MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
MADANAPALLE
(UGC-AUTONOMOUS)
www.mits.ac.in

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course structure
And
Detailed Syllabi

For the students admitted to

B. Tech. Regular Four Year Degree Programme from the academic year 2018-19

and

B. Tech. Lateral Entry Scheme from the academic year 2019-20

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: ELECTRICAL AND ELECTRONICS ENGINEERING

Total Credits: 160 (4 Year Course)

I. Induction Program and Holistic Development Activities

Sl.No.	Title	Duration
1	Induction Program (Mandatory)	Three weeks duration at the start of First Year (Refer Annexure - I)
2	Holistic Development Activities (Every Student from Semester 2 – 8 should register for at least one activity)	Three hours per week (Activity list is enclosed in Annexure - I)
3	Virtual Laboratory (Students are encouraged to choose and register for any of the Virtual laboratories he /she is interested)	As specified by the Virtual Laboratory

II. Semester-wise Structure of Curriculum

(L = Lecture, T = Tutorial, P = Practical, C = Credit)

I Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Basic Science Course	18MAT105	Calculus and Differential Equations	3	1	0	4	4
2	Basic Science Course	18PHY102	Modern Physics	3	1	0	4	4
3	Engineering Science Course	18EEE101	Basic Electrical Engineering	3	0	0	3	3
4	Engineering Science Course	18CSE101	Programming for Problem Solving (Python)	2	0	2	4	3
5	Basic Science Course	18PHY201	Physics Laboratory	0	0	3	3	1.5
6	Engineering Science Course	18EEE201	Electrical Engineering Laboratory	0	0	3	3	1.5
			Total	**11**	**2**	**8**	**21**	**17**

I Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Humanities, Social Sciences including Management	18ENG101	Professional English	2	0	2	4	3
2	Basic Science Course	18MAT106	Linear Algebra and Transform Calculus	3	1	0	4	4
3	Basic Science Course	18CHE101	Engineering Chemistry	3	0	0	3	3
4	Engineering Science Course	18CSE102	C Programming and Data Structures	3	0	0	3	3
5	Engineering Science Course	18ME101	Engineering Graphics	2	0	3	5	3.5
6	Basic Science Course	18CHE201	Chemistry Laboratory	0	0	3	3	1.5
7	Engineering Science Course	18CSE201	C Programming and Data Structures Laboratory	0	0	3	3	1.5
8	Engineering Science Course	18ME201	Workshop Practice	0	0	3	3	1.5
			Total	**13**	**1**	**14**	**28**	**21**

II Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Humanities, Social Sciences including Management	18HUM101	Economics and Financial Accounting for Engineers	3	0	0	3	3
2	Basic Science Course	18BIO101	Life Sciences for Engineers	3	0	0	3	3
3	Professional Core Course	18EEE102	Electrical Circuit Analysis	3	1	0	4	4
4	Professional Core Course	18EEE103	Analog Electronics	3	0	0	3	3
5	Professional Core Course	18EEE104	DC Machines and Transformers	3	0	0	3	3
6	Humanities, Social Sciences including Management	18ENG201	English Communication – Listening & Speaking Laboratory	0	0	3	3	1.5
7	Professional Core Course	18EEE202	Analog Electronics Laboratory	0	0	3	3	1.5
8	Professional Core Course	18EEE203	DC Machines and Transformers Laboratory	0	0	3	3	1.5
9	Mandatory non-credit Course		Mandatory Course – I (Refer Annexure - V)	2	0	0	2	0
			Total	**17**	**1**	**9**	**27**	**20.5**

Dept. of Electrical and Electronics Engineering

II Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Humanities, Social Sciences including Management	18HUM102	Principles of Management	3	0	0	3	3
2	Basic Science Course	18MAT104	Probability and Statistics	3	0	0	3	3
3	Professional Core Course	18EEE105	Electromagnetic Fields	2	1	0	3	3
4	Professional Core Course	18EEE106	Digital Electronics	3	0	0	3	3
5	Professional Core Course	18EEE107	Induction and Synchronous Machines	3	0	0	3	3
6	Professional Core Course	18EEE108	Control Systems	2	1	0	3	3
7	Professional Core Course	18EEE204	Digital Electronics Laboratory	0	0	3	3	1.5
8	Professional Core Course	18EEE205	Induction and Synchronous Machines Laboratory	0	0	3	3	1.5
9	Professional Core Course	18EEE206	Control Systems Laboratory	0	0	3	3	1.5
10	Mandatory non-credit Course		Mandatory Course – II (Refer Annexure - V)	2	0	0	2	0
			Total	**19**	**1**	**9**	**29**	**22.5**
Summer Internship								

III Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Humanities, Social Sciences including Management	18ENG102	English Communication - Reading and Writing	2	0	0	2	2
2	Professional Core Course	18EEE109	Power Systems – I (Generation, Transmission and Distribution)	2	1	0	3	3
3	Professional Core Course	18EEE110	Power Electronics	3	0	0	3	3
4	Professional Core Course	18EEE111	Microcontrollers and Interfacing	3	0	0	3	3
5	Professional Elective Course		Discipline Elective – I (Refer Annexure - III)	3	0	0	3	3
6	Open Elective Course		Open Elective – I (Refer Annexure - II)	3	0	0	3	3
7	Professional Core Course	18EEE207	Power Systems – I Laboratory	0	0	3	3	1.5
8	Professional Core Course	18EEE208	Power Electronics Laboratory	0	0	3	3	1.5
9	Professional Core Course	18EEE209	Microcontrollers and Interfacing Laboratory	0	0	3	3	1.5
10	Mandatory non-credit Course		Mandatory Course – III (Refer Annexure - V)	2	0	0	2	0
			Total	**18**	**1**	**9**	**28**	**21.5**

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III Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Engineering Science Course	18EEE112	AI Tools, Techniques and Applications	3	0	0	3	3
2	Professional Core Course	18EEE113	Signals and Systems	2	1	0	3	3
3	Professional Core Course	18EEE114	Power Systems – II (Analysis)	2	1	0	3	3
4	Professional Elective Course		Discipline Elective –II (Refer Annexure - III)	3	0	0	3	3
5	Professional Elective Course		Discipline Elective – III (Refer Annexure - III)	3	0	0	3	3
6	Open Elective Course		Open Elective – II (Refer Annexure - II)	3	0	0	3	3
7	Humanities, Social Sciences including Management	18ENG202	Corporate Communication Laboratory	0	0	2	2	1
8.	Professional Core Course	18EEE210	Power Systems – II Laboratory	0	0	3	3	1.5
9	Professional Core Course		Virtual Laboratory (Refer Annexure - IV)	0	0	2	2	0
10	Mandatory non-credit Course		Mandatory Course – IV (Refer Annexure - V)	2	0	0	2	0
			Total	**18**	**2**	**7**	**27**	**20.5**
Summer Internship								

Dept. of Electrical and Electronics Engineering

IV Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Engineering Science Course	18EEE115	Internet of Things	3	0	0	3	3
2	Professional Core Course	18EEE116	Switch Gear and Protection	3	0	0	3	3
3	Professional Elective Course		Discipline Elective – IV (Refer Annexure - III)	3	0	0	3	3
4	Professional Elective Course		Discipline Elective – V (Refer Annexure - III)	3	0	0	3	3
5	Open Elective Course		Open Elective – III (Refer Annexure - II)	3	0	0	3	3
6	Engineering Science Course	18EEE211	Internet of Things Laboratory	0	0	2	2	1
7	Professional Core Course	18EEE212	Protection and Simulation Laboratory	0	0	2	2	1
8	PROJ-EEE	18EEE701	Project Work – I	0	0	4	4	2
			Total	**15**	**0**	**8**	**23**	**19**

Dept. of Electrical and Electronics Engineering

IV Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Professional Elective Course		Discipline Elective –VI (Refer Annexure - III)	3	0	0	3	3
2	Open Elective Course		Open Elective – IV (Refer Annexure - II)	3	0	0	3	3
3	PROJ - EEE	18EEE702	Project Work - II	0	0	24	24	12
			Total	6	0	24	30	18

ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

- Yoga and Meditation
- Sports and Games
- NSS
- NCC
- MITS Social Responsibility Club
- Management module
- Design Thinking
- Spoken and Written Communication

- ***Proficiency modules***

  - Basic Computer Proficiency
  - Interpersonal skills
  - Computer Graphics
  - Web programming
  - Mobile Apps
  - Vocabulary enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Physical and Health
2. Culture
3. Literature and Media
4. Social Service
5. Self-Development
6. Nature and Environment
7. Innovation

ANNEXURE - II

OPEN ELECTIVE – I

(To be offered under MOOC's Category from SWAYAM – NPTEL)
Students can opt to be assessed either in Conventional mode or through proctored exams conducted by Swayam NPTEL

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	18ENG3M01/ 18ENG3M01C	Soft Skills	English & Training
2	18ENG3M02/ 18ENG3M02C	Developing Soft Skills and Personality	English & Training
3	18ENG3M03/ 18ENG3M03C	Soft Skill Development	English & Training
4	18HUM3M01/ 18HUM3M01C	Project Management for Managers	Humanities
5	18HUM3M02/ 18HUM3M02C	Ethics in Engineering Practice	Humanities
6	18CE3M01/ 18CE3M01C	Integrated Waste Management for Smart City	Civil
7	18CE3M02/ 18CE3M02C	Soil and Water Conservation Engineering	Civil
8	18CE3M03/ 18CE3M03C	Engineering Geology	Civil
9	18ME3M01/ 18ME3M01C	Six Sigma	Mechanical
10	18ME3M02/ 18ME3M02	Operations Research	Mechanical
11	18ME3M03/ 18ME3M03C	Design Thinking and Innovation	Mechanical
12	18ECE3M01/ 18ECE3M01C	Semiconductor Opto-Electronics	ECE
13	18ECE3M02/ 18ECE3M02C	Digital VLSI Testing	ECE
14	18CSE3M01/ 18CSE3M01C	Social Networks	CSE
15	18CSE3M02/ 18CSE3M02C	Privacy and Security in Online Social Media	CSE

Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.

Dept. of Electrical and Electronics Engineering

OPEN ELECTIVE – II (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	18MAT301	Advanced Numerical Methods	Mathematics
2	18MAT302	Engineering Optimization	Mathematics
3	18PHY301	Optical Physics and its Applications	Physics
4	18PHY302	LASER Physics and Advanced LASER Technology	Physics
5	18CHE301	Introduction to Petroleum Industry	Chemistry
6	18CHE302	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
7	18HUM301	Intellectual Property Rights	Humanities
8	18HUM302	Human Resource Development	Humanities
9	18HUM304	National Cadet Corps	Humanities
10	18CE301	Ground Improvement Techniques	Civil
11	18CE302	Environmental Impact Assessment	Civil
12	18CE303	Watershed Management	Civil
13	18ME302	Elements of Mechanical Engineering	Mechanical
14	18ME303	Basic Thermodynamics	Mechanical
15	18ECE301	Bio-Medical Electronics	ECE
16	18ECE302	VLSI Design	ECE
17	18CSE301	Operating Systems	CSE
18	18CSE302	E-Learning Technologies	CSE

OPEN ELECTIVE – III

(To be offered under MOOC's Category from SWAYAM – NPTEL)
Students can opt to be assessed either in Conventional mode or through proctored exams conducted by Swayam NPTEL

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	18ENG3M04/ 18ENG3M04C	Speaking Effectively	English
2	18HUM3M03/ 18HUM3M03C	Management Information System	Humanities
3	18CE3M04/ 18CE3M04C	Remote Sensing and GIS	Civil
4	18CE3M05/ 18CE3M05C	Waste Water Treatment and Recycling	Civil
5	18CE3M06/ 18CE3M06C	Building Materials and Composites	Civil
6	18ME3M04/ 18ME3M04C	Power Plant Engineering	Mechanical
7	18ME3M05/ 18ME3M05C	Mechatronics and Manufacturing Automation	Mechanical
8	18ECE3M03/ 18ECE3M03C	Introduction to Embedded Systems	ECE
9	18ECE3M04/ 18ECE3M04C	Embedded System Design with ARM	ECE
10	18ECE3M05/ 18ECE3M05C	Advanced Computer Architecture	ECE
11	18CSE3M03/ 18CSE3M03C	Human Computer Interactions	CSE
12	18CSE3M04/ 18CSE3M04C	Programming in JAVA	CSE
13	18CSE3M05/ 18CSE3M05C	Multi-Core Computer Architecture – Storage and Interconnects	CSE
14	18IE3M01/ 18IE3M01C	Introduction to Research	General

Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.

OPEN ELECTIVE – IV (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	18ENG301	Creative Writing	English
2	18HUM303	Entrepreneurship Development	Humanities
3	18MAT303	Graph Theory	Mathematics
4	18MAT304	Mathematical Modeling and Numerical Simulation	Mathematics
5	18PHY303	Thin Film Technology and its Applications	Physics
6	18CHE303	Introduction to Nano Science and Technology	Chemistry
7	18CHE304	Computational Methods in Materials Science and Engineering	Chemistry
8	18CE304	Green Building and Energy Conservation	Civil
9	18CE305	Environmental Engineering	Civil
10	18ME304	Internet of Manufacturing Things	Mechanical
11	18ME305	Entrepreneurship	Mechanical
12	18ME306	Total Quality Management	Mechanical
13	18ECE303	Nano Electronics	ECE
14	18ECE304	Wireless Sensor Networks	ECE
15	18CSE304	Mobile Application Development	CSE
16	18CSE305	Software Project Management	CSE
17	18CSE306	Software Testing	CSE

ANNEXURE – III

List of Discipline Electives – Electrical and Electronics Engineering

Discipline Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	18EEE401	Modern Control Systems
2.	18EEE402	Advanced Digital System Design
3.	18EEE403	Industrial Electrical Systems
4.	18EEE404	Special Electrical Machines
5.	18EEE405	Electrical Safety
6.	18EEE406	Electrical Engineering Materials
Any advanced courses can be appended in future.		

Discipline Elective – II (To be offered under MOOC's Category from SWAYAM – NPTEL) Students can opt to be assessed either in Conventional mode or through proctored exams conducted by Swayam NPTEL		
Sl. No.	**Course Code**	**Course Title**
1.	18EEE4M01/ 18EEE4M01C	Computational Electromagnetics
2.	18EEE4M02/ 18EEE4M02C	Computer Aided Power System Analysis
3.	18EEE4M03/ 18EEE4M03C	Microelectronics: Devices to Circuits
4.	18EEE4M04/ 18EEE4M04C	Design of Photovoltaic Systems
5.	18EEE4M05/ 18EEE4M05C	Non-conventional Energy Resources
6.	18EEE4M06/ 18EEE4M06C	Design of Power Electronic Converters
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

Discipline Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	18EEE407	Electrical Drives and Control
2.	18EEE408	Control Systems Design
3.	18EEE409	Electrical Measurement and Instrumentation
4.	18EEE410	Utilization of Electrical Energy
5.	18EEE411	Switched Mode Power Converters

6.	18EEE412	Electrical Machine Design
Any advanced courses can be appended in future.		

Discipline Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	18EEE413	Electrical Energy Conservation and Auditing
2.	18EEE414	Line Commutated and Active Rectifiers
3.	18EEE415	Electrical and Hybrid Vehicles
4.	18EEE416	Power System Deregulation
5.	18EEE417	Static Relays
Any advanced courses can be appended in future.		

Discipline Elective – V		
Sl. No.	**Course Code**	**Course Title**
1.	18EEE418	Discrete Time Signal Processing
2.	18EEE419	Power System Operation and Control
3.	18EEE420	HVDC and FACTS
4.	18EEE421	Wind and Solar Energy Systems
5.	18EEE422	Illumination Engineering
Any advanced courses can be appended in future.		

Discipline Elective – VI		
Sl. No.	**Course Code**	**Course Title**
1.	18EEE423	Robotics
2.	18EEE424	Smart Power Grid
3.	18EEE425	High Voltage Engineering
4.	18EEE426	Power Quality
5.	18EEE427	EHVAC Transmission
Any advanced courses can be appended in future.		

ANNEXURE - IV

ELECTRICAL AND ELECTRONICS ENGINEERING -VIRTUAL LABORATORIES

Sl. No.	Course Code	Course Title
1.	18EEE213	Sensors Modeling and Simulation
2.	18EEE214	Virtual Power Laboratory
3.	18EEE215	Industrial Electric Drives and Substation Automation Laboratory
4.	18EEE216	Industrial Automation Laboratory
5.	18EEE217	Electronic instrumentation Laboratory
6.	18EEE218	PLC Laboratory
7.	18EEE219	Creative Design, Prototyping and Experiential Simulation Laboratory
8.	18EEE220	Real Time Embedded Systems Laboratory
9.	18EEE221	Mobile Robotics Laboratory
10.	18EEE222	Electronic Design Laboratory (using DSP, FPGA, CPLD and Microcontrollers, through simulation and direct access of the hardware)

ANNEXURE - V

ELECTRICAL AND ELECTRONICS ENGINEERING – MANDATORY COURSES

Sl. No.	Course Code	Course Title
1	18CHE901	Environmental Sciences
2	18HUM902	Indian Constitution
3	18HUM903	Essence of Indian Traditional Knowledge
4	18CE904	Disaster Management

Annexure VI

Honors in Electrical and Electronics Engineering

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	**Professional Elective Course (Choose any two from three courses)**	18HDEEE101	Advanced Electric Drives	3	0	0	3	3
2		18HDEEE102	Control Systems Design	3	0	0	3	3
3		18HDEEE103	Electrical Machine Design	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
	III Year II Semester							
4	**Professional Elective Course (Choose any two from three courses)**	18HDEEE104	Switched Mode Power Converters	3	0	0	3	3
5		18HDEEE105	Fuzzy logic, ANN and Introduction to GA	3	0	0	3	3
6		18HDEEE106	Static VAR Compensation and Harmonic Filtering	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
	IV Year I Semester							
7	**Professional Elective Course (Choose any one from three courses)**	18HDEEE107	Power System Dynamics and Stability	3	0	0	3	3
8		18HDEEE108	Digital Protective Relaying	3	0	0	3	3
9		18HDEEE109	Power Apparatus & Networks	3	0	0	3	3
10	**Project**	18HDEEE701	Mini Project	0	0	10	10	5
	Sub Total			**3**	**0**	**10**	**13**	**8**
	Total			**15**	**0**	**10**	**25**	**20**

Annexure VII

Minors in Electrical and Electronics Engineering
(Applicable to CE and ME)

Stream Name: Electrical Machines and Control

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	**Professional Core Course**	18MDEEE101	Electric Circuit Analysis	3	0	0	3	3
2	**Professional Core Course**	18MDEEE102	Electrical Machines	3	0	0	3	3
III Year II Semester								
3	**Professional Core Course**	18MDEEE103	Electrical Measurements and Instrumentation	3	0	0	3	3
4	**Professional Core Course**	18MDEEE104	Control Systems	3	0	0	3	3
5	**Professional Core Course**	18MDEEE201	Electrical Machines and Control System Laboratory	0	0	4	4	2
IV Year I Semester								
6	**Professional Core Course**	18MDEEE105	Electrical and Hybrid Vehicles	3	0	0	3	3
7	**PROJ-EEE**	18MDEEE701	Mini Project	0	0	6	6	3
			Total	**15**	**0**	**10**	**25**	**20**

Minors in Electrical and Electronics Engineering
(Applicable to ECE, CSE and CST)

Stream Name: Power Electronics and Instrumentation

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	**Professional Core Course**	18MDEEE106	Introduction to Electrical Power Generation System	3	0	0	3	3
2	**Professional Core Course**	18MDEEE107	Electrical Machine Technology	3	0	0	3	3
III Year II Semester								
3	**Professional Core Course**	18MDEEE103	Electrical Measurement and Instrumentation	3	0	0	3	3
4	**Professional Core Course**	18MDEEE108	Power Electronics	3	0	0	3	3
5	**Professional Core Course**	18MDEEE202	Power Electronics and Electrical Measurement Laboratory	0	0	4	4	2
IV Year I Semester								
6	**Professional Core Course**	18MDEEE105	Electrical and Hybrid Vehicles	3	0	0	3	3
7	**PROJ-EEE**	18MDEEE701	Mini Project	0	0	6	6	3
			Total	**15**	**0**	**10**	**25**	**20**

B. Tech I Year I Semester

Dept. of Electrical and Electronics Engineering

B. Tech I Year I Semester

18MAT105 CALCULUS AND DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

Course Prerequisite: Mathematics at Intermediate or Equivalent Level

Course Description: This course reviews and continues the study of calculus, Multivariable calculus, ordinary, partial differential equations and sequence and series. Evaluation of definite and improper integrals; mean value theorems; maxima and minima; limits and continuity; applications of derivatives and integrals; theorems of Green, Stokes and Gauss, ordinary and partial differential equations, convergences of sequences and series.

Course Objectives:

1. To gain basic concepts of Beta and Gamma functions, definite integrals, improper integrals and mean value theorems.
2. To familiarize the knowledge of limit, continuity and their derivatives, extreme values in multivariable functions.
3. To emphasize the role of Double and Triple integrals in dealing with area and volume of the regions.
4. To formulate and solve first order ordinary differential equations.
5. To obtain the solutions of second order partial differential equations.

UNIT I: CALCULUS

Rolle's Theorem Mean value theorems, Taylor's and Maclaurin theorems (without proof); Maxima and minima. Definite integrals; Applications of definite integrals to evaluate area and length of curves, surface areas and volumes of revolutions.

(12)

UNIT II: **MULTIVARIABLE DIFFERENTIAL CALCULUS**

Limit, continuity and partial derivatives, directional derivatives, total derivative; Maxima, minima and saddle points; Method of Lagrange multipliers.

(12)

UNIT III: **MULTIVARIABLE INTEGRAL CALCULUS**

Multiple Integration: double integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar),Applications: areas (double integration), Green's, Stokes and Gauss divergence theorems (without proofs).

(12)

UNIT IV: ORDINARY DIFFERENTIAL EQUATIONS OF FIRST AND HIGHER ORDER

Linear Differential Equation, Exact and Bernoulli's equation, Second order linear differential equations with constant coefficients, Cauchy-Euler equation.

(12)

UNIT V: SEQUENCES & SERIES AND PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER

Convergence of sequence and series, tests for convergence, Solutions of first order linear and non-linear PDEs.

(12)

Course Outcomes:

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

1. Evaluate the definite integrals, Beta and Gamma functions and calculate length of curve and underlying area.
2. Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering.
3. Compute the area and volume by interlinking them to appropriate double and triple integrals.
4. Find the solution of engineering problems formulated in the form of linear differential equations.
5. Use the power series for determining the stability and convergence of various techniques and solving first order partial differential equations occurring in engineering.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2. G. B. Thomas, Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas' Calculus Pearson education 11th Edition, 2004.

References:

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", Pearson, 2002.
2. T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.
3. B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill, New Delhi, 2010.
4. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", LaxmiPublications, 2010.
5. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.
6. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.
7. S. L. Ross, "Differential Equations", Wiley India, 1984.
8. E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.
9. E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.
10. G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007

Mode of Evaluation: Assignments, Internal Mid Examination, External End Examination.

Dept. of Electrical and Electronics Engineering

B. Tech. I Year I Semester

18PHY102 MODERN PHYSICS

	L	T	P	C
Course Prerequisite: Intermediate physics	3	1	0	4

Course Description: ModernPhysics for Electrical and Computer Engineers isa basic physics course which provides fundamental knowledge to understand the concepts of Waves, Optics, Quantum Mechanics, Semiconductors and Lasers.

Course Objectives:

1. Expose students in understanding the basic laws of nature through wave equation using the principles of oscillations and waves.
2. Analyze and understand the concepts of waves and optics to prepare the students for advanced level courses.
3. Expose students to theoretical and mathematical aspects of Interference, Diffraction techniques and Lasers for testing of materials.
4. Develop knowledge and understanding the fundamental concepts of Quantum mechanics.
5. Adaptability to new developments in science and technology.

UNIT I: WAVES

Simple harmonic motion, damped harmonic oscillations, forced harmonic oscillations, resonance, and quality factor. Superposition of vibrations along same direction (equal frequency) and in perpendicular directions, Lissajous figures. Transverse waves, one dimensional wave equation, solution for wave equation, velocity of a transverse wave along a stretched string, modes of vibration of stretched string, standing waves, standing wave ratio.

(12)

UNIT II: OPTICS

Light as an electromagnetic wave, Huygens' Principle, superposition of waves, interference of light by division of wavefront - Young's double slit experiment, expression for fringe width, intensity distribution graph, interference of light by division of amplitude- interference in thin film by reflection, Newton's rings experiment, Diffraction, Farunhofer diffraction due to single slit, double slit and Diffraction grating (N-slit).

(12)

UNIT III: QUANTUM MECHANICS

Introduction to Quantum Mechanics-Postulates of quantum mechanics, de Broglie's hypothesis, Uncertainty principle (Qualitative only), Time-dependent and time-independent Schrodinger equations for wave function, Free-particle wave function and wave-packets, Solution of wave equation: Solution of stationary-state, Schrodinger equation for one dimensional problems – particle in a box, Scattering from a potential barrier and principle of tunnelling- operation of scanning tunnelling microscope. **(12)**

UNIT IV: SEMICONDUCTORS

Introduction to solids and semiconductors. Free electron theory of metals (drift velocity and electrical conductivity), Fermi energy level, density of states, Kronig-Penney model (Qualitative only) and origin of energy bands, band structure of metals, semiconductors, and insulators. Direct and indirect bandgap semiconductors, Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), p-n junction-IV characteristics.

(12)

UNIT V: LASERS

Introduction to lasers, characteristics of laser, spontaneous and stimulated emission, Einstein's coefficients; population inversion, excitation mechanisms, types of lasers: solid-state lasers – ruby laser, gas lasers - He-Ne Laser, semiconductor p-n junction diode laser; applications of lasers.

(12)

Course Outcomes:

Upon successful completion of this course, the students should be able to:

1. Describe a mathematical wave equation using the principles of wavesand oscillations
2. Apply the knowledge for materials testing using Interference and Diffraction techniques.
3. Understand the idea of wave function and to solve Schrodinger equation for simple potentials.
4. Explain the role of semiconductors in different realms of physics and their applications in both science and technology.
5. Identify the working elements of different lasers and estimate laser operation parameters.

Text Books:

1. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.
2. A. Ghatak, "Optics", McGraw Hill Education, 2012.
3. D. J. Griffiths, "Quantum mechanics", Pearson Education, 2014.
4. B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
5. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010

References:

1. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.
2. Physics Vol I & II, Halliday/Resnick/Krane 5th Edition, John Wiley, 2003.
3. D. A. Neamen, "Semiconductor Physics and Devices", Times Mirror High Education Group, Chicago, 1997.
4. G. Aruldhas, "Quantum Mechanics", Prentice Hall India Pvt., Limited 2002.

Mode of Evaluation: Assignment, Class room participation, Mid-term Examinations, Mini Project / Term paper and External End Examination.

B. Tech. I Year I Semester

18EEE101 BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisite: Intermediate Physics

Course Description:
This course equips the students with a basic understanding of Electrical circuits and machines for specific applications. In specific, the course covers basic of DC circuit & its analysis, introduction to single-phase and three-phase AC Systems, magnetic circuits, transformers, DC & AC electrical machines, basic converters and Components of LT Switchgear.

Course Objectives:
1. To learn the basics of the D.C. circuit analysis.
2. To have an idea about single-phase and three-phase A.C. electrical circuits.
3. To gain knowledge about basic magnetic circuits and transformers.
4. To learn the construction and operation of D.C. and A.C. machines.
5. To understand the operation of basic rectifiers and various components of LT Switchgear.

UNIT I: DC CIRCUIT ANALYSIS
Electrical circuit elements (R, L and C), voltage and current sources, Series and parallel resistive circuits, Kirchhoff's current and voltage laws, Nodal and Mesh analysis of simple circuits with dc excitation. Source Transformation, Star-Delta Transformation, Superposition Theorem.

(9)

UNIT II: AC CIRCUIT ANALYSIS
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations. Three phase balanced circuits, voltage and current relations in star and delta connections.

(9)

UNIT III: MAGNETIC MATERIALS AND TRANSFORMERS
Magnetic materials, B-H characteristics, ideal and practical transformer, principle of operation, emf equation, equivalent circuit, losses in transformers, regulation and efficiency.

(9)

UNIT IV: DC AND AC MACHINES
Construction, working, emf equation of DC generator, methods of excitation, speed control of dc motor. Generation of rotating magnetic fields, construction and working of a three-phase induction motor. Introduction of Single-phase induction motor. Introduction to Alternators.

(9)

UNIT V: RECTIFIERS AND ELECTRICAL INSTALLATIONS
PN junction diode, half wave, full wave and bridge rectifiers. Components of LT Switchgear: switch fuse unit (SFU), MCB, ELCB, MCCB, types of wires and cables, earthing.

(9)

Course Outcomes:

Upon successful completion of the course, students will be able to

1. To understand and analyze basic DC electric circuits.
2. To measure and analyze various electrical quantities of single phase and three AC electric circuits.
3. To develop magnetic circuits to experiment and analyze the transformers.
4. To study the working principles of electrical machines.
5. To create power converters for domestic applications with LT switchgear.

Text Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

References:

1. Abhijit Chakrabarti, "Circuit Theory : Analysis and Synthesis", Dhanpat Rai & Co., 2014
2. J.B. Gupta, "Theory & Performance of Electrical Machines", S. K. Kataria& Sons, 2013.
3. John Bird, "Electrical Circuit Theory and Technology", Fourth edition, Elsevier Ltd., 2010.
4. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
6. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech I Year I Semester

18CSE101 PROGRAMMING FOR PROBLEM SOLVING (PYTHON)

L	T	P	C
2	0	2	3

Course Prerequisite: None

Course Description:
Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. This course provides knowledge on how to implement programs in python language and to solve computational problems using the various programming constructs including data structures, functions, string handling mechanisms and file handling concepts.

Course Objectives:
1. Learn Python programming constructs.
2. Implement Python programs with conditional structures and loops.
3. Use functions for structuring Python programs.
4. Handle compound data using Python lists, tuples, and dictionaries.
5. Manipulate data using files handling in Python.

UNIT-I

Introduction: Algorithms, building blocks of algorithms (flow chart), History of Python, features of Python Programming, Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. **Data Types** - Integers, Strings, Boolean.

a) Develop a flowchart for the various arithmetic operations on numbers.
b) Develop a flowchart to check whether the number is positive or negative.
c) Develop a flowchart for finding whether a given number is even or odd.
d) Develop a flowchart for finding biggest number among three numbers.
e) Develop a flowchart for displaying reversal of a number.
f) Develop a flowchart to print factorial of a number using function.
g) Develop a flowchart to generate prime numbers series up to N using function.
h) Develop a flowchart to check given number is palindrome or not using function.
i) Alexa travelled 150 kms by train. How much distance in miles she actually covered?

(12)

UNIT-II

Operators and Expressions: Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations .**Control Flow** - if, if-elif-else, for, while,break,continue,pass.

a) Swapping of two number with and without using temporary variable.
b) If the age of Ram, Sam, and Khan are input through the keyboard, write a python program to determine the eldest and youngest of the three.
c) Develop a program that performs arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers. Input the two integer values and operator for performing arithmetic operation through keyboard. The operator codes are as follows:

- For code '+', perform addition.
- For code '-', perform subtraction.
- For code '*', perform multiplication.
- For code '/', perform division.

d) Implement the python program to generate the multiplication table.
e) Implement Python program to find sum of natural numbers
f) If the first name of a student is input through the keyboard, write a program to display the vowels and consonants present in his/her name.
g) The marks obtained by a student in 5 different subjects are input through the keyboard. Find the average and print the student grade as per the MITS examination policy as shown below.

% OBTAINED	GRADE
90 - 100	O (Outstanding)
80 - 89	A+ (Excellent)
70 - 79	A (Very Good)
60 - 69	B+ (Good)
50 - 59	B (Above)
45 - 49	C (Average)
40 - 44	P (Pass)
< 40	F (Fail)

h) Implement Python Script to generate prime numbers series up to N.
i) Given a number x, determine whether it is Armstrong number or not. Hint: For example, 371 is an Armstrong number since 3**3 + 7**3 + 1**3 = 371. Write a program to find all Armstrong number in the range of 0 and 999.

(12)

UNIT-III

Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions. **Functions** - Defining Functions, Calling Functions, Passing Arguments, variable in python-Global and Local Variables.

a) Write a Python script to
    - create a list
    - access elements from a list
    - slice lists
    - change or add elements to a list
    - delete or remove elements from a list

b) Write a Python script to read the values from a list and to display largest and smallest numbers from list.
c) Write a Python script to compute the similarity between two lists.
d) Write a Python script to read set of values from a Tuple to perform various operations.
e) Write a Python script to perform basic dictionary operations like insert, delete and display.
f) Write a Python program to count the occurrence of each word in a given sentence.
g) Define a dictionary named population that contains the following data.

Keys	Values
Shanghai	17.8

Keys	Values
Istanbul	13.3
Karachi	13.0
Mumbai	12.5

h) Write a Python script to create Telephone Directory using dictionary and list to perform basic functions such as Add entry, Search, Delete entry, Update entry, View and Exit.
i) Implement Python script to display power of given numbers using function.
j) Implement a Python program that takes a list of words and returns the length of the longest one using function. **(12)**

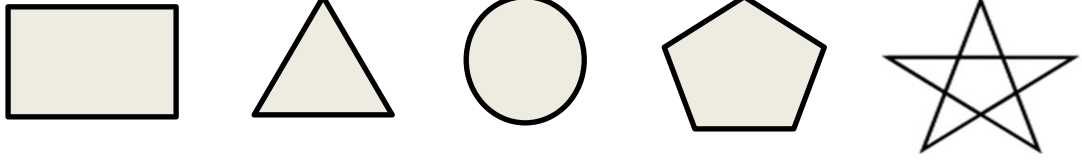
UNIT-IV
String Handling -Modules: Creating modules, import statement, from.import statement, name spacing-**Files and Directories**

a) Implement Python program to perform various operations on string using string libraries.
b) Implement Python program to remove punctuations from a given string.
c) Write a Python program to change the case of the given string (convert the string from lower case to upper case). If the entered string is "computer", your program should output "COMPUTER" without using library functions.
d) Implement Python program to capitalize each word in a string. For example, the entered sentence "god helps only people who work hard" to be converted as "God Helps Only People Who Work Hard"
e) Write a Python script to display file contents.
f) Write a Python script to copy file contents from one file to another.
g) Write a Python script to combine two text files contents and print the number of lines, sentences, words, characters and file size.
h) Write a Python commands to perform the following directory operations.
   - List Directories and Files
   - Making a New Directory
   - Renaming a Directory or a File
   - Removing Directory or File

(12)

UNIT-V
Python packages, Introduction to PIP, Installing Packages via PIP (Numpy, Pandas etc.., Using PythonPackages.
Brief Tour of the Standard Library - Dates and Times, Data Compression, Turtle Graphics. (10)

a) Create a package named Cars and build three modules in it namely, BMW, Audi and Nissan. Illustrate the modules using class. Finally we create the __init__.py file. This file will be placed inside Cars directory and can be left blank or we can put the initialization code into it.
b) Write a python script to display following shapes using turtle.



(12)

Course Outcomes:

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

1. Understand problem solving techniques and their applications.
2. Apply the basic elements and constructs of python to solve simple logical problems.
3. Demonstrate different data structures using functions.
4. Demonstrate different file operations and modules.
5. Apply object-oriented principles to build simple applications.

Text Book:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

References:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers,LLC,2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

Dept. of Electrical and Electronics Engineering

B. Tech I Year I Semester

18PHY201 PHYSICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Description:
Physics Practical course is meant for making the students to gain practical knowledge to co relate with the theoretical studies. It covers experiments on Principles of Mechanics and Optics, Measurement of Magnetic field and studying Resonance using LCR Circuit.

Course Objectives:
1. Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.
2. Illustrate the basics of mechanics, waves and optics to analyze the behavior and characteristics of various materials for its optimum utilization.
3. Develop an ability to apply the knowledge of physics experiments in the later studies.

LIST OF EXPERIMENTS: (Any 10 Out of 18)
1. Spring constant - Coupled Pendulums.
2. Study of resonance effect in series and parallel LCR circuit.
3. Determination of radius of curvature of a curved surface - Newton's Rings.
4. Wavelength of a laser - Diffraction Grating
5. Wavelength of the spectral lines - Diffraction Grating.
6. Magnetic field along the axis of a current carrying coil - Stewart Gees' Apparatus
7. Ferroelectric hysteresis (B-H Curve).***(ECE)***
8. Thickness of a given wire - Wedge Method.
9. Determination of Planck's constant. ***(EEE, CSE, CSIT, CST)***
10. Dispersive power of prism – Spectrometer.
11. Frequency of the tuning fork - Melde's apparatus.
12. Energy gap of a material of p-n junction. ***(EEE, CSE, CSIT, CST)***
13. Width of single slit - Diffraction due to Single Slit.
14. Measurement of e/m of electron (Helical Coil method) ***(ECE)***
15. Biot -Savart Law with Helmholtz Coil. ***(ECE)***
16. The Wheatstone Bridge. ***(ECE)***
17. Determination of particle size using Laser.
18. Torsional Pendulum. ***(ME & Civil)***

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Course Outcomes:

Upon successful completion of this course, the students should be able to:

1. Apply the scientific process in the conduct and reporting of experimental investigations.
2. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
3. Verify the theoretical ideas and concepts covered in lecture by doing hands on in the experiments.
4. Know about the characteristics of various materials in a practical manner and gain knowledge about various optical technique methods.
5. Acquire and interpret experimental data to examine the physical laws.

References:

1. Physics Laboratory Manual
2. Optics, A. Ghatak, 4^{th} Edition, Tata McGraw-Hill, New Delhi 2011.
3. Fundamentals of Optics, F. A. Jenkins and H. E. White, 4^{th} edition, McGraw-Hill Inc., 1981.
4. Engineering Mechanics, 2nd ed. — MK Harbola
5. Introduction to Electrodynamics- David J Griffiths

Mode of Evaluation: Continuous Internal Evaluation, Practical End Examination.

Dept. of Electrical and Electronics Engineering

B. Tech. I Year I Semester

18EEE201 ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description:
The laboratory facilitates the students to deal with electrical instruments which further strengthen the concepts & operation of various AC & DC circuits, and machines, and their characteristics. The lab also reinforce the concepts discussed in class with a hands-on approach which enable the students to gain significant experience with electrical instruments such as ammeter, voltmeter, digital multimeters, oscilloscopes, tachometer, switches, fuses and power supplies.

Course Objectives:
1. To provide hands on experience in setting up simple electrical circuits (DC and AC).
2. To get exposure to handle different electrical equipment's.
3. To measure various electrical parameters with different measuring instruments.
4. To get hands on experience in operating DC and AC machines.
5. To understand the operation of basic converters and various components of LT Switchgear.

LIST OF LABORATORY EXPERIMENTS/DEMONSTRATIONS:
DEMONSTRATIONS:
1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Study of passive components - resistors, capacitors and inductors.
2. Demonstration of voltage and current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). In star and delta connections.
3. Demonstration of cutout sections of transformer and DC & AC machines.
4. Demonstration of induction machine. Motor operation and generator operation of an induction machine driven at super-synchronous speed.
5. Familiarization of (i) different types of cables/wires and switches and their uses, (ii) different types of fuses & fuse carriers; MCB, ELCB, MCCB their ratings and uses (components of LT switchgear).

EXPERIMENTS:
1. Wiring of a simple circuit for controlling (1) a lamp/fan point, (2) Staircase or Corridor Winding.
2. Wiring of a power circuit for controlling an electrical appliance (16A Socket).
3. Verification of Kirchhoff's current and voltage laws (KCL & KVL).
4. Verification of superposition theorem
5. Sinusoidal steady state response of R-L, and R-C circuits (impedance calculation and verification).
6. Measurement of voltage, current and power in a single-phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.
7. Measurement of active power for star and delta connected balanced loads (single wattmeter method).
8. Open-circuit and short-circuit test on a single-phase transformer.
9. Speed control of separately excited DC motor.

10. Wiring of a power distribution arrangement using single phase MCB distribution board with ELCB, main switch and energy meter (or residential house wiring).
11. Regulated power supply for generating a constant DC Voltage.
12. Fabrication of a given electronic circuit on a PCB and test the same.

Course Outcomes:
Upon successful completion of the course, the students are expected to
1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of various power electronic converters.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year II Semester

Dept. of Electrical and Electronics Engineering

B. Tech I Year II Semester

18ENG101 PROFESSIONAL ENGLISH

L	T	P	C
2	0	2	3

Course Prerequisite: None

Course Description:
Communication takes place in many forms, however the major impact and effectiveness is in its professionalism. This course defines, enlightens and enables learners to engage in Professional Communication by addressing all the areas of communication – Listening, Speaking, Reading and Writing. This course also deals with various types of communication – Verbal, Non-verbal, Storytelling, Crucial Conversations, Written Communication, Vocalics, Eye Contact, Posture, etc.

Course Objectives:
This course enables the student to –
1. Engage effectively in a professional environment
2. Understand the intricacies and implications of professional communication
3. Use linguistic skills in any given context
4. Conduct self in a learning environment
5. Be better prepared for employment

UNIT I: GRAMMAR & VOCABULARY;
Grammar - Tense, Reported Speech, Modals, Conditionals; Vocabulary development - prefixes, suffixes, compound words, synonyms & antonyms. **(6)**
Practical: Dumb Charade, Giving Direction, Talking about an experiment (Tenses), Running Commentary **(6)**

UNIT II: READING SKILLS & WRITTEN COMMUNICATION;
Reading - short comprehension passages, practice in skimming, scanning and predicting; Writing- completing sentences, developing hints; Paragraph writing- topic sentence, main ideas, coherence. **(6)**

Practical: Short Passages – Reading Comprehension, Paragraph Writing, Skit Writing. **(6)**

UNIT III: VERBAL & NON-VERBAL ASPECTS;
Verbal - Introducing oneself, exchanging personal information, Using 'Wh'- Questions, asking and answering, yes or no questions-asking about routine actions and expressing opinions; **Non-Verbal** – Use of body language, combating nervousness. **(6)**
Practical: Daily Activities, Role Play, JAM **(6)**

UNIT IV: CONVERSATIONS;
Listening-short texts & conversing, formal and informal conversations, short group conversations, speaking about oneself, speaking about one's friend. **(6)**

Practical: Speaking: formal and informal conversations, short group conversations, speaking about oneself, speaking about one's friend, Character Portrayal.
Listening: Listening/watching interviews, conversations, documentaries, etc.; Listening to lectures , discussions from TV/Radio/Podcast. **(6)**

UNIT V: BUSINESS ENVIRONMENT & ETIQUETTES; sharing information of a personal kind - greeting & taking leave; Writing e-mails, memos, reports, etc. **(6)**
Practical: Mock Interview, Oral Presentation **(6)**

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

1. Read articles and understand professional communication
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind and personal letters and emails in English.

Suggested Reading/Textbooks:

1. Guy Brook Hart & Norman Whitby; Cambridge English-Business Benchmark: Pre-Intermediate to Intermediate; Published by: Cambridge University Press.
2. Adrian Doff, Craig Thaine, Herbert Puchta, et al; Empower: Intermediate (B1+); Published by: Cambridge University Press.

Reference:

1. AJ Thomson & AV Martinet; A Practical English Grammar; Oxford University Press, 2015.
2. Raymond Murphy; English Grammar in Use with CD; Cambridge University Press, 2013.
3. K.S. Yadurajan; Modern English Grammar; Oxford University Press, 2014.
4. William Strunk Jr; The Elements of Style; ITHACA, N.Y.; W.P. HUMPHREY, 2006.
5. Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P. HUMPHREY, 2006
6. Anjana Agarwal; Powerful Vocabulary Builder; New Age Publishers, 2011.
7. Writing Tutor; Advanced English Learners' Dictionary; Oxford University Press, 2012.
8. www.cambridgeenglish.org/in/
9. https://learnenglish.britishcouncil.org/en/english-grammar
10. https://www.rong-chang.com/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech. I Year II Semester

18MAT106 LINEAR ALGEBRA AND TRANSFORM CALCULUS

L	T	P	C
3	1	0	4

Course Prerequisite: 18MAT105

Course Description: Linear algebra, Transforms is one of the most important topics in the study of electrical and electronics engineering because of its widespread applications. This course is to give a presentation of basic concepts of linear algebra, Fourier and Z-Transforms through applications of engineering.

Course Objectives

1. To introduce various methods for finding rank of a matrix, solve linear equations using matrices, compute eigen values and eigenvectors.
2. To analyze the function of complex variable and its analytic property with a review of elementary complex function.
3. To apply Laplace transform and inverse Laplace transform to solve ordinary differential equations.
4. To apply Fourier transform and Inverse Fourier transform to solve sine and cosine transforms.
5. Introduce the concept of Z-transforms and its applications.

UNIT I: MATRICES
Algebra of matrices, Determinants, Inverse and rank of a matrix, Symmetric, Skew-symmetric and orthogonal matrices, System of linear equations, Eigen values and eigenvectors, Diagonalization of matrices, Cayley-Hamilton Theorem (without proof), Orthogonal transformation and quadratic to canonical forms. Nature of quadratic forms.

(12)

UNIT II: COMPLEX VARIABLE

Function of complex variable, analytic function, Cauchy's integral theorem, Cauchy's integral formula, Taylor series, Laurent series, Residue theorem, Evaluation of real definite integrals.

(12)

UNIT III: LAPLACE TRANSFORMS
Laplace transform, Properties of Laplace transform, Laplace transform of derivatives, integrals, periodic functions, unit step and delta functions. Inverse Laplace transform, convolution theorem. Solutions of ODE.

(12)

UNIT IV: FOURIER TRANSFORMS
Introduction to Fourier transforms, sine and cosine transforms, properties of Fourier transforms, Inverse Fourier sine and cosine transforms, Applications to solve boundary value problems.

(12)

UNIT V: Z - TRANSFORMS
Introduction to z-transform, properties of z- transform, Inverse z- transform, Applications to solve difference equations.

(12)

Course Outcomes

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

1. Solve the system of linear equations occurring in various fields of Engineering and obtain Eigen values and Eigenvectors.
2. Find the analytic functions, Taylor and Laurent expansions and evaluate the integrals.
3. Apply Laplace transforms in solving ordinary differential equations prevalent in engineering problems.
4. Use Fourier transforms and Inverse Fourier transforms for solving boundary value problems.
5. Apply Z-Transforms and Inverse Z- transforms for solving difference equations.

Text Book

1. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 42nd Edition, 2012.

References

1. D. Poole, “Linear Algebra: A Modern Introduction”, Brooks/Cole, 2005.
2. N.P. Bali and M. Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2008.
3. V. Krishnamurthy, V. P. Mainra and J. L. Arora, “An introduction to Linear Algebra”, Affiliated East-West press, 2005.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

B. Tech. I Year II Semester

18CHE101 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

Course Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description: Deals with the basic principles of various branches of chemistry like physical, organic, inorganic, analytical and nanomaterial chemistry.

Course Objectives:
Students will

1. Understand, analyse and determine the impurities present in the water.
2. Appreciate the synthetic organic reactions used in daily life
3. Learn the principles of spectroscopies to analyse them.
4. Value the basic concepts of thermodynamics and electrochemistry.
5. Be exposed to the importance of nano and engineering materials used in their daily life and industry.

UNIT I:IMPURITIES PRESENT IN WATER AND WATER TREATMENT
Impurities present in Water: Impurities in water(BIS and WHO standards), Hardness of water-determination of hardness - EDTA Method (numerical problems), Alkalinity of water (numerical problems) and its importance and Chlorides. Disadvantages (industry level) of using hard water. Softening of water (Ion exchange method), Treatment of brackish water by Reverse Osmosis method. Water treatment for civic applications: coagulation, sedimentation, filtration, sterilization - chlorination and ozonation. Concept of break point chlorination.

(9)

UNIT II: PERIODIC PROPERTIES AND ORGANIC REACTIONS

Periodic properties: Electronic configurations, atomic and ionic sizes, ionization energies, oxidation states, molecular geometries. Organic Reactions: Introduction to substitution (S_N^1 and S_N^2), elimination (E_1 and E_2) - Addition, Condensation and Free Radical Polymerization Reaction (only the mechanism).

(9)

UNIT III: SPECTROSCOPY
Basic Principle and Applications of UV-Visible, FT-IR, Raman, Microwave and Nuclear Magnetic Resonance (NMR) Spectroscopy.

(9)

UNIT IV: THERMODYNAMICS AND ELECTROCHEMISTRY
Thermodynamics: Systems, State Functions, Thermodynamic Functions: Work, Energy, Entropy and Free energy. Estimations of Entropy in Isothermal, Isobaric and Isochoric processes and Free Energies. Electrochemistry: Free energy and EMF. Cell potentials, the Nernst equation and applications. Batteries (Lead-Acid and Lithium ion) and Fuel-Cells (H_2-O_2 and Solid Oxide).

(9)

UNIT V: ENGINEERING MATERIALS, NANOSCIENCE & NANOTECHNOLOGY

Engineering Materials: Cement Materials and Manufacturing Process. Lubricants – definition, Properties of lubricants – Viscosity, Viscosity Index, Saponification Number, Flash Point and Pour Point. Nanomaterials: Introduction, Classes/Types, Chemical synthesis of Nanomaterials: Sol-Gel, Hydrothermal (Metal Oxide Nanoparticles) and Chemical Vapor Deposition method (Carbon Nanotubes), Characterization by powder XRD (Scherrer's equation). Applications of Nanomaterials – Energy (Hydrogen Storage and Solar Energy) and Environmental Sciences- Photocatalytic Dye Degradation (TiO_2 and ZnO)

(9)

Course Outcomes:

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

1. Analyse and determine the impurities in water such as hardness, alkalinity for sustainable development.
2. Prepare organic compounds/polymers for environmental, safety and society need.
3. Comprehend the principles and applications of spectroscopies
4. Apply the concept of free energy in thermodynamics, electrochemistry for solving the problems evolve in the engineering processes.
5. Acquire spotlight to the nanomaterials and basic engineering materials used in academics, industry and daily life.

Text Books:

1. P.W. Atkins & Julio de Paula, 'The Elements of Physical Chemistry', Ninth edition (Oxford University Press, Oxford 2010).
2. C. N. Banwell, Fundamentals of Molecular Spectroscopy, Fourth Edition, (Tata McGraw Hill, 2008).
3. Ralph H. Petrucci, F. Geoffrey Herring, Jeffry D. Madura, Carey Bissonnette, General Chemistry - Principles and Modern Applications, Tenth Edition, (Pearson, 2011).
4. Dr S. S. Dara and Dr S. S. Umare, A Text book of Engineering Chemistry,1stEdition.(S. Chand & Company Ltd, 2000).
5. T. Pradeep, Nano: The Essentials, 1st Edition, (Tata McGraw-Hill Publishing Company Limited, 2017).

References:

1. 'Physical Chemistry', D. W. Ball, First Edition, India Edition (Thomson, 2007).
2. Perry's Chemical Engineers' Handbook, Don W. Green and Marylee Z. Southard, 9th Edition (McGraw Hill, 2018).
3. Engineering Chemistry, Dr. Suba Ramesh and others, 1st Edition (Wiley India, 2011).
4. Jain and Jain, Engineering Chemistry,16th Edition (Dhanpat Rai Publishing Company (P) Ltd, 2016).
5. Amretashis Sengupta, Chandan Kumar Sarkar (eds.), Introduction to Nano Basics to Nanoscience and Nanotechnology (Springer-Verlag, Berlin, Heidelberg, 2015)

Mode of Evaluation: Assignment / Quiz, Classroom participation, Mini-project / Report, Internal Mid Examination and external semester end examination.

Dept. of Electrical and Electronics Engineering

B. Tech. I Year II Semester

18CSE102 C PROGRAMMING AND DATA STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisite: 18CSE101

Course Description:
This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:
1. To make the student understand problem solving techniques and their applications
2. Students will be able to understand the syntax and semantics of C programming language
3. Develop algorithms for manipulating stacks, queues, searching and sorting.

UNIT I: C PROGRAMMING
Structure of C Program, C Tokens: Variables, Data types, Constants, Identifiers, key words and Operators, Expressions. **Control Structures**: Conditional Statements (Simple if, if-else, Nested -if-else, Switch). Iterative Statements (for, While, Do-While), Jump Statements (break, Continue).

(9)

UNIT II: FUNCTIONS & ARRAY
Functions Introduction, User defined function, accessing a function, Function prototypes, Recursion, storage classes **Arrays**: Defining an array, processing an array, one dimensional arrays, two dimensional arrays. **Searching:** Linear and Binary search **Sorting:** Bubble Sort and Insertion Sort.

(9)

UNIT III: POINTERS AND STRUCTURE
Pointers: Fundamentals of pointer, Pointer Declarations, Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference. Dynamic memory allocation. **Structures:** Defining a structure, processing a structure.

(9)

UNIT IV: STACK AND QUEUE
Classification of Data Structure, **Stack and Queues:** stack, stack operations, stack implementations using arrays.Queue, queue operations, queue implementations using array, types of queues, applications of stack and queue.

(9)

UNIT V: STRINGS & FILES
Declaring and Defining a string, Initialization of strings, Strings Library functions **Files:** File Definition, Opening and closing a data file, Reading and Writing a data file, Files I/O Functions.

(9)

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Course Outcomes:

Upon successful completion of the course, students will be able to

1. Illustrate the use of control structures, decision making and looping statement.
2. Build programs using arrays and functions.
3. Implement the concepts of pointer, structure and list.
4. Implement storage and retrieval of ordered data using stacks and queues.
5. Illustrate the concepts of Strings and File processing.

Text Books:

1. The C Programming Language, Kernighan and Ritchie, 2 nd Edition, Prentice Hall, India 1988.
2. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.

References:

1. Programming in ANSI C, E. Balagurusamy, Sixth Edition, Tata Mc-Graw Hill Publishing Co.Ltd.-New Delhi
2. Problem Solving & Program Design in C, Hanly, Jeri R and Elliot. B Koffman, Pearson Education,5th edition, 20007.
3. K. N. King ,"C Programming ": A Modern Approach, 2nd Edition 2nd Edition
4. Byron Gottfried , Jitender Chhabra , Programming with C (Schaum's Outlines Series)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech. I Year II Semester

18ME101 ENGINEERING GRAPHICS

L	T	P	C
2	0	3	3.5

Course Prerequisite: None

Course Description:
Introduction to AutoCAD commands, simple drawings, orthographic projections, projection of points, lines, planes; auxiliary projections; projections and sections of solids; development and intersection of surfaces; isometric projections.

Course Objectives:
1. Engineering Graphics is the primary medium for development and communicating design concepts.
2. Through this course the students are trained in Engineering Graphics concepts with the use of AutoCAD.
3. The latest ISI code of practice is followed while preparing the drawings using AutoCAD.
4. Computerized drawing is an upcoming technology and provides accurate and easily modifiable graphics entities.
5. Storage and Retrieval of Drawings is also very easy and it takes very less time to prepare the drawings. Also enhances the creativity.

UNIT I: INTRODUCTION TO AUTO CAD
Introduction to AutoCAD commands, simple drawings, Orthographic Projections-Theory, techniques, first angle projections and third angle projections.

(15)

UNIT II: PROJECTIONS OF POINTS & LINES
Projections of points: Positions, notation system and projections. Projections of lines: positions, terms used, different cases, traces of lines and finding true lengths, auxiliary projections.

(15)

UNIT III: PROJECTIONS OF PLANES & SOLIDS
Projections of planes: positions, terms used, different cases and projections procedure. Projections of Solids: Projections of Regular Solids inclined to one planes.

(15)

UNIT IV: SECTIONS AND DEVELOPMENTS OF SOLIDS
Section Planes and Sectional View of Right Regular Solids-Prism, cylinder. True shapes of the sections. Development of Surfaces of Right Regular Solids-Prism, Cylinder and their Sectional Parts.

(15)

UNIT V: INTERSECTIONS & ISOMETRIC PROJECTIONS
Intersections of surfaces of solids: Intersection between: Line-plane, Plane-plane, line-solid, solid-solid. **Isometric Projections**: Theory of isometric drawing, construction of isometric projection from orthographic.

(15)

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Course Outcomes:
The students after completing the course will be able to:

1. Identify various commands in AutoCAD and their usage for engineering graphics
2. Draw the projections of points and straight lines with AutoCAD
3. Draw the projections of the planes and sections of solids.
4. Sketch the intersections of surfaces and developments of solids
5. Draw the conversion of the orthographic views to isometric views and vice versa.

Text Book:

1. D.M. Kulkarni, A.P. Rastogi and A.M. Sarkar., Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi 2009.

References:

1. Dhananjay A Jolhe, Engineering Drawing: with an introduction to AutoCAD, Tata McGraw Hill, 2008
2. Warren J. Luzadder& Jon M. Duff Fundamentals of Engineering Drawing, 11th edition, Prentice Hall of India, New Delhi.ss

Mode of Evaluation : Lab classes Evaluation, Mid and End Examination

Dept. of Electrical and Electronics Engineering

B. Tech I Year II Semester

18CHE201 CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites: Basic Chemistry at Intermediate or equivalent level.

Course Description:
It deals with basic principles of volumetric and instrumental analytical methods.

Course Objective:
This Engineering Chemistry Laboratory is common to all branches of I Year B Tech. At the end of the course the student is expected to Students will

1. Learn to estimate the chemical impurities present in water such as hardness, alkalinity, chlorine, etc.
2. Understand and experience the formation of inorganic complex and analytical technique for trace metal determination.
3. Be trained to use the instruments to practically understand the concepts of electrochemistry.
4. Bridge theoretical concepts and their practical engineering applications, thus highlighting the role of chemistry in engineering.

Learn and understand the practical implementation of fundamental concepts.

LAB EXPERIMENTS (12 EXPERIMENTS)

1. Estimation of total, permanent and temporary hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Adsorption of acetic acid by charcoal.
4. Determination of molecular weight of a polymer by using Ostwald's viscometer.
5. Determination of rate constant of an ester hydrolysis (Pseudo First Order reaction).
6. Determination of strength of a Strong acid (conc. H_2SO_4) by conductometric titration (Neutralisation Titration).
7. Conductometric titration of $BaCl_2$ Vs Na_2SO_4 (Precipitation Titration).
8. Dissociation constant of weak electrolyte by Conductometry.
9. Determination of percentage of Iron in Cement sample by colorimetry.
10. Estimation of ferrous ion by Potentiometric titration (Redox Titration).
11. Saponification value of oil.
12. Formation of Iron- 1,10-phenanthroline complex and determination of iron bycolorimetry.

Course Outcome:
After the completion of the Engineering Chemistry Laboratory experiments, students will be able to

1. Develop and perform analytical chemistry techniques to address the water related problems (for e.g., hardness, alkalinity present in water) technically.
2. Handle electro-analytical instruments like digital conductivity meter and potentiometer to perform neutralization, precipitation and redox titrations respectively.
3. Acquire practical skills to handle spectro-photochemical methods to verify Beer-Lambert's Law.
4. Operate various instruments for the analysis of materials and produce accurate results in a given time frame.
5. Think innovatively and improve the creative skills that are essential for solving engineering problems.

Text Book:

1. Engineering Chemistry Lab Manual (2017-18), Dept. of Chemistry, Madanapalle Institute of Technology and Science, Madanapalle – 517325, Chittoor Dist., Andhra Pradesh, India.
2. "Vogel's Textbook of Qualitative Chemical Analysis", Arthur Israel Vogel, Prentice Hall, 2000.
3. Laboratory Manual on Engineering Chemistry, by Dr Sudha Rani, Dhanpat Rai Publishing house, 2009.
4. A Text book on Experiments and calculations in Engineering Chemistry, by SS Dara, S Chand publications, 2015.
5. Laboratory Manual of Organic Chemistry, by Raj K Bansal, Wiley Eastern Limited, New age international limited, 2009.

Mode of evaluation: Continuous Internal Evaluation and End Semester Examination.

Dept. of Electrical and Electronics Engineering

B. Tech I Year II Semester

18CSE201 C PROGRAMMING AND DATA STRUCTURES LABORATORY

Course Prerequisite: 18CSE101

L	T	P	C
0	0	3	1.5

Course Description:
This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:
1. To make the student understand problem solving techniques and their applications
2. Students will be able to understand the syntax and semantics of C programming language
3. Develop algorithms for manipulating linked lists, stacks, queues, searching and sorting.

LIST OF EXPERIMENTS
1. a) Write a C program to swap the two numbers.
   b) Write a C Program to find the eligibility of admission for a Professional course based on the following criteria:
   Marks in Maths >=65
   Marks in Physics >=55
   Marks in Chemistry>=50
   OR
   Total in all three subject>=180

6. a) Write a C program to list all the factorial numbers less than or equalto an input number n.
   A number N is called a factorial number if it is the factorial of a
   Positive integer. For example, the first few factorial numbers are
   1, 2, 6, 24, 120, ...
   Note - We do not list the factorial of 0.
   b) Write a program that reads numbers which are in the range 0 to 100, till it encounters -1.

7. a) Given three points (x1, y1), (x2, y2) and (x3, y3), write a program to check if all the three points fall on onestraight line.
   b) The digital root (also called repeated digital sum) of a number is a single digit value obtained by aniterative process of summing digits. Digital sum of 65536 is 7, because 6+5+5+3+6=25 and 2+5 = 7.Write a program that takes an integer as input and prints its digital root.

8. a) Write a C program to find the series of prime numbers in the given range.
   b) Write a C Program to Check Whether a Number is Palindrome or Not.

9. a) Write a c program to check whether a given number is a perfect number or not. (Perfect number is a positive number which sum of all positive divisors excluding that number is equal to that number. For example 6 is perfect number since divisor of 6 are 1, 2 and 3. Sum of its divisor is 1 + 2+ 3 = 6)

   b) Write a C function to find the kth occurrence of an integer n in a sequence of non-negative integers, and then call your function frommain.
   Your function should be according to the following declaration:
   int find(int n, int k);
   sample example: input 3 2
   1 1 3 2 3 -1

Output: 4

10. Write a C program to find Factorial, GCD, Fibonacci, (Using recursion)

11. Your program should take as input: dimension of a square matrix N, two matrices of size N x N with integer values, and one operator symbol (+, - ,*). It must perform the Corresponding operation given below

a) Matrix Addition b) Matrix Subtraction c) Matrix Multiplication

12. One needs to first input a set of N number of ALPHABETIC Strings each representing a name of a student in an array studname [N] . Assume each string can be Max. 40 Characters long. subsequently, one needs to input Marks obtained by those students in another array marks [N] Assume that studname [I] i.e. ith student in the list of student names has obtained Marks [I] in the Marks List. You need to find out and print the Max Marks obtained by a student and also print the name of the student who has obtained this mark.

13. Implement the following searching techniques

a) Linear Search b) Binary Search

14. a) Bubble sort is a sorting algorithm that works by repeatedly stepping through lists that need to be sorted, comparing each pair of adjacent items and swapping them if they are in the wrong order. This passing procedure is repeated until no swaps are required, indicating that the list is sorted. Bubble sort gets its name because smaller elements bubble toward the top of the list. Consider an array of size 10. It will be filled it by reading 10 integers.The final output will be sorted output in Ascending Order.

b) Insertion sort is a sorting algorithm in which the elements are transferred one at a time to the right position. Here the first element in the array is considered as sorted, even if it is an unsorted array. Then each element in the array is checked with the previous elements, resulting in a growing sorted output list. With each iteration, the sorting algorithm removes one element at a time and finds the appropriate location within the sorted array and inserts it there. The iteration continues until the whole list is sorted. First an array of size 10 will be taken. We will fill it by reading 10 integers. The final output will be sorted output in Ascending Order.

15. a) Write a C program to swap two integers using pointers. You have to write a swap unction that will accept the address of two integer and swap their values

b) Write a program in C to add two numbers using pointers. You have to write the fsum() function which accepts the address of two variables and returns the sum of their values to the main function.

16. Write a C program to compute internal marks of students for five different subjects using Structures.

17. Implement the following Data Structures

a) Stack ADT b) queue ADT c) Circular queue ADT

18. a) Write a C program to implement all string operations (string length, string copy, string compare, string concatenation and string reverse) without using standard string library functions.

b) Write a C program for reading a string and assigning its base address to the character pointer to count characters are vowels or consonants.

19. a) Write a C program to copy the file contents from one file to another file (pass file names as Command line arguments).
b) Write a C program to count no of lines, words and characters in a file.

Course Outcomes:
After completing this course the students should be able to

1. Apply the concepts of control structures using C.
2. Implement the concepts of arrays and functions through C programming.
3. Develop the source code to implement the concepts of Strings, Pointers and File processing.
4. Implement sorting and searching algorithms using arrays.
5. Implement stack and queue data structures using arrays.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

Dept. of Electrical and Electronics Engineering

B. Tech. I Year II Semester

18ME201 WORKSHOP PRACTICE

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description:
This course will provide students with a hands-on experience on various basic engineering practices. This course will also provide an opportunity to the students to experience the various steps involved in the industrial product fabrication.

Course Objectives:
1. Introduction to the use of Tools, Machinery and Power tools,
2. Hands on practice in Carpentry, Fitting, Forging, Tinsmith, Plumbing, Foundry, Welding, Fabrication of plastic components, Metrology, Fabrication of Polymer Composite materials, simple machine turning and wood turning, and basic electrical connections.
3. Introduction to 3 D Printing
4. Fabrication of final product at end of the semester.

LIST OF TRADES
1. Carpentry (Cross half lap Joint and Miter Joint)
2. Fitting (Square and 'V' fit)
3. Turning (Ball pane hammer and handles)
4. Forging (S hook L hook)
5. Tin smithy (Square tray)
6. Plumbing (Wash basin and simple connection)
7. Foundry (Solid and Split pattern)
8. Welding (Arc and Gas welding)
9. Fabrication of plastic components (Pen Stand)
10. Metrology (Internal and External dimension)
11. Composite Material Sample Preparation (Demo Only)
12. Introduction of Power Tools and CNC (Demo Only)
13. Introduction to 3D Printing (Demo Only)

Course Outcomes
On successful completion of this course, the student will be able to
1. Fabricate carpentry components with suitable joint and pipe connections including plumbing works.
2. Perform welding operation to join various structures.
3. Perform basic machining operations.
4. Create the models using sheet metal and plastic works.
5. Illustrate the operations of foundry, fitting and smithy
6. Fabricate a product using composite and plastic material
7. Design and fabricate a product using the tools and skills learned in the workshop.

Suggested Text/References:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998. (v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata Mc Graw Hill House, 2017.
4. Work shop Manual / P. Kannaiah/ K.L. Narayana/ SciTech Publishers.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata Mc Graw Hill House, 2017.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

B. Tech II Year I Semester

Dept. of Electrical and Electronics Engineering

B. Tech II Year I Semester

18HUM101 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description: The Engineering Economics and Financial Accounting aims to provide an insight into production, cost analysis, market structure, Accounting Basic concepts and financial Statement Analysis. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics and accounts. This course introduces the accounting system, principles, types of accounts, and financial statements etc. The ratio analysis and financial analysis are useful to know the position of financial statements. Funds flows statements and cash flow statements are explained to know the analysis of financial matters.

Course Objectives: The course is intended to:

1. Describe the nature of engineering economics in dealing with the issues of scarcity;
2. Know the supply, demand, production and cost analysis to analyze the impact of economic events on markets;
3. Explain the performance of firms under different market structures and Price determination in various market conditions.
4. Explain the accounting principles, types of accounting and preparation of final accounts; and
5. Describe the financial analysis through ratios, funds flow and cash flow statements.

UNIT I: DEMAND ANALYSIS:

Scope and Significance of Economics- Understanding the problem of scarcity and choice - Elements of market Economy: Demand, Supply and Market Equilibrium- Theory of Demand, Elasticity of Demand, Supply and Law of Supply.

(9)

UNIT II: PRODUCTION AND COST ANALYSIS

Production Function – Short-run and long- run production – Cost Analysis: Cost concepts - Cost Structure of Firms and output decision- Break-Even Analysis (BEA) – Managerial significance and limitations of BEA - Determination of Break Even Point (Simple Problems).

(9)

UNIT III: MARKET STRUCTURE:

Classification of Markets - General Equilibrium and efficiency of Perfect competition, Monopoly, Monopolistic, Oligopoly, Duopoly – Price determination and various market conditions.

(9)

UNIT IV:BASICS OF ACCOUNTING:

Uses of Accounting - Book Keeping Vs Accounting - Double Entry System - Accounting Principles - Classification of Accounts - Rules Of Debit & Credit. Accounting Cycle: Journal, Ledger, Trial Balance. Final Accounts: Trading Account - Profit & Loss Account - Balance Sheet with Adjustments, (Simple Problems).

(9)

UNIT V: BASICS OF FINANCIAL ANALYSIS

Ratio Analysis - Liquidity, Leverage, Solvency and Profitability Ratios - Interpretation of Financial Statements - FundS Flow Statement - Capital Budgeting

(9)

Course Outcomes:

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

1. Understand Engineering economics basic concepts,
2. Analyze the concepts of demand, elasticity, supply, Production, Cost Analysis and its essence in floating of an organization,
3. Compare different market structures and identify suitable market,
4. Demonstrate an understanding and analyzing the accounting statements, and
5. Demonstrate the ability to apply knowledge of accounting concepts through Financial Statements Analysis.

Text Book:

1. Case E. Karl & Ray C. Fair, "Principles of Economics", Pearson Education, 8^{th} Edition, 2007
2. Financial Accounting, S.N. Maheshwari, Sultan Chand, 2009
3. Financial Statement Analysis, Khan and Jain, PHI, 2009
4. Financial Management, Prasanna Chandra, T.M.H, 2009

References:

1. Lipsey, R. G. & K. A. Chrystal , "Economics", Oxford University Press, 11^{th} Edition, 2007
2. Samuelson P. A. & Nordhaus W. D. "Economics", Tata McGraw-Hill 18^{th} Edition, 2007
3. Financial Management and Policy, Van Horne, James C., Pearson , 2009.
4. Financial Management, I.M. Pandey, Vikas Publications

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

B. Tech. II Year I Semester

18BIO101 LIFE SCIENCES FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Prerequisite: Basic knowledge about sciences up to intermediate or equivalent level.

Course Description:
The course deals with basic concepts of life sciences, its impact on human& universe, biological systems and functions, human physiology and metabolism.

Course Objectives:

1. Introduce the molecular basis of life.
2. Provide the basis for classification of living organisms.
3. Describe the transfer of genetic information**.**
4. Introduce the techniques used for modification of living organisms**.**
5. Describe the applications of biomaterials

UNIT I: INTRODUCTION TO LIFE SCIENCES & LIVING ORGANISMS
Why we need to study Life Sciences? Comparison and differences of biological organisms with manmade systems (Eye &Camera, Bird flying &Aircraft), Biological observations of 18th Century that led to major discoveries. Classification of living organisms, Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources.

(9)

UNIT II: BIOMOLECULES & MACROMOLECULES

Molecules of life: Water, Sugars, Starch, Cellulose, Amino acids, Structure and functions of proteins (primary, secondary, tertiary and quaternary structure),Structure and functions of nucleotides, nucleic acids, DNA (single and double strand) & RNA, hemoglobin, antibodies and enzymes, Industrial applications of enzymes and Fermentation process.

(9)

UNIT III: HUMAN PHYSIOLOGY
Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Human physiology, Neurons, Synaptic and Neuromuscular junctions.

(9)

UNIT IV: GENES, DNA & RNA
Mendel's laws, gene mapping, Mitosis and Meiosis, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation. Discuss the concept of complementation using human genetics .Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

(9)

UNIT V: METABOLISM
Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Mechanism of Photosynthesis).

(9)

Dept. of Electrical and Electronics Engineering

Course Outcomes

After studying the course, the student will be able to:

1. Explain the differences between biological organisms and manmade systems and classify organisms (L2)
2. Interpret the relationship between the structure and function of proteins, nucleic acid and summarize the industrial applications of biomolecules (L2)
3. Explain the mechanism of respiration
4. Demonstrate the mapping of genes. (L2) and explain the medical importance of gene disorders. (L2)
5. Apply thermodynamic and kinetic principles to biological systems (L2)

Text books:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press, 2011.
3. Cell and Molecular Biology by De Robetis and De Robertis.

References:

1. Alberts Et.Al. The molecular biology of the cell, 6/e, Garland Science, 2014.
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.
3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech. II Year I Semester

18EEE102 ELECTRICAL CIRCUIT ANALYSIS

L	T	P	C
3	1	0	4

Course Prerequisite: 18EEE101, 18MAT105, 18MAT106

Course Description:
This course deals with analysis techniques that can applied to all circuits from tiny ones in integrated circuits in mobile phones, to giant ones that carry power to our homes. Course covers various network theorems, steady state and transient state response of RLC circuits, single-phase and three-phase AC Systems, Two Port Networks and Laplace transform applications to network analysis.

Course Objectives:
1. To understand the various network theorems for the analysis of electrical circuits.
2. To gain knowledge about single phase and three phase circuits
3. To know the transient and steady-state response of electrical circuits
4. To calculate the various two port network parameters and to know interconnections.
5. To understand the application of Laplace transforms in network analysis.

UNIT I: NETWORK THEOREMS
Node and Mesh Analysis, Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources.

(12)

UNIT II: SINUSOIDAL STEADY STATE ANALYSIS
Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances. AC circuit analysis - effective or RMS values, average power and complex power. Three-phase circuits, Analysis of balanced three phase circuits, Analysis of three Phase unbalanced circuits.

(12)

UNIT III: SOLUTION OF FIRST AND SECOND ORDER NETWORKS
Solution of first and second order differential equations for Series R-L, R-C, RL-C circuits (DC and Sinusoidal excitation), initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

(12)

UNIT IV: TWO PORT NETWORKS
Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

(12)

UNIT V: ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS
Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Series and parallel resonances.

(12)

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Apply network theorems for the analysis of electrical circuits.
2. Obtain various parameters pertaining to single-phase and three-phase systems.
3. Obtain the transient and steady-state response of electrical circuits.
4. Calculate the different two port circuit parameters.
5. Make use of Laplace transforms for analyzing the circuits

Text Books:

1. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.
2. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.

References:

1. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.
2. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.
3. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.
4. Abhijit Chakrabarti, “Circuit Theory: Analysis and Synthesis”, Dhanpat Rai & Co., 2014.
5. Sudhakar and Shyammohan S Palli, “Network Analysis”, Tata McGraw- Hill publications, 2007.
6. N.C. Jagan and C. Lakshmi Narayana “Network Ananlysis”, BS Publications, 2nd edition, 2005

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech. II Year I Semester

18EEE103 ANALOG ELECTRONICS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course deals the characteristics, small signal model and biasing circuits of various semiconductor devices. The operational amplifier is introduced and different applications of op-amp is discussed.

Course Objectives:
1. To understand the basic concepts of semiconductor devices.
2. To learn the operationof semiconductor devices and its characteristics.
3. To gain knowledge about the working of operational amplifiers and its applications.
4. To understand the working of oscillator circuits and active filters.
5. To learn the concepts of ADC & DAC and its applications.

UNIT I: DIODE AND BJT CIRCUITS
P-N junction diode-diode current- diode capacitance, I-V characteristics of a diode; Zener diodes; clamping and clipping circuits-BJT-types of configurations-input, output characteristics-small signal model; biasing circuits-stability factor; high frequency model.

(9)

UNIT II: FET, MOSFET AND OPERATIONAL AMPLIFIER CIRCUITS
Introduction to FET–operation-characteristics-MOSFET structure-operation-characteristics; small signal model and biasing circuits; high frequency equivalent circuits; Introduction to operational amplifier-ideal op-amp-equivalent circuit-DC and AC characteristics-frequency response.

(9)

UNIT III: APPLICATIONS OF OPERATIONAL AMPLIFIER
Inverting and non-inverting amplifier-differential amplifier; instrumentation amplifier; differentiator; integrator; programmable gain amplifier-comparators-schimtt trigger; sample and hold circuits-voltage regulators; introduction to phase lock loop circuits.

(9)

UNIT IV: SIGNAL GENERATORS AND ACTIVE FILTERS
Sinusoidal oscillator-RC phase shift-wein bridge oscillator-crystal oscillator-RC relaxation oscillator; 555 timer-abatable operation-PWM generation-active filters-first and second order-low pass and high pass filters-frequency response.

(9)

UNIT V: DATA CONVERTERS& APPLICATIONS
Data Converters: Introduction-Digital-to-Analog converters-weighted registers-R-2R ladder-inverted R-2R ladder; Analog-to-Digital converters-Successive approximations- flash ADC-dual slope ADC-characteristics; MEMS, Typical IC sensors.

(9)

Course Outcomes:
1. Understand the basic concepts of semiconductor devices.
2. Learn the operation of semiconductor devices and its characteristics.
3. Understand the working of operational amplifiers and its applications.
4. Understand the working of oscillator circuits and active filters.
5. Learn the concepts of ADC & DAC and its applications.

Text Books:

1. A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.

References:

1. J. Millman and A. Grabel, “ Microelectronics”, McGraw Hill Education, 1988.
2. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
3. P. R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech. II Year I Semester

18EEE104 DC MACHINES AND TRANSFORMERS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18PHY102

Course Description:
This course is designed to obtain thorough knowledge on performance and control of dc machines, Single phase, three phase transformers and Autotransformers during normal and extreme working conditions. Course covers basic theory of electromagnetic circuits and its application in dc machines and transformers, performance, testing, applications and control of electromechanical and static energy equipment's like DC Generator, DC Shunt, Series and Compound motor and Transformers. To have hands-on experience by testing transformers and electrical machines to evaluate their performance.

Course Objectives:
1. To study the concepts related to Magnetic and Electromagnetic Circuits.
2. To familiarize with the constructional details, principle of operation, prediction of performance, the methods of testing of dc generator.
3. To impart knowledge on construction, principle of operation and control of DC motors.
4. To acquaint with the constructional details, the principle of operation, prediction of performance, the methods of testing the Single-phase transformer and Autotransformer.
5. Inference the operation of three phase transformers circuits.

UNIT I:MAGNETIC FIELDS AND ELECTROMAGNETIC CIRCUIT'S, FORCE AND TORQUE
Review of magnetic field - MMF, flux, reluctance, inductance; Visualization of magnetic fields produced by a bar magnet and a current carrying coil; influence of highly permeable materials on the magnetic flux lines. Magnetic circuits - energy stored in the magnetic circuit linear and non-linear circuits; Force and Torque - force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element.

(9)

UNITII: DC GENERATOR
Basic construction, Operation and magnetic structure of a DC Generator- visualization, Demonstration of magnetic field produced by the field winding excitation with armature winding open, Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation. Induced EMF in an armature coil; Armature Reaction; Open circuit characteristic of separately excited DC generator; Types of field excitations – separately excited, shunt, series and Compound; Testing - voltage build-up in a shunt generator, critical field resistance and critical speed.

(9)

UNIT III: DC MOTOR
Basic construction, Operation and magnetic structure of a DC motor - air gap flux density distribution, Back EMF in an armature coil. Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, Types of field excitations – separately excited, shunt, series and Compound; V-I characteristics and torque-speed characteristics of separately excited, shunt, series and Compound motors; Testing - starting of DC Motors, Speed control, Losses, load testing, Swinburne's test and back-to-back testing of DC machines.

(9)

UNIT IV: SINGLE PHASE TRANSFORMER AND AUTOTRANSFORMER
Single Phase Transformers- Principle, construction and operation, EMF equation, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency; Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses, Parallel operation; Autotransformers - construction, principle, applications and comparison with two winding transformers.

(9)

UNITV: THREE-PHASE TRANSFORMER
construction, Principle and operation, types of connection and their comparative features, Cooling of transformers; Testing - Parallel operation of three-phase transformers, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap changing of transformers, Three-winding transformers.

(9)

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Demonstrate the concepts of magnetic circuits.
2. Evaluate the application of magnetic circuits in dc machines
3. Understand the operation of dc machine as Motor and Generator.
4. Analyse the differences in operation of different dc machine configurations.
5. Inference the operation of single phase and three phase transformers circuits.

Text Books:
1. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
2. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

References:
1. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
2. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
3. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech II Year I Semester

18ENG201 ENGLISH COMMUNICATION - LISTENING & SPEAKING LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18ENG101

Course Description:
As the **s**tudents are being exposed to the global language 'English; it has become a widespread need. This course builds on what was offered in the first semester and facilitates deeper understanding into the mechanics of the English language, especially in regard to two particular skills, i.e. Listening and Speaking. This course is offered in order to help students cultivate and nurture a mind that "thinks in English." Intricate issues of pronunciation, modulation, timbre are dealt with in regard to Speaking and also the sub-skills of Listening, thus the whole course is entirely lab oriented.

Course Objectives:
This course enables students to –

1. Hone in on their listening skills
2. Grasp the differences between native level and mother-tongue influenced pronunciation
3. Develop crucial speaking skills
4. Enhance vocabulary for greater communicative impact
5. Overall development of thinking in the English language

UNIT I: Listening; Understanding key vocabulary; Listening for main ideas; Listening in detail; Syllable stress; Sentence stress; Presentation.
(12)

UNIT II: Vocabulary for important places (bank, library, restaurant, etc.); Prepositions for places; Stress determiners (this & that); Intonation.
(12)

UNIT III: Using background knowledge; Collocations; Pronouncing clusters of consonants (e.g. –gh, -ing, ph, ck); Mapping ideas; Pronunciation of phrases; Listening for opinion; Vocabulary and collocations for jobs
(12)

UNIT IV: Listening for lecture organization; Text organization features; Phrases with make; Evaluating and proposing ideas; Expressing attitudes
(12)

UNIT V: Identifying opposing viewpoints; Silent letters; Idioms; Fixed expressions; Phrasal verbs **(12)**

Course Outcomes:

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

1. Listening with intent
2. Pronounce more fluently
3. Develop crucial thinking skills
4. Enhance vocabulary
5. Overall development in the English language

Suggested Reading/Textbook:

1. Sabina Ostrowska; Unlock 3 series(B1): Listening & Speaking; Published by: Cambridge University Press.

Reference:

1. Gary Buck; Assessing Listening; Cambridge University Press, 2010.
2. Adrian Doff, Craig Thaine, Herbert Puchta, et al; Empower: Upper Intermediate (B2+); Published by: Cambridge University Press.
3. Josh Sreedharan; The Four Skills for Communication; Cambridge University Press, 2014.
4. William Strunk Jr; The Elements of Style; ITHACA, N.Y.; W.P. HUMPHREY, 2006.
5. Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P. HUMPHREY, 2006.
6. Miles Carven; Listening Extra; Cambridge University Press, 2008.
7. Jayashree Mohanraj; Speak Well; Orient Blackswan, 2013.
8. F. Kipple; Keep Talking; Cambridge University Press, 2013.
9. www.cambridgeenglish.org/in/
10. https://learnenglish.britishcouncil.org/en/english-grammar
11. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech. II Year I Semester

18EEE202 ANALOG ELECTRONICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18EEE201

Course Objectives:
1. To design amplifier circuits using transistors.
2. To design amplifier circuits using op-amps.
3. To design oscillator circuits.
4. To design filter circuits.

LIST OF EXPERIMENTS

1. Common Emitter Amplifier
2. Characteristics of MOSFET
3. High Input Resistance Transistor Amplifier
4. Basic Configuration and characteristics of Op-amp
5. Study of Feed Back Amplifiers using Op-amp
6. Instrumentation Amplifier, Arithmetic Operation using Op-Amp
7. Study of Active Filters
8. Precision Circuit
9. Sinusoidal and Non-Sinusoidal Oscillators
10. Integrated Circuit Timer and Phase Locked Loop
11. IC Fixed and adjustable Voltage Regulators
12. Magnitude comparator and window detector using Op-Amp

Project Based Learning: Every student should design an analog electronic circuit and test the same.

Course Outcomes:
At the end of this lab, student will able to
1. Understand the characteristics of transistors.
2. Design and analyse various rectifier and amplifier circuits.
3. Design sinusoidal and non-sinusoidal oscillators.
4. Understand the functioning of OP-AMPs
5. Design of OP-AMP based circuits.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech. II Year I Semester

18EEE203 DC MACHINES AND TRANSFORMERS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18EEE201

Course Objectives:

1. To conduct various tests on transformers.
2. To analyse the Open circuit and load. Characteristics of DC separately excited shunt generator.
3. To conduct and analyse the load test on DC shunt, series and compound motors.
4. To examine the self-excitation in DC generators.
5. To Pre-determine and determine the efficiency of different DC machines.

LIST OF EXPERIMENTS

1. Scott connection.
2. Sumpner's test on transformer.
3. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
4. Hopkinson's test.
5. Swinburne's test and Speed control on DC Motor.
6. Load test on DC shunt generator. Determination of characteristics.
7. Load test on DC series generator. Determination of characteristics.
8. Brake test on DC shunt motor. Determination of performance curves.
9. Field's test on DC series machines. Predetermination of efficiency
10. Load test on DC compound generator. Determination of characteristics.
11. Parallel operation of single-phase transformers
12. Three-phase transformer connections
13. Retardation test on DC shunt motor. Determination of losses at rated speed.
14. Electrical Braking in DC Shunt Motor
15. Simulation Experiments on Transformer and DC Machines

Course Outcomes:

At the end of this lab, student will able to

1. Start and control the Different DC Machines.
2. Assess the performance of different machines using different testing methods
3. Analyse the Open circuit and load. Characteristics of DC separately and self-excited shunt generator
4. Conduct various test on Transformer
5. Analyse various method to determine the efficiency of DC machine.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year II Semester

Dept. of Electrical and Electronics Engineering

B. Tech. II Year II Semester

18HUM102 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description: The course provides students with a practical and concrete explanation of management concepts and techniques they will need to manage today's and tomorrow's organizations. The course will follow the "planning, organizing, leading, controlling" format of managerial functions while putting together many small pictures presented by individual modules into one bigger meaningful picture in which managerial knowledge would apply. At the end of the course students are expected to understand role of components of bigger picture and interactions between and among components.

Course Objectives:

The course is intended to:

1. Describe the concepts of Management theories, approaches and their application with organizations around us;
2. Know the concepts of planning and management;
3. Explain the basic concepts of organization, types and structure of organization;
4. Make the students know leading, good communication, theories of motivation;
5. Explain about controlling, managing operations and functional areas of marketing and financial management.

UNIT I: INTRODUCTION:

Introduction to Management and Organizations- Management definition, skills, roles, goals and functions of a manager, organization, value of studying management - Managing in a Global Environment- Global Perspective, Understanding global environment, - Social Responsibility and Managerial Ethics.

(9)

UNIT II: PLANNING

Decision-making process, Types of decisions and decision making conditions, styles, biases and errors, Planning: Meaning of planning, establishing goals and developing plans, contemporary issues in planning - Strategic Management-Importance of strategic management, strategic management process, types of organizational strategies, current issues in strategic management.

(9)

UNIT III: ORGANIZING:

Organizational structures - HRM process, Contemporary issues in HRM – Departmentation – decentralization – delegation of Authority -Managing Change and Innovations.

(9)

UNIT IV: COMMUNICATION, MOTIVATION AND LEADING

Functions of communication, Inter-personal communication, Barriers of Communication – Understanding Information Technology- Motivation**:** Theories of motivation and current issues in motivation. Leading: Leaders and Leadership, Leadership theories - Leadership issues in twenty first century.

(9)

UNIT V: CONTROLLING

Process of control – Types of Control - feed-forward, concurrent and feedback controls, contemporary issues in control –Strategic role of Operations Management - Value Chain Management

(9)

Course Outcomes:

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

1. Understand the various concepts, approaches and theories of management in the real situation,
2. Analyze the concept of planning and apply on the decisions in strategic management,
3. Compare organization structure designs and chart diligently with theoretical learning concepts,
4. Apply communication and theories of motivation in an organization, and
5. Understand various tools for controlling organizational performance and apply to achieve the corporate objectives.

Text Book:

1. Stephen P. Robbins, Mary Coulter "Management", Pearson Education, 2010, 10th edition.

References:

1. Gary Dessler, "Management", Prentice Hall, Inc., 1998, 1st edition.
2. Daft Richard L. 'Management' Thomson South Western, 5th edition.
3. Koontz H. and Weihrich H., "Essentials of Management", McGraw Hill Int. ed., 2004, 6th edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

B. Tech. II Year II Semester

18MAT104 PROBABILITY AND STATISTICS

L	T	P	C
3	0	0	3

Course Prerequisite: 18MAT105, 18MAT106

Course Description:
This course provides an introduction to probability, distributions and statistics with applications. Topics include: Conditional probability, Random variables, Probability distributions, Joint densities, Bayesian inference, Hypothesis testing, Confidence intervals, Correlation and linear regression.

Course Objectives:

The objectives of this course are

1. To revise the elementary concepts of probability
2. To extend and formalize knowledge of the theory of probability and random variables.
3. To analyze and interpret basic summary and modeling techniques for Multi-variate data
4. To introduce techniques for carrying out probability calculations and identifying probability distributions.
5. To understand the foundations for statistical inference involving confidence intervals and hypothesis testing.

UNIT I: BASIC PROBABILITY
Introduction to Probability, sample space and events, Axioms of probability, theorems on probability, conditional probability, multiplication theorem and independence of events, Bayes theorem.

(9)

UNIT II: RANDOM VARIABLES & EXPECTATION

Random Variables - Types of Random Variables - Probability Mass Function - Probability Density Function- Distribution Function and its properties-. Expectation – Properties of Expected Value - Variance - Moment generating function- Chebychev's inequality.

(9)

UNIT III: BI-VARIATE RANDOM VARIABLES

Joint Densities and Independence - Marginal Distributions (discrete & continuous)- Transformation of Random Variables - Conditional Distributions and Expectations –Covariance-Correlation - Multiple Linear Regression Models.

(9)

UNIT IV: PROBABILITY DISTRIBUTIONS

Discrete Distributions: Bernoulli trail, Binomial distribution, Poisson approximation to the binomial distribution, Poisson distribution and Hyper geometric distribution –properties.

Continuous Distributions: Uniform distribution, Exponential distribution, Gamma distribution, Normal distribution.

(9)

UNIT V: HYPOTHESIS TESTING

Point and interval estimation, Hypothesis Testing- Introduction, Significance Levels, Tests Concerning the Mean of a Normal Population (σ know and unknown), Testing the Equality of Means of Two Normal Populations, Case of Unknown and Unequal Variances, The Paired *t*-Test , Hypothesis Tests Concerning proportions.

(9)

Course Outcomes:
On successful completion of this course, student will be able to:

1. Understand the probability concepts and their importance in engineering.
2. Apply discrete and continuous probability distributions to solve various engineering problems.
3. Get an idea about joint density functions, distribution functions to the random variables and analyze the multivariate problems in engineering
4. Apply the method of least squares to estimate the parameters of a regression model.
5. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.

Text Book:

1. Sheldon M. Ross: Introduction to Probability and Statistics for Engineers and Scientists, 4^{th} Edition, Elsevier, Academic Press, 2010.

References:

1. J.S. Milton and J.C. Arnold, Introduction to Probability and Statistics, 4^{th} edition, 2003 Tata McGraw-Hill Publications.
2. Walpole, R.E., Myers R.H., Myer S.L., Ye. K: Probability and Statistics for Engineers and Scientists, 8^{th} ed., Pearson Education, 2008.
3. Johnson, R.A. Miller Freund's: Probability and Statistics, 7^{th} Edition, PHI, 2005.
4. Sheldon Ross: A First Course in Probability, 6^{th} Edition, Pearson Education, 2002.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

B. Tech. II Year II Semester

18EEE105 ELECTROMAGNETIC FIELDS

L	T	P	C
2	1	0	3

Course Prerequisite: 18EEE101, 18PHY102

Course Description:
This course facilitates the students with the fundamentals of electromagnetic fields and their applications in Electrical Engineering. In specific, the course gives an insight of vector calculus, electrostatics and magnetostatics, time varying electric fields and electromagnetic waves.

Course Objectives:
1. To recall the basic knowledge of vector calculus.
2. To understand the concept of electrostatics, electrical potential, dipole, energy density and their applications.
3. To evaluate the concept of magnetostatics, magnetic flux density, scalar and vector potential and their applications.
4. To interpret Maxwell's equations and to understand the concept of Faraday's laws and induced emf.
5. To learn the concept of electromagnetic waves and Poynting theorem.

UNIT I: INTRODUCTION
Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, tripe products, three orthogonal coordinate systems (rectangular, cylindrical and spherical), transformation between co-ordinate systems, vector calculus differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl.

(9)

UNIT II: ELECTROSTATICS
Coulomb's law, electric field intensity, electrical field due to point charges, line, surface and volume charge distributions, Gauss law and its applications, potential difference, calculation of potential differences for different configurations, electric dipole, electrostatic energy and energy density, current and current density, continuity of current, boundary conditions capacitance (concentric sphere, co-axial cable, parallel two wire line), Poisson's equation, Laplace's equation

(9)

UNIT III: MAGNETOSTATICS
Magnetic flux and magnetic flux density, Lorentz law of force, Biot-Savart law, Ampere Law, scalar and vector magnetic potentials. Steady magnetic fields produced by current carrying conductors. Force – on moving charge- on differential current element - between differential current elements, magnetization and permeability, magnetic boundary conditions, self and mutual inductances.

(9)

UNIT IV: TIME VARYING FIELDS AND MAXWELL'S EQUATIONS
Faraday's law for electromagnetic induction, induced EMF, displacement current, divergence and stroke's theorems, point form of Maxwell's equation, integral form of Maxwell's equations, motional electromotive forces, boundary Conditions.

(9)

UNIT V: ELECTROMAGNETIC WAVES

Derivation of wave equation, polarization and types of polarization, uniform plane waves, Maxwell's equation in phasor form, wave equation in phasor form, plane waves in free space and in a homogenous material, wave equation for a conducting medium, plane waves in lossy dielectrics, propagation in good conductors, reflection and refraction, skin effect, poynting theorem.

(9)

Course Outcomes:

Upon successful completion of the course, students will be able to

1. To understand and the basic laws of electromagnetism.
2. To estimate the electric field intensity, potential and capacitance for different configurations.
3. To obtain the electric and magnetic fields for simple configurations under static conditions.
4. To understand Maxwell's equation in different forms and in different media.
5. To understand the propagation of EM waves.

Text Books:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.

References:

1. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
2. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
3. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.
4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
6. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
7. B.D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech. II Year II Semester

18EEE106 DIGITAL ELECTRONICS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18EEE103

Course Description:
This course imparts knowledge of the basics of digital circuits and to provide methods and procedures suitable for a variety of digital design applications. This course covers number systems, logic gates, different minimization techniques for Boolean expressions, design and analysis of combinational circuits and sequential circuits, memory units and programmable devices and basics of Verilog in realization of digital circuits.

Course Objectives:
1. To introduce various number systems, logic gates and different minimization techniques for Boolean expressions.
2. To outline the formal procedures for the analysis and design of combinational circuits
3. To outline the formal procedures for the analysis and design of sequential circuits
4. To introduce the number systems and digital logic families.
5. To introduce digital simulation for development of application oriented logic circuits.

UNIT I: FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES
Digital signals, Digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates.Number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes. Characteristics of digital lCs, Digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

(9)

UNIT II: COMBINATIONAL DIGITAL CIRCUITS
Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions.
Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, Digital comparator, Parity checker/generator, Code converters, Priority encoders, Decoders/drivers for display devices, Q-M method of function realization.

(9)

UNIT III: SEQUENTIAL CIRCUITS AND SYSTEMS
A 1-bit memory, the circuit properties of bistable latch, the clocked SR flip flop, J- K-T And D-types flip flops, applications of flipflops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter. State Machines- Moore and Mealy, State Diagram, State Table, State Reduction and Assignment Design Procedure -Circuit implementation.Ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

(9)

UNIT IV: DIGITAL LOGIC FAMILIES
Review of number systems, binary codes, error detection and correction codes. Digital Logic Families – Introduction to RTL, DTL, TTL, ECL and MOSL families –operation, characteristics of digital logic family – comparison of different logic families.

(9)

UNIT V: SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

(9)

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Understand working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the digital logic families and their operation.
4. Use PLDs to implement the given logical problem.

Text Books:

1. M. Moris Mano and Michael D. Ciletti "Digital Design", PHI, 4th Edition, 2007.
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

References:

1. Charles H. Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
2. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
3. John F. Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008.
4. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
5. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011.
6. Donald D. Givone, "Digital Principles and Design", TMH, 2003.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech II Year II Semester

18EEE107 INDUCTION AND SYNCHRONOUS MACHINES

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18PHY102

Course Description:
This course is designed to obtain thorough knowledge on AC machinery fundamentals, machine parts, operation of Single phase and Three phase AC machines. The course also equips students with ability to understand and analyse the phasor diagrams and equivalent circuits of AC Induction and Synchronous Machines. Course covers Theory, performance, testing, applications and control of electromechanical energy converters like Induction machines, synchronous machines. To have hands-on experience by testing Single phase, three phase Induction motor and synchronous machines to evaluate their performance.

Course Objectives:
1. To emphasize the basic concepts of AC rotating machines.
2. To deal with the detailed analysis of Synchronous generators and motors.
3. To introduce the concept of parallel operation of synchronous generators.
4. To deal with the detailed analysis of polyphase induction motors.
5. To understand operation, construction and types of single phase motors and their applications in house hold appliances and control systems.

UNIT I: FUNDAMENTALS OF AC MACHINE WINDINGS
Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Rotating Magnetic field: Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

(9)

UNIT II: SYNCHRONOUS GENERATOR
EMF equation, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation by synchronous impedance method, M.M.F. method, Parallel operation of alternators - synchronization and load division, control of P and Q outputs - operating chart for synchronous machine. Salient pole machine - two reaction theory, Synchronous Condenser.

(9)

UNIT III: SYNCHRONOUS MOTOR
Principle of operation - different starting methods- equivalent circuit - effect of load changes on synchronous motor - mechanical load diagram - armature current as function of power developed and excitation - V curves - inverted V curves - transition of a machine from generator mode to motor mode - phasor diagram - torque and power relations - hunting - periodicity of hunting - suppression.

(9)

UNIT IV: INDUCTION MOTORS

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit, Circle diagram, Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Induction Generator operation.

(9)

UNIT V: FRACTIONAL HORSE POWER MACHINES

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications, Introduction to BLDC, SRM, Stepper Motors.

(9)

Course Outcomes:

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

1. Understand the operating principles of different ac machines.
2. Understand the design of stator and rotor of ac machines.
3. Demonstrate practical testing of different ac machines.
4. Inference the theory of single phase induction motor.
5. Understand the operation of special electrical machines.

Text Books:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

References:

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.
5. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.
6. K. Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.

Mode of Evaluation: Assignments, Internal Mid Examination, External End Examination**.**

Dept. of Electrical and Electronics Engineering

B. Tech. II Year II Semester

18EEE108 CONTROL SYSTEMS

L	T	P	C
2	1	0	3

Course Prerequisite: 18EEE101, 18MAT105, 18MAT106

Course Description:

This course tries to bring out the basic principles of Feedback Control Systems. Course covers modelling of various physical systems, block diagram reduction techniques, signal flow graph, time domain analysis of continuous systems, role of different controllers, bode plot, Nyquist criterion, lag, lead and lag-lead compensators design using bode plot and root locus, Routh stability criterion, state space representation of continuous systems.

Course Objectives:

1. To understand the use of transfer function models for analysis physical systems and introduce the control system components.
2. To provide adequate knowledge in the time response of systems and steady state error analysis.
3. To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
4. To introduce stability analysis and design of compensators.
5. To introduce state variable representation of physical systems and study the effect of state feedback

UNIT I: INTRODUCTION TO CONTROL PROBLEM AND SYSTEM MODELING

Industrial Control examples. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Transfer function models of linear time-invariant systems. Control hardware and their models. Block diagrams and Signal flow graphs.

(9)

UNIT II: TIME RESPONSE ANALYSIS

Standard test signals. Time response of first and second order systems for standard test inputs. Steady state response - Steady state errors and error constants. Application of Proportional, Integral and Derivative Controllers.

(9)

UNIT III: CONCEPT OF STABLITY AND ROOT LOCUS

Concept of Stability, Routh-Hurwitz Criteria. Relative Stability analysis, Root-Locus technique. Construction of Root-loci. Design specifications for second-order systems based on the time-response.

(9)

UNIT IV: FREQUENCY-RESPONSE ANALYSIS

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response. Lead and Lag compensation in designs.

(9)

UNIT V: STATE VARIABLE ANALYSIS

Concepts of state variables. State space model. State transition matrix. Solution of state equations. Eigenvalues and Stability Analysis.

(9)

Course Outcomes:

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

1. Apply the knowledge of engineering fundamentals to form mathematical model and obtain transfer function.
2. Solve to get time domain response of LTI system.
3. Analyse stability of the system in time domain using classical techniques.
4. Analyse stability of the system in frequency domain using classical techniques.
5. Model and analyse the control system in state space.

Text Books:

1. M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education, 1997.
2. I. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International, 2009

References:

1. K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.
2. B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.

Mode of Evaluation: Assignments, Internal Mid Examination, External End Examination.

B. Tech. II Year II Semester

18EEE204 DIGITAL ELECTRONICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18EEE202

Course Objectives:

1. To conduct experiments on logic gates and verify their truth tables.
2. To design and construct adder and subtractor circuits using logic gates.
3. To design & implement code converter circuits and verify the truth table.
4. To verify the truth tables of different flip flops, realize different Shift Registers and counters.
5. To realize ADC and DAC.

LIST OF EXPERIMENTS

1. (a) Study of logic gates and verify their truth tables, (b) Implementation of boolean functions.
2. Design and construct half adder, full adder using logic gates and verify the truth table.
3. Design and construct half subtractor and full subtractor circuits using logic gates
4. Design and implement BCD TO EXCESS-3 CONVERTER and verify the truth table
5. Design & implement 4-bit Binary to gray code converter/ 4-bit Gray to Binary code converter and verify the truth table.
6. Truth Table verification of different flip flops.
7. Realize and study of Shift Register. i)SISO (Serial in Serial out) ii) SIPO (Serial in Parallel out) iii) PIPO (Parallel in Parallel out) iv) PISO (Parallel in Serial out)
8. Realize (a) Ring Counter and Johnson counter, (b) 4-bit binary up/down counter.
9. Design and test 3-bit binary asynchronous and synchronous counters.
10. Verification of Analog to Digital Converter.
11. Verification of Digital to Analog converter.
12. Understand the overall architecture of PLD's; specifically, PLA, PAL, CPLD, and FPGA families.
13. Realisation of logic gates/logic functions using universal gates.
14. Realisation MUX, DEMUX, Encoders, Decoders.

Course Outcomes:

At the end of the course, students will able to

1. Design and construct circuits using logic gates.
2. Design & implement code converter circuits.
3. Realise different Shift Registers and counters.
4. Realise ADC and DAC.
5. Realise logic functions using universal gates.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech. II Year II Semester

18EEE205 INDUCTION AND SYNCHRONOUS MACHINES LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18EEE201, 18EEE203

Course Objectives:
1. To conduct various tests on Single phase induction motor.
2. To deal with the detailed analysis of polyphase induction motors & Synchronous generators and motors.
3. To introduce the concept of regulation and its calculations.
4. To Pre-determine and determine the efficiency of alternator.
5. To introduce the concept of Synchronization of synchronous generators.

LIST OF EXPERIMENTS
1. Equivalent circuit and Load test on single phase induction motor
2. No load, blocked rotor and load test on 3 phase squirrel cage induction motor
3. Load test on Slip ring induction motor.
4. Speed Control on three phase induction motor
5. Regulation of three phase alternator by EMF and MMF methods
6. Synchronization of three phase alternator with infinite bus bar
7. V and inverted V-curves of synchronous motor
8. Determination of X_d and X_q of a salient pole synchronous machine / slip test salient pole synchronous machine.
9. Different Method of Starting of Three-Phase Squirrel Cage Induction Motor and Their Comparison. [DOL, Auto-Transformer, Star-Delta].
10. Efficiency of a three-phase alternator.
11. Measurement of sequence Impedance of a 3phase alternator.
12. Regulation of three phase alternator by slip test.

Course Outcomes:
At the end of the course, students will able to
1. Identify different parts of induction motors and synchronous motor and specify their functions.
2. Understand the operation of synchronous and induction machine.
3. Carry out different testing methods and assess the performance of synchronous and poly phase induction motors.
4. Start and control the induction motor
5. Demonstrate synchronization of alternator to infinite bus-bar.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech. II Year II Semester

18EEE206 CONTROL SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18EEE201, 18EEE203

Course Objectives:
1. To obtain the Transfer Function of separately excited D.C. Machine.
2. To study the effect of feedback on a DC Servo Motor and also to determine the characteristics of an AC Servo Motor.
3. To learn the effect of controllers on Second Order Systems and placement of compensators.
4. To understand and validate the characteristics of a DC Motor using MATLAB/ SIMULINK.
5. To carryout stability analysis of LTI systems, Compensator and State feedback Controller design using MATLAB / SIMULINK.

LIST OF EXPERIMENTS

Hardware experiments:
1. Transfer Function of separately excited D.C. Machine
2. Effect of Feedback on DC Servo Motor
3. Characteristics of AC Servo Motor
4. Effect of P, PD, PI, PID Controller on a Second Order Systems
5. Lag and Lead Compensation – Magnitude and Phase Plot
6. Temperature Controller Using PID

Simulation Experiments:
1. State Space Modeling of DC Motor and validation of its characteristics using MATLAB/ SIMULINK
2. Stability analysis (Bode, Root Locus, Nyquist) of LTI system using MATLAB / SIMULINK
3. Compensator design and simulation using MATLAB- PI and PID controllers
4. State feedback Controller design for Inverted-pendulum using MATLAB / SIMULINK
5. Study of stable and unstable limit cycle behaviour of nonlinear systems using MATLAB / SIMULINK

Project Based Learning: Every student should design a controller for any specific application and test the stability of the same.

Course Outcomes:
At the end of the course, students will able to
1. Obtain the Transfer Function of separately excited D.C. Machine.
2. Understand the effect of feedback on a DC Servo Motor and also to determine the characteristics of an AC Servo Motor.
3. Learn the effect of controllers on Second Order Systems and placement of compensators.
4. Understand and validate the characteristics of a DC Motor using MATLAB/ SIMULINK.
5. Carryout stability analysis of LTI systems, Compensator and State feedback Controller design using MATLAB / SIMULINK.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year I Semester

Dept. of Electrical and Electronics Engineering

B. Tech III Year I Semester

18ENG102 ENGLISH COMMUNICATION – READING AND WRITTING

L	T	P	C
2	0	0	2

Course Prerequisite: None

Course Description:
Students being exposed to the global language 'English' has become a widespread need. This course builds on what was offered in the first semester and facilitates deeper understanding into the mechanics of the English language, especially in regards to 2 particular skills, i.e. Reading and Writing. This course is offered in order to help students cultivate and nurture a mind that "thinks in English." Intricate issues of understanding academic texts, vocabulary needed to comprehend texts, evaluate and analyze writing tasks, etc.

Course Objectives:
This course enables students to
1. Hone in on their reading skills
2. Cultivate critical reading and writing skills
3. Develop crucial comprehension of texts, graphs and graphics
4. Enhance vocabulary for greater communicative impact
5. Overall development in the English language

UNIT I: Reading for main ideas; Applying background knowledge to predict content; Skimming; Scanning; Making inferences; Understanding discourse. **(6)**

UNIT II: Identifying audience; Reading for detail; Using visuals; Academic vocabulary, collocations and synonyms. **(6)**

UNIT III: Scanning to find crucial information; Using critical thinking to identify purpose; Previewing; Topic related vocabulary; Writing an introduction; Essay structure; Descriptive paragraphs; Writing a conclusion. **(6)**

UNIT IV: Analyzing essay questions; Writing a problem-solution based on graphs and graphics; Developing own ideas. **(6)**

UNIT V: Writing cause-effect paragraphs; Evaluating diagrams; Brainstorming; Academic verbs and topical language. **(6)**

Course Outcomes:
At the end of the course, learners will be able to
1. Read and comprehend academic texts, graphs, diagrams and graphics
2. Develop crucial thinking skills
3. Write purposefully and effectively
4. Enhance vocabulary
5. Overall development in the English language

Suggested Reading/Textbook:
1. Matt Firth; Unlock 3 series; Published by: Cambridge University Press

Reference:

1. Liz Driscoll; Reading Extra; Cambridge University Press – 2004
2. Graham Palmer; Writing Extra; Cambridge University Press – 2004
3. Writing Tutor; Advanced English Learners' Dictionary, 9th Edition; Oxford University Press– 2012
4. https://www.nypl.org/blog/2012/11/28/11-great-free-websites-practice-english
5. *www.readbrightly.com/6-great-websites-teen-writers/*

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech III Year I Semester

18EEE109 POWER SYSTEMS – I
(GENERATION, TRANSMISSION AND DISTRIBUTION)

L	T	P	C
2	1	0	3

Course Prerequisite: 18EEE101, 18EEE104, 18EEE105, 18EEE107, 18EEE109

Course Description:
This course covers modelling of the transmission lines (short, medium and long) and the mechanical design of the lines and cables.

Course Objectives:
1. To study the basic structure and concepts of power systems.
2. To impart knowledge on transmission line parameters
3. To learn the classification of transmission lines and to analyze the performance of transmission lines.
4. To design transmission lines and cables.
5. To impart knowledge on basic concepts of DC power transmission system and renewable energy system.

UNIT I: STRUCTURE AND BASIC CONCEPTS OF POWER SYSTEMS

Evolution of Power Systems and Present-Day Scenario. Structure of a power system - system load - load characteristics - load curves - load factor - diversity factor-plant factor.
Generation: Conventional source of electrical energy: Thermal power stations, Hydroelectric power generation, Nuclear power stations, Introduction to Renewable Energy Sources (RES) generation – Photovoltaic, Wind.
Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems).

(9)

UNIT II: TRANSMISSION LINE PARAMETERS
Types of Conductors – ACSR, Bundled and Standard Conductors- Resistance for Solid Conductors – Skin Effect- Calculation of Inductance for Single Phase and Three Phase, Single and Double Circuit Lines, Concept of GMR&GMD, Symmetrical and Asymmetrical Conductor Configuration with Transposition, Capacitance Calculations for Symmetrical and Asymmetrical Single and Three Phase, Single and Double Circuit Lines, Effect of Ground on Capacitance.

(9)

UNIT III: PERFORMANCE OF TRANSMISSION LINES
Classification of Transmission Lines - Short, Medium and Long Line and Their Exact Equivalent Circuits-Nominal-T, Nominal-Pie. Mathematical Solutions to Estimate Regulation and Efficiency of all types of Lines. Long Transmission Line-Rigorous Solution, Evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Surge Impedance and Surge Impedance Loading - Wavelengths and Velocity of Propagation – Ferranti Effect, Charging Current.

(9)

UNIT IV: MECHANICAL DESIGN OF TRANSMISSION LINE AND CABLES
Overhead Line Insulators: Types of Insulators, String Efficiency and Methods for Improvement, Capacitance Grading and Static Shielding. Corona: Corona Phenomenon, Factors Affecting Corona, Critical Voltages and Power Loss, Radio Interference. Sag and Tension Calculations: Sag and Tension Calculations with Equal and Unequal Heights of Towers, Effect of Wind and Ice on Weight of Conductor, Stringing Chart and Sag Template and Its Applications. CABLES: Types of Cables, Construction, Types of Insulating Materials, Grading of Cables - Capacitance Grading.

(9)

UNIT V: INTRODUCTION TO DC TRANSMISSION & RENEWABLE ENERGY SYSTEMS
DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission.
Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines.
(9)

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Illustrate the basic concepts and structure of power systems.
2. Classify and Evaluate the electrical parameters of conductors utilized in transmission line.
3. Identify the Transmission Lines and analyze the performance of transmission lines.
4. Demonstrate the mechanical design of transmission line and classification of cables.
5. Interpret the concepts of DC power transmission and renewable energy generation.

Text Books:
1. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.
2. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 2003.

References:
1. A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc., 1999.
2. Singh, S.N., Electric Power Generation, Transmission and Distribution, Prentice Hall of India (P) Ltd, New Delhi, 2006.
3. C. L. Wadhwa –Generation, Distribution and Utilization of Electrical Energy, Second Edition, New Age International, 2009
4. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.
5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power Systems”, Wiley, 2012.
6. Luces M. Fualkenberry., Walter Coffer., Electrical Power Distribution and Transmission, Pearson education, 1996.

Mode of Evaluation: Assignment, Mid Term Test, End Semester Examination

B. Tech III Year I Semester

18EEE110 POWER ELECTRONICS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18EEE103

Course Description:
This course aims to cover the basics of power semiconductor devices and operational behavior of various power electronic converters. This course covers Single phase and Three phase-controlled rectifiers, buck & boost converters, single phase & three phase voltage source inverters and cyclo-converters.

Course objectives:
1. To get an overview of different types of power semiconductor devices and their switching characteristics.
2. To understand the operation, characteristics and performance parameters of controlled rectifiers
3. To study the operation, switching techniques and basics types of DC-DC converters.
4. To learn the different modulation techniques of voltage source inverters.
5. To study the operation of AC voltage controller and various configurations of AC to AC converter.

UNIT I: POWER SWITCHING DEVICES
Power Diode, Power Transistor, Thyristor (SCR), MOSFET and IGBT: Construction, Operation, Switching characteristics and specification of switches; two-transistor model, turn-on methods and Firing circuit for thyristor; methods of commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

(9)

UNIT II: THYRISTOR RECTIFIERS
Circuit design and operation of - Single-phase full-bridge rectifier with R, R-L and R-L-E load; Three-phase full-bridge rectifier with R-load and highly inductive load; Dual Converter; twelve pulse converter; Output voltage with LC filter, Input current wave shape and power factor improvement.

(9)

UNIT III: DC TO DC CONVERTERS
Elementary chopper with an active switch and diode, Classification of choppers, control methods for chopper – Time ratio control and Current limiting control, Buck, Boost, Buck-Boost , Converter - power circuit, steady state analysis for CCM and DCM modes, duty ratio control of output voltage, Introduction to Fly-Back Converter.

(9)

UNIT IV: DC TO AC CONVERTERS
Types of DC to AC Converters, Single Phase Inverter – Principle of operation, performance parameters; Voltage Control of single-phase pulse width modulated inverter; Harmonics analysis of single phase inverter; Three Phase Inverter – 120^0, 180^0 conduction, Voltage Control of three phase inverter – Sinusoidal PWM, SVPWM. Introduction to Current Source Inverter, Comparison of VSI and CSI.

(9)

UNIT V: AC TO AC CONVERTERS

Single phase AC voltage controllers with R and Inductive load, Three phase - half wave Controller, full wave controller with star and delta connected R load; Types of cyclo-converter, Different configuration of Single-Phase Cyclo-converter, Three-Phase Cyclo-converter.

(9)

Course Outcomes:

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

1. Exemplify the process of selection of power electronic switch.
2. Analyse the performance of a controlled rectifier circuits.
3. Illustrate the operation of different topologies in DC-DC choppers.
4. Analyse the performance and control of DC to AC Converters.
5. Analyse the operation of AC to AC Converters.

Text Books:

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.

References:

1. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
2. Dubey, G.K., Doradlla, S.R., "Thyristerised Power Controllers", Wiley Eastern, 1987
3. V R Moorthi, "Power Electronics: Devices, Circuits and Industrial Applications", Oxford University Press, 2010.
4. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination**.**

Dept. of Electrical and Electronics Engineering

B. Tech III Year I Semester

18EEE111 MICROCONTROLLERS AND INTERFACING

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18EEE103, 18EEE106

Course Description:
This course facilitates the students with the fundamentals of Microprocessors, Introduction to 8051 micro controllers, 8051 architecture and programming, peripheral interfacing and applications.

Course Objectives:
1. To learn how to write assembly language programs.
2. To study interfacing of peripherals like I/O, A/D, D/A, timer etc.
3. To develop systems using different microcontrollers.
4. To design a complete Microprocessor based system for a real-world application.

UNIT I: FUNDAMENTALS OF MICROPROCESSORS

Fundamentals of Microprocessor Architecture. 8-bitMicroprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

(9)

UNIT II: THE 8051 ARCHITECTURE
Internal Block Diagram, CPU, ALU, address, data and control bus, working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

(9)

UNIT III: INSTRUCTION SET AND PROGRAMMING
Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.

(9)

UNIT IV: MEMORY AND I/O INTERFACING
Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices.

(9)

UNIT V: EXTERNAL COMMUNICATION INTERFACE AND APPLICATIONS
Architecture of PIC microcontrollers, PIC peripherals, Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee.
LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing.

(9)

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Write assembly language programming.
2. Illustrate the architecture of 8051 microcontroller.
3. Develop systems using different microcontrollers.
4. Interface peripherals like I/O, A/D, D/A, timer etc
5. Understand various communication interfaces.

Text Books:
1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Pearson Education, 2007.
2. K. J. Ayala, “8051 Microcontroller”, Delmar Cengage Learning, 2004.

References Books:
1. R. Kamal, “Embedded System”, McGraw Hill Education,2009.
2. R. S. Gaonkar, “, Microprocessor Architecture: Programming and Applications with the 8085”, Penram International Publishing, 1996
3. D. A. Patterson and J. H. Hennessy, "Computer Organization and Design: The Hardware/Software interface”, Morgan Kaufman Publishers, 2013.
4. D. V. Hall, “Microprocessors & Interfacing”, McGraw Hill Higher Education, 1991.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination**.**

Dept. of Electrical and Electronics Engineering

B. Tech III Year I Semester

18EEE207 POWER SYSTEMS – I LABORATORY

Course Prerequisite: 18EEE09

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To understand the insulator properties
2. To interpret the operating characteristics of RES.
3. To evaluate the parameters of transmission line model.
4. To understand the PV and wind models
5. To understand the DC transmission system

LIST OF EXPERIMENTS

1. Determination of flash over voltage of Insulator
2. Determination of voltage distribution and string efficiency of String insulator
3. Determination of Parameters of Transmission line model.
4. Demonstrate Ferranti Effect of Long Transmission Lines.
5. Determination of efficiency and voltage regulation of a transmission line.
6. To plot V-I and P-V characteristics of solar panel.
7. Illustration of single-phase Transmission line models using MATLAB.
8. Illustration of three-phase Transmission line models using MATLAB.
9. Modelling and simulation of PV module using MATLAB.
10. Modelling and simulation of Wind turbine systems and obtain power curve using MATLAB.
11. Modelling and simulation of DC Transmission system using MATLAB.

Course Outcome:

At the end of the course, students will able to

1. Analyze the characteristics of insulator.
2. Carry the transmission line model
3. Analyze the performance of the transmission line
4. Design the solar PV and Wind power generation in MATLAB
5. Understand the concept of DC Transmission

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech III Year I Semester

18EEE208 POWER ELECTRONICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18EEE109

Course Objectives:

1. To analyze the Characteristics of SCR, MOSFET & IGBT.
2. To design single phase AC voltage controllers with R and RL Loads
3. To analyze the forced Commutation circuits.
4. To analyze the different converter circuits.
5. To understand gate driver circuits.

LIST OF EXPERIMENTS

1. Study of Characteristics of SCR, MOSFET& IGBT.
2. Gate firing circuits for SCR‘s.
3. Single Phase AC Voltage Controller with R and RL Loads.
4. Single Phase half & fully controlled bridge converter with R and RL loads.
5. Single Phase thyristor-based inverter with R and RL loads.
6. Single Phase Cycloconverter with R and RL loads.
7. Three Phase half-controlled bridge converter with R-load.
8. Single Phase dual converter with RL loads.
9. Forced Commutation circuits.
10. Modelling and simulation of gate driver circuits for MOSFET, IGBT.
11. Simulation of three phase voltage source inverter with Sine PWM technique.
12. Simulation of Buck, Boost and Buck-Boost converter.

Course Outcomes:

At the end of the course, students will able to

1. Analyze the Characteristics of SCR, MOSFET&IGBT.
2. Design the single phase AC voltage controller with R and RL Loads.
3. Design forced Commutation circuits
4. Design and develop different converter circuits.
5. Design the gate driver circuits.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

Dept. of Electrical and Electronics Engineering

B. Tech III Year I Semester

18EEE209 MICROCONTROLLERS AND INTERFACING LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18EEE111

Course Objectives:
1. To introduce the basics of microcontroller and its applications.
2. To provide in depth knowledge in 8051 assembly language programming
3. To study serial communication concepts using 8051.
4. To study I/O interfacing concepts for developing real time systems.
5. To encourage the students in building real time applications.

LIST OF EXPERIMENTS
1. Arithmetic operation – Multi byte Addition and Subtraction, Multiplication and Division Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.
2. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
3. Generate a square wave form.
4. Reading and Writing on a parallel port.
5. Timer in different modes.
6. Serial communication implementation.
7. Waveform generation using DAC 9 ADC & DAC Interface)
8. Motor Interfacing.
9. LCD and keypad Interfacing (8279 – Keyboard Display: Write a small program to display a string of characters).
10. Traffic Controller Interface
11. 8251- UART Interfacing

Course Outcomes:
At the end of the course, students will able to
1. Write assembly language program for basic mathematical and logical operations.
2. Write assembly language program for generating wave forms.
3. Evaluate the analog to digital and digital to analog converters with 8081.
4. Analyze the different modes of Timer.
5. Write assembly language program for interfacing peripherals with 8081.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year II Semester

B. Tech III Year II Semester

18EEE112 AI TOOLS, TECHNIQUES AND APPLICATIONS

Course Prerequisite: None

L	T	P	C
3	0	0	3

Course Description:
To understand the importance of AI and its applications, Machine learning and Deep Learning algorithms and smart solutions for various domains.

Course Objectives:
The objectives of this course are to
1. Expose fundamental concepts in AI
2. Demonstrate the capability to create simple AI applications using Natural Language Processing, Speech Recognition, Computer Vision, Pattern recognition.
3. Present various modeling and formulation techniques to solve problems using AI techniques.
4. Introduce state-of-art AI tools and techniques to solve various problems faced by Engineers in design and analysis.

UNIT I : FUNDAMENTALS OF AI
AI-Definition, Applications of AI, Search Strategies – BFS, DFS, Knowledge representation and reasoning – Knowledge based Agent, Wumpus World Environment, Logics. **Machine Learning:** Supervised Learning - Linear Regression, Logistic Regression, Unsupervised Learning – K-means clustering, Anomaly Detection, Reinforcement Learning. **(9)**

UNIT II: NLP AND BOT TECHNOLOGIES
Natural Language Processing: Natural language Understanding, Sentiment Analysis, Segmentation and recognition, Speech Recognition, Text-to-Speech, NLP in the cloud, NL Interface, **Chatbots:** Chatbot definition, Build a Chatbot, How has chatbot transformed user experience, Designing elements, best practices for chatbot development, **Virtual Assistants:** What is a Virtual Assistant? **(9)**

UNIT III: IMAGE PROCESSING &APPLICATIONS
What is Image processing?, Image Noise, Removal of Noise from Images, Color Enhancement, Fourier transforms, Feature detection and matching, Segmentation**,** Object detection, Face recognition, Recognition Databases and test sets. Application: Optical Character Recognition. **(9)**

UNIT IV DEEP LEARNING
Introduction - Neural Networks, Deep Learning, Different types of Deep Neural Networks - CNN,RNN, forward propagation, Cost function, backpropagation. APIs using Softwares Tensorflow and Keras. **(9)**

UNIT V SMART APPLICATIONS
Smart Agriculture, Smart Transportation &Autonomous Vehicles, Smart Homes, Smart cities. **(9)**

Course Outcomes:

Upon the completion of the course, students able to

1. Understand the basic concepts and applications of Artificial Intelligence.
2. Design Chatbots based on the user requirements
3. Identify the features of digital images for analysis.
4. Implement the deep learning techniques using software tools.
5. Develop smart applications for various domains

Textbooks:

1. Tom Markiewicz& Josh Zheng,Getting started with Artificial Intelligence, Published by O'Reilly Media,2017
2. Stuart J. Russell and Peter Norvig,Artificial Intelligence A Modern Approach
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer 2010
4. Ian Goodfellow, Yoshua Bengio, Aaron Courvill, Deep Learning

References:

1. AurélienGéron,Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017
2. A classical approach to Artificial Intelligence, Munesh Chandra Trivedi, Khanna Publications
3. Artificial Intelligence and Machine Learning, Chandra S.S. & H.S. Anand, PHI Publications
4. Machine Learning, Rajiv Chopra, Khanna Publishing House

Mode of evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

B. Tech III Year II Semester

18EEE113 SIGNALS AND SYSTEMS

L	T	P	C
2	1	0	3

Course Prerequisite: 18MAT105, 18MAT106

Course Description:
This course reviews and continues the study of different signals with the objective of introducing classical methods for solving, analysis and synthesis of various signals and systems. This course serves as a basis of the applications for differential equations, Fourier series and Laplace transform in various branches of engineering and sciences.

Course Objectives:

1. To understand the basic properties of signals & systems and the various methods of classification
2. Understand the concepts of continuous time and discrete time systems
3. Analyse systems in complex frequency domain.
4. To characterize LTI systems in the Time domain and various Transform domains.
5. Understand sampling theorem and its implications.

UNIT I: INTRODUCTION TO SIGNALS AND SYSTEMS

Basics of signals and systems. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the complex exponential, some special time-limited signals; continuous and discrete time signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability and Examples.

(9)

UNIT II: BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS

Impulse response and step response, convolution, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response, Properties of LTI system.

(9)

UNIT III: FOURIER, AND FFT ALGORITHMS

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, Linear convolution, discrete time convolution, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Inverse DFT& convolution using FFT.

(9)

UNIT IV: LAPLACE and Z-TRANSFORM

Review of the Laplace Transform for continuous time signals and systems, System functions, poles and zeros of system functions and signals. Laplace Domain analysis, Solution of LTI continuous time systems using Laplace transforms. Z-Transform for discrete time signals and systems, Properties of Z transform, Inverse Z transform, system functions. Introduction to analog and digital filters.

(9)

UNIT V: SAMPLING AND RECONSTRUCTION

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Effects of under sampling Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

(9)

Course Outcomes:

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

1. Analyses the properties of different types of signals and systems.
2. Understand the concepts of continuous time and discrete time systems. Classify systems based on their properties and determine the response of LTI systems using convolution.
3. Apply the Fourier Transform for analyze the signals in frequency domain.
4. Apply the Laplace and Z transform for analyze of both continuous time and discrete time LTI systems.
5. Understand the sampling theorem and the process of reconstructing a continuous time signal.

Text Books:

1. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
2. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.

References Books:

1. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
2. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009
3. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18EEE114 POWER SYSTEMS – II (ANALYSIS)

L	T	P	C
2	1	0	3

Course Prerequisite: 18EEE104, 18EEE107, 18EEE109, 18EEE112

Course Description:
This course is designed to provide basic understanding of analysis and control of power system. This course covers representation of power system elements essential characteristics of a good algorithm, graph theory, formation of Y bus and Z bus of a Power System, modelling of turbines, generators and automatic controllers. It emphasizes on single area and two area load frequency control.

Course Objectives:
1. To learn the basics of power system and its representation.
2. To analyse the power system in steady state and under fault condition.
3. To learn the mathematical modeling of steam turbines and speed governors.
4. To understand the load frequency control and voltage control.
5. To understand the monitoring and control aspects of power system.

UNIT I: REPRESENTATION OF POWER SYSTEM COMPONENTS
Review of the structure of a Power System and its components. The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system, per unit representation of power system. Network graph, Bus incidence matrix, Primitive network- construction of Y-Bus formulation by Direct and Singular Transformation method.

(9)

UNIT II: LOAD FLOW ANALYSIS
Bus classification - Formulation of Power Flow problem in polar coordinates, Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems.

(9)

UNIT III: SYMMETRICAL FAULT ANALYSIS
Importance of short circuit analysis. Symmetrical Fault Analysis: Short Circuit Current and MVA Calculations, Bus Impedance matrix building algorithm (without mutual coupling) – Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level – Current limiting reactors.

(9)

UNIT IV: UNSYMMETRICAL FAULT ANALYSIS
Introduction to symmetrical components - Symmetrical Component Transformation, Positive, Negative and Zero Sequence Components of Voltages, Currents and Impedances. Sequence of Positive, Negative and Zero Networks, Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without Fault Impedance.

(9)

UNIT V: POWER SYSTEM STABILITY ANALYSIS

Classification of power system stability, Rotor angle stability, Swing equation, Power-Angle equation, Equal area criterion, Critical clearing angle and time, Classical step-by-step solution of the swing equation, modified Euler method, Methods to improve Stability

(9)

Course Outcomes:

At the end of the course, students will able to

1. Understand the representation in power system
2. Understand numerical methods to analyse a power system in steady state.
3. Understand the fault analysis of power system under fault condition
4. Understand stability constraints in a synchronous grid.
5. Understand methods to control the voltage and frequency.

Text Books:

1. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 2003.
2. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power Systems”, Wiley, 2012.

References:

1. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.
2. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.
3. A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc., 1999.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

B. Tech III Year II Semester

18ENG202 CORPORATE COMMUNICATION LABORATORY
(Common to all branches)

L	T	P	C
0	0	2	1

Course Prerequisite: 18ENG201

Course Description:
English is practical and it is a must for any institution to provide students with opportunities to indulge in actively applying their language skills. Thus the Communication Skills Lab facilitates students with adequate opportunities to put their communication skills in use. It also accommodates peer learning by engaging students in various interactive sessions.

Course Objectives:
This course enables the student to
1. Develop their communicative competency
2. Focus on their interactive skills
3. Fortify their employability skills
4. Empower their confidence and overcome their shyness
5. Become effective in their overall performance in the industry

UNIT I: LISTENING & SPEAKING
Group discussion, Interview Skills, Presentation Skills, Role Plays, Small Talks, listening to and understanding Lectures, News, Discussions, Debates, Theatre, Movies, etc.

UNIT II: READING & WRITING
Reading a plethora of writing from Newspapers to Philosophical Treatise, Understanding Graphics, Interpreting, Summerizing, Etc.

UNIT III: VERBAL & NON-VERBAL ASPECTS
Speaking- introducing oneself - exchanging personal information- Language development- 'Wh'- Questions- asking and answering-yes or no questions-asking about routine actions and expressing opinions.

UNIT IV: STORYTELLING & CONVERSATIONS
Listening-short texts-formal and informal conversations-participating in conversations- short group conversations- speaking about oneself- speaking about one's friend.

UNIT V: BUSINESS ENVIRONMENT & ETIQUETTES
Saring information of a personal kind; greeting; taking leave; Writing e-mails, memos, reports, etc.

Course Outcomes:
At the end of the course, learners will be able to:
1. Read articles from magazines and newspapers
2. Participate effectively in informal conversations;
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind and personal letters and emails in English.

Suggested Reading/Textbook:
1. Meenakshi Raman &Sangeetha Sharma; Technical Communication – Principles and Practice (2^{nd} Edition-2014); Oxford University Press –2014
2. Michael Swan & Catherine Walter; How English Work (9^{th} Edition); Oxford University Press - 2001

Reference:
1. Nutall J. C.; Reading Comprehension; Orient Blackswan
2. Jane Willis; Teaching English through English; Published by Longman Handbooks
3. www.cambridgeenglish.org/in/
4. https://learnenglish.britishcouncil.org/en/english-grammar
5. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year II Semester

18EEE210 POWER SYSTEMS – II LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18EEE114

Course Objectives:
1. To analyze various faults in power system.
2. To paraphrase the operational characteristics of synchronous machine.
3. To carry out the load flow analysis of a power system.
4. To investigate the response of a two area power system for tie line deviations.

LIST OF EXPERIMENTS
1. Determination of Sequence Impedances of a Cylindrical Rotor Synchronous Machine
2. Fault Analysis-I
    i) LG Fault
    ii) LL Fault
3. Fault Analysis-II
    i) LLG Fault
    ii) LLLG Fault
4. Capability curve of a Synchronous Generator.
5. Power Angle Characteristics of a Salient Pole Synchronous Machine
6. Gauss Seidel load flow analysis using MATLAB Software
7. Newton Raphson method of load flow analysis using MATLAB Software.
8. Formation of Y bus matrix by inspection / analytical method using MATLAB Software.
9. Formation of Z bus using building algorithm using MATLAB Software.
10. Fast decoupled load flow analysis using MATLAB Software.
11. Step Response of Two Area System with Integral Control and Estimation of Tie Line Power Deviation using MATLAB/SIMULINK
12. Step Response of Two Area System with Integral Control and Estimation of Tie Line Frequency Deviation using MATLAB /SIMULINK
13. Transient Stability Analysis

Course Outcome:
At the end of the course, students will able to
1. Analyze the various faults in power system.
2. Verify the operational characteristics of synchronous machine.
3. Obtain the Y bus and Z bus matrix using MATLAB software.
4. Carryout the various load flow analysis using MATLAB software.
5. Realize the stability analysis using MATLAB /SIMULINK.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech IV Year I Semester

B. Tech IV Year I Semester

18EEE115 INTERNET OF THINGS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
The Internet of Things (IoT) is a network of a wide variety of devices like vehicles, humans, soil etc. These devices gather data using sensors, which can be used for monitoring or control. This course is an introduction to the embedded devices, communication protocols and APIs used in IoT.

Course Objectives:
This course enables students to
1. Introduce the fundamental concepts of IoT and physical computing
2. Expose the student to a variety of embedded boards and IoT Platforms
3. Create a basic understanding of the communication protocols in IoT communications.
4. Familiarize the student with application program interfaces for IoT.
5. Enable students to create simple IoT applications.

UNIT I - OVERVIEW OF IOT
The Internet of Things: An Overview; The Flavor of the Internet of Things; The "Internet" of "Things"; The Technology of the Internet of Things; Enchanted Objects; Who is Making the Internet of Things?; Design Principles for Connected Devices; Calm and Ambient Technology; Privacy; Keeping Secrets; Whose Data Is It Anyway?; Web Thinking for Connected Devices; Small Pieces, Loosely Joined; First-Class Citizens On The Internet; Graceful Degradation; Affordances **(9)**

UNIT II - EMBEDDED DEVICES – I (ARDUINO)
Embedded Computing Basics; Microcontrollers; System-on-Chips; Choosing Your Platform; Arduino; Developing on the Arduino; Some Notes on the Hardware; Openness; **(9)**

UNIT III - EMBEDDED DEVICES – II (RASPBERRY PI)
Raspberry Pi ; Cases and Extension Boards; Developing on the Raspberry Pi; Some Notes on the Hardware; Openness; Other notable platforms; Mobile phones and tablets; Plug Computing: Always-on Internet of Things **(9)**

UNIT IV - COMMUNICATION IN THE IOT
Internet Principles; Internet Communications: An Overview ; IP; TCP; The IP Protocol Suite (TCP/IP); UDP ; IP Addresses; DNS ; Static IP Address Assignment ; Dynamic IP Address Assignment; IPv6 ; MAC Addresses ; TCP and UDP Ports ; An Example: HTTP Ports ; Other Common Ports; Application Layer Protocols- HTTP; HTTPS: Encrypted HTTP ; Other Application Layer Protocols. **(9)**

UNIT V - PROTOTYPING ONLINE COMPONENTS
Getting Started with an API; Mashing Up APIs; Scraping; Legalities; Writing a New API; Clockodillo; Security; Implementing the API; Using Curl to Test; Going Further; Real-Time Reactions; Polling; Comet; Other Protocols; MQ Telemetry Transport; Extensible Messaging and Presence Protocol; Constrained Application Protocol. **(9)**

Course Outcomes:

After completing this Unit, students will be able to

1. Interpret the design principles that govern connected devices and select a platform for a particular embedded computing application
2. Develop simple applications using Arduino microcontroller
3. Develop simple applications using Raspberry Pi
4. Utilize the Internet communication protocols for IoT applications
5. Design and develop a solution for a given application using APIs

Text Books

1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley Publications, 2014, ISBN:978-1-118-43062-0.
2. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015. ISBN: 978-8173719547

Reference Books:

1. Pethuru Raj, Anupama C. Raman, The Internet of Things, Enabling technologies and use cases, CRC Press. 2017. ISBN: 978-1498761284.
2. Matt Richardson & Shawn Wallace, Make:Getting Started with Raspberry Pi, O'Reilly, 3rd Edition, 2016, ISBN:978-1-680-45246-4.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech IV Year I Semester

18EEE116 SWITCH GEAR AND PROTECTION

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE104, 18EEE107, 18EEE109 & 18EEE114

Course Description:
This course introduces all varieties of Circuit Breakers and Relays for protection of Generators, Transformers and feeder bus bars from over voltages and other hazards. It provides emphasis on protection of power system against over voltages.

Course Objectives:
1. To learn the operation of Electromagnetic and Static relays
2. To learn the principles of fusing characteristics and circuit breaker
3. To learn the description and operation of different types of circuit breakers
4. To learn the construction and characteristics, generator protection, transformer protection, feeder and bus-bar protection
5. To learn about protection against over voltages

UNIT I: ELECTROMAGNETIC AND STATIC RELAYS
Principles and need for Protective Schemes- Basic Requirements of Relays – Primary and Backup protection –protection zone. Construction details of – Attracted armature, balanced beam, inductor type and differential relays – Universal Torque equation – construction and working of over current, Direction and distance relays.
Static Relays –Basics for static relay development, Advantages and Disadvantages – Definite time, Inverse and IDMT static relays –Comparators – Amplitude and Phase comparators.
(9)

UNIT II: PRINCIPLES OF FUSING CHARACTERISTICS AND CIRCUIT BREAKER
Elementary Principles of switches and fuses, Circuit Breakers: Physics of Arc Phenomena, Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average and Max. RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. **(9)**

UNIT III: OPERATION OF DIFFERENT TYPES OF CIRCUIT BREAKERS
Description and Operation of following types of circuit breakers: Oil Circuit breakers, Air Blast Circuit Breakers, Air break circuit breakers, Vacuum and SF6 circuit breakers. Basic Steps for design of Circuit Breaker – Testing of Circuit Breaker. **(8)**

UNIT IV: POWER SYSTEM EQUIPMENT PROTECTION
Generator protection: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CT's Ratio, Buchholtz relay. Protection of Feeder (Radial & Ring main) using over current Relays, Protection of Transmission line – current grading and time grading protection, 3 Zone protection using Distance Relays. Protection of bus-bars, motor protection.
(10)

UNIT V: OVER VOLTAGE PROTECTION AND DIGITAL PROTECTION
Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Peterson Coils, Surge Absorbers, Surge Diverters Insulation Coordination –BIL. Digital protection: Numerical over current Protection, Microprocessor based relays – Distance relay Protection, Directional relay, Differential relay Protection, Concepts of Digital Relaying.

(9)

Course Outcomes:
At the end of the course, students will able to
1. Analyze the operation of Electromagnetic and Static relays
2. Analyze the principles of fuses and circuit breaker
3. Apply the operation of different types of circuit breakers
4. Analyze the Generator, Transformer, Feeder and Bus-Bar Protection
5. Analyze the Protection against over voltages and importance of Digital protection

Text Books:
1. Switchgear and Protection – by Sunil S Rao, Khanna Publishers, New Delhi, 1999
2. Power System Protection and Switchgear by Badari Ram, D.N. Viswakarma, TMH Publications.

References:
1. Electrical Power Systems by C.L.Wadhwa, New Age international (P) Limited, Publishers, 3rd edition
2. Ravindranath B., Chander, N., Power Systems Protection and Switch Gear,
3. Wiley Eastern (P) Ltd., 2001.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech IV Year I Semester

18EEE211 INTERNET OF THINGS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description:
This course provide hands-on practices on IoT using Arduino & Raspberry microcontrollers with various interfaces such as sensors, actuators, mobile app, cloud, social media.

Course Objectives:
1. To understand working principles of IoT devices
2. To get exposure towards the IoT internals
3. To understand the concepts of real-world designs, industrial automation and commercial needs for designing IOT enabled solution

LIST OF EXPERIMENTS

1. Study on IoT Platform
a) Getting information and study of IOT microcontrollers (Arduino, Resperrypi)

2. Study on IoT Platform
a) Getting information about Sensors (IR, temperature, pressure, gas sensor)
b) Getting information about actuators. (Piezoelectric actuator, pneumatic actuator)

3. Programming with Arduino platform
a) Installation of Arduino in computer and verifying any errors in connection.
b) Control LED using Arduino
c) Traffic Light Control

4.Programming with Arduino platform and Reading from Sensors
a) interfacing sensors to Arduino board and getting information from them (any two sensors).
b) Experiment with both analog and digital sensors.

5.Programming with Resperrypi
a) Displaying Date on Serial Monitor
b) Automated Door Opening System

6.Connecting Android Phone with Arduino
a) Connecting Arduino with Mobile Device Using the Bluetooth Module.
b) Control any two actuators connected to the development board using Bluetooth.

7. Integrating Ethernet Shield.
Read data from sensor and send it to a requesting client using socket communication.
Note: The client and server should be connected to same local area network

8. Creating Mobile App
a) Create a mobile app to control an actuator.
b) Control Electronic Devices from anywhere across the world using Internet & Mobile App.

9. **Interfacing Cloud**
a) Push sensor data to cloud - Use Arduino to Upload data from Environmental Sensors to Cloud Server.
b) Control an actuator through cloud

10. Data analysis and Visualization
Access the data pushed from sensor to cloud and apply any data analytics or visualization services.

11. Social media with IoT
Creating Program for Local host Web Server for controlling devices and update status on Twitter through Arduino.

12. Mini Project
Identify a problem in your local area or college which can be solved by integrating the things you learned so far and create a prototype to solve it.

Course Outcomes:
At the end of the course, students will be able to
1. Choose the sensors and actuators for an IoT application
2. Select protocols for a specific IoT application
3. Utilize the cloud platform and APIs for IoT application
4. Experiment with embedded boards for creating IoT prototypes
5. Design and develop a solution for a given IoT application

Text/ Reference Books:
1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley Publications, 2014, ISBN:978-1-118-43062-0.
2. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015. ISBN: 978-8173719547
3. Pethuru Raj, Anupama C. Raman, The Internet of Things, Enabling technologies and use cases, CRC Press. 2017. ISBN: 978-1498761284.
4. Matt Richardson & Shawn Wallace, Make:Getting Started with Raspberry Pi, O'Reilly, 3rd Edition, 2016, ISBN:978-1-680-45246-4.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Electrical and Electronics Engineering

B. Tech IV Year I Semester

18EEE212 PROTECTION AND SIMULATION LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 14EEE112 & 14EEE116

Course description:
This practical course provides the knowledge to the students to analyze various faults in power system, power flow analysis and the operating characteristics of various protective relays.

Course Objectives:
1. To analyze various faults in power system.
2. To paraphrase the Stability analysis in power system.
3. To interpret the operating characteristics of various protective relays.

LIST OF EXPERIMENTS
1. Characteristics of IDMT over Current Relay.
2. Characteristics of Static Negative Sequence Relay.
3. Characteristics of Over Voltage Relay.
4. Characteristics of Percentage Biased Differential Relay.
5. Characteristics of frequency relay in Feeder protection scheme
6. Characteristics of voltage protection schemes in Power distribution Feeder
7. Parallel operation and load sharing of two alternators
8. Symmetric and Unsymmetrical Fault Analysis using Simulation Software
9. Transient Stability Analysis for a Single Machine Infinite Bus System using Simulation Software.
10. Small Signal Analysis for a Single Machine Infinite Bus System using Simulation Software
11. Swing Equation implementation by point-by-point method using Simulation Software.
12. Transient Stability analysis of a multi-machine power system using Simulation Software.

Course Outcome:
At the end of the course, students will able to
1. Analyze the operating characteristics of various protective relays
2. Verify the operational characteristics of Feeder protection.
3. Analyze the various faults in electrical power system.
4. Analyze the transient stability in power system using simulation software
5. Carry the small signal analysis using simulation software

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

OPEN ELECTIVE II

OPEN ELECTIVE - II

18MAT301 ADVANCED NUMERICAL METHODS

L	T	P	C
3	0	0	3

Course Description

This course reviews and continues the study of computational techniques for evaluating interpolations, derivatives and integrals; solving system of algebraic equations, transcendental equations, ordinary differential equations and partial differential equations. The course emphasizes on numerical and mathematical methods of solutions with appropriate error analysis. The students use MATLAB as the computer language to obtain solutions to a few assigned problems.

Course Objectives

1. To introduce computation methods of solving algebraic and transcendental equations.
2. To avail the basics of numerical techniques for solving the system of linear equations.
3. To familiarize the knowledge of interpolation and numerical calculus.
4. To use numerical calculus for solving ordinary differential equations.
5. To introduce the computational techniques for solving partial differential equations.

UNIT-I: SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

Introduction to MATLAB, errors, sources of errors, floating point arithmetic, significant digits, relative error, propagation of errors, how to avoid loss of significant digits, evaluation of polynomial.
Bisection method, False-position method, Secant method, Fixed-point iteration method, Newton's method – single and multiple roots, Order of convergence of the methods.
Exercises of Bisection method and Newton's method through MATLAB

(9)

UNIT-II: SOLUTIONS OF SYSTEM OF ALGEBRAIC EQUATIONS

Gaussian Elimination, LU decomposition, Thomas algorithm for the tridiagonal systems, Norms-Euclidean, mini-maxi, Frobenius and 1-,2- and ∞-norms, Condition numbers and errors in computed solutions. Jacobi's method, Gauss-Seidel method, Power method for obtaining eigenvalues and eigenvectors of matrices.
Exercises of Gaussian Elimination and Gauss-Seidel method through MATLAB

(9)

UNIT-III: INTERPOLATION & NUMERICAL CALCULUS

Existence and Uniqueness of interpolating polynomial, Lagrange polynomials, Divided differences, Evenly spaced points, Error of interpolation, cubic spline, Inverse interpolation, Derivatives from difference table, Higher order derivatives, Trapezoidal rule, Simpsons rule, a composite formula, Gaussian Quadrature.
Exercises of Divided differences and Simpson's rule through MATLAB

(9)

UNIT-IV: NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS

Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods for initial value problems, Shooting method, Finite difference method for boundary value problems.
Exercises of Runge-kutta method and Shooting method through MATLAB

(9)

UNIT-V: NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS
Finite difference methods for one-dimensional Wave and Heat equations; Laplace and Poisson equations (five-point formula).
Exercises of Finite difference method (forward, central and backward differentiation) and Crank-Nicolson method through MATLAB

(9)

Course Outcomes

At the end of this course, students should be able to

1. Solve the system of algebraic and transcendental equations.
2. Apply the numerical techniques to find the solution to system of equations.
3. Calculate and analyze the rate of variations and numerical sum of such changes using numerical calculus relevant to the field of Engineering.
4. Find the accurate numerical solutions to ordinary differential equations representing some Engineering problems.
5. Compute the solutions for engineering problems represented by partial differential equations.

Text Books

1. Curtis F. Gerald, Patrich O. Wheatley, Applied Numerical Analysis, Pearson Education, 7^{th} Edition, 2003.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4^{th} Edition, 2005.

Reference Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35^{th} Edition, 2010.
2. Burden and Faires, Numerical Analysis 7^{th} ed., Thomson Learning, 2001.
3. Advanced Engineering Mathematics by E. Kreyszig, 10^{th} ed., Wiley, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3^{rd} ed., Mc Graw Hill, 2012.
5. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5^{th} Edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

OPEN ELECTIVE - II

18MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

Course prerequisite:18MAT101,18MAT106, 18MAT104, 18MAT108, 18MAT109.

Course description: Unconstrained and constrained optimization, Linear programming problem, transportation and assignment problems, dynamic programming problem, project management and queuing models.

Course objectives:
1. Understand the optimization techniques for solving engineering problems.
2. Formulate and solve linear programming problem.
3. Obtain the optimal solution for transportation and assignment problems.
4. Avail knowledge to solvedynamic programming problem using recursive relations.
5. Analyze the techniques of project management and queuing models.

UNIT 1: CLASSICAL OPTIMIZATION.

Introduction to optimization, unconstrained optimization with single variable and multi variable. Constrained multivariable optimization with equality constraints- Lagrange multipliers method, constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions. **(9)**

UNIT II: LINEAR PROGRAMMING PROBLEM.

Linear Programming Problem (LPP), Mathematical formulation, graphical solution, simplex method. Artificial variable technique - Big M-method and two phase simplex method.Duality, dual Simplex method. **(9)**

UNIT III: TRANSPORTATION PROBLEM AND ASSIGNMENT PROBLEM

Transportation problem: definition and algorithm, transshipment problem. Assignment problem, travelling salesman problem. **(9)**

UNIT IV: DYNAMIC PROGRAMMING.

Introduction, developing optimal decision policy, Dynamic Programming Problem (DPP) under certainty, DPP approach for solving LPP. **(9)**

UNIT V: PROJECT MANAGEMENT AND QUEUING MODELS.

Network analysis: Network representation, Critical Path Method (CPM) and Project Evolutionary and Review Technique (PERT). Introduction to queuing system, single server queuing models (M/M/1) :(∞/FCFS), (M/M/1): (N/FCFS). **(9)**

Course outcomes:

At the end of the course the students should able to

1. Understood the importance of unconstrained and constrained optimization to solve engineering problems.
2. Get an idea about the linear programming techniques.
3. Solve transportation andassignment problems in engineering situations.
4. Applythe Bellman principle of optimality to solvedynamic programming problem.
5. Analyze the problems of network analysis for project management and Queuing systems engineering & industry.

Text Books:

1. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5th edition,2013.
2. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.

References:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, 9/E, 2011.
2. FS Hillier and GJ Lieberman, Introduction to Operations Research, TMH, 8/E, 2006.
3. JC Pant, Introduction to Optimization: Operations Research, Jain Brothers, New, 6/E, 2004.
4. A Ravindran, DT Philips and JJ Solberg, Operations Research: Principles and Practice, John Wiley& Sons, Singapore, 2ndedition.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Dept. of Electrical and Electronics Engineering

OPEN ELECTIVE - II

18PHY301 OPTICAL PHYSICS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:

The course will cover Geometrical optics, Aberrations, Physical Optics, Diffraction and Optical fibers.

Course Objectives:

1. Knowledge of basic principles and concepts in optics and the techniques used to deal with them.
2. Explain the limitations associated with spherical and chromatic aberration
3. Describe optical systems such as microscopes and telescopes with reference to parameters such as angular magnification and depth of field
4. Provide students with a working knowledge of optical physics, including interference, diffraction and physical optics.
5. Introduce construction and concepts of basic fiber optic communication system and to make the students learn about its important applications for societal needs.

UNIT I: INTRODUCTION

Corpuscular and wave theory, Fermat's principle, Matrices for translation, refraction and reflection, Unit and nodal planes, Eigenvalues and Eigenvectors.

(9)

UNIT II: ABERRATIONS AND OPTICAL INSTRUMENTS

Types of aberrations, Chromatic and monochromatic aberrations. Different types of monochromatic aberrations. Simple and Compound microscopes, Astronomical and Terrestrial telescopes. Ramsden's and Huygens' eye pieces.

(9)

UNIT III: WAVE OPTICS & INTERFERENCE

Huygens's principle, Superposition of waves, Fourier transforms, representation of slits and apertures, Two beam interference by Division of wave front. Applications of Interference, Nonlinear interaction of light with matter (self-study).

(9)

UNIT IV: DIFFRACTION & POLARISATION

Fraunhoffer diffraction, Diffraction from single slit, double slit & multiple slits, Fresnel half-period zones, Zone plate, Applications of diffraction, Polarization, Malus' law, double refraction. Applications of polarization.

(9)

UNIT V: FIBER OPTICS

Construction and working principle of optical fibers, Numerical aperture and acceptance angle, Types of optical fibers. Attenuation and losses in optical fibers, Analog and Digital optical fiber communication system. Applications of optical fibers in communications, sensors and medicine.

(9)

Course Outcomes:

Upon completion of this course the students shall be able to:

1. Recollect the fundamental characteristics of light and their mathematical principles.
2. Learn the principles of superposition, Interference and Diffraction
3. Understand nonlinear optics and photonics phenomena.
4. Be exposed to the application of optical techniques in cutting edge research areas.
5. Describe the basic laser physics, working of lasers and principle of propagation of light in optical fibers.

Text Book:

1. Optics by Ghatak, 4th Edition, Tata McGraw Hill (2011).

Reference Books:

1. Optics by Lipson, Lipson & Lipson, 4th Edition, Cambridge Univ Press (2010).
2. Optics by Hecht, 4th Edition, Addison-Wesley (2002).

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

OPEN ELECTIVE - II

18PHY302 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

Course Prerequisite: Basic knowledge of atomic structure at intermediate (10+2) level is sufficient

Course Description:
Laser usage is rampant in various technological applications. Several fields gaining attention in the usage of lasers. This course covers the introduction to the theory and mechanism of laser action, various types of lasers and their applications and future use.

Course Objectives:

1. Make the student to understand the detailed principles of various lasers.
2. Profound understanding of different variety of lasers will provide them to think of superior selection and usage of lasers in practical technological applications.
3. Students are aware of latest developments in certain areas of Laser technology which have important applications for societal needs.
4. Explain how material processing is accomplished with lasers. Estimate laser operation parameters for material processing.
5. Exposure about Lasers applications in engineering, communications, spectroscopy and material process etc.

UNIT I: INTRODUCTION TO LASER TECHNOLOGY
Laser characteristics, The Einstein Coefficients, Absorption and Emission Cross Sections, Spontaneous and Stimulated emission of radiation, Population inversion, Methods of Population Inversion, Laser Rate Equations, stable two minor optical resonators, Mode selection, Gain in the regenerative laser cavity.

(9)

UNIT II: GASES AND LIQUIDS LASING MEDIUM
Energy levels & Radiative properties of Atoms and molecules**;** *Atomic lasers*: He-Ne laser, Argon Ion laser**;** *Molecular Lasers*: Carbon dioxide laser, Liquid energy levels and their radiative properties, Organic Dye laser.

(9)

UNIT III: SOLID STATE LASERS
Energy Levels in solids-dielectric medium, Solid-state lasing materials, Narrow line width laser materials, broad band line width laser materials, solid state lasers: Nd:YAG, Nd:YLF; Ti:Sapphire (introduction only)
Energy Levels in solids-semiconductor medium, direct and indirect band gap semiconductors, Semiconductor diode laser, Quantum dot lasers (Introduction only);

(9)

UNIT IV: PULSED OPERATION OF LASERS

Nanosecond: Q-Switching, Techniques of Q-Switching: electro-optic, Acousto-Optic.
Femtosecond: Relationship between pulse duration and Spectral Width, Passive mode-locking, Active mode locking, Kerr lens mode locking, Amplification of femtosecond pulses.

(9)

UNIT V: LASER APPLICATIONS

Laser processing of materials: laser cutting, laser drilling, welding; Lasers in metrology- Accurate measurement of length, light wave communications; Laser spectroscopy: Laser fluorescence and Raman scattering

(9)

Course Outcomes

Upon completion of this course the students shall be able to:

1. Understand the principle of phenomenon of laser and identify the operating principle involved in various type of lasers.
2. Estimate stability requirements in producing laser light by different types of sources
3. Differentiate or list the various types of lasers and their means of excitation.
4. Assess (Identify) which laser would best meet the need for a particular industrial or research task.
5. Student can knowledge of latest technological developments in laser technology. Femtosecond laser etc.

Text books:

1. Laser Fundamentals: William T Silfvast. Cambridge Publication.
2. Laser Theory and Applications: A.K. Ghatak and K. Thyagarajan, Springer

Reference books:

1. Solid State Laser Engineering: Walter Koechner. Springer series in optical sciences.
2. Ultrafast Optics, Andrew M. Weiner
3. Laser spectroscopy: Demtroder
4. Laser Applications: Monte Ross
5. Femtosecond Laser Pulses Principles and Experiments: Claude Rulli`ere, Springer
6. Principles of Laser: O. Svelto
7. Laser Physics: Peter W Miloni, Joseph H Eberly.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

OPEN ELECTIVE - II

18CHE301 INTRODUCTION TO PETROLEUM INDUSTRY

	L	T	P	C
Course Pre-requisite: Basic Chemistry at Intermediate or equivalent level.	**3**	**0**	**0**	**3**

Course Description:
It deals with basic principles of petroleum engineering and the processes involved in petroleum industry.

Course Objective:
1. To get exposure to the basic concepts of petroleum refining.
2. To understand the basic properties of various fuels, additives and their importance.
3. To introduce the basic concepts of refining processes and technologies.
4. To familiarize the basic concepts of catalysis and various catalysts used in the refinery.
5. To understand the safety and environmental issues in petroleum industry

UNIT I: BASIC PROCESSES IN PETROLEUM REFINING AND FUEL TESTING
Source of Crude oils and types, Overview of refinery process, Atmospheric Distillation, Vacuum distillation, Desalter, Desulphurization, Cracking, catalysis, Effluent treatment plant(ETP). Properties and quality control of fuel: Density, Viscosity, Pour Point, Flashpoint, Fire Point, Octane Number, Cetane Number, Ductility, Water Content, Sulphur Analysis, Micro Carbon Residue Test(MCRT), Saturate, Aromatic, Resin and Asphaltene(SARA), High Frequency Reciprocating Rig(HFRR), Calorific Value.

(9)

UNIT II: CHEMICAL ADDITVES IN PETROLEUM INDUSTRY
Types of products in the refinery and their structural properties, Neutralizing amines, Corrosion inhibitors, Multifunctional additives, viscosity modifiers, drag reducing agents, antioxidants, Lubrication modifiers, Antifoam agents, Oil spill absorbers, Dispersants, Chemicals used for ETP plant.

(9)

UNIT III: ROLE OF HYDROPROCESSING AND FLUID CATALYTIC CRACKING IN PETROLEUM INDUSTRY
Hydrocracking reactions, Hydrocracking feedstock's, Modes of Hydrocracking, Effects of process variables, Hydro treating process and catalysts, Resid hydro processing, FCC Cracking, Catalyst coking and regeneration, Design for Fluidized-Bed Catalytic Cracking Units

(9)

UNIT IV: ROLE OF CATALYSTS AND BIOPROCESSES IN PETROLEUM INDUSTRY
Types of catalyst and their importance, Design and selection of catalyst. Catalytic processes. Bioprocesses: Introduction, Refining of petroleum using biodesulphurisation, Bioremediation, commercial processes for bioethanol, isopropanol.

(9)

UNIT V: SAFETY AND MANAGEMENT IN PETROLEUM INDUSTRY
Safety policy, Personal protective equipment, Different type of extinguishers, Types of gloves and their application, Hydrants and their role, Safety indicators, Safety contact, Environmental pollution, precaution and first aid, safety measures, Different elements and their role in Occupational safety and Management.

(9)

Course Outcomes:
At the end of the course, the students will
1. Be able to understand the overview of petroleum industry
2. Be able to understand the concepts of crude oil, types of crude oils, properties of fuels such as octane number, cetane number, viscosity, density etc. Instruments.
3. Be familiarized with importance and their use of chemicals involved in the petroleum industry.
4. Be familiarized with the processes involved in hydroprocessing and fluid catalytic cracking.
5. Be familiarized the types of catalysts and bioprocesses in the petroleum industry.
6. Understanding the PPE, different types of extinguishers, First aid, process safety and management in the petroleum industry.

TEXT BOOKS

1. Mohamed A. Fahim, Taher A. Al-Sahhaf and Amal Elkilani, Fundamentals of Petroleum Refining, Elsevier,2009
2. David T Day, Handbook of the Petroleum Industry, Volume 1, ISBN: 137595962X, Chizine Publ., 2017

REFERENCE BOOKS:

1. Sankara Papavinasam, Corrosion Control in the Oil and Gas Industry, Elsevier, 2013
2. Petroleum Engineering Handbook (Vol. 1 - VIII). Editor in Chief: Larry W. Lake, Society of Petroleum Engineers.
3. Srinivasan Chandrasekaran. Health, Safety and Environmental Management for offshore and Petroleum Engineers, John Wiley and Sons, U.K., ISBN: 978-11-192-2184-5, 2016.
4. S. P. Srivastava and Jenő Hancsók, Fuels and fuel additives, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
5. Robert O. Anderson, Fundamentals of the Petroleum Industry–University of Oklahoma Pres, 1987.
6. James G. Speight, Handbook of Petroleum Product Analysis, John Wiley & Sons, Inc, 2015
7. Physical Chemistry by G.W. Castellan (Addison Wesley Publishing Company), 2004

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

OPEN ELECTIVE - II

18CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L	T	P	C
3	0	0	3

Course Prerequisite: Basic Engineering Chemistry or equivalent level

Course Description:
This course aims to introduce the interdisciplinary concept for engineering's to enhance their knowledge that they need to contribute with relevance and confidence in developing green technologies.
This course covers feedstocks, green metrics and the design of safer, more efficient processes, as well as the role catalysts, solvents and green processes for nanoscience.

Course Objectives:

1. Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry
2. Sensitize the students in redesigning of chemicals, industrial processes and products by means of catalysis.
3. Understand the use of alternatives assessments in using environmentally benign solvents.
4. Emphasize current emerging greener technologies and the need of alternative energies.
5. Learn to adopt green chemistry principles in practicing nanoscience.

UNIT I: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

Introduction, Green chemistry principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, Elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation.

(9)

UNIT II: CATALYSIS AND GREEN CHEMISTRY

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites: Catalytic cracking, ZSM-5 catalyst and high silica zeolites, TS1 Oxidation catalyst, Catalytic Converters, Homogeneous catalysis: Hydrogenation of alkenes using Wilkinson's catalyst, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide. Recycling of catalyst.

(9)

UNIT III : ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: carbondioxide, water - water as a reaction solvent, water based coatings, Ionic liquids as solvent.

(9)

UNIT IV: EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell, SOFC and PEMFC), Photochemical Reactions: Advantages and Challenges of Photochemical Processes, Example-Caprolactum, chemistry Using Microwaves: heating, assisted Reactions, Sonochemistry.

(9)

UNIT V: GREEN PROCESSES FOR NANOSCIENCE

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

(9)

Course Outcomes:

Upon completion of this course the students should

1. Recognize green chemistry concepts and apply these ideas to develop respect for the interconnectedness of our world and an ethic of environmental care and sustainability.
2. Understand and apply catalysis for developing eco friendly processes.
3. Be in a position to use environmental benign solvents where ever possible.
4. Have knowledge of current trends in alternative energy sources.
5. Apply green chemistry principles in practicing green Nanoscience.

Text Books :

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA 2005.

Reference Books :

1. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Nanoscience, wiley-VCH
2. V.K. Ahluwalia , M. Kidwai, New trends in Green chemistry, 2004, Springer.
3. Benny Joseph, Environmental Science and Engineering, TATA Mc Graw Hill, New Delhi 2006.
4. Albert Matlack, Introduction to Green Chemistry, Second Edition CRC press, 2010

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

OPEN ELECTIVE - II

18HUM301 INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
3	0	0	3

Course Description: Intellectual property (IP) is a legal term that refers to creations of the mind. Examples of intellectual property include music, literature, and other artistic works; discoveries and inventions; and words, phrases, symbols, and designs. Under intellectual property laws, owners of intellectual property are granted certain exclusive rights. Some common types of intellectual property rights (IPR) are copyright, patents, and industrial design rights; and the rights that protect trademarks, trade dress, and in some jurisdictions trade secrets. Intellectual property rights are themselves a form of property, called intangible property.

Course Objectives: The course is intended to:

1. Explain the importance of Intellectual Property Rights, its protection and management;
2. Explain the types/tools of IPR;
3. Make aware the students to understand the commercialization of IPR;
4. Know the filing of patent rights, acts, rules & portfolio analysis, management, patent strategy; and
5. Create awareness about Right to Information Act (RTI), its powers, functions, penalties and appeal.

UNIT I: INTRODUCTION:

Intellectual property and its protection, WTO, TRIPS Agreement& its Protection

(9)

UNIT II: INTRODUCTION TO COPYRIGHTS

Copyright Principles – Copyright Law - Copyright ownership - Right to prepare derivative works – Rights of Distribution - Copyright Formalities and Registrations - Copyright disputes - International Copyright Law – Patent Trademark – Geographical indications

(9)

UNIT III: COMMERCIALIZATION OF IP ASSETS:

Contracting, Licensing, Assignment and technology transfer; Drawing up a business strategy IP rights in export markets; Ownership of rights by employees; Valuation of intellectual property rights.

(9)

UNIT IV: PROCEDURE FOR FILING PATENT IN INDIA AND OTHER COUNTRIES,

PCT filing, Patent Search, Patent Acts & Rules, Patent Infringement, Patent Portfolio analysis and management, Patent Strategy.

(9)

UNIT V: RTI

Introduction – Objectives – Obligation of Public Authorities – The Central & State information commission – Powers & Functions – Penalties & Appeal.

(9)

Course Outcomes:

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

1. Understand the importance of Intellectual Property Rights, its protection and management.
2. Analyze and apply the types/tools of IPR.
3. Identify the process of commercialization of IPR.
4. Understand the procedure of filing of patent, acts, rules and portfolio analysis, management, patent strategy.
5. Apply the Right to Information Act (RTI) in real life situation.

Text Book:

1. Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 4th Edition (2013) By **Deborah E. Bouchoux, Cengage Learning**

References:

1. Latest Research Papers

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

OPEN ELECTIVE - II

18HUM302 HUMAN RESOURCE DEVELOPMENT

L	T	P	C
3	0	0	3

Course Description: The course content includes: Introduction to HRM, strategic human resource challenges, work flows, job analysis, managing diversity, concepts, goals, mechanism and system of HRD, recruitment and selection, downsizing and outplacement, appraising and managing employee performance, training, career development, managing compensation, rewarding performance, designing benefit plans, employee relation and employee discipline, and workplace safety and health.

Course Objectives: The course is intended to:

1. Explain the nature and scope of HRM, its functions, policies and strategies;
2. Describe the human resource planning, work analysis and importance in designing jobs;
3. Know the recruitment, selection and the process of performance appraisal;
4. Make the student to learn about training and development; and
5. Explain the industrial relations, trade unions, Ethics and fair treatment at work.

UNIT I: INTRODUCTION

Understanding the nature and scope of Human Resource Management- Definition, Functions / objectives, organization of department.

(9)

UNIT II: HUMAN RESOURCE PLANNING

Human Resource Planning- Factors affecting HRP, the planning process, managerial succession planning. Job Analysis, Methods of collecting job data, Competency based Job Analysis, Job design approach, contemporary issues in Job Description.

(9)

UNIT III: RECRUITMENT, SELECTION AND PERFORMANCE APPRAISAL

Recruiting and selecting employees-, Selection process, Barriers, selection in India. Performance Management, Process of Performance Appraisal, Methods of Performance Appraisal - Errors in Performance Appraisal.

(9)

UNIT IV: TRAINING AND DEVELOPMENT

Training v/s development – Training Methods - challenges in training - Career development – Reward Management – Performance Appraisal – Compensation Management.

(9)

UNIT V: INDUSTRIAL RELATIONS, TRADE UNIONS

Industrial Relations, Trade unions, resolving dispute- Labor Movement - Trade Union in India, Collective Bargaining: Process and Methods, Grievance: Sources and process of Redressal, Managing Ethical issues in Human Resource Management- Ethics and fair treatment at work.

(9)

Course Outcomes:

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

1. Understand the concept of HRM, its nature, scope, functions, policies and strategies;
2. Analyse human resource planning and apply in designing jobs;
3. Evaluate the recruitment, selection and the process of performance appraisal;
4. Understand the importance of training and development activities; and
5. Examine the industrial relations, trade unions, employee safety and health measures.

Text Books:

1. Aswathappa K., Human Resource Management- Text and Cases, Tata McGraw Hill, 6th Edition, 2010
2. Gomez-Mejia, L.R., Balkin, D.B., &Cardy, R.L. Managing Human Resource Management 6th edition, Pearson Edu. 2007.

References:

1. Garry Dessler, BijuVarkkey , Human Resource Management ,11th Edition, Pearson Education, 2009.
2. R. Wayne Mondy, Human Resource Management, 10th Edition, 2010

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective II

18HUM304 NATIONAL CADET CORPS

L	T	P	C
3	0	0	3

Pre-requisite: NCC B-Certificate

Course Description:

The main aim of this course is to mould the youth into responsible citizens of the nation. It helps to improve character and leadership qualities towards nation building. This course also motivates the youth to offer Selfless service to the society and nation. The course comprises Common subjects, Service subjects of NCC, societal aspects and basic organization of Indian Armed Forces.

Course Objectives:

This course enables the student to –

1. Get aware of NCC organization and general structure of Defence Forces.
2. Learn leadership and national integration.
3. Motivate towards to maintain Health and hygiene, personality development.
4. Learn elementary characteristics of disaster management, Field craft and Battle craft.
5. Acknowledge the Social activities, Communication and Military History.

UNIT I **10 hours**

INTRODUCTION TO NCC

Introduction, History of NCC , NCC Motto, NCC Flag, Aims of NCC, Cardinal points of NCC, Organization of defence forces in general, Organizational structure of Indian Army(Armed forces), Organizational structure of NCC, NCC Song, Incentives of NCC, Ranks in Army, Navy and Air Force, current representatives – Certificate Examination in NCC– Honours and Awards.

FOOT DRILL BASICS

Aims of Drill, Word of Commands, Attention, Stand at Ease, Turning Left, Right and Inclining at the Halt. Sizing, Forming up in three Ranks and Numbering, Open and Close March Order, Dressing the Squad, Saluting at the Halt, Getting on Parade, Falling Out and Dismissing, Marching, Guard of Honour.

UNIT II **10 hours**

LEADERSHIP

Meaning, Leadership Traits, Types of Leadership, Discipline & Duty of an Indian Citizen, Motivation, Code of Ethics, Perception, Communication, Customs of Services, Importance of Team Work, leaders(swami Vivekananda).

NATIONAL INTEGRATION

Meaning and Importance, Unity in Diversity, Indian History and Culture, Religion and Customs of India, India and its Neighbours, Contribution of Youth in Nation Building, Contribution of leaders in nation unification .

UNIT III **12 hours**

HEALTH AND HYGIENE

Structure and Function of Human Body, Hygiene and Sanitation, Preventable Diseases, First Aid, Yoga: Introduction and Exercises, Physical and Mental Health, Fractures: Types and Treatment.

PERSONALITY DEVELOPMENT

Introduction to personality development, Physical and social factors influencing / shaping personality, psychological and philosophical factors influencing / shaping personality, Self-awareness, SWOT analysis, mind set, interpersonal relationship and communication, effective communication, barriers of communication.

ENVIRONMENT AND ECOLOGY

Environment: Meaning, Global Warming, Acid Rain, Depletion of Ozone Layer, Conservation of Environment. Ecology: Introduction, Component of Ecological System, Forest Ecology, Wild Life, Pollution Control.

UNIT IV **10 hours**

DEFENCE AND DISASTER MANAGEMENT

Civil Defence: Meaning, Organization and its Duties, Civil Defence Services, Fire Fighting : Meaning, Mode of Fire, Fire Fighting Parties, Fire Fighting Equipment. Introduction, Classification of Disaster: Natural Disaster & Man Made Disaster, Disaster Management During Flood, Cyclone and Earth Quake, Assistance in Removal of Debris, Collection and Distribution of Aid Material, Message Services.

SOCIAL SERVICE ACTIVITIES (Social Service And Community Development)

Basics of Social Service, Weaker Sections in the Society and its Identification, Contribution of Youth towards Social Welfare, NGOs and their Role and Contribution , Social Evils, Drug Abuse, Family Planning, Corruption, Counter Terrorism, Eradication of Illiteracy – Aids Awareness programme – Cancer Awareness Programme.

UNIT V **10 hours**

COMMUNICATION

Types of communication, characteristics of wireless technology, Walkie/talkie, Basic RT procedure, Latest trends and development(Multimedia, video conferencing, IT)

MILITARY HISTORY

Biography of Indian Historical Leaders: Chatrapati Shivaji, Maharana Pratap, Akbar Famous Battles / Wars of India: Indo – Pak War 1971(all wars), Kargil War.(Categorise: before/ After independence) Biography of Successful Leaders: General Patton, General Mac. Arthur, Field Marshal Sam Maneksha.

Course Outcomes:

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

1. Analyse the NCC structure and different ranks in Indian Armed Forces along with foot drill.
2. Notify the leadership traits and the need of national integrity towards nation building.
3. Instill respect and responsibility towards personal health and hygiene, develop dynamic personality with adequate qualities.
4. Identify different disasters and judging measurements on the ground.
5. Recognise various communication devices, analyse the Military Organization.

Text Books:

1. HAND BOOK OF NCC – “SANJAY KUMAR MISHRA, MAJOR RC MISHRA”, published by Kanti prakashan-2020.
2. NCC HAND BOOK - “SHASHI RANJAN & ASHISH KUMAR”, published by Goodwin Publications-2021.

Reference Books:

1. NCC Hand book – “R.Gupta’s”, Ramesh Publishing House-2021.
2 NCC (ARMY WING)- “R.Guptas’s”,RPH Editorial Board-2021
3 Hand Book Of N.C.C. – “Ashok Pandey”, Kanti Publications-2017

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

OPEN ELECTIVE - II

18CE301 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

Identification of problematic soils; ground improvement techniques; densification in granular soils; densification in cohesive soils; soil stabilization; confinement; reinforced earth; geosynthetics; improvement of expansive soils.

Course Objectives

1. To introduce engineering properties of soft, weak and compressible deposits, principles of treatment for granular and cohesive soils and various stabilization techniques.
2. To bring out concepts of reinforced earth.
3. Applications of geotextiles in various civil engineering projects.

UNIT I: DEWATERING & GROUTINHG

Introduction- Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique.

Methods of de-watering- sumps and interceptor ditches- wells- drains- Electro- osmosis. Objectives of grouting- grouts and their properties-grouting methods.

(9)

UNIT II: DENSIFICATION

In - situ densification methods in cohesionless Soils: - Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth. In - situ densification methods in cohesive soils: - preloading or dewatering, Vertical drains - Sand Drains- Sand wick geo-drains - Stone and lime columns - thermal methods.

(9)

UNIT III: STABILIZATION

Methods of stabilization-mechanical-cement- lime-bituminous-chemical stabilization with calcium chloride- sodium silicate and gypsum.

(9)

UNIT IV: REINFORCED EARTH & GEOSYNTHETICS

Principles - Components of reinforced earth - factors governing design of reinforced earth walls design principles of reinforced earth walls. Geotextiles- Types, Functions and applications - geo- grids and geo-membranes - functions and applications.

(9)

UNIT V: EXPANSIVE SOILS

Problems of expansive soils - tests for identification - methods of determination of swell pressure. Improvement of expansive soils - Foundation techniques in expansive soils - under reamedpiles.

(9)

Course Outcomes

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

1. Identify basic deficiencies of various soil deposits and able to decide various dewatering methods to improve the soil.
2. Implement different techniques of soil densification.
3. Use admixtures in stabilizing the soil.
4. Use geo-synthetics materials in engineering applications.
5. Suggest different types of foundation techniques and methods to control swelling of soil

Text Books

1. Dr. Purushotham Raj, P., Ground Improvement Techniques, Laxmi Publications, New Delhi.
2. Dr. Sivakumar Babu, GL, An Introduction to Soil Reinforcement & Geosynthetics, Universities Press

Reference Books

1. Hausmann M.R., Engineering Principles of Ground Modification, McGraw-Hill International Edition, 1990.
2. Moseley M.P., Ground Improvement, Blackie Academic and Professional, Boca Taton, Florida, USA, 1993.
3. Xanthakos P.P., Abramson, L.W and Brucwe, D.A., Ground Control and Improvement, John Wiley and Sons, New York, USA, 1994.
4. Robert M. Koerner, Designing with Geosynthetics, Prentice Hall New Jercy, USA.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electrical and Electronics Engineering

OPEN ELECTIVE - II

18CE302 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The course will focus on Basic concept of Environmental Impact Assessment (EIA), EIA Methodologies, Impactof Developmental Activities and Land use in soil, water, and vegetation, Environmental Audit, Post Audit activities, The Environmental pollution Acts.

Course Objectives

1. To impart knowledge on Environmental management and Environmental Impact Assessment.
2. To give the student the brief knowledge about various legislations and audit protocols.
3. To give student knowledge about the framing of environmental audit through case studies.

UNIT I: CONCEPTS AND METHODOLOGIES IN EIA

Introduction - Elements of EIA - Factor affecting EIA -Impact evaluation and analysis - Preparation of Environmental Base map - Classification of environmental parameters. Criteria for the selection of EIA Methodology - EIA methods: Ad-hoc methods - matrix methods - Network method - Environmental Media Quality Index Method -overlay methods - cost/benefit Analysis.

(9)

UNIT II: IMPACT OF DEVELOPMENTAL ACTIVITIES

Introduction and Methodology for the assessment of soil and ground water - Delineation of study area - Identification of actives. Procurement of relevant soil quality - Impact prediction - Assessment of Impact significance -Identification and Incorporation of mitigation measures. EIA in surface water - Air and Biological environment.

(9)

UNIT III: IMPACT ON VEGETATION AND WILD LIFE

Assessment of Impact of development Activities on Vegetation and wildlife - environmental Impact of Deforestation - Causes and effects of deforestation.

(9)

UNIT IV: ENVIRONMENTAL AUDIT

Environmental Audit & Environmental legislation objectives of Environmental Audit - Types of environmental Audit - Audit protocol - stages of Environmental Audit - onsite activities - evaluation of audit data and preparation of audit report - Post Audit activities.

(9)

UNIT V: ENVIRONMENTAL POLLUTION ACTS

The water Act-1974 - The Air Act-1981 (Prevention & Control of pollution Act.) - Wild life Act- 1972 - Indian Forest Conservation Act-1980 -National Green Tribunal Act –2010 - Biological Diversity Act-2002.

(9)

Course Outcomes

The students after completing the course will be able to:

1. Utilize the various methods used in predicting environmental impacts.
2. Utilize site information to interpret impacts on land and groundwater.
3. Outline the environmental impacts of various development activities on existing ecosystem.
4. Utilize the procedures and various protocols involved in preparation of environmental audit report.
5. Utilize the implications of environmental prevention and protection acts in relation to environmental impact assessment.

Text Books

1. Anjaneyulu, Y., Environmental Impact Assessment Methodologies, B.S. Publication, Sultan Bazar, Kakinada.

Reference Books

1. Glynn, J. and Gary W. Hein Ke., Environmental Science and Engineering, Prentice Hall Publishers
2. Suresh K. Dhaneja Environmental Science and Engineering, S.K., Katania& Sons Publication, New Delhi.
3. Dr. Bhatia, H.S., Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

OPEN ELECTIVE - II

18CE303 WATERSHED MANAGEMENT

Course Prerequisites: None

L	T	P	C
3	0	0	3

Course Description

Topic covers basic concepts of watershed, sustainable watershed management approached and practices, integrated watershed management and modelling, social aspect inwatershed management, quantification of water quality and quantity at the catchment outlet using modern techniques, drought, flood and storm management at catchment scale.

Course Objectives

1. To discuss various aspects of water resources development and management on watershed basis.
2. To proliferate the sustainable use and development of natural resources.
3. To enrich the students for change in the hydrological fluxes due altered physiographic condition (land use or elevation) on a watershed scale.
4. To improve the quantitative problem solving skills of the students for natural resources management.

UNIT I

CONCEPT OF WATERSHED: Concept of watershed - classification of watershed - introduction to watershed management - objective of watershed development - Hydrological cycle - water balance equation - different stakeholders and their relative importance - watershed management policies and decision making. **(9)**

FACTOR AFFECTING WATERSHED DEVELOPMENT: Morphological characteristics: linear - Arial and Relief aspect - land use - vegetation - soil and geological characteristics - Hydrology and geology and socio-economic characteristics. **(9)**

UNIT II

WATERSHED MODELING: Watershed delineation - modelling of rainfall - runoff process - Concept of integrated watershed management conjunctive use of water resources - Integrated water resources management. PRA - Private sector participation - Institutional issues - Socio-economy issues - Integrated development - Water legislation and implementations - Tools and emerging technologies for watershed management and planning. **(9)**

UNIT III

EROSION AND SEDIMENTATION: Types of erosion - factor affecting erosion - effect of erosion on land fertility and capacity - estimation of soil loss due to erosion: universal soil loss equation. **(9)**

PREVENTION AND CONTROL TO EROSION: contour techniques - ploughing - furrowing- trenching - bunding - terracing - gully control - rockfill dams - check dams - brushwood dam - Gabion structure. **(9)**

UNIT IV

WATER HARVESTING: Rain water harvesting - catchment harvesting - harvesting structures - soil moisture conservation - check dams - artificial recharge from pond - percolation tanks.

FLOOD AND DROUGHT MANAGEMENT: Definition of flood - Flood frequency analysis: Weibul - Gumbel - and log Pearson methods.Definition and classification of drought - drought analysis techniques - drought mitigation planning.

MANAGEMENT OF WATER QUALITY: Water quality and pollution - types and Sources of pollution - water quality modeling - environmental guidelines for water quality.

(9)

UNIT V

COVER MANAGEMENT: Land use land cover change estimation through satellite imageries

- land capability classification - management of forest - agricultural - grassland and wild land - Reclamation of saline and alkaline soil. Classification of columns based on slenderness ratio - reinforcement & loading - Design of rectangular and circular columns subjected to axial load - (axial load + uni-axial bending) and (axial load + bi-axial bending). Different Types of Footings - Design of isolated - square - rectangular and circular footings.

INTEGRATED CROPPING SYSTEM FOR WATERSHEDS: Intercropping - mix cropping strip and terrace cropping - sustainable agriculture - cover cropping (biomass conservation) - horticulture - dryland agriculture and afforestation.

(9)

Course Outcomes

The students after completing the course will be able to:

1. Classify watershed and Identify factors to consider for watershed Development.
2. Apply the concepts of watershed development and planning
3. Evaluate the erosion rate and total amount of soil loss from a watershed
4. Select the flood and drought mitigation measures
5. Quantify the change in land use land/cover and its impact on hydrological processes.

Text Books

1. Kenneth N. Brooks Peter F. Ffolliott Joseph A. Magner. Hydrology and the Management of Watersheds. A John Wiley & Sons, Inc., Publication (4th Edition)
2. VVN, Murthy. Land and Water Management- Kalyani Pblication

Reference Books

1. JVS Murthy. Watershed Management. New Age International publisher.
2. A.M. Michel and T.P. Ojha. Hand Book on Agricultural Engineering, Volume 2.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

OPEN ELECTIVE - II

18ME302 ELEMENTS OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:

Course Objectives:

Students belonging to all branches of Engineering are made to learn following fundamental topics related to mechanical engineering

1. To teach students the basic concepts of Thermodynamics.
2. To teach students the basic Classification and working principles of boilers and turbines.
3. To teach students about IC engines, Refrigeration, and Air-Conditioning systems.
4. To teach students about engineering materials and casting manufacturing processes.
5. To teach students and machines tools and manufacturing systems.

UNIT I:

Basic concepts of Thermodynamics: Introduction, Important terminologies used in thermodynamics, Specific heat capacity, First law of thermodynamics, Second law of thermodynamics, Reversible and irreversible processes, the Carnot cycle and the Clausius inequality.

(9)

UNIT II:

Boilers: Introduction to boilers, Classification of boilers, requirements of a good boiler, Cochran, Babcock, Locomotive, and Lancashire boilers.

Turbines: Hydraulic Turbines-Classification and specification, Principles and operation of Pelton wheel turbine, Francis turbine, and Kaplan turbine (elementary treatment only).

Hydraulic Pumps: Introduction, Classification, and specification of pumps, reciprocating pump, and centrifugal pump.

(9)

UNIT III:

Internal Combustion Engines

Classification, I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines, Working principle of IC engines, Valve timing diagrams, Otto cycle, Diesel cycle, and Dual cycle.

Refrigeration and Air conditioning Refrigeration – Introduction, Refrigerator, and Heat pump, Components of refrigeration system, Types of refrigeration system, and Type of refrigerants.

(9)

UNIT IV:
Engineering Materials: Introduction, mechanical properties of engineering materials, mechanical testing of engineering materials, Impact test, and Classification of engineering materials.
Casting: Introduction to casting processes, Classification of casting processes, Sand casting, and special casting methods.
Power Transmission Devices: Introduction, belt drive, rope drive, Chain drive, Gear drive, Classification of gears.
(9)

UNIT V:
Machine Tools: Introduction, Mechanism of metal cutting, Geometry of single point cutting tool, Orthogonal and oblique metal cutting, Lathe, and Milling machines.
Manufacturing Systems Introduction, Computer Integrated Manufacturing, CAD/CAM, Numerical Control (NC), Computer Numerical Control, and Dynamics Numerical Control. **(9)**

Course Outcomes:

On successful completion of the course, the student will be able to:

1. State first, second and third law of thermodynamics.
2. Sketch components of boilers and turbines.
3. State working principle of IC engines and R& AC systems.
4. Fair understanding of application and usage of various engineering materials, Casting process, and different types of drives with applications.
5. Explain the role of Computers in manufacturing systems.

Text Book:

1. "Basic Mechanical Engineering" by Pravin Kumar, Pearson Edition ISBN: 9789332505759, 9789332505759.

References:

1. George E Dieter, "Mechanical Metallurgy", 3rd Edition, McGraw Hill, 2017.
2. S. Kalpakjian and S. R. Schmid, "Manufacturing Engg, and Technology", 7th Edition, Pearson, 2018.
3. P K Nag, "Engineering Thermodynamics", 6th Edition, McGraw Hill, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

OPEN ELECTIVE - II

18ME303 BASIC THERMODYNAMICS

L	T	P	C
3	0	0	3

Course Prerequisite: Differential Equations

Course Description:
Thermodynamics is one of the fundamental courses in the study of mechanical engineering. The principles of thermodynamics are applicable to a wide range of problems encountered in all branches of engineering. Also thermodynamics is an essential pre-requisite for subsequent courses in mechanical engineering like fluid mechanics, applied thermodynamics, heat transfer, gas dynamics, refrigeration and air conditioning, etc. This course is designed to equip the students with a thorough understanding of basic concepts of thermodynamics and with necessary skills and techniques to solve problems in thermodynamics through a systematic analysis using fundamental principles. The specific topics to be covered in the course include concepts of system and surroundings, energy, energy transfer by work and heat, properties of substances and property changes, first and second laws of thermodynamics.

Course Objectives:
1. To introduce the concepts of system, surroundings, energy interactions, thermodynamics properties of substances and to teach different techniques used for estimating the properties like gas laws and property tables
2. To explain the principles of work and energy.
3. To introduce the fundamentals of thermodynamic laws, concepts and principles.
4. To teach the systematic approach to be employed for effectively solving the problems in thermodynamics.
5. To explain the principles of various cycles and to apply the thermodynamic concepts in various applications like IC engines and Refrigeration and Air conditioning systems.

UNIT I: THERMODYNAMIC BASICS
Macroscopic versus Microscopic viewpoint, Thermodynamic system and control volume, Thermodynamic properties, processes and cycles, Homogeneous and heterogeneous systems, Thermodynamic equilibrium, Quasi-static process, Concept of continuum, Zeroth law of thermodynamics, temperature scale, Ideal gas, Work Transfer, Heat transfer, First law of thermodynamics, Specific heat, Enthalpy, Internal Energy, Steady flow energy equation and application, PMM1 and Steady flow energy equation. **(9)**

UNIT II : PROPERTIES OF PURE SUBSTANCES
Pure substance, Vapor-Liquid-Solid-Phase equilibrium in a pure substance, Independent properties of a pure substance, Phase boundaries, tables of thermodynamic properties, Thermodynamic Surfaces, p-v and p-T diagram for a pure substance, p-v-T surface, T-s and h-s or Mollier diagram for a pure substance, dryness fraction, Steam Tables, Charts of Thermodynamic properties, Measurement of steam quality. **(9)**

UNIT III : SECOND LAW OF THERMODYNAMICS AND ENTROPY
Qualitative difference between heat and work, cyclic heat engine, Kelvin-Planck statement of second law, Clausius' statement of second law, Refrigerator and heat pump, Equivalence of Kelvin-Planck and Clausius statement, Reversibility and Irreversibility, Carnot cycle, Reversed heat engine, Carnot's Theorem, Corollary of Carnot's theorem, absolute thermodynamic temperature scale and Efficiency of heat engine, Entropy, Inequality of Clausius, Temperature-Entropy plot, Entropy generation in an open and closed system and Entropy change in an Irreversible process. **(9)**

UNIT IV : THERMODYNAMIC PROPERTY RELATIONS AND GAS MIXTURES
Equation of state, Ideal gas, Real gas, Compressibility chart, Internal energy, enthalpy, entropy, specific heats and Gibbs free energy of gas mixture, Maxwell's Equations, TdS equation, Difference in heat capacities, Ratio of heat capacities, Joule-Kelvin Effect, Clausius-Clapeyron equation, Properties of atmospheric air, Psychrometric chart and Psychrometric process. **(9)**

UNIT V : THERMODYNAMIC CYCLES
Rankine cycle, Actual vapour cycle processes, Comparison of Rankine and Carnot cycles, Air standard cycles - Otto, Diesel, dual and Brayton cycles, Reversed heat engine cycle, Vapour compression refrigeration cycles. **(9)**

Course Outcomes:
On successful completion of the course, the student will be able to:
1. Define the fundamentals of the zeroth and first laws of thermodynamics and explain their application to a wide range of systems.
2. Apply the properties of steam to design steam systems.
3. Apply the second law of thermodynamics for the design of heat engine, heat pump and refrigerators. The student will also be able to Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
4. Explain the cycles on which IC engines, Gas turbines and refrigerator works.
5. Explain the importance of Tds relations and be able to use psychometric charts for the design of air conditioning systems.

Text Books:

1. Cengel, Y.A and Boles, M.A, Thermodynamics: An Engineering Approach, 5th ed., McGraw-Hill, 2006.

References:

1. Sonntag, R.E., Borgnakke, C., and Van Wylen, G.J., Fundamentals of Thermodynamics, 6th ed., John Wiley, 2003.
2. Nag, P.K., Engineering Thermodynamics, 3rd ed., Tata McGraw-Hill, 2005.

Mode of Evaluation: Assignment, Mid Examination, End Examination

OPEN ELECTIVE - II

18ECE301 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course provides the fundamental knowledge on applications of electronics in bio-medical signal measurements and processing, bio-medical instrumentation and imaging techniques.

Course Objectives:
This course enables students to
1. Acquire the basic knowledge on human physiology and biological transducers.
2. Learn about bio-electrodes and bio-amplifiers used in bio-signal acquisition.
3. Understand the working principle of bio-medical measuring instruments.
4. Study various types of imaging techniques used in medicine.
5. Learn the applications of medical instrumentation in designing artificial medical aids.

UNIT I: HUMAN PHYSIOLOGY AND BIOMEDICAL TRANSDUCERS
Introduction to human physiology - Biomedical transducers for measuring displacement, velocity, force, acceleration, potential, dissolved ions and gases.

(9)

UNIT II: BIO-ELECTRODES AND AMPLIFIERS
Introduction to bio-potential, Bio-electrodes, Typical waveforms and characteristics of ECG, EMG and EEG, Bio-potential amplifiers for ECG, EMG and EEG – Lead systems and recording methods.

(9)

UNIT III: BIOMEDICAL MEASURING INSTRUMENTS
Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography.

(9)

UNIT IV: MEDICAL IMAGING
X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging.

(9)

UNIT V: PROSTHESES AND AIDS

Pacemakers, Defibrillators, Heart-lung machine, Artificial kidney, Aids for the handicapped, Safety aspects.

(**9)**

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Understand the applications of biological transducers in medical field.
2. Analyze the design of bio-electrodes and bio-amplifiers.
3. Apply suitable measuring instruments to measure various medical parameters.
4. Understand and test various imaging techniques used in bio-medical diagnosis.
5. Analyze the applications of artificial medical aids.

Text Books

1. W.F. Ganong, Review of Medical Physiology, 26th Edition, Tata McGraw-Hill, New Delhi, 2019.
2. J.G. Websster, ed., Medical Instrumentation, 3rd Edition, Wiley India Pvt. Ltd. 2009.

Reference Books

1. A.M. Cook and J.G. Webster, eds., Medical Devices and Human Engineering, Taylor & Francis, 2014.
2. R.S.Khandpur, "Handbook of Biomedical Instrumentation", 2nd edition, Tata McGraw-Hill, New Delhi, 2005.
3. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice-Hall, New Delhi, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

OPEN ELECTIVE - II

18ECE302 VLSI DESIGN

	L	T	P	C
Course Prerequisite: None	**3**	**0**	**0**	**3**

Course Description

This course describes about various VLSI design methodologies, fundamentals of CMOS technology. It incorporates basics of MOSFET, CMOS processing technology, circuit characterization and performance estimation, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives

This course enables students to

1. Know the different VLSI Design Methodologies
2. Understand the characteristics of CMOS device
3. Study CMOS design rules
4. Designing of CMOS by considering the low power
5. Understand different types of CMOS circuit families

UNIT I: Introduction to VLSI design methodologies

Introduction to VLSI Design Methodologies, Scaling, CMOS Logic: Inverter, NAND Gate, NOR Gate, Combinational Logic, Compound Gates, Pass Transistors and Transmission Gates, CMOS Inverter Cross-section, Stick Diagrams. VLSI Design Flow, Complementary CMOS Inverter DC Characteristics, Beta Ratio Effects, Noise Margin.

(9)

UNIT II: MOS transistor theory

MOS Ideal I-V Characteristics, C-V Characteristics, MOS Small-signal Model, MOS Capacitance Models, MOS Gate Capacitance Model, MOSFET as a Switch, non-ideal I-V Effects: Velocity Saturation and Mobility Degradation, Channel Length Modulation, Body Effect, Sub-threshold Conduction, Junction Leakage, Tunneling.

(9)

UNIT III: CMOS technologies

CMOS Technologies: Background, Wafer Formation, Photolithography, Well and Channel Formation, Isolation, Gate Oxide, Gate and Source/Drain Formation, Contacts and Metallization, Passivation, Metrology. Scribe Line and Other Structures, MOSIS Scalable CMOS Design Rules, Micron Design Rules.

(9)

UNIT IV: Low power design
Delay Estimation using RC Delay Model and Linear Delay Model, Logical Effort, Parasitic Delay. Logical Effort and Transistor Sizing: Delay in a Logic Gate, Delay in Multistage Logic Networks, choosing the Best Number of Stages. Power Dissipation: Static Dissipation, Dynamic Dissipation, Low-Power Design. Interconnect: Resistance, Capacitance, Delay, and Crosstalk.

(9)

UNIT V: Circuit families
Circuit Families: Static CMOS, Ratioed Circuits, Cascade Voltage Switch Logic, Dynamic Circuits, Sense Amplifier Circuits, Bi-CMOS Circuits, Multiplexers, Sequential Static Circuits, Design of Latches and Flip-Flops.

(9)

Course Outcomes
Upon successful completion of the course, students will be able to
1. Explain the VLSI design methodologies and basic CMOS circuits used in modern Integrated circuits applications.
2. Discuss the fundamentals of MOS transistor theory.
3. Discuss about the CMOS processing technology.
4. Discuss about the integrated circuit characterization and performance estimation.
5. Describe the different types of circuit families.

Text Books
1. J. P. Uyemura: Introduction to VLSI Circuits and Systems, Wiley.
2. Neil H.E. Weste, David Harris, Ayan Banerjee: CMOS VLSI Design, Third Edition, Pearson Education.

Reference Books
1. Philip E. Allen and Douglas R Holberg: CMOS Analog Circuit Design, Oxford.
2. Carver Mead and Lynn Conway: Introduction to VLSI systems, BS Publication.
3. Plummer: Silicon VLSI Technology, Pearson Education.
4. J. P. Uyemura: Chip Design for Submicron VLSI, Cengage Learning.
5. Neil H.E. Weste, Kamran Eshraghian: Principle of CMOS VLSI Design, Pearson Education.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

OPEN ELECTIVE - II

18CSE301 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: Nil

Course Description:

This course will cover the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems.

Course Objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To give introduction to shell programming.
3. To learn the mechanisms involved in memory management in contemporary OS
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
5. To know the components and management aspects of concurrency management

UNIT I: INTRODUCTION

Concept of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Case study on UNIX and WINDOWS Operating System. KORN SHELL PROGRAMMING:Basic Script Concepts,Expressions, Decisions: Making Selections, Repetition, Special Parameters and Variables, Changing Positional Parameters, Argument Validation, Debugging Scripts.

(9)

UNIT II: PROCESS CONCEPTS

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling.

(9)

UNIT III: PROCESS SYNCHRONIZATION AND DEADLOCKS
Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery. **(9)**

UNIT IV: MEMORY MANAGEMENT STRATEGIES
Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU). **(9)**

UNIT V: FILE SYSTEM:
File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks. **(9)**

Course Outcomes:
At the completion of the course the students will be able to:
1. Write shell scripts using korn shell.
2. Create processes & threads and implement the various process scheduling techniques.
3. Analyse the concurrent processing and deadlock situations.
4. Design algorithmic solutions to solve memory management problems.
5. Implement the different types of file management techniques.

Text Books:
1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

References:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

OPEN ELECTIVE - II

18CSE302 E-LEARNING TECHNOLOGIES

Course Prerequisite: Nil

L	T	P	C
3	0	0	3

Course Description:

The course provides a comprehensive understanding of the fundamental theory of E-learning and the Strategies of E-Learning .The relation between Models of E-Learning and Multi/Hyper Media for E-learning has been explained across various stages of learning techniques.

Course Objectives:

1. To enable the students to understand the concept of e-learning and integrating the technology.
2. To inculcate knowledge in planning the role of information technology in virtual classroom and university.
3. To make the students to understand the technology mediated communication and its applications.
4. To include knowledge in planning models of E-learning in in virtual classroom and university.
5. To make the students to understand the future of E-learning technology and its development.

UNIT I: CONCEPT OF E-LEARNING

Meaning, Evolution of E-Learning – Components of E-Learning – Virtual classroom: Teleconferencing, Audio and Video conferencing.

(9)

UNIT II: STRATEGIES OF E-LEARNING

Process of E-Learning: Knowledge Acquisition and Creation, Sharing of Knowledge, Utilization of Knowledge – E-Learning Instructional Grounds: Behaviourism, Cognitivism and Constructivism.

(9)

UNIT III: MODELS OF E-LEARNING

Role of Web-Based Instruction in Learning – Models of WBI: Instructional Design Model (ISD) & Hyper Media Design Model (HMD) – Computer Languages for Designing WBI – Future of E-Learning.

(9)

UNIT IV: MULTI/HYPER MEDIA FOR E-LEARNING
Concept, Meaning, Characteristics and Applications – Teaching Techniques through Multi/Hyper Media – Multimedia & Learning – Multimedia for Co-operative and Collaborative Learning Strategies – General Guidelines for Multi/Hyper Media Applications – Advantages & Disadvantages of Multi/Hyper Media.

(9)

UNIT V: FUTURE OF E-LEARNING TECHNOLOGY
21stCentury Education – Challenges of Distance Education – Electronic Media in Distance Education – Open Educational Resources / Open Learning – Internet in Distance Education – Virtual University System.E-Patashala, Indian Institutes Developing E-Content.

(9)

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

1. Understand the concept of e-learning and integrating the technology.
2. Make the students to understand the technology mediated communication and its applications.
3. Understand the technology mediated communication and its applications.
4. Include knowledge in planning models of E-learning in in virtual classroom and university.
5. Make the students to understand the future of E-learning technology and its development.

Text Books:

1. Badrul Khan and Mohamed Ally(Edited), 2015, International Hand book of E-Learning:Volume-1 Theoretical Perspectives and Research, Routledge,.
2. Robyler , 2007, Integrating Educational Technology into Teaching, 4th Edition, Pearson Education India .
3. Richard Andrews and Caroline Heythornthwaite (Edited), 2007, The SAGE Hand Book of E-Learning Research, SAGE,Delhi.

References:

1. Bryn Holmes and John Gardiner, 2006,E-Learning Concepts and Practice, ,Pine Forge Press.
2. Y.R. Ramaiah , 2002,Distance Education and Open Learning, , Mittal Publications.
3. PradeepMandav, 2001, Visual Media Communication, Authorspress.
4. Michael D.Wiliams, Prentice Hall, 2000,Integrating Technology into Teaching and Learning: Concepts and Applications,.
5. Laura Parker Roerden, O'Reilly, 1997,Net Lessons: Web-based Projects for Your Classroom, Volume 1.
6. Paul F. Merrill, Allyn and Bacon, 1996,Computers in Education, 3rd Edition.
7. Joan Riedl, Allyn and Bacon, 1995,The Integrated Technology Classroom.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

OPEN ELECTIVE – IV

Open Elective - IV

18ENG301 CREATIVE WRITING

L	T	P	C
3	0	0	3

Course Description: The course functions as a broad-based introduction to various forms of creative writing, such as short fiction, poetry and drama. Short story writing is geared towards creative writing so that students learn about character, dialogue, voice, style and description in fiction. The course provides them with the opportunity to delve deeper into the analysis of selected short fiction and to work on stories of their own. Students explore the genre of poetry in-depth through their own writing and that of published poets. The study of playwriting involves many of the same focuses as short story writing, such as dialogue, character and plot. Students also experiment with writing these genres. The class is usually comprised of technique and style discussions, reading assignments and writing exercises.

Course Objectives:
This course enables the students to –

1. Familiarize with different forms of writing: poetry, scene writing, vignette and feature writing.
2. To encourage reading and acquainting, appreciating and responding to different genres of writing.

UNIT I: Introduction to creative writing and reading. Poetry, Short Story, Drama, Fiction, Non Fiction, Feature Writing, etc. **(9)**

UNIT II: Poetry, Scenario writing, feature and vignette writing. Haiku, Object Poem, List Poem, Visual Poem, Nature Poem. Scanning a poem and understanding its meaning. **(9)**

UNIT III: Writing a scene, finding sources from which to draw ideas to write scenes, creating an effective setting for a scene to take place; creating strong, believable characters in a scene **(9)**

UNIT IV: Learning how a scene can drive the plot of a story, how to effectively use point of view to enhance a scene, how to write interesting and useful dialogue, self-editing own writing. **(9)**

UNIT V: Writing a vignette, finding sources from which to draw ideas to write a vignette, organizing one's time and ideas to produce a longer piece of writing. **(9)**

Course Outcomes:

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

1. Develop skills in reading, writing, and editing various literary genres.
2. Obtain an awareness of the role of analysis to inform appreciation and understanding of poetry.
3. Demonstrate the ability to read and respond thoughtfully.
4. Develop plot of the story and sketch characters with relevant dialogues
5. Obtain effective writing skills such as good essays and projecting scholarly ideas.

Text Book:

1. Tondeur, Louise. 2017. How to Think Like a Writer: A Short Book for Creative Writing Students and Their Tutors. Louise Tondeur

Reference Books:

1. Middleton, Daniel. 2012. The 7 Points of Write: An Essential Guide to Mastering the Art of Storytelling, Developing Strong Characters, and Setting Memorable Scenes. 711 Press

2. Kumar, Amrita. 2017. Kissing the Demon: The Creative Writer's Handbook. Harper Collins
3. Mastering Creative Writing: A Writer's Guide by Dahveed Bar-Daniel (kindle book) published :12 April 2017

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

Open Elective- IV

18HUM303 ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

Course Description: The objective of this course is to inculcate in students the skills necessary to craft strategies and initiatives which can enable growth and sustainability in an entrepreneurial venture, to include the effective management of inventory, receivables, production, human resources, financial resources, and risk. Students will develop higher-level critical thinking skills, evidenced by analysis, evaluation, and synthesis.

Course Objectives: The course is intended to:

1. Explain the basic concepts of entrepreneurship and its role in Indian Economy;
2. Describe the SWOT analysis, promotional and financial aspects of entrepreneurship
3. Explain project planning and feasibility studies;
4. Make the students acquire knowledge about women entrepreneurship; and
5. Explain the rural entrepreneurship and role of NGOs and EDPs in India.

UNIT I: INTRODUCTION

Entrepreneurial competencies, attitudes, qualities, functions - Forms of Entrepreneurship - Types of ownership - sole trading, partnership and corporation – Role of Government in Entrepreneurship Development. **(9)**

UNIT II: PROMOTIONAL & FINANCIAL ASPECTS OF ENTREPRENEURSHIP

Idea generation– opportunities - SWOT Analysis - patents and trademarks, Intellectual Property Rights. Financial Aspects of the Entrepreneurship: Source of Capital, Debt capital, seed capital, venture capital - Informal Agencies in financing entrepreneurs, Government Grants and Subsidies, Types of Investors and Private Offerings. **(9)**

UNIT III: PROJECT PLANNING AND FEASIBILITY STUDIES

Concept of Project, Project Life Cycle -Project Planning, Feasibility Report – Project proposal & report preparation. Technical Feasibility and Economic Viability – sources of New Ideas. **(9)**

UNIT IV: WOMEN ENTREPRENEURSHIP

Scope of entrepreneurship among women – Promotional effects – Institutional framework - Successful cases of women entrepreneurs. **(9)**

UNIT V: RURAL ENTREPRENEURSHIP AND EDPS

Role of NGO's– Organizing EDPs – Social Entrepreneurship – Startups – Entrepreneurship development among target groups of society. **(9)**

Course Outcomes:

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

1. Understand the concepts of entrepreneurship and its role in Indian Economy;
2. Compare and apply sources of different promotional and financial aspects;
3. Understand and analyze the feasibility study in project planning;
4. Find the women entrepreneurship development in India; and
5. Assess the rural entrepreneurship and strengthen the role of NGOs and EDPs.

References:

1. Entrepreneurial Development, S. Chand and Company Limited, S.S. Khanka, New Delhi, 2009.
2. Fundamentals of Entrepreneurship, H. Nandan, PHI, First/e, New Delhi, 2009.
3. Entrepreneurship, 6/e, Robert D Hisrich, Michael P Peters, Dean A Shepherd, TMH,2009.
4. The Dynamics of Entrepreneurial Development and Management, Vasanth
5. Desai, Himalaya,2009
6. Entrepreneurship Management – text and cases, Bholanath Dutta, Excel Books, 2009
7. Entrepreneurship – New venture Creation, Holt, PHI, 2009

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

Open Elective – IV

18MAT303 GRAPH THEORY

L	T	P	C
3	0	0	3

Course Prerequisite: Modern Algebra, Linear algebra

Course Description:

Graph theory is the core content of Discrete Mathematics. This course introduces in an elementary way some basic knowledge and the primary methods in Graph Theory also it is important in regarding to find out the mathematical structures from graph theory in concrete examples.

Course Objectives

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

1. To understand the fundamental definitions and properties of graphs.
2. To know the concepts of trees and spanning trees.
3. To learn about the matching and factors, connectivity.
4. To study the concepts of coloring of graphs, Planer graphs.
5. To introduce about the edges and cycles.

UNIT I: FUNDAMENTAL CONCEPTS

Graphs, path, cycles and trails, vertex degree and counting, directed graphs **(9)**

UNIT II: TREES AND DISTANCE

Basic properties, spanning trees, optimization and trees. **(9)**

UNIT III: MATCHING AND CONNECTIVITY

Matching and covers, algorithm and applications, Cuts and Connectivity, k-connetced graphs. **(9)**

UNIT IV: COLOURING OF GRAPHS AND PLANER GRAPHS

Vertex coloring, structure of k-chromatic graphs, Euler's formula, characterization of planar graphs. **(9)**

UNIT V: EDGES AND CYCLES

Line graphs and edge coloring, Hamiltonian cycles, planarity, coloring and cycles. **(9)**

Text Book:

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India 2014.

References

1. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall.
2. Frank Harary, Graph Theory, Narosa.
3. R. Ahuja, T. Magnanti, and J. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice-Hall.

Course Outcomes:

At the completion of the course the students will be able to:

1. Understand the basic terminology of graphs.
2. Determine the number of trees and spanning trees in a graph.
3. Find the matching and connectivity in graphs.
4. Learn about the concepts of coloring of graphs and Planer graphs.
5. Determine the number of edges and cycles of a graph.

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Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

Open Elective - IV

18MAT304 MATHEMATICAL MODELING AND NUMERICAL SIMULATION

L	T	P	C
3	0	0	3

Course Description:

This course introduces mathematical modelling and numerical simulation as tools for analyzing and solving real world problems. Here, data assimilation (DA) technique has been discussed to find the best estimate of the state by combining available information including model forecasts, observations and their respective errors. The accurate initial condition obtained by DA is used as input to numerical weather prediction (NWP) modules to improve the model forecast. Data visualization techniques allow engineering students to use their perception to better understanding of the implications of the data and their importance in many different fields.

Course Objectives:

1. To understand the overview of dynamic model system with dynamical and thermo-dynamical equations
2. To understand the basic concept and classification of partial differential equations and importance of initial and boundary value problem.
3. To introduce the development and use of modeling system in terms of scale and physical process.
4. To provide a conceptual and mathematical overview of the data assimilation.
5. To develop the skills for design and a comparative study between observed and modeled data.

UNIT I: BASIC CONSERVATION LAWS AND APPLICATIONS OF BASIC EQUATIONS

Total differentiation, Vectorial form of the momentum equation in rotating coordinates, Component equations in spherical coordinates, The continuity equation, The thermodynamic energy equation, Basic equations in isobaric coordinates, Balanced flow, Trajectories and streamlines, Thermal wind, Vertical motion **(9)**

UNIT II: NUMERICAL DISCRETIZATION OF EQUATIONS

Classification of partial differential equations (PDEs), Initial value problems, Finite difference method for space discretization, Boundary value problems: Heat, Wave and Laplace equations **(9)**

UNIT III: NUMERICAL MODELS AND PHYSICAL PROCESSES

Numerical models: Global, Regional, Mesoscale models, Parameterization of sub-grid scale physical processes: Planetary boundary layer, Moist microphysics physics, Cumulus convection, Radiation, Air-sea interaction processes, and Land-surface processes, Overview of interactions and parameterizations of these processes **(9)**

UNIT IV: DATA ASSIMILATION

Data assimilation: Empirical analysis schemes, Objective analysis schemes, Variational data assimilation techniques (unsteady three dimensional); Forecast error covariance; Dynamical and physical balance in the initial conditions; Quality control of observations; Atmospheric predictability; Concepts of chaotic systems and ensemble forecasting. **(9)**

UNIT V: DATA ANALYSIS AND VISUALIZATION

Introduction of WRF model and its Applications; Analysis of simulated and observed data sets through Grid Analysis and Display System (GrADS), MATLAB, and Excel software. **(9)**

Course outcomes

At the end of the course students are able to

1. Understand overview of dynamic model system and solve a set of dynamical and thermo-dynamical equations governing the state of the atmosphere.
2. Find accurate results through simulations by using proper and suitable representation of dynamical processes
3. Gain the knowledge of how and where to use the mathematical models in regional, mesoscale and global scales and develop an understanding of the physical processes
4. Compute the best estimate of the state by statistically combining model forecasts, observations, and their respective errors by using data assimilation technique.
5. Prepare the data for visualization and compare the results with observations.

Text books:

1. An Introduction to Dynamic Meteorology, Fourth Edition, by James R. Holtan, Elsevier Academic Press
2. Atmospheric Modeling, Data Assimilation, and Predictability, by Eugenia Kalnay (Cambridge University Press, 2003)
3. A description of the advanced research WRF version 3. Tech. Note, by Skamarock, W.C (2008).

References:

1. Dynamics, Volume 101, Second Edition: Physical and Numerical Aspects. Academic Press
2. Mark Z Jacobson. Fundamentals of Atmospheric Modeling, Cambridge University Press
3. James C. McWilliams. Fundamentals of Geophysical Fluid Dynamics, Cambridge University Press
4. Introduction to Grid Analysis and Display System (GrADS) by Guilherme Martins (2014) DOI :10.13140/RG.2.1.2594.2249.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

Open Elective - IV

18PHY303 THIN FILM TECHNOLOGY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
Nucleation, crystallization, surface energy, various thin film coating processes including both physical vapour deposition such as evaporation, sputtering, pulsed laser deposition and chemical vapour deposition, spray coating, and other methods such as spin-coating, plasma polymerization, Langmuir Blodgett, transport phenomena in thin films, various properties of thin films, techniques and method to characterize thin films, current application of thin film, introduction to fabrication of thin film devices

Course Objectives:
1. To provide students with a comprehensive overview on the fundamentals of thin film preparation and characterization.
2. To enable the students to develop a thorough understanding of how core physics can be used to understand thin film deposition processes.
3. To establish the correlation between processing variables and materials characteristics and performance within the framework of key modern technologies.
4. To realize thin film applications to science and technology

UNIT I: PHYSICS OF THIN FILMS
Introduction - Role of thin films in devices - Thin film definition - Crystalline and amorphous films - Crystal defects - Nucleation and growth - film formation. **(9)**

UNIT II: THIN FILM DEPOSITION TECHNIQUES
Physical methods of films deposition-evaporation, e-beam, sputter deposition, pulsed laser, molecular beam epitaxy. Chemical methods of film deposition -Deposition of Inorganic films from Solutions-Chemical vapour deposition - Electrolysis, Anodization, Spray pyrolysis, Other techniques: Langmuir Blodgett and Spin Coating. **(9)**

UNIT III: PROPERTIES OF THIN FILMS
Structural-Optical-Electrical-Magnetic-Mechanical and Thermal properties of thin films. **(9)**

UNIT IV: CHARACTERIZATION OF THIN FILMS
Imaging Techniques (SEM, AFM, TEM) - Structural Techniques (XRD, Raman)-Optical Techniques (UV-Vis-NIR, PL)-Electrical Techniques (Hall Effect, IV, CV)-Magnetic Techniques (EPR, H-V curve)-Mechanical Techniques (Hardness testing)-Thickness measurement (profilometer, ellipsometry). **(9)**

UNIT V: APPLICATIONS OF THIN FILMS
Transparent conducting coating - Optical coating – Solar cells – Photocatalytic – Sensors - Superconductivity- Superhard coatings – Thin film transistors. **(9)**

Course Outcomes:
After a successfully completed course the students will be able to:
1. Discuss the differences and similarities between different vacuum based deposition techniques, evaluate and use models for nucleating and growth of thin films.
2. Asses the relation between deposition technique, film structure, and film properties.
3. Know the typical thin film applications.
4. Motivate selection of deposition techniques for various applications.

Text books:

1. Thin Film Deposition: Principles and Practice, *Donald L. Smith*, McGraw Hill, Singapore, 2001.
2. Maissel, L.I and Glang. R, “Handbook of thin film technology”, McGraw Hill, 1970.

References:

1. Thin film phenomena / *Kasturi L. Chopra*, New York: McGraw-Hill, c1969.
2. G. Cao, “Nanostructures & Nanomaterials: Synthesis, Properties & Applications” Imperial College Press, 2004.
3. An introduction to physics and technology of thin films / *Alfred Wagendristel, Yuming Wang*, Singapore: World Scientific, c1994.
4. Thin film processes, *John L Vossen, Werner Kehn* editors, Academic Press, New York, 1978.
5. Thin film physics / *O.S. Heavens*, London: Methuen, c1970.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective – IV

18CHE303 INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

Course Description

This is primarily a lecture course which brings together relevant knowledge from the disciplines of physics and chemistry to give students a fundamental understanding of the integrated multidisciplinary nature of Nanotechnology.

Objectives

1. To understand the emergence of nanoscience and technology through history.
2. The various process techniques available for nanostructured materials.
3. The role of nanotechnology in electronics how basic nano-systems work
4. To use physical reasoning to develop simple nanoscale models to interpret the behaviour of such physical systems

UNIT I: MOLECULE TO MATERIALS: BASICS OF NANOTECHNOLOGY

History & emergence (Feynman to present) of Nanoscience and Nanotechnology, Challenges in Nanotechnology. Atomic Structures: Rutherford and Bohr's model of atom. Bohr's model to Quantum: Wave function, Uncertainty principle, Orbital quantum numbers, Shape of the orbitals. Types of simple crystal structures, defects in crystals. **(9)**

UNIT II: TYPES AND SYNTHESIS OF NANOSTRUCTURES

Definition of a Nano system - Zero Dimensional (OD), One Dimensional (1D) - Two Dimensional (2D) - Three Dimensional (3D) nanostructured materials. Nanoscale building blocks, Top-down and Bottom-up approaches. Synthesis of Nanomaterials – Physical & Chemical methods: Chemical Vapour Deposition (CVD), Atomic Layer Deposition (ALD), Chemical Reduction, Co-precipitation, Emulsion Polymerization (Polymer and Organic NPs), Sol-Gel, Green synthesis of Nanoparticle (NP). **(9)**

UNIT III: PROPERTIES OF NANOMATERIAL

Thermal, Mechanical, Optical, Electrical and Magnetic properties of nanomaterials (Metal oxides, Ceramics, Nanocomposites, Semiconductors). Carbon age materials: CNTs, and other Carbon-based materials). Effect of size and shape on the properties of nanomaterials. **(9)**

UNIT IV: CHARACTERIZATION OF NANOMATERIALS

Structure: Powder XRD (SAXS); Composition: XPS; Thermal: TG-DTA; Optical & Electron microscopes: Atomic force microscopes (AFM), Scanning electron microscope (SEM), Transmission electron microscope (TEM); Magnetic characterization (SQUID). **(9)**

UNIT V: APPLICATIONS OF NANOMATERIALS

Molecular electronics and nano-electronics – LED applications, Quantum electronic devices - CNT based transistor and Field Emission Display – Biological (anti-bacterial, anti-fungal, anti-microbial) applications - Biochemical sensor - Membrane based water purification, Target based drug delivery system. **(9)**

Course Outcomes:

Upon completion of this course the students will be able to:

1. Understand the correlation between atomic, molecular structures and nanomaterials
2. Classify the types and synthesis the nanomaterials based on the needs of the society and environment.
3. Infer and interpret the properties of nanomaterials
4. Apply the knowledge of characterization tools towards making the sustainable engineering products.
5. Illustrate the application of various nanomaterials in daily life, industry towards the sustainable development.

Text Books:

1. M. Wilson, K. Kannangara, G. Smith, M. Simmons, and