preparation, e-mail & letter Writing.

Verbal ability: Synonyms, antonyms, one-word substitutes-correction of sentences-analogies, spotting errors, sentence completion, course of action-sentences assumptions, sentence arguments, reading comprehension, practice work.

UNIT-IV

Job-Oriented Skills-I: Group discussion, mock group discussions.

Job-oriented skills–II: Resume preparation, interview skills, mock interviews.

Text Books:

[1] Barun K. Mitra, "*Personality Development and Soft Skills*", Oxford University Press, 1st Edition, 2011.

[2] Meenakshi Raman &Sangeeta Sharma, "*Technical Communication*", Oxford University Press, 2nd Edition, 2011.

Reference Books:

[1] S.P. Dhanavel, "*English and Soft Skills*", Orient Blackswan, 2010.

[2] R.S. Aggarwal, "*A Modern Approach to Verbal & Non-Verbal Reasoning*", S. Chand & Company Ltd., 2018.

[3] Dr.ShaliniVerma, "*Body Language*", S. Chand Publishers, 1st Edition, 2013.

E-resources and other digital material:

[1] www.Indiabix.com

[2] www.freshersworld.com

17EE3551-MICROCONTROLLERS LAB

Course Category:	**Program core**	**Credits:**	1.5
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	Microcontrollers (17EE3503)	**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Design** and conduct experiment.
CO2	**Evaluate** and **Analyze** experimental results.
CO3	**Exhibit** professional behavior.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				**M**					**H**					**H**
CO2									**H**	**H**				**H**
CO3									**H**	**M**				**H**

Course Content

Part A: Basic programming

1. Basic programs for understanding data transfers.
2. Basic programs for understanding arithmetic operations.
3. Basic programs for understanding conditional jump instructions.

Part B: Interfacing of Basic I/O using Arduino

1. Generic LED interfacing with different duty cycle blinking.
2. Interfacing of push button for reset and on/off operation.
3. Two-digit Seven Segment LED interfacing for loop timer for 99sec.
4. Interfacing of 16X2 LCD for displaying messages.
5. Interfacing of 4X4Hex keypad.
6. Interfacing of Temperature sensor using LM35 and 16X2 LCD.
7. Design of Password based relay.
8. Interfacing of STEPPER motor.

Part C: Hardware Interfacing with 8051

1. Generic LED interfacing with different duty cycle blinking
2. Interfacing of push button for reset and on/off operation.
3. Two-digit Seven Segment LED interfacing for loop timer for 99sec.
4. Interfacing of 16X2 LCD for displaying messages.
5. Interfacing of 4X4 Hex keypad.
6. Interfacing of Temperature sensor using LM35.
7. Serial communication with PC.
8. Interfacing of STEPPER motor using interrupts.

NOTE: A minimum of **Five from Part B and Five from Part C** to be conducted with a total of **Ten** experiments.

17EE3552 –ELECTRONIC CIRCUITS LAB-II

Course Category:	**Program Core**	**Credits:**	1.5
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:		**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Design** and conduct experiment.
CO2	**Evaluate** and **Analyze** experimental results.
CO3	**Exhibit** professional behavior.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**			**M**					**H**					**M**
CO2	**M**	**M**							**H**	**M**				
CO3	**M**								**H**	**M**				

Course Content

List of Experiments:

1. Measurement of op-amp parameters.
2. Applications of op-amp adder, subtractor, comparator.
3. Realization of integrator & differentiator using op-amp.
4. Realization of instrumentation amplifier using op-amp.
5. Waveform generation using op-amp (square, triangular).
6. Design of clipper and clamper circuits using op-amp.
7. Wein-bridge oscillator using op-amp.
8. Design of active filters using op-amp (LPF & HPF-first order).
9. IC 555 timer monostable operation circuit.
10. IC 555 timer astable operation circuit.
11. Schmitt trigger using IC 555 timer.
12. IC 565 PLL applications.
13. Three terminal voltage regulators IC 7805 & IC 7905.
14. Design of IC regulator using 723.
15. D/A converter (R-2R ladder).

Note: - Realizing all the above experiments using different types of ICs.

V.R.SIDDHARTHA ENGINEERING COLLEGE: VIJAYAWADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION FOR B.TECH(EEE) THIRD YEAR

Semester-VI **Contact Hours: 28**

S.No	CourseCode	Course	L	T	P	Credits
11.	17EE3601	Power Systems - II	3	1	0	4
12.	17EE3602	PowerElectronics	3	1	0	4
13.	17EE4603	Program Elective-1 A. Advanced Control Systems B. Digital Control Systems C. Programmable Logic Controller	3	0	0	3
14.	17HS1604	Engineering Economics and Finance	2	0	0	2
15.	17EE2605	Open Elective-IV	3	0	0	3
	17EE2605A	Industrial Electrical System				
	17EE2605B	Electrical Energy Conservation and Audit				
16.	17TP1606	Quantitative Aptitude	0	0	2	1
17.	17EE3651	PowerElectronics Lab	0	0	3	1.5
18.	17EE3652	Digital Signal Processing Lab	0	0	3	1.5
19.	17EE5653	Engineering Project for Community Services*	0	1	2	2
Total			**14**	**3**	**10**	**22**
20.	17MC1607	Biology for Engineers	2	0	0	---

17EE3601 - POWER SYSTEMS-II

Course Category:	**Program Core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Power System-I (17EE3501)	**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Design** insulators and underground cables.
CO2	**Illustrate** the working principle of basic protective relays.
CO3	**Explain** the working principle of Static and Microprocessor based protective relays.
CO4	**Analyze** the concepts of protection and different circuit breakers.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**H**					**M**						**H**	
CO2	**H**	**M**	**M**	**H**			**L**						**M**	
CO3	**M**	**M**	**M**	**H**			**L**						**M**	
CO4	**H**	**M**	**M**	**H**			**M**						**H**	

Course Content

UNIT-I [Text Book-1]

Mechanical Design and Insulators: Mechanical design- calculation of supports at different levels-effect of ice, wind pressure, stringing charts. Types of insulators-Potential distribution over a string of suspension insulators- methods of increasing string efficiency.

Underground Cables: Types of cables, Insulation resistance-electric stress and capacitance of single core cable-use of inter sheath-capacitance grading-capacitance of three core belted type cable.

UNIT-II [Text Book-1]

Electromagnetic Relays: Introduction, basic requirement of protective relaying, types of protection, classification of relays, electromagnetic relays-induction, non-directional over current or earth-leakage (Induction type) relays, directional relay(over current or earth fault relay), universal torque equation-distance relays- Impedance, admittance (MHO) and reactance relays, differential relays.

UNIT-III [Text Book–1&2]

Static Relays: Introduction, comparison of static relays with electromagnetic relays, different static relays-static over-current relays, static time over-current relays, Static instantaneous over-current relay.

Microprocessor Based Relays: Advantages and Disadvantages – block diagram for over

Current (Definite, Inverse and IDMT) and distance Relays and their Flow Charts.

UNIT-IV **[Text Book-1]**

Generation of Over-voltages: Mechanism of lightning-Lightning Stroke-Over voltages due to lightning-Protection against lightning-Protection against travelling waves.

Power System Grounding: Ungrounded neutral system-Grounded neutral system.

Circuit Breakers: Introduction, Arc phenomena –terminology of circuit breakers, Resistance switching, Classification of circuit breaker - Impulse type circuit breaker, low oil circuit breaker, air blast -SF_6 Circuit Breaker-Vacuum interrupters, testing of circuit breakers.

Text Books:

[1] M.L. Soni, P.V. Gupta, U. S. Bhatnagar and A. Chakraborti, "*Power System Engineering*", DhanpatRai& co. Pvt. Ltd., 2016.
[2] Badri Ram, D.N Viswakarma, "*Power System Protection and Switchgear*", Tata Mc.Graw Hill, 4th Edition, 2011.

Reference Books:

[1] Sunil S Rao, "*Switchgear and Protection*", Khanna Publishers, Latest Edition.
[2] C.L. Wadhwa, "*Electrical Power Systems*", New Age international (P) Ltd, 2012.

E-resources and other digital material:

[1] https://nptel.ac.in/courses/108102047/18
[2] https://nptel.ac.in/courses/108108116/
[3] https://nptel.ac.in/downloads/108101039/

17EE3602-POWER ELECTRONICS

Course Category:	**Program Core**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-1-0
Prerequisites:	Electronic Circuits (17EE3302), Network Analysis-I & II (17EE1204&17EE3303)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the theory of various power electronic devices.
CO2	**Analyze** the operation of AC and DC converters.
CO3	**Elucidate** the operation of various DC and AC choppers.
CO4	**Analyze** the operation of various inverters**.**

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**M**		**M**	**M**									**M**
CO2	**M**	**H**		**H**	**M**				**H**					**H**
CO3	**M**	**H**		**H**	**M**				**H**					**H**
CO4	**M**	**H**		**H**	**M**				**H**					**H**

Course Content

UNIT-I **[Text Book-1]**

Power semiconductor& switching devices: Power electronic devices-Introduction, characteristics of ideal switch, real switch, V-I characteristics of power diodes, Silicon Controlled Rectifier (SCR), Metal Oxide Semiconductor Field Effect Transistor(MOSFET) and Insulated Gate Bipolar Transistor (IGBT), two transistor model of SCR, turn ON methods of SCR, turn OFF methods of SCR (voltage commutation), snubber protection for SCR, quadrant operation of power semiconductor devices, GATE drive circuits for MOSFET/IGBT.

UNIT-II **[Text Book–1]**

AC to DC converters: Introduction, single phase fully controlled bridge rectifier with R, pure inductor, RL and RLE loads-effect of source inductance performance parameters of converters.

Three Phase Converters: Three phase uncontrolled and fully controlled bridge converters with R, RL loads-performance parameters of converters.

UNIT-III **[Text Book-1]**

AC to AC Regulators: Introduction-single phase two SCRs in anti-parallel– with R and RL loads–derivation of RMS load voltage, current and power factor.

DC to DC converters: Introduction, Chopper classification, time ratio control, buck converter, boost converter, buck-boost converters – Voltage and Current ripple calculations and design of L & C for all converters.

UNIT-IV **[Text Book-1]**

DC to AC converters: Introduction, single phase full bridge inverters, comparison between VSI & CSI, three phase VSI (180 &120-degree conduction modes).

Voltage control techniques for inverters: Pulse-width modulation techniques - single pulse, multi-pulse, sinusoidal pulse width modulation techniques.

Text Book:

[1] P.S. Bhimbra, "*Power Electronics Circuits, Devices and Applications*", Khanna Publications, 5th Edition 2011.

Reference Books:

[1] Ned Mohan, Tore M. Undeland, and William P. Robbins, "*Power Electronics Converters Applications and Design*", Wiley Publications, 3rd Edition.
[2] Ramnarayana, "*Course Material on Switched Mode Power Conversion*", IISc. Bangalore.
[3] M. H. Rashid, "*Power Electronics: Circuits Devices and Applications"*, Pearson, 4th Edition.
[4] M.D. Singh and K.B. Kanchandani "*Power Electronics*", McGraw Hill Publications, 2nd Edition.

E-resources and other digital material:

[1] www.nptel.ac.in/courses/108101038/

17EE4603A –ADVANCED CONTROL SYSTEMS

Course Category:	**Programme Elective-I**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Linear Control Systems (174EE3401) Matrices and Differential Calculus (17MA1101)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Design** ofcompensators using time and frequency domain.
CO2	**Design** control systems using state feedback.
CO3	**Analyze** nonlinear control systems using describing functions.
CO4	**Determine** the stability of nonlinear systems using Lyapunov's method.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**M**	**H**						**M**					**L**
CO2	**H**	**M**												
CO3	**H**	**M**												
CO4	**M**	**M**							**M**		**M**			

Course Content

UNIT-I [Text Book No-1]

Compensation Techniques: Introduction, types of compensators, selection of compensator, realization of basic compensators-design of lead lag compensator**.**

UNIT-II [Text Book No-1]

State Feedback Controllers and Observers: State Space Representation, Solution of State Equation, State Transition Matrix, Controllable Canonical form, observable canonical form, Jordan canonical form, controllability and observability. Effect of state feedback on controllability and observability, Design of state feedback control through pole placement. Full order observer and reduced order observer.

UNIT-III [Text Book No-1]

Nonlinear Systems: Introduction to nonlinear systems, types of nonlinearities, describing functions, describing function analysis of nonlinear control systems, singular points, introduction to phase-plane analysis, method of isoclines for constructing trajectories.

UNIT-IV [Text Book No-1]

Lyapunov's Stability Theory: Stability in the sense of Lyapunov, Lyapunov's stability and instability theorems. Direct method of Lypanov for the Linear and Nonlinear continuous time

autonomous systems, Krasovskii's method.

Text Book:

[1] I.J. Nagrath& M. Gopal, *"Control Systems Engineering"*, New Age Int.(P), 5th Edition, 2007.

Reference Books:

[1] K. Ogata, "*Modern Control Engineering*", PHI, 5th Edition.
[2] M. Gopal, "*Modern Control System Theory*", New Age, 3rd Edition.

E-resources and other digital material:

[1] https://nptel.ac.in/courses/108103007/

17EE4603B–DIGITAL CONTROL SYSTEM

Course Category:	**Program Elective–I**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Digital Signal Processing (17EE3404) Linear Control Systems (174EE3401)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Formulate** digital control system.
CO2	**Analyze** state variable techniques.
CO3	**Analyze** observability, controllability and stability.
CO4	**Design** digital Control Systems.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**													
CO2	**H**		**M**											
CO3	**H**	**M**												
CO4	**H**	**M**												**L**

Course Content

UNIT-I [Text Book-1& 2]

Introduction to discrete time control system, zero order hold-sampling theorems, Pulse transfer function–general procedures for Obtaining pulse transfer functions z-domain equivalent to s-domain–correlation between time response and root location in the z-plane–effect of pole-zero configuration in z-plane–transient response of sampled data systems–steady state error.

UNIT-II [Text Book-1& 2]

State Variable Technique: State equations of discrete time systems–solution of state equation-state transition matrix, its Properties –state space realization and state diagram–pulse transfer function from state equation characteristic equation-Eigen values –Eigenvectors, similarity transformation.

UNIT-III [Text Book-1 &2]

Controllability, Observability and Stability: Controllability and observability of linear Time Invariant (LTI) discrete data systems–tests for controllability and observability-relationship between controllability, observability and pulse Transfer functions, Stability of LTI discrete time systems-Jury's stability tests.

UNIT-IV [Text Book-1&2]

Controller Design: Transform of digital control systems–design specifications–bilinear transformation and State Feedback-Design via pole placement–observer-based state feedback–full and reduced order observers.

Text Books:

[1] K. Ogata, *"Discrete time control systems"*, Pearson Education, 2nd Edition, 2003.

[2] Gene F. Franklin, J. David Powell, Michael L. Work man, "*Digital Control of Dynamic systems*", Pearson Education, 3rd Edition, 2002.

Reference Books:

[1] Benjamin C. Kuo, "*Digital Control Systems*", Oxford University, 2nd Edition, 1997.

[2] M. Gopal, "*Digital Control and state variable methods*", Tata McGraw hill, New Delhi, 2003.

E-resources and other digital material:

[1] https://nptel.ac.in/courses/108103008/

17EE4603C–PROGRAMMABLE LOGIC CONTROLLER

Course Category:	**Program Elective-I**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Microcontrollers (17EE3503)	**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the PLC internal architecture and ladder logic concepts.
CO2	**Apply** the concept of register, timer, counter, and other intermediate programming.
CO3	**Control** the robots using PLC.
CO4	**Extend** knowledge of PLC in analog operations.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**H**	**L**	**M**	**H**	**H**			**L**			**M**		**H**
CO2	**H**	**H**	**M**	**M**	**H**	**H**			**H**			**M**		**H**
CO3	**H**	**H**	**M**	**M**	**H**	**H**			**H**		**L**	**M**		**H**
CO4	**H**	**H**	**M**	**M**	**H**	**H**			**H**			**M**		**H**

Course Content

UNIT-I [Text Book-1&2]

PLC Basics: PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

PLC Programming: PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT-II [Text Book-1&2]

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers PLC Functions Timer functions and industrial applications counters counter function industrial applications. Architecture functions, Number comparison functions, number conversion functions.

UNIT-III [Text Book-1&2]

Data Handling Functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register,

sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT-IV[Text Book-1&2]

Analog PLC Operation: Analog modules and systems Analog signal processing multi bit data processing, analog output application examples. PID principles position indicator with PID control, PID modules, PID tuning, PID functions.

Case Studies: Different applications of Push buttons, working of different types of Timers, working of different types of Counters, Sequential operation of ON/OFF of a set of lights, Latching and Unlatching of a Motor, Automatic indication of water tank level, Traffic lights indication.

Text Books:

[1] John W Webb and Ronald A Reiss, "*Programmable Logic Controllers: Principle and Applications*", Printice Hall of India, 5th Edition.

[2] JR Hackworth and ED Hackworth, "*Programmable Logic Controllers: Programming Method and Applications*", Prentice Hall, 2004.

ReferenceBook:

[1] Max Rabiee, "*Programmable Logic Controllers: Hardware and Programming*", Goodheart-Willcox Publisher.

E-resources and other digital material:

[1] https://nptel.ac.in/courses/112102011/11

17HS1604 - ENGINEERING ECONOMICS AND FINANCE

Course Category:	**Institutional Core**	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:		**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** various forms of organizations and principles of management.
CO2	**Understand** the various aspects of business economics.
CO3	**Acquire** the knowledge on human resources and marketing functions.
CO4	**Understand** best alternatives for various investment decisions and different depreciation methods.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**										**M**			
CO2	**M**	**H**									**M**			
CO3	**M**										**M**			
CO4	**M**	**H**									**M**			

Course Content

UNIT-I [Text Book-1&2]

Forms of Business Organization: salient features of sole proprietorship, partnership, joint stock company, private limited and public limited companies, co-operative society and public sector.

Management: Introduction to management, management an art or science, functions of management, principles of scientific management, Henri Fayol's principles of management.

UNIT-II [Text Book-1&2]

Introduction to Economics: Introduction to basic economic concepts, utility analysis, marginal utility and total utility, law of diminishing marginal utility, law of equi-marginal utility, demand analysis: theory of demand, demand function, factors influencing demand, demand schedule and demand curve, shift in demand, elasticity of demand, elastic and inelastic demand, types of elasticity, factors of production, production function, production with one variable input, isoquants, returns to scale, cost function: cost-output relationship in short run and long run, relationship between AC and MC. Supply analysis, supply schedule and supply curve, factors influencing supply, supply function, theory of firm: price determination under equilibrium of firm, perfect competition.

National Income, Money and Banking, Economic Environment:

National income concepts, GNP, NNP, methods of measuring national income, inflation,

deflation, kinds of money, value of money, functions of bank, types of bank, economic liberalization, privatization, globalization.

UNIT-III [Text Book –1&2]

Human Resource Management: Meaning and difference between personnel management and human resource management, functions of human resource management, recruitment and selection process.

Marketing Management: Concept of selling and marketing, differences, functions of marketing, product life cycle, concept of advertising, sales promotion, types of distribution channels, marketing research, break, even analysis, problems.

UNIT-IV [Text Book-1&2]

Financial management: Functions of financial management, time value of money with cash flow diagrams, calculation of simple and compound interest, present worth, future worth, annual equivalent, methods of evaluating alternatives under present worth method, future worth method, annual equivalent method for choice of decision making among alternative projects. Depreciation, causes of depreciation, factors influencing depreciation, common methods of depreciation: straight line method, declining balance method, sum of year's digits method, problems.

Text Books:

[1] P. PremchandBabu and M. Madan Mohan"*Managerial Economics and Financial Analysis*", Himalaya publishing house, 2011.
[2] M. Mahajan "*Industrial Engineering and Production Management*", DhanpatRai Publications, 2nd Edition.

Reference Books:

[1] Theusen&Theusen, "*Engineering Economy*".
[2] Philip Kotler&Gary Armstrong "*Principles of Marketing*", Pearson prentice Hall, New Delhi, 2012.
[3] B.B Mahapatro, **"***Human Resource Management*", New Age International, 2011.
[4] IM Pandey, "*Financial Management*" Vikas Publications 11th Edition
[5] R. Panneerselvam, "*Production and operations management*", PHILearning Pvt Ltd, New Delhi, 2012.

E-resources and other digital material:

[1] www.tectime.com
[2] www.exinfm.com
[3] www.slideshare.net
[4] www.economywatch.com

17EE2605A-INDUSTRIAL ELECTRICAL SYSTEMS

Course Category:	**Open Elective-IV**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Power Systems-I (17EE3501)	**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** various components of industrial electrical systems.
CO2	**Understand** the electrical wiring systems for residential, commercial and industrial consumers.
CO3	**Analyze** and **Select** the proper size of various electrical system components.
CO4	**Understand** the electrical systems automation.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**H**	**H**	**H**									**M**	
CO2	**H**	**H**	**H**	**H**			**H**						**M**	
CO3	**H**	**H**	**H**	**H**			**H**						**H**	
CO4	**H**	**H**	**H**				**H**						**M**	

Course Content

UNIT-I **[Text Book-1]**

Electrical system components: Low tension system wiring components, selection of cables, wires, switches, distribution box, metering system, tariff structure, protection components-fuse, Miniature Circuit Breaker (MCB), inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, isolator, relays, electric shock and electrical safety practices.

UNIT-II **[Text Book-1]**

Residential and commercial electrical systems: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation.

UNIT-III **[Text Book-2]**

Industrial electrical systems: High tension connection, industrial substation, transformer selection, Industrial loads, motors, starting of motors, cable and switchgear selection, earthingdesign, type of compensation.

UNIT-IV[Text Book-2&Ref-3]

Industrial electrical system automation: Study of basic programmable logic controller, role of PLC in automation, advantages of process automation, programmable logic controller-based control system design, panel metering and introduction to supervisory control and data acquisition (SCADA) system for distribution automation.

Text Books:

[1] S.L. Uppal and G.C. Garg, "*Electrical Wiring, Estimating*& Costing", Khanna publishers, 10th Edition, 2018.

[2] K. B. Raina, "*Electrical Design, Estimating & Costing*", New age International, 2007.

Reference Books:

[1] Singh and R. D. Singh, "*Electrical estimating and costing*", DhanpatRai and Co.

[2] H. Joshi, "*Residential Commercial and Industrial Systems*", McGraw Hill Education, 2008.

[3] Er.Tanuj Kumar Bisht, "SCADA and Energy Management System", S.K.Kataria Publishers, 2nd edition , 2016.

[4] V.K. Mehta, Rohit Mehta " Priniciples of power system", S. Chand, Edition,2008.

E-resources and other digital material:

[1] https://www.electricaltechnology.org/2015/09/types-of-wiring-systems-electrical-wiring-methods.html

[2] https://www.electronicshub.org/electrical-systems-and-methods-of-electrical-wiring/

17EE2605B–ELECTRICAL ENERGY CONSERVATION AND AUDIT

Course Category:	**Open Elective–IV**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Electrical Machines - I (17EE3303) Electrical Machines - II (17EE3403)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the concepts of energy audit, instruments.
CO2	**Analyze** depreciation methods and Energy efficient motor controls.
CO3	**Analyze** energy efficient transformers and reactive power management.
CO4	**Evaluate** the advantages of demand side management.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**H**			**L**			**L**	**M**				**L**	
CO2	**H**	**H**			**L**			**M**	**H**				**H**	
CO3	**H**	**H**			**L**			**M**	**H**				**H**	
CO4	**H**	**H**			**L**			**M**	**H**				**H**	

Course Content

UNIT-I [Text Book–1]

Energy Audit: Definitions, need of concepts, types of energy audit, audit instruments, energy index, cost index, pie charts, sankey diagrams, System approach, end user approach to efficient use of electricity, energy auditing of a typical industrial/institutional unit - case study.

UNIT-II [Text Book–2]

Energy Economics: Introduction, cost benefit, risk analysis, payback period, straight line depreciation, sinking fund depreciation, reducing balance depreciation, net present value method, internal rate of return method.

Energy Efficient motors: Energy efficient controls, methods to improve starting efficiency, load analysis and motor efficiency, load matching and selection of motors.

UNIT-III [Text Book-2]

Energy efficient transformers: Introduction, transformer loading/efficiency analysis, case studies.

Reactive power management: Capacitor sizing, degree of compensation, capacitor losses, location-placement-maintenance, case studies, peak demand control methodologies, types of industrial loads, optimal load scheduling, case studies;

UNIT-IV [Text Book–1&2]

Demand Side Management: Introduction, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for planning load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment.

Text Books:

[1] Wayne C.Turner, "*Energy management Hand book*", John Wiley and son8th Edition.
[2] S.C. Tripathy, "*Electric Energy Utilization and Conservation*", Tata McGraw Hill, 1991.
[3] Arry C. White, Philip S. Schmidt, David R. Brown, "I*ndustrial Energy Management Systems*", Hemisphere Publishing Corporation, New York, 1994.

Reference Books:

[1] John C. Andreas, "*Energy efficient electric motors selection and application*".
[2] Amit Kumar Tyagi, "*Hand book on Energy Audit and Management*", TERI (Tata Energy Research Institute).
[3] Paul W.O. Callaghan, "*Energy Management*", McGraw hill Book Company.
[4] Rakosh Das Begamudre, "*Energy conversion systems*", 10th Edition, New Age International Publishers.
[5] W.R. Murphy & G. MckeyButterworths, "*Energy Management*", New Age International Publishers.
[6] Kurose and Ross, "*Computer Networks- A Top-down Approach Featuring the Internet*", Pearson Education.
[7] *Economic Analysis of Demand Side Programs and Projects-California Standard Practice Manual*, June 2002-Free download available online.

E-resources and other digital material:

BEE Reference book: No.1/3/4.

[1] www.bee-india.com

17TP1606–QUANTITATIVE APTITUDE

Course Category:	**Institutional Core**	**Credits:**	1
Course Type:	Learning by doing	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:	Course title/course code	**Continuous Evaluation:**	100M
		Semester End Evaluation:	--
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	Solve basic mathematics problems.
CO2	Apply strategies to simplify the problems.
CO3	Apply mathematical skills in solving analytical problems personal life.
CO4	Interpretation of data through graphs and charts.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**													
CO2		**M**												
CO3	**M**													
CO4				**M**										

Course Content

UNIT-I

Numerical ability I: Number system, HCF & LCM, average, simplification, problems on numbers.

Numerical ability II: Ratio & proportion, partnership, percentages, profit & loss.

UNIT-II

Arithmetical ability I: Problems on ages, time & work, pipes & cistern, chain rule.

Arithmetical ability II: Time & distance, problems on boats &steams, problems on trains.

UNIT-III

Arithmetical ability III: Allegation, simple interest and compound interest, races & games of skills, calendar and clock.

Logical ability: Permutations, combination and probability.

UNIT-IV

Mensuration: Geometry, areas, volumes,

Data interpretation: Tabulation, bar graphs, pie charts, line graphs

Text Book:

[1] R. S. Aggarwal, "*Quantitative Aptitude"*, Revised, S Chand publication, 2017, ISBN: 8121924987.

17EE3651– POWER ELECTRONICS LAB

Course Category:	**Program core**	**Credits:**	1.5
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	Power Electronics(17EE3602) Electronic Circuits (17EE3302)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes

	Upon successful completion of the course, the student will be able to:
CO1	**Design** and **conduc**t experiment.
CO2	**Evaluate** and **Analyze** experimental results.
CO3	**Exhibit** professional behavior.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				**M**					**H**	**M**				**M**
CO2				**M**					**H**	**M**				**M**
CO3								**M**						

Course Content

List of Experiments:

1. Static characteristics of SCR.
2. Static characteristics of MOSFET &IGBT.
3. Gate/base drive circuits for MOSFET &IGBT.
4. Single phase fully controlled rectifier.
5. Single phase dual converter (circulating &non- circulating modes).
6. Three phase fully controlled rectifier.
7. Single phase AC voltage controller.
8. IGBT/MOSFET based H-bridge inverter.
9. Frequency control of single phase cyclo-converter (Centre tapped).
10. Step down/Step up MOSFET based chopper.

Additional Experiments:

1. FPGA & DSP based control of single-phase full bridge inverter.
2. FPGA & DSP based control of buck converter.
3. FPGA & DSP based control of boost converter.
4. Three phase voltage source inverter.

Minimum of 10 experiments.

Task: Developing microcontrollers-based gate drive circuits.

17EE3652 – DIGITAL SIGNAL PROCESSING LAB

Course Category:	**Program Core**	**Credits:**	1.5
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	Digital Signal Processing(17EE3404) Microcontrollers (17EE3503)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes

	Upon successful completion of the course, the student will be able to:
CO1	**Design** and **conduct** experiment.
CO2	**Evaluate** and **Analyze** experimental results.
CO3	**Exhibit** professional behavior.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				**M**					**H**					**M**
CO2									**H**	**H**				**M**
CO3									**H**	**M**				

Course Content

List of Experiments:

Part A: Programming

1. Evaluation of DFT of a 16-sample sequence using DIT algorithm.
2. Evaluation of IDFT of a 16-sample sequence using DIT algorithm.
3. Evaluation of DFT of a 16-sample sequence using DIF algorithm.
4. Evaluation of IDFT of a 16-sample sequence using DIF algorithm.
5. Design of FIR filter using windowing methods.
6. Design of digital Butterworth filter using bilinear transformation.
7. Design of digital Chebyshev filter using bilinear transformation.
8. Design of digital Butterworth filter using impulse Invariance Transformationmethod.
9. Design of digital Chebyshev filter using Impulse Invariance Transformation method
10. Digital filters using frequency transformation method.

Part B: Digital Signal Processors

1. Program to perform Linear convolution using CC Studio.
2. Program to perform Circular convolution using CC Studio.
3. Program to perform FFT operation using CC Studio.
4. Program to perform Correlation using CC Studio.
5. Implementation of FIR filters using Window Techniques.
6. Sine Wave generation using lookup table output using DAC.
7. Implementation of PI controller using Numerical methods.
8. Design of Low Pass Filters.

NOTE: A minimum of five **from part 'A' and five from part 'B'** are to be conducted

17MC1607-BIOLOGY FOR ENGINEERS

Course Category:	**Mandatory course**	**Credits:**	0
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:		**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	100M - 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	Describe the fundamental principles and methods of engineering.
CO2	Identify the functions of different types in bio-molecules.
CO3	Describe mechanisms underlying the working of molecular biological processes including enzyme catalysis,metabolic pathways, gene expression.
CO4	Use Excel, MATLAB and other computational tools to quantitatively analyze biological processes.

Contribution of Course Outcomes towards achievement of Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**H**												
CO2		**H**												
CO3		**M**		**H**										
CO4		**L**		**M**	**H**									

Course Content

UNIT-I [Text Book-1]

Introduction and Classification of Living organisms:

Introduction: Fundamental differences between science and engineering by drawing acomparison between eye and camera, Bird flying and aircraft.Biology as an independent scientific discipline. Discuss how biological observations of 18th Century that lead to major discoveries.Examples from Brownian motion and the origin of thermodynamics by referring to theoriginal observation of Robert Brown and Julius Mayor.

Classification: Classification of living organisms based on (a) Cellularity- Unicellular or multi-cellular (b)Ultra-structure- prokaryotes or eukaryotes. (c) Energy and Carbon utilization – Autotrophs,heterotrophs, lithotrophs (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e)Habitat- acquatic, terrestrial (e) Molecular taxonomy- three major kingdoms of life.

UNIT-II

Biomolecules and Enzymes:

Biomolecules: Structures ofsugars(Glucose and Fructose), starch and cellulose. Nucleotides and DNA/RNA.Amino acids and lipids.Proteins- structure and functions- as enzymes, transporters,

receptors and structural elements.
Enzymes:Enzyme classification.Mechanism of enzyme action.Enzyme kinetics and kinetic parameters.

UNIT-III
Genetics and Genetic information Transfer:
Genetics:"Genetics is to biology what Newton's laws are to PhysicalSciences"Mendel's laws, Concept of segregation and independent assortment. Concept of alleleConcepts of recessiveness and dominanceGene interaction, EpistasisMeiosis and Mitosis be taught as a part of genetics.Emphasis to be give not to the mechanics of cell division nor the phases but how geneticmaterial passes from parent to offspring.
Genetic Information Transfer:DNA as a genetic material. Hierarchy of DNAstructure- from single stranded to double helix to nucleosomes. Concept of genetic code.Universality and degeneracy of genetic code. Define gene in terms of complementation andrecombination.

UNIT-IV
Metabolism and Microbiology
Metabolism: Exothermic and endothermic versusendergonic and exergoinc reactions.Concept of Keq and its relation to standard free energy.ATP as an energy currency.Breakdown of glucose toCO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O(Photosynthesis).Energy yielding and energy consuming reactions.
Microbiology: Concept of single celled organisms.Concept of species and strains.Identification andclassification of microorganisms.Growth kinetics.Ecological aspects of single celled organisms, Microscopy.

Text Books:

[1] Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. *"Biology: A global approach*" Pearson Education Ltd
[2] Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H.,*"Outlines of Biochemistry"*, John Wileyand Sons
[3] By Nelson, D. L.; and Cox, M. M.W.H. Freemanand Company "*Principles of Biochemistry"* (V Edition),
[4] Stent, G. S.; and Calender, R.W.H. Freeman andcompany, Distributed by Satish Kumar Jain "*Molecular Genetics*," Second edition, CBS Publisher)
[5] , Prescott, L.M J.P. Harley and C.A. Klein "*Microbiology*" Wm, C.Brown Publishers . 2nd edition 1995

V.R.SIDDHARTHA ENGINEERING COLLEGE: VIJAYAWADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION FOR B.TECH(EEE) FOURTH YEAR

Semester-VII **Contact Hours: 25/29**

S.No	Course Code	Course	L	T	P	Credits
10	17EE3701	Power System Analysis	3	0	2	4
11	17EE4702	Program Elective -2 A. Power System Operation & Control B. HVDC & FACTS C.High Voltage Engineering D. Optimization Techniques	3	0	0	3
12	17EE4703	Program Elective -3 A. Utilization of Electrical Energy B. Power Quality C. Electrical Distribution Systems D. Power System Protection	3	0	0	3
13	17EE4704 17EE4755D	Program Elective -4 A. Digital Communications B. VLSI Design C. Embedded Systems D. Digital Controllers Lab	3 1	0 0	0 4	3
14	17EE4705 17EE4756D	Program Elective -5 A. Industrial Drives B. Advanced Power Electronics C. Modelling of Electrical Machines D. PLC & SCADA Lab	3 1	0 0	0 4	3
15	17EE4751	Power Systems Lab	0	0	2	1
16	17EE4752	Simulation of Electrical Systems Lab	0	0	2	1
17	17EE5753	Mini Project *	0	0	4	2
18	17EE6754	A. Internship B. Industry Offered Course C. Global Professional Certification	-	-	-	2
Total			**15/11**	**0**	**10/18**	**22**

*Could be done in a group of students; involves working under a faculty member and carrying out a detailed feasibility study, literature survey and preparing a work plan for major project.

17EE3701-POWER SYSTEM ANALYSIS

Course Category:	**ProgramCore**	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-2
Prerequisites:	Power Systems-I&II (17EE3501&17EE3601)	**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Apply** the concept of per unit system and symmetrical components of inter-connected power system.
CO2	**Perform** power flow analysis using iterative techniques.
CO3	**Analyze** symmetrical and unsymmetrical faults of power system.
CO4	**Analyze** steady state and transient stability phenomena in power system.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H			M						M			H	
CO2	H	H		H		H				M			H	
CO3	H	H		H		H				M			H	
CO4	H	H		H		M				M			H	

Course Content

UNIT-I **[Text Book-1]**

Per Unit Representation of Power Systems: Introduction, change of base, per unit impedance of a transformer, per unit quantities in three phase systems, selection of base values, base quantities in terms of kV and MVA, per unit load impedance, advantages of per unit representation, one line diagrams, preparation of impedance diagrams.

Symmetrical Components: Introduction, symmetrical component transformation, power in terms of symmetrical components, phase shift in star/delta transformers, sequence impedances of power system components, construction of sequence networks of a power system.

UNIT-II **[Text Book-1]**

Load Flow Analysis: Introduction, load flow problem, direct inspection method to form Bus admittance matrix [Y_{BUS}], static load flow equations, methods of load flow solution, Gauss-Seidel method using [Y_{BUS}], computation for load buses and computation for PV buses, acceleration factor,Newton-Raphson method for load flow solution (polar coordinates only), power flow through lines and slack bus power, decoupled load flow method, fast decoupled load flow method.

UNIT-III **[Text Book-1]**

Symmetrical Faults: Introduction, effects of faults, purpose of fault analysis, 3-phase short

circuit and 3-phase to ground fault.
Unsymmetrical Fault Analysis: Introduction-single line to ground fault, line-to-line fault, double line-to-ground fault, open conductor faults.

UNIT-IV [Text Book-2]
Power System Stability: Introduction-concept and definitions of power system stability, power angle equation of salient and non-salient pole synchronous machines, dynamics of synchronous machine, and development of the swing equation for single machine connected to infinite bus-swing curves, equal area criterion, step by step method, factors affecting stability, methods of improving stability.

List of Laboratory Experiments:

1. Representation of per unit quantities of impedance diagram.
2. Transformation of phase components into symmetrical components for unbalanced networks.
3. Transformation of symmetrical components into phase components for different systems.
4. Formation of [Y_{bus}] matrix using direct inspection method.
5. Load flow studies using GS method.
6. Load flow studies using NR/FDLF methods.
7. Symmetrical fault studies.
8. Unsymmetrical fault analysis.
9. Short circuit studies.
10. Transient and small signal stability analysis: Single-machine infinite bus system
11. Solution of the swing equation using step by step method
12. Determination of power angle curve for non- salient pole synchronous machines

Note: Minimum of **two** experiments has to be performed from each unit and total **eight** experiments are to be conducted in this course as a part of lab.

Text Books:

[1] D.P.Kothari and I.J.Nagrath, "Modern Power System Analysis", Tata Mc.Graw Hill, 4th edition, 2011.
[2] W.D.Stevenson.Jr, "Elements of Power System Analysis", Mc.Graw Hill, Latest edition.

Reference Books:

[1] A.Hussain, "*Electrical Power Systems*", CBS Publishers and Distributors, 5th edition, 2010.
[2] T.K.Nagsarkar, M.S.Sukhija, "*Power System Analysis*", Oxford university press, 2007.

E-resources and other digital material

http://freevideolectures.com/Course/2353/Power-Systems-Analysis

17EE4702A-POWER SYSTEM OPERATION&CONTROL

Course Category:	**Program Elective-2**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Linear Control System (17EE3401) Power Systems-II (17EE3601)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Solve** economic load dispatch problem of thermal units.
CO2	**Model** LFC, AGC for a thermal power system.
CO3	**Model** AVR for an isolated thermal system. **Explain** methods of voltage control in transmission and distribution systems
CO4	**Understand** the functions of power system control centers and distribution automation using SCADA

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H				H				M			M	
CO2	H		H							H				H
CO3	M	M	H			H				H				H
CO4	L					H				M				H

Course Content

UNIT-I **[Text Book-1]**

Economic Operation of Power Systems: Economic dispatch in thermal power station-heat rate curves, cost curves, incremental fuel and production costs, economic distribution of load between units without consideration of line losses, transmission line losses as a function of plant generation, calculation of loss coefficients, optimum generation allocation between thermal plants, unit commitment, constraints and priority list method.

UNIT-II **[Text Book-1]**

Basic Power System Control Loops: Importance of keeping voltage and frequency constant in a power system. Load frequency control single area case, P-F loop, schematic of load frequency control and Q-V loop, AVR of a synchronous generator.

Load Frequency Control: Mathematical modeling of generator, loads, prime mover and speed governor for load frequency control and corresponding block diagram representation, load frequency control block diagram of an isolated power system, steady state analysis, dynamic response, automatic generation control (AGC) scheme, AGC in a single and two area systems and block diagram representation of AGC for an isolated power system.

UNIT-III **[Text Book-1&2]**

Reactive Power Control in Synchronous Generators: Role of excitation system- exciter, generator and sensor models, simplified AVR block diagram, steady state response for a step change in terminal voltage.

Transmission Line Compensation: Series compensation, shunt compensation, static VAR compensators- Thyristor Controlled Reactors (TCR), Thyristor Switched Capacitors (TSC), combined TCR and TSC, schematic of all three types.

Voltage Control of Distribution Systems: Tap changing transformers, booster transformers, synchronous phase modifiers and static capacitors.

UNIT-IV **[Text Book-2&3]**

Power System Control Centers: Aim of control centers, functions of control centers-planning, monitoring and data acquisition and system control, setup, locations, central and civil facilities, and facilities in control room, communication-PLCC and emergency control.

Distribution Automation: Functions and operations-devices of distribution automation, flow diagram for man machine power system interface, schematic diagram of remote terminal unit, SCADA system-schematic diagram, components.

Text Books:

[1] H.Saadat, "*Power System Analysis*", Tata McGraw Hill, Latest edition.

[2] A.Chakrabarti and S.Halder, "*Power System Analysis Operation and Control*", Prentice Hall of India, 3rd edition, 2010.

[3] CL.Wadhwa, "*Generation Distribution and Utilization of Electrical Energy*", New Age International publications, 2nd edition, 2006.

Reference Books:

[1] D.P.Kothari and I.J.Nagrath, "*Modern Power System Analysis*", McGraw Hill, Latest edition.

[2] C. L. Wadhwa, "*ElectricalPower Systems*" New Age International Publishers, 6th edition, 2010.

[3] William D. Stevenson, Jr., "*Elements of Power System Analysis",* McGraw Hill, 4th edition

[4] Allen J. Wood, Bruce F. Wollenberg, "*Power Generation,Operation and Control*" Wiley India, 2nd edition

E-resources and other digital material

[5] http://kluweronline.com/

[6] https://nptel.ac.in/courses/108104013/

[7] https://nptel.ac.in/courses/108107114/

17EE4702B-HVDC & FACTS

Course Category:	**Program Elective-2**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Power System-II (17EE3601) Power Electronics (17EE3602)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Summarize** different types of HVDC Transmission systems; **Analyze** power converter circuits.
CO2	**Examine** control schemes of HVDC transmission systems.
CO3	**Classify** different types of FACTS devices and their applications in compensation of reactive power.
CO4	**Analyze** static series and combined compensators.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M						H						
CO2	H	M						H	M					M
CO3	H	M						H	M					M
CO4	H	M						H	M					M

Course Content

UNIT- I **[Text Book-1]**

Introduction: Comparison of AC-DC transmission systems, application of DC transmission, types of DC links, typical layout of HVDC converter station. HVDC converters, pulse number, analysis of Graetz circuit with and without overlap, converter bridge characteristics, and equivalent circuit of rectifier and inverter configurations of twelve pulse converters. Reactive power requirements, AC & DC side filters.

UNIT-II **[Text Book-1]**

HVDC System Control: Principles of DC Link control, converter control characteristics, system control hierarchy, firing angle control, current and extinction angle control, energization and de-energization of DC Link.

UNIT-III **[Text Book-2]**

Introduction to FACTS: Power flow in AC Parallel paths and meshed systems, basic types of FACTS controllers, brief description and definition of FACTS controllers. Static shunt compensators-objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators, SVC and STATCOM, comparison between SVC and STATCOM.

UNIT-IV **[Text Book-2]**

Static Series Compensators: Objectives of series compensation, variableimpedance type and thyristors switched series capacitors (TCSC), and switching converter type series compensators, static series synchronous compensator (SSSC), power angle characteristics, basic operating control schemes**.**

Combined Compensators: Introduction, unified power flow controller (UPFC), basic operating principle, independent real and reactive power flow controller, control structure.

Text Books:

[1] S.Kamakshaiah, V.Kamaraju, "*HVDC Transmission systems*", Mc Graw Hill Companies, 2nd edition, 2011.

[2] N.G.Hingorani, L.Gyugyi," *Understanding FACTS, Concepts and Technology of Flexible AC Transmission systems*", IEEE press,John Wiley and Sons India, 2nd edition, 2001.

Reference Books:

[1] K.R.Padiyar, "*HVDC Power transmission systems*",New Age International, 2nd edition, 2011.

[2] R.M.Mathur, R.K.Varma, "Thyristor *Based Controllers for Electrical Transmission Systems"*Wiley India, 1st edition, 2002.

[3] V.K.Sood, "*HVDC and FACTS Controllers applications of static Converters in power systems*", Springer-Verlag New York, 2013.

E-resources and other digital material

[2] http://kluweronline.com/

[3] https://nptel.ac.in/courses/108104013/

[4] https://nptel.ac.in/courses/108107114/

17EE4702C- HIGH VOLTAGE ENGINEERING

Course Category:	**Program Elective-2**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Power Systems-I (17EE3501) Power Systems-II(17EE3601)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Elucidate** the concepts used for the generation of high voltages and currents and **design** corresponding circuits.
CO2	**Elucidate** the concepts used for the measurement of high voltages and current and **design** corresponding circuits
CO3	**Analyze** high voltage testing techniques of power apparatus and insulation coordination in power systems
CO4	**Understand** the breakdown phenomenon in various types of insulating materials and to **solve** electrical field problems using numerical methods.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H					H				H				M
CO2	M					H				H				M
CO3	L					H				H				M
CO4	H					H				H				M

Course Content

UNIT-I **[Text Book-1&2]**

Generation of High DC and AC Voltages: Principle of voltage doublers circuit, Cockcroft-Walton cascade arrangement, and its mathematical analysis; cascade connection of transformers, resonant transformers and Tesla coil.

Generation of Impulse Voltages: Standard specifications, standard wave shapes for testing, properties of double exponential wave shapes, approximate estimate of wave shape control resistors, multistage impulse generator and energy of impulse generator.

Generation of Impulse Currents: Standard specifications, analysis of impulse current generator.

UNIT-II **[Text Book-1&2]**

Measurement of High Voltages and Currents:DC, AC and impulse voltages and currents, CRO/DSO electrostatic and peak voltmeters, sphere gaps, factors affecting measurements, potential dividers, series impedance ammeters, Rogowski coils and Hall effect generators.

UNIT-III **[Text Book-1]**

High Voltage Testing Techniques: Testing of insulators, transformers, lightning arresters, bushings, power cables, circuit breakers and isolators.

Insulation Coordination: Principle of insulation coordination on high voltage and extra high voltage power systems.

UNIT-IV **[Text Book-1&2]**

Breakdown of Insulators-Solid, Liquid and Gas Dielectrics: Introduction to solid, liquid and gaseous dielectrics, break down of solid, liquid, amorphous, gasses and gas mixtures dielectrics, breakdown in uniform and non-uniform fields, Paschen's law, Townsend's criterion, streamer mechanism, corona discharge and breakdown in electro negative gases.

Text Books:

[1] M.S.Naidu and V.Kamraju, "*High Voltage Engineering*", Tata Mc. Graw Hill Pvt. Ltd, 5th edition, 2012.

[2] C.L. Wadhwa, "*High Voltage Engineering*", New Age International publications, Latest edition.

Reference books:

[1] E.Kuffel, W.S.Zaengl and J.Kuffel, "*High Voltage Engineering Fundamentals*", Elsevier Publication, 2nd edition, 2005.

[2] M.S.Naidu, "*Gas Insulated Substations*", I.K International Publishing House Pvt. Ltd. 2008

E-resources and other digital material

http://nptel.ac.in/courses/108104048/ui/TOC.htm

17EE4702D-OPTIMIZATION TECHNIQUES

Course Category:	**Program Elective-2**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Power Systems-I (17EE3501) Power Systems-II(17EE3601)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Formulate** and **Solve** linear programming problems.
CO2	**Solve** non-linear programming problems, assignment and transportation problems.
CO3	**Apply** search methods to solve optimization problems.
CO4	**Understand** the basics of non-traditional optimization techniques and solve LPP using dynamic programming.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**H**											**L**	
CO2	**H**	**M**										**M**	**L**	
CO3	**H**	**M**											**L**	
CO4	**L**				**H**							**H**	**L**	

Course Content

UNIT-I[Text Book-1]
Linear Programming (LP): Introduction and formulation of models, standard and canonical forms of Linear Programming Problem(LPP), assumptions in LPP, simplex method, simplex method using artificial variables, degeneracy in simplex method, duality, dual simplex method and sensitivity analysis-change in coefficients of objective function.

UNIT-II [Text Book-1]
Assignment Problem: Hungarian method.
Transportation Problem: Vogel's approximation method, modified distribution method.
Non-linear Programming: Unconstrained problems of maxima and minima and constrained problems of maxima and minima, Lagrangian method and Kuhn Tucker conditions.

UNIT-III[Text Book-2]
Search Methods: Single Variable Search Methods-Exhaustive search, interval halving method and Fibonacci search, Multi Variable Search Methods-Univariate search method,

steepest descent method and conjugate gradient (Fletcher-Reeves) method.

UNIT-IV [Text Book-1&3]

Dynamic Programming: Solution of linear programming problem using dynamic programming, simple problems.

Heuristic Optimization Techniques: Fundamentals of evolutionary algorithms, trajectory based methods-genetic algorithm and swarm intelligence based algorithms-particle swarm optimization, advantages and disadvantages of non-traditional optimization techniques. Application of heuristic optimization methods to Electrical Engineering problems.

Text Books:

[1] S.D.Sharma, "*Operations Research*", Kedar Nath Ram Nathand Co, Latest edition.

[2] S.S.Rao, "*Engineering Optimization: Theory and Practice*",New Age International, Latest edition.

[3] K.Deb, "*Optimization for Engineering Design: Algorithms and Examples*", Prentice Hall of India Learning Pvt. Ltd., 2nd edition. 2012.

Reference Books:

[1] K.V.Mittal, C. Mohan, "*Optimization Methods in Operations Research and Systems Analysis*", New Age International, Latest edition

[2] H.A.Taha, "*Operations Research: An introduction*", Prentice Hall of India Learning Pvt. Ltd., Latest edition.

[3] D.P.Kothari, J.S.Dhillon, "*Power System Optimization*", Prentice Hall of India Learning Pvt. Ltd., 2nd edition, 2011.

E-resources and other digital material

https://www.nptel.ac.in/content/syllabus_pdf/112106064.pdf

17EE4703A-UTILIZATION OF ELECTRICAL ENERGY

Course Category:	**Program Elective-2**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Electrical Machines-I (17EE3303)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Illustrate** the concepts of electric traction and braking methods.
CO2	**Demonstrate** the concepts of electric heating, welding and design of heating element.
CO3	**Explain** the construction and working principle of different types of lights, designing of lightning system.
CO4	**Demonstrate** the concepts of refrigeration and air conditioning.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**M**								**M**			**H**	
CO2	**M**	**M**	**M**							**M**			**M**	
CO3	**M**	**M**	**M**				**M**			**M**			**M**	
CO4	**L**	**M**					**L**			**M**			**H**	

Course Content

UNIT-I [Text Book-1]
Electric Traction: Systems of electric traction-mechanics of train movement, speed-time curves, effect of speed, acceleration and distance on schedule, power and energy output from driving axles, specific energy output, series-parallel method of speed control, transition methods, collectors, different types of electric braking-plugging, rheostatic and regenerative braking.

UNIT-II [Text Book-1]
Electric Heating: Modes of heat transfer, Stefan's law, electric furnaces, resistance heating, heating element properties, design of heating element, losses and efficiency, temperature control of resistance ovens, arc furnaces, induction heating, construction and working of different types of induction furnaces, dielectric heating.
Welding: Types of welding-resistance and arc welding, characteristics of carbon and metallic arc welding, comparison, ultrasonic and laser beam welding.

UNIT-III [Text Book-1]
Illumination: Terms used in illumination, laws of illumination-inverse square law and Lambert's cosine law, Polar curves, Gas discharge lamps- sodium vapor lamp, mercury vapor lamp, fluorescent lamp, CFL, LED lighting, LED Drivers, design of street lighting, flood

lighting and factory lighting.

UNIT-IV [Text Book-1]

Refrigeration: Introduction to refrigeration, refrigeration cycle, vapor compression refrigeration system, domestic refrigerator.

Air-Conditioning: Introduction to air conditioning, summer air conditioning systems, winter air conditioning systems, year-round air conditioning systems, room air conditioning systems, central air conditioning systems, sizing of air conditioning system.

Text Books:

[1] C.L.Wadhwa, "*Generation, distribution, and utilization of electrical energy*", Kent England: New Academic Science Limited, 3rd edition, 2013.

[2] R.K.Rajput, "*Utilization of Electrical Power*", Laxmi Publications Pvt., Ltd., New Delhi, 5th edition, 2006.

Reference Books:

[1] U.Rathore "*Energy management*", S.K.Kataria and Sons, 2nd edition, 2014.

[2] H.Partab, "*Art and Science of Utilization of Electrical Energy*" Dhanpat Rai and Co. (P) Ltd, 3rd edition, 2011.

[3] E.O.Taylor, "*Utilization of Electric Energy*", Orient Longman Private Limited, SI edition, 2006.

E-resources and other digital material

http://nptel.ac.in/courses/108105060/

17EE4703B-POWER QUALITY

Course Category:	**Program Elective-3**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Power System-I (17EE3501) Power System-II (17EE3601)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** and **assess** the severity of different power quality problems.
CO2	**Analyze** voltage sag problems and suggest preventive techniques.
CO3	**Understand** the fundamentals of harmonics and mitigation techniques.
CO4	**Assess** the effect of DG in power quality problems and know power quality monitoring.

Contribution of Course Outcomes towards achievementof Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**H**											**M**	
CO2	**M**	**M**	**M**	**M**			**L**						**M**	
CO3	**H**	**H**	**M**	**M**			**L**						**H**	
CO4	**M**	**M**	**M**				**M**						**H**	

Course Content

UNIT-I **[Text Book-1]**

Overview: Power quality definition, the power quality evaluation procedure, general classes of power quality problems- transients, short duration and long duration voltage variations, voltage imbalance, waveform distortion, voltage fluctuations, power frequency variation, Power acceptability curves-CBEMA and ITI Curves.

UNIT-II **[Text Book-1]**

Voltage Sags and Interruptions: Sources of sags and interruptions, estimating voltage sag performance-area of vulnerability, equipment sensitivity to voltage sags, transmission system and utility distribution system, sag, performance evaluation, fundamental principles of protection, solutions at the end user level, ferro resonant transformers, magnetic synthesizers, standby UPS, hybrid UPS and superconducting magnetic energy storage (SMES) devices.

UNIT-III **[Text Book-1& 2]**

Fundamentals of Harmonics: Harmonic distortion, voltage versus current distortion, harmonics versus transients, power system quantities under non-sinusoidal conditions, harmonic indexes, harmonic sources from commercial loads, harmonic sources from industrial loads, effects of harmonic distortion-impact on capacitors, transformers, motors and telecommunications, inter harmonics, harmonic current mitigation

UNIT-IV **[Text Book-1]**

Distributed Generation and Power Quality: Resurgence of DG, DG technologies, interface to the utility system, power quality issues.

Power Quality Monitoring: Monitoring consideration, power quality measuring instruments-wiring and grounding testers, power analyzer, oscilloscopes, disturbance analyzers.

Text Book:

[1] R.C.Dugan, MF.Mc.Granaghan, S.Santoso and HW. Beaty, "*Electrical Power Systems Quality*", McGraw Hill, Latest edition.

[2] Sankaran. C, "Power Quality", CRC Press, 2017.

Reference Books:

[1] J.Arrillaga, N.R. Watson, "*Power System Harmonics*", John Wiley and Sons.

[2] A.Baggini, "*Handbook of Power Quality*",John Wiley and Sons.

[3] M.H.J.Bollen, "*Understanding Power Quality Problems- Voltage sag and Interruptions*", IEEE Press.

[4] S.Chattopadhyay, M.Mitra, and S.Sengupta, "*Electric Power Quality*", Springer.

E-resources and other digital material

https://nptel.ac.in/courses/108/106/108106025/

17EE4703C-ELECTRICAL DISTRIBUTION SYSTEMS

Course Category:	**Program Elective-3**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Power System- I (17EE3501)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Summarize** distribution system planning and automation
CO2	**Describe** design considerations of sub-transmission lines and distribution substations.
CO3	**Describe** design consideration of primary and secondary systems.
CO4	**Analyze** the voltage drop & power loss calculations and effect ofcapacitors in distribution systems.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**H**					**M**						**H**	
CO2	**H**	**M**	**M**	**H**			**L**						**M**	
CO3	**M**	**M**	**M**	**H**			**L**						**M**	
CO4	**H**	**M**	**M**	**H**			**M**						**H**	

Course Content

UNIT-I **[Text Book-1]**

Distribution Systems Planning and Automation: Introduction, distribution system planning, factors affecting system planning, substation site selection, present distribution planning techniques, distribution system planning in the future, central role of the computer in distribution planning, distribution system automation and control functions.

Load Characteristics: Basic definitions, relationship between load and loss factor, load management.

UNIT-II [Text Book-1]

Design of Sub-Transmission Lines and Distribution Substations: Introduction, sub-transmission systems, distribution substation, substation bus schemes, description and comparison of switching schemes, substation location, rating of a distribution substation, substation service area with n primary feeders, comparison of four and six feeder patterns.

UNIT-III **[Text Book-1]**

Design Consideration of Primary Systems: Introduction, types of feeders-radial type, loop type primary feeders, primary network, primary feeder voltage levels, primary feeder loading, and radial feeders with uniformly distributed load and non-uniformly distributed loads.

Design Consideration of Secondary Systems: Introduction, secondary voltage levels, secondary banking, secondary networks-grid network, spot network, secondary mains, distribution system protection-basic definitions, over current protection devices-fuses, automatic circuit re-closers, automatic line sectionalizers, automatic circuit breakers, objectives of distribution system protection, coordination of protective devices-fuse to fuse co-ordination, re-closer to fuse coordination, fuse to circuit breaker co-ordination, re-closer to circuit breaker co-ordination.

UNIT-IV[Text Book-1]

Voltage Drop and Power Loss Calculations: Voltage drop and loss calculation in three phase balanced primary lines, method to analyze distribution costs.

Capacitors in Distribution Systems: Application of capacitors in distribution systems, effect of series and shunt capacitors, power factor correction-concept of leading and lagging power factors, economic power factor, economic justification for capacitors, procedure to determine the best capacitor location, distribution system voltage regulation, quality of service, voltage control and line drop compensation.

Text Book:

[1] T.Gonen, "*Electric Power Distribution system Engineering*" CRC press, Latest edition.

Reference Books:

[1] Jr.A.S.Pabla, "*Electric Power Distribution*", Tata McGraw Hill Ltd, Latest edition.
[2] V Kamaraju "*Power Distribution Systems*" Tata McGraw Hill Publishing Company, 2nd edition, 2010.
[3] Dale R.Patrick, Stephen W.Fardo, "*Electrical Distribution Systems*" CRC Press, Special Indian,2nd edition.
[4] T.A. Short, "*Electric Power Distribution*" Hand Book, CRC Press

E-resources and other digital material

[1] https://nptel.ac.in/courses/108/107/108107112/
[2] https://nptel.ac.in/courses/108/108/108108099/
[3] https://nptel.ac.in/courses/108/106/108106025/

17EE4703D-POWER SYSTEM PROTECTION

Course Category:	**Program Elective-3**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Power Systems–I&II (17EE3501, 17EE3601)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Acquire** knowledge about basic protection principles.
CO2	**Apply** protection principles to alternator and AC motor.
CO3	**Apply** protection principles to transformer and bus bar.
CO4	**Understand numerical** relays and transmission line protection.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						**M**							**H**	
CO2						**M**							**H**	
CO3	**M**					**M**							**H**	
CO4	**M**					**M**						**H**	**H**	

Course Content

UNIT-I **[Text Book-1]**

Introduction: Faults in power system, characteristics of short circuit currents and their harmful effects, necessity of protection system, basic requirements of protection system, classification of protection equipment, instrument transformers.

Fuses: Introduction to fuses, fuse element materials, definitions related to fuses, characteristics, types of fuses, fuse ratings, MCCB, RCCB, MCB, ELCB, auto re-closer.

UNIT-II **[Text Book-1]**

Alternator Stator Protection: Differential protection of stator, biased circulating current protection, balanced earth fault protection, stator inter turn protection, stator over heat protection, problems on percentage of winding protected, over voltage protection, over speed protection, protection against motoring.

Alternator Rotor Fault Protection: Rotor earth fault protection, loss of excitation protection, negative sequence protection of generators against unbalanced loading, external fault backup protection.

Protection of AC Motors: Protection against abnormal operating conditions, low voltage protection, over load protection, protection of large sized AC motors and synchronous motors.

UNIT-III **[Text Book-1]**

Transformer Protection: Combined leakage and over load protection, differential protection

of power transformers, problems of differential protection of transformers, biased differential protection, harmonic restraint relay, restricted earth fault protection, generator transformer unit protection.

Bus Bar protection: Bus bar arrangements, bus zone faults, frame leakage protection, differential over current protection.

UNIT-IV **[Text Books-1&2]**

Protection of Transmission Lines: Over current and earth fault protection, time graded protection, current graded protection, Merz-Price differential pilot wire protection, carrier current protection, distance protection of lines.

Numerical Protection: Numerical relay, advantages and disadvantages of numerical relays, data acquisition system, introduction to numerical relay algorithms.

Text Books:

[1] J.B.Gupta, "*Switch gear andProtection*", S.K Kataria and sons, 2nd edition, 2004.

[2] B.Ram, D.N.Viswakarma, "*Power System Protection and Switch gear*", Tata Mc. Graw Hill, 4th Edition, 2011.

Reference Book:

[1] S.S.Rao, "*Switch gear and Protection*", Khanna Publishers New Delhi, Latest edition.

E-resources and other digital material

https://www.nptel.ac.in/courses/108101039

17EE4704A-DIGITAL COMMUNICATIONS

Course Category:	**Program Elective-4**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Electronic Circuits(17EE3302) Digital Electronics (17EE3305)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Identify** the constituents of a digital communications system.
CO2	**Analyze** and **Demonstrate** various methods of baseband and band pass digital transmission and detection methods**.**
CO3	**Understand** the basics of information theory and characterize the influence of channel**.**
CO4	**Analyze** the performance of different error control coding schemes for the reliable transmission of digital information over the channel.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**													**M**
CO2	**H**													**M**
CO3	**H**													**M**
CO4	**H**													**M**

Course Content

UNIT-I **[Text Book-1]**

Pulse Modulation: Sampling process, quantization process, pulse code modulation, delta modulation.

Base Band Pulse Transmission: Matched filter and its properties**,** inter-symbol interference, Nyquist's criterion for distortion less baseband binary transmission, correlative level coding.

UNIT-II **[Text Book-1]**

Pass Band Digital Transmission: Introduction, pass band transmission model, coherent phase shift keying, and coherent frequency shift keying, generation and detection of signals with unknown phase non-coherent binary frequency shift keying, differential phase shift keying.

UNIT-III **[Text Book-1]**

Information Theory: Introduction, uncertainty, information and entropy, source coding theorem, data compaction, discrete memory less channels, mutual information, channel capacity, channel coding theorem, information capacity theorem (statement and formula only)**.**

UNIT-IV **[Text Book-1]**

Error Control Coding: Linear block codes, cyclic codes, convolution codes, maximum likelihood decoding of convolution codes.

Text Book:

[1] S.Haykin, "*Communication systems*", John Wiley and sons, 4th edition, 2007.

Reference Books:

[1] Bernard.Sklar, "*Digital Communication*", Pearson Education, 2nd edition, 2004.

[2] Taub, Schilling, "*Principles of Communication Systems*", Tata Mc Graw Hill, Latest edition.

E-resources and other digital material

[1] https://nptel.iitm.ac.in/Id=117101051

[2] https://www.ece.utah.edu/~npatwari/ece5520

17EE4704B-VLSI DESIGN

Course Category:	**Program Elective-4**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Electronic Devices(17EE3302) Digital Electronics(17EE3305)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** VLSI fabrication processes for MOS, BICMOS technologies**.**
CO2	**Analyze** and **Design** NMOS, CMOS logic circuits using stick diagram and layout.
CO3	**Identify** the physical circuit parameters and analyze the effects of parasitic on overall performance of the circuits.
CO4	**Access** the effect of scaling on various device parameters**.**

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**L**													**M**
CO2			**M**	**M**										**M**
CO3				**M**										**M**
CO4				**M**										**M**

Course Content

UNIT-I **[Text Book-1]**

Introduction to MOS technology: The integrated circuit era, MOS VLSI technology, Basic MOS transistors, Enhancement mode transistor action, Depletion mode transistor action, NMOS fabrication, CMOS fabrication, BICMOS technology.

Basic Electrical Properties of MOS: Drain-to-Source current Ids Versus Voltage Vds relationships, Aspects of MOS transistor threshold Voltage $V_{T,}$ MOS transistor conductance g_m and output conductance g_{ds}, MOS transistor figure of merit.

UNIT-II **[Text Book-1]**

MOS Circuits: Pass Transistor, NMOS inverter, pull-up to pull-down ratio for and NMOS inverter driven by one or more pass transistors, alternative forms of pull-up, CMOS inverter, Latch-up in CMOS circuits.

MOS Circuit Design Processes: MOS layers, stick diagrams, design rules and layout

UNIT- III **[Text Book-1]**

Basic Circuit Concepts: Sheet resistance Rs, Standard unit of capacitance, the delay unit, inverter delays, driving large capacitance loads, propagation delays, wiring capacitances, choice of layers.

UNIT-IV **[Text Book-1]**

Scaling of MOS Circuits: Scaling models and scaling factors, scaling factors for device parameters.

Subsystem Design and Layout: Architectural issues, switch logic, gate logic, examples of structured design (Combinational logic).

Text Book:

[1] D.A.Pucknell and K.Eshranghian, "*Basic VLSI Design*",Prentice Hall of India, 3rd edition,2005.

Reference Books:

[1] Wayne Wolf, "*VLSI Design: System-on-Chip Design*", 3rd edition, 2004.

[2] N.H.E.Weste and K.Eshranghian, "*Principles of CMOS VLSI Design-A system perspective*", Pearson Education, 2nd edition, 2002.

E-resources and other digital material

[1] https://cc.ee.ntu.edu.tw/~ywchang/courses/Vlsi2k/vlsi2k.html.

[2] https://faculty.kfupm.edu.sa/COE/elrabaa/coe360.html

17EE4704C-EMBEDDED SYSTEMS

Course Category:	**Program Elective-4**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Electronic Devices (17EE3302)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Illustrate** real time programming concepts.
CO2	**Apply** RTOS functions to **implement** embedded applications
CO3	**Understand** fundamentals of design consideration for embedded **applications**
CO4	**Understand** the case studies and apply independent skills according to the applications

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**													**M**
CO2				**M**										**M**
CO3				**M**										**M**
CO4	**H**													**M**

Course Content

UNIT-I **[Text Book-1]**

Introduction to Embedded Systems: Embedded systems, processor embedded into a system, embedded hardware units and devices, embedded software in a system, design process in embedded system, design process and design examples, classification of embedded systems, skill required for an embedded system designer.

UNIT-II **[Text Book-1]**

Devices and Communication Buses for Devices Network: I/O types and examples-serial communication devices, parallel device ports, sophisticated interfacing features in device ports, Timer and counting devices, watchdog timer, real time clock, networked embedded systems, serial communication protocol, parallel bus device protocols, internet enabled systems- network protocols**.**

UNIT-III **[Text Book-1]**

Programming Concepts and Embedded Programming in C, C++: Software programming in assembly language (ALP) vs. high level language, C Program elements, header and source files and preprocessor directives, Macros and functions, data types data structures, modifiers, statements, loops and pointers, embedded programming in C++.

UNIT- IV **[Text Book-1]**

Real Operating Time Systems: Multiple process in an application, multiple threads in an application, task states, task and data, concept of semaphores, shared data, inter process communication, signal function, semaphore function, mutex lock and spin lock-message queue functions, mail boxes-pipes-sockets.

Operating System Services, process management, timer function, memory management, device, file and subsystem, management Organization, interrupt routines handling in RTOS, RTOS task scheduling models, OS security issues**.**

Text Book:

[1] Rajkamal, "*Embedded Systems Architecture, Programming and Design*", Tata Mc. Graw Hill, 1st edition,Oct 2003.

Reference Books:

[1] S. Heath, "*Embedded Systems Design"*, 2nd edition, 2003.

[2] D.E.Simon, "*An Embedded Software Primer"*, Pearson Education Asia, 1st Indian Reprint 2000.

[3] W.Wolf, "*Computers as Components- Principles of Embedded Computing System Design"* Harcourt India, Morgan Kaufman Publishers, 1st Indian Reprint 2001.

[4] F.Vahid and T.Givargis, "*Embedded Systems Design - A unified Hardware /Software Introduction",* John Wiley, 2002.

E-resources and other digital material

[1] https://www.freertos.org/about-RTOS.html

[2] https://www.highintegritysystems.com/rtos/what-is-an-rtos

[3] http://dev.ti.com/tirex/content/simplelink_academy/rtos_concepts/rtos_concepts.html

17EE4755D-DIGITAL CONTROLLERS LAB

Course Category:	**Program Elective-4**	**Credits:**	3
Course Type:	Practice	**Lecture-Tutorial-Practice:**	1-0-4
Prerequisites:	Microcontrollers(17EE3503)	**Continuous Evaluation:**	30M
		Semester End Evaluation:	70M
		Total Marks:	100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the basics of assembly language programs for the digital signal processors
CO2	**Understand** different data transfer techniques in the digital signal processors
CO3	**Configure** and use Digital Input / Output lines and ADCs
CO4	**Configure** and use Event Managers for PWM generation

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		**H**		**H**	**H**									**M**
CO2		**H**		**H**	**H**									**M**
CO3		**H**		**H**	**H**						**H**			**M**
CO4		**H**		**H**	**H**						**H**			**M**

Course Content

LIST OF EXPERIMENTS:

UNIT-I
Basic Programming

1. Program to perform the basic arthematic operations.
2. Program to perform maximum and minimum of numbers.
3. Program to find out square root of a number.
4. Program to generate trianguar, ramp up and ramp down waveforms.

UNIT-II
Data Transfer Techniques in Digital Signal Processors

5. Program to perform direct data transfer.
6. Program to perform indirect data transfer.
7. Program to transfer data from lower memory address to upper memory address.
8. Program to transfer data from upper memory address to lower memory address.

UNIT-III

Digital Input/Output Lines and ADCs

9. Program to display up counter on a LED board using the general purpose input and output pins.
10. Program to display down counter on a LED board using the general purpose input and output pins.
11. Program to display fibonacii series on a LED board using the general purpose input and output pins.
12. Program to interface the onboard analog to digital converter.

UNIT-IV

PWM Generation for Event Managers

13. Program to generate the pulses for a H-bridge inverter.
14. Program to generate the pulses for athree-phase inverter.
15. Program to generate the pulses for athree-phase inverter with dead band.
16. Program to generate the pulses for the DC DC converter.

Note: The above Programs can be executed in either 'C' or in Assembly language.

Text Books:

[1] H.A.Tolyat, "*DSP based Electromechanical Motion Control*"-CRC press, 2004.
[2] Application Notes from the website of Texas Instruments.

E-resources and other digital material

http://www.ti.com/lit/ds/symlink/tms320f28335.pdf

17EE4705A-INDUSTRIAL DRIVES

Course Category:	**Program Elective-5**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Power System- I (17EE3501)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Acquire** basic concepts of electric drives.
CO2	**Apply** speed control methods of converter fed DC and Chopper fed DC drives.
CO3	**Apply** various speed control methods of induction motor drives, slip power recovery scheme.
CO4	**Analyze** various speed control methods of synchronous motor drive.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**L**											**M**	**L**
CO2	**H**	**M**	**M**	**H**		**L**							**M**	**H**
CO3	**H**	**M**	**M**	**H**		**L**							**M**	**H**
CO4		**M**	**M**	**H**		**L**							**M**	**H**

Course Content

UNIT-I **[Text Book-1]**

Introduction To Electric Drives: Advantages of electric drives, parts of electrical drives, choice of electric drives and selection of drives for various applications, fundamental torque equation, nature and classification of load torques, components of load torque, multi-quadrant operation, basic principles of closed-loop control.

UNIT-II **[Text Book-1]**

DC Motor Drives: Methods of speed control, speed control using single-phase and three-phase fully controlled and half controlled rectifiers in continuous and discontinuous mode of operation, speed control of DC motor drives using chopper control in continuous and discontinuous mode of operation.

UNIT-III **[Text Book-1]**

Induction Motor Drives: Methods of speed control, speed control of squirrel cage induction motor with v/f control, slip power recovery scheme, static Scherbius and Krammer methods, variable frequency and variable voltage control using two-level voltage source inverter, AC and DC dynamic braking methods.

UNIT-IV[Text Book-1]
Synchronous Motor Drives: Speed control methods of synchronous motor drive.
Special Machines: Speed control of SRM, PMSM and BLDC motor, field weakening techniques.

Text Book:

[1] G.K.Dubey, "*Fundamentals of Electric Drives*", Narosa Publishers, 2nd edition, 2007.

Reference Books:

[1] V.Subramanyam, "*Electric Drives Concepts and Applications*", Tata McGraw HillPrivate.Ltd, 2nd edition, 2011.
[2] C.L.Wadhwa, "*Electrical Power Systems*", New Age international (P) Ltd, 2012.
[3] S.B.Dewan, G.R.Slemom, A.Straughen, "*Power semiconductor drives*", John Wiley and Sons, Latest edition

E-resources and other digital material

https://nptel.ac.in/courses/108108077

17EE4705B-ADVANCED POWER ELECTRONICS

Course Category:	**Program Elective-5**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Power Electronics (17EE3602)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Analyze** the operation of non-isolated and isolated converters
CO2	**Elucidate** the operation of resonant converters
CO3	**Analyze** power quality problems and suggest solutions
CO4	**Design** of passive components used in power converters

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**H**				**H**	**H**							**H**
CO2	**H**	**H**	**H**				**H**							**H**
CO3	**H**	**H**				**H**	**H**							**H**
CO4			**H**			**H**			**H**					**H**

Course Content

UNIT-I **[Text Book-1]**

DC-DC Converters: Non-isolated DC-DC Converters-buck, boost, buck-boost, CUK converters under continuous and discontinuous conduction operation.Isolated DC-DC Converters-forward, fly-back, push-pull, half-bridge, and full-bridge converters, relationship between input and output voltages, expression for filter inductor and capacitors.

UNIT-II **[Text Book-1]**

Resonant Converters: Introduction, basic resonant circuit concepts, classification-Load resonant converters, resonant switch converters, zero voltage switching, clamped voltage converters, resonant DC link inverters, high frequency link integral half cycle converters, phase modulated resonant converters.

UNIT- III **[Text Book-1]**

Inverters:PWM techniques-single, multiple and sinusoidal PWM techniques, selective harmonic elimination, space vector modulation, multi-level inverters-diode-clamped, cascaded, and flying capacitor types, introduction to current source inverter.

UNIT-IV **[Text Book-1]**

Design of Power Converters Components: Design of magnetic components, design of transformer, design of inductor and current transformer, selection of filter capacitors,

selection of ratings for devices, filter design, thermal design.

Text Book:

[1] E.W.Robert, M.Dragan,"*Fundamentals of Power Electronics*", Springer, 1997.

Reference Books:

[1] L.Umanand, *"Power Electronics: Essentials and Applications"*, chapter 1 to 7, John Wiley, India, 2009.

[2] N.Mohan, T.M.Undeland, WP.Robbins, "*Power Electronics: Converters and Applications*", John Wiley and Sons, 3rd edition, 2009.

[3] M.H.Rashid, "*Power Electronics-circuits, Devices and Applications*", Prentice Hall of India, 3rd edition, 2005.

E-resources and other digital material

https://nptel.ac.in/courses/108107128/

17EE4705C-MODELLING OF ELECTRICAL MACHINES

Course Category:	**Program Elective-5**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Electrical Machines I&II (17EE3303&17EE3403)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Analyze** the steady state and dynamic state operation of DC machine through mathematical modelling and simulation in digital computer.
CO2	**Illustrate** the different types of reference frame theories and transformation relationships.
CO3	**Understand** the Electrical machine equivalent circuit parameters and modelling of Induction machines.
CO4	**Analyze** the steady state and dynamic state operation of three-phase synchronous machines using transformation theory based mathematical modelling and digital computer simulation.

Contribution of Course Outcomes towards achievementof Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**L**			**H**							**M**	**M**	
CO2	**L**	**M**			**M**							**L**	**L**	
CO3	**H**	**M**			**H**							**H**	**M**	
CO4	**H**	**M**			**H**							**H**	**M**	

Course Content

UNIT-I **[Text Book-1]**

DC Machines: Elementary DC machine and analysis of steady state operation, Voltage and torque equation, dynamic characteristics of permanent magnet and shunt DC motors, Time domain block diagrams, solution of dynamic characteristic by Laplace transformation, digital computer simulation of permanent magnet and shunt DC machines.

UNIT-II **[Text Book-1]**

Reference Frame Theory: Historical background, phase transformation and commutator transformation, transformation of variables from stationary to arbitrary reference frame,variables observed from several frames of reference.

UNIT-III **[Text Book–1&2]**

Induction Machines: Three phase induction machine, equivalent circuit and analysis of steady state operation, free acceleration characteristics-voltage and torque equations in

machine variables and arbitrary reference frame variables, analysis of dynamic performance for load torque variations, digital computer simulation.

UNIT-IV[Text Book-1&2]

Synchronous Machines: Three phase synchronous machine and analysis of steady state operation-voltage and torque equations in machine variables and rotor reference frame variables (Park's equations), analysis of dynamic performance for load torque variations, Generalized theory of rotating electrical machine and Krons primitive machine.

Text Books:

[1] P.C.Krause, O.Wasynezuk and S.D.Sudhoff, "*Analysis of Electric Machinery and Drive Systems*", John Wiley, 2010.

[2] P.S.Bimbhra, "*Generalized Machine Theory*", Khanna Publishers, 2008.

Reference Books:

[1] A.E.Fitzgerald, Jr.Ch.Kingsley and D.Stephan, Umans, "*Electric Machinery*", Tata McGraw Hill, 6th edition,2009.

[2] R.Krishnan, *"Electric Motor and Drives: Modelling, Analysis and Control*", Prentice-Hall of India Private Ltd, 2008.

[3] Ch.M.Ong,"*Dynamic and Simulation of Electrical Machinery using MATLAB/Simulink*," Prentice Hall of India Publications.

E-resources and other digital material

https://nptel.ac.in/courses/108106023/

17EE4756D-PLC & SCADA LAB

Course category:	**Program Elective-5**	**Credits:**	3
Course type:	Practice	**Lecture-Tutorial-Practice:**	1-0-4
Prerequisites:	Programmable logic controller(17EE4603C)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Design** and conduct experiment.
CO2	**Analyze** and present experiment results.
CO3	**Exhibit** Professional behaviour.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**		**H**	**L**	**L**						**H**		**M**	**H**
CO2			**H**							**H**	**H**		**M**	
CO3			**H**							**H**				

Course Content

PART-A: Concepts of PLC & SCADA

1. Implementation of selection criteria and bit logic operations in PLC.
2. Industrial applications of TIMERS in PLC.
3. Industrial applications of counters in PLC.
4. Applications of "Move" operation and analog value processing.
5. Implementation of RT and RC packages, tags and configuration of PLC to SCADA communication.
6. SCADA screen designing with movements, animations and symbols etc.
7. User administration and recipes in SCADA.
8. Implementation of reports and trends in SCADA.

PART-B: Case Studies

1. Home automation using PLC and SCADA.
2. Implementation of elevator control system using PLC and SCADA.
3. Nuclear power plant Modeling using PLC and SCADA.
4. Thermal power plant modeling using PLC and SCADA.
5. Beverage preparation and bottle filling using PLC and SCADA.
6. Product sorting and machine bypassing using PLC and SCADA.
7. Implementation of batch processing using PLC and SCADA.
8. Multi level car parking design using PLC and SCADA

Note:Part A is mandatory and any **Four** experiments from **Part B** are to be completed

17EE4751-POWER SYSTEMS LAB

Course Category:	**Program core**	**Credits:**	1
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:	Power Systems-I&II (17EE3501& 17EE3601)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Design** and conduct experiment.
CO2	**Analyze** and present experiment results.
CO3	**Exhibit** Professional behaviour.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**		**H**	**L**	**L**						**H**		**M**	**H**
CO2			**H**							**H**	**H**		**M**	
CO3			**H**							**H**				

Course Content

LIST OF EXPERIMENTS.

PART-A

1. Performance of transmission line model
2. Characteristics of electromagnetic relays
3. Characteristics of static relays
4. Characteristics of microprocessor based relays
5. a. Communication of numerical relay with PC
   b. Configuration of numerical relay for over current and over voltage protection
6. Relay coordination and Three phase fault simulation on transmission line model
7. Obtain sequence reactance of alternator
8. Obtain sequence reactance of transformer and voltage control using tap changing transformer
9. High voltage testing of insulators and cables
10. Load flow analysis and fault studies using AC network analyzer

PART - B

11. Studyof Buchholz relay,thermo-magnetic over current relay operated air circuit breaker
12. Study of basic LV switch gear (MCB, MPCB, Contactor)
13. Realization of DOL starter using relays
14. Soft starter for motor start and stop using relays
15. Assembly of Air Circuit Breaker (ACB)
16. Remote Control of Air Circuit Breaker.

NOTE: Six from **PART-A** and **four** from **PART-B** are to be completed.

17EE4752-SIMULATION OF ELECTRICAL SYSTEMS LAB

Course Category:	**Program core**	**Credits:**	1
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:	Electrical Machines-I& II (17EE3303 &17EE3403) Linear Control Systems (17EE3401) Power Systems-I(17EE3501)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Design** and conduct experiment.
CO2	**Analyze** and present experiment results.
CO3	**Exhibit** Professional behaviour.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				**M**					**H**		**H**		**M**	**L**
CO2									**H**	**H**	**H**		**M**	
CO3									**H**	**M**	**H**			

Course Content

LIST OF EXPERIMENTS:

1. Modelling of transmission lines.
2. Speed control of three phase induction machine.
3. Simulation of three phase rectifier with R,R-L and R-L-E loads.
4. Simulation of three-phase inverter.
5. Transient analysis of electrical system.
6. Fault analysis of a simple power AC system.
7. Simulation of 3-phase power system network for different loads.
8. Simulation of single area load frequency control.
9. Step response of second order transfer function for different damping factors.
10. Representation of transfer functions from block diagram.
11. Economic dispatch.
12. Voltage stability analysis.
13. Program for load flow studies using Gauss-Seidel method.
14. Modelling of over current relay.
15. Program for short circuit analysis.

NOTE: A minimum of 10 experiments are to be completed.

V.R.SIDDHARTHA ENGINEERING COLLEGE: VIJAYAWADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION FOR B.TECH(EEE) FOURTH YEAR

Semester-VIII **Contact Hours: 19/22**

S.No	Course Code	Course	L	T	P	Credits
4.	17EE4801 17EE4852	Program Elective - 6 A. Solar Photovoltaics B. Fuel Cell and Ocean Energy Conversion Systems. C. Energy Management and Audit D. **Industrial Drives Lab**	3 1	0 0	0 4	3
5.	17EE2802	Open Elective-V* A. Introduction to Smart Grid Technology B. Electrical And Hybrid Vehicles	3	0	0	3
6.	17EE5851	Major Project**	0	5	8	9
Total			**6/4**	**5**	**8/12**	**15**

*Open Elective-V may also opt as self-learning course. Students register and complete the opted course in approved MOOCS platform on or before last instruction day of VIII semester. They have to submit the certificate before the last instruction day of VIII semester. Students who have not opted as a self-learning are required to attend for the class work and internal assessment as per the regular theory course.

**Major project involves continuation of Mini Project. The objective is to complete the work as per the prepared work plan and prepare a detailed project report.

17EE4801A-SOLAR PHOTOVOLTAICS

Course Category:	**Program Elective-6**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Network Analysis-I (17EE1204) Electronics Circuits(17EE3302) Environmental Studies(17MC1407A)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the concepts of solar cell.
CO2	**Understand**the solar cell characteristics.
CO3	**Understand**the concept of solar radiation and photovoltaic modules.
CO4	**Design**concepts of solar photovoltaic systems.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**		**L**	**L**			**L**	**M**				**M**		L
CO2	**H**		**L**	**L**			**L**	**M**				**M**		L
CO3	**H**		**L**	**L**			**L**	**M**				**M**		L
CO4	**H**		**L**	**L**			**L**	**M**				**M**		M

Course Content

UNIT-I [**TextBook-1**]

Introduction to Solar Cells: Introduction to solar photovoltaic, place of solar photovoltaic in energy supply, PN junction equilibrium condition, space charge region, energy band diagram of PN junction, PN junction potential, width of depletion region, carrier movements and current densities, PN junction under illumination-generation of photo voltage, light generated current, types of solar cells.

UNIT-II **[Textbook-1]**

Solar Cell Characteristics and Performance: Solar cell characteristics-I-V relation of solar cells, P-V Characteristics, limits of cell parameters-short circuit current, open circuit voltage, maximum voltage, maximum current, maximum power, fill factor, efficiency, losses in solar cells-simple calculation in efficiency of solar cell.

UNIT-III **[Textbook-1]**

Solar Radiation and Photo Voltaic Modules: Sun and earth movement-declination angle,

apparent motion of the sun and solar altitude, angle of sun rays on solar collector, sun tracking,solar PV modules from solar cells, series connection, parallel connection-mismatch in series and parallel connections, feedback diode, PV module power output.

UNIT-IV **[Textbook-1]**

Solar Photo Voltaic System Design and Applications: Introduction to solar PV systems, stand alone PV system configuration, stand alone system with battery and AC (or) DC load-case study problems, grid connected PV systems configuration-working of a grid connected system, example-single stage grid connected-simple problems related to design of standalone PV system and grid connected PV systems-case study.

Text Book:

[1] Ch.S.Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications'', Prentice Hall of India, 3rd edition, 2015.

Reference books:

[1] B.H.Khan, "*Non Conventional Energy Resources*", Mc.Graw Hill Education private limited, New Delhi, 2nd edition, 2009.
[2] K.Mertens, "*Photovoltaic Fundamentals Technology and Practice*",John and Willey publishers, 2nd edition, 2018.
[3] M.Jamil, M.Rizwan, D.P.Kothari, "*Grid Integrated Solar Photovoltaic Systems*", CRC press, Taylor and Francis, 2018.

E-resources and other digital material

[1] https://www.nptel.ac.in/courses/115107116
[2] https://www.nptel.ac.in/courses/112105051

17EE4801B-FUEL CELL AND OCEAN ENERGY CONVERSION SYSTEMS

Course Category:	**Program Elective-6**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Electrical Machines-I&II (17EE3303&17EE3403) Power Systems-I (17EE3501)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the operation of fuel cells.
CO2	**Apply** control techniques for grid connected fuel cell power generation system.
CO3	**Understand** the concept of tidal energy conversion systems.
CO4	**Understand** the concept of ocean wave energy harvesting process.

Contribution of Course Outcomes towards achievement of Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**M**	**H**				**H**							**H**	
CO2		**H**		**H**		**H**						**M**		
CO3	**M**	**H**				**H**							**H**	
CO4	**M**	**H**				**H**							**H**	

Course Content

UNIT-I **[Text Book-1]**

Operation of Fuel Cells: Chemical and thermal energy of an element, fundamentals of thermodynamics, fundamentals of electrochemical processes, energy balance in chemical reactions, types of fuel cells,fuel cell equivalent circuit, capacitance of double-layer charge effect.

UNIT-II **[Text Book-1]**

Control of Grid-Connected Fuel Cell Power Generation Systems: Grid-Connected system configuration-Polymer Electrolyte Membrane Fuel Cells (PEMFC) unit configuration, Solid Oxide Fuel Cells (SOFC) unit configuration, circuit and controller design for the boost DC/DC converter, controller design for the three-Phase VSI.

UNIT-III **[Text Book-2]**

Tidal Energy Harvesting: Categories of tidal power and corresponding generation technology, turbine and generator's control, tidal energy conversion systems, grid connection interfaces for tidal energy harvesting applications.

UNIT-IV **[Text Book-2]**

Ocean Wave Energy Harvesting: Wave energy harvesting technologies, wave power generators, grid connection topologies for different generators used in wave energy harvesting applications wave energy applications.

Text Books:

[1] M.H.Nehrir, C.Wang,"*Modelling and Control of Fuel Cells - Distribution Generation and Applications"*, Wiley-IEEE Press, 2009.

[2] A.Khaligh, C.O.Omar,"*Energy Harvesting Solar, Wind, and Ocean Energy Conversion Systems,"* CRC Press, 2010.

Reference Book:

[1] B.H.Khan, "*Non Conventional Energy Resources*", Mc. Graw Hill education private limited, New Delhi, 2nd edition, 2009.

E-resources and other digital material

https://nptel.ac.in/courses/106105173/

17EE4801C-ENERGY MANAGEMENTANDAUDIT

Course Category:	**Program Elective-6**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:		**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the need for energy auditing.
CO2	**Formulate** the financial analysis during energy audit reporting.
CO3	**Understands** working principles of energy efficient devices
CO4	**Understand** different energy management strategies.

Contribution of Course Outcomes towards achievementof Program Outcomes
(L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M							M			H	M	M	
CO2	M							M			H	M	M	
CO3	M		M					M			H	L	M	
CO4	M							M			H	L	M	

Course Content

UNIT-I **[Text Book-1]**

Energy Auditing: Energy scenario, need of energy audit, types and objectives of energy audit, energy audit instruments, minimum energy paths, model report of energy audit, case study**.**

Financial Management-1: Depreciation calculation methods- straight line method, diminishing value method, sinking fund method.

UNIT- II **[Text Book-1]**

Financial Management-2: Payback period introduction, simple payback period (SPP), Discounted Payback Period (DPP), Accounting Rate of Return (ARR), Net Present Value (NPV), Profitability Index (PI), Internal Rate of Return (IRR).

Energy Conservation: Introduction, need of energy conservation, different techniques used in energy conservation**.**

UNIT-III[Text Book-1]

Types of Energy Efficient Devices: Electric motors-energy efficient controls and starting efficiency, load matching and selection of motors, variable speed drives, pumps and fans-efficient control strategies, optimal selection and sizing, transformer loading/efficiency analysis, reactive power management, capacitor sizing, degree of compensation, capacitor losses, location-placement**.**

UNIT- IV **[Text Book-1]**

Energy Management: Peak demand controls-methodologies, types of industrial loads-optimal load scheduling, lighting-energy efficient light sources-energy conservation in lighting, electric loads of air conditioning and refrigeration, energy conservation measures and cool storage, electric water heating and energy conservation measures.

Text Book:

[1] Petrecca, Giovanni. "*Industrial Energy Management: Principles and Applications"*, Springer Science & Business Media, 2012.

Reference Books:

[1] A.J.Pansini, D.S.Kenneth, "*Guide to Electric Load Management*", Pennwell Books; Latest edition.

[2] Jordan, Howard E. "*Energy-efficient electric motors and their applications*" Springer Science & Business Media, 2013

[3] Y.P.Abbi, S.Jain, "*Handbook on Energy Audit and Environment Management*", TERI, 2006.

[4] A.Thumann, W.J.Younger, "*Handbook of Energy Audits*", Terry Niehus, 2009.

E-resources and other digital material

https://nptel.ac.in/courses/108106022/

17EE4852D-INDUSTRIAL DRIVES LAB

Course Category:	**Program Elective-6**	**Credits:**	3
Course Type:	Practice	**Lecture-Tutorial-Practice:**	1-0-4
Prerequisites:	Power Electronics (17EE3602)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Design** and conduct experiment.
CO2	**Analyze** and present experiment results.
CO3	**Exhibit** professional behaviour.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				**M**					**H**		**H**		**M**	**L**
CO2									**H**	**H**	**H**		**M**	
CO3									**H**	**M**	**H**			

Course Content

LIST OF EXPERIMENTS:

1. Two or three wire control of AC drive
2. Controlling of AC drive using input and output with analog set points
3. V/f Ratio control of AC drive
4. Digital potentiometer control of AC drive
5. PID Control techniques of AC drive
6. Fixed set point control of AC drive
7. Ramp function generator for AC drive
8. Conveyor control method of AC drive
9. Injection of EMF method for AC drive
10. PID control techniques of DC drive
11. Digital potentiometer control of DC drive
12. Oscillating technique control of DC drive.

NOTE: A minimum of 10 experiments are to be completed.

17EE2802A-INTRODUCTION TO SMART GRID TECHNOLOGIES

Course Category:	**Open Elective-V**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:		**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the basics of smart grid architecture and its components.
CO2	**Understand** the information and communications technology for the smart grid
CO3	**Acquire** knowledge about sensing and measurement technologies and related measuring unit in smart grid.
CO4	**Know** the concept of smart metering and demand-side integration.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**							**L**	**M**		**H**			
CO2									**H**					**M**
CO3	**M**			**H**	**M**						**M**			**M**
CO4							**H**	**H**	**H**					**M**

Course Content

UNIT-I **[Text Book-1]**

Smart Grid Architectural Designs : Introduction, comparison of power grid with smart grid, power system enhancement, communication and standards, general view of the smart grid market drivers, stakeholder roles and function, measures, representative architecture, functions of smart grid components**.**

UNIT-II **[Text Book-2]**

Information and Communications Technology for the Smart Grid Data Communication: Introduction, dedicated and shared communication channels, switching techniques, communication channels, layered architecture and protocols**.**

Communication Technologies for the Smart Grid: Introduction communication technologies-IEEE 802 series, mobile communications, multi-protocol label switching, power line communication, standards for information exchange, standards for smart metering Modbus, DNP3, IEC 61850.

Information Security for The Smart Grid: Encryption and decryption, authentication, digital signatures, cyber security standards**.**

UNIT-III **[Text Book-1]**

Sensing and Measurement: Monitoring, PMU, smart meters, and measurements technologies-Wide Area Monitoring Systems (WAMS), Phasor Measurement Units (PMU), smart meters, smart appliances, advanced metering infrastructure, GPS and mapping tools, Multi Agent Systems (MAS) Technology**.**

UNIT-IV **[Text Book-2]**

Smart Metering and Demand-Side Integration: Introduction, smart metering-evolution of electricity metering, key components of smart metering, smart meters- an overview of the hardware used, communications infrastructure and protocols for smart metering, demand-side integration.

Text Books:

[1] J.Ekanayake, K.Liyanage, Wu.Jianzhong, A.Yokoyama, N.Jenkins, "*Smart Grid: Technology and Applications*" Wiley, 2012.

[2] J.Momoh, "*Smart Grid: Fundamentals of Design and analysis"*Wiley, IEEE Press, 2012.

Reference Book:

[1] Cl.W.Gellings, "*The Smart Grid, Enabling Energy Efficiency and Demand Side Response*" CRC Press, 2009.

E-resources and other digital material

[1]. https://swayam.gov.in/nd1_noc19_ee64/preview

[2]. https://nptel.ac.in/courses/108107113

17EE2802B-ELECTRICAL AND HYBRID VEHICLES

Course Category:	**Open Elective-V**	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Linear Control Systems (17EE3401) Electrical Machines-I & II (17EE3303 & 17EE3403). Power Electronics (17EE3602)	**Continuous Evaluation:** **Semester End Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	
	Upon successful completion of the course, the student will be able to:
CO1	**Understand** the basic components of hybrid electric vehicles and conventional vehicles**.**
CO2	**Understand** hybrid electric drive trains and electric drive trains**.**
CO3	**Understand** electric propulsion unit.
CO4	**Understand** energy storage and sizing the drive system.

Contribution of Course Outcomes towards achievementof Program Outcomes (L - Low, M - Medium, H - High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**H**	**H**	**H**				**H**							**H**
CO2	**H**		**H**			**H**	**H**							**H**
CO3	**H**		**H**			**H**	**H**						**H**	
CO4	**H**		**H**			**H**	**H**							**H**

Course Content

UNIT-I **[Text Book-1]**

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics.

UNIT-II **[Text Book-1]**

Hybrid Electric Drive-Trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis**.**

Electric Drive-Trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis**.** .

UNIT-III **[Text Book-2]**

Electric Propulsion Unit: Introduction to electric components used in hybrid and electric vehicles, configuration and control of DC Motor drives, configuration and control of induction motor drives, configuration and control of permanent magnet motor drives, configuration and control of switch reluctance motor drives, drive system efficiency.

UNIT-IV **[Text Book-2]**

Energy Storage: Introduction to energy storage requirements in hybrid and electric vehicles, battery based energy storage and its analysis, fuel cell based energy storage and its analysis, super capacitor based energy storage and its analysis, flywheel based energy storage and its analysis, hybridization of different energy storage devices**.**

Text Books:

[1] I.Hussein, "*Electric and Hybrid Vehicles: Design Fundamentals*", CRC Press, 2003.

[2] M.Ehsani, Y.Gao, E.S.Gay, A.Emadi, "*Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design*", CRC Press, 2004.

Reference Books:

[1] J.Larminie, J.Lowry, "*Electric Vehicle Technology Explained*", Wiley, 2003

[2] M.G.Say,"*The Performance and Design of Alternating Current Machines"*, CBS Publishers, New Delhi.

[3] D.C.Hanselman*, "Brushless Permanent Magnet Motor Design"*, Magna Physics Pub, 2006.

[4] R.Krishnan,"*Electric motor drives: modelling, analysis, and control"*, Prentice Hall, 2001.

[5] P.C.Krause, O.Wasynczuk, S.D.Sudhoff, "*Analysis of electric machinery"*, IEEE Press, 1995.

E-resources and other digital material

https://nptel.ac.in/content/syllabus_pdf/108103009.pdf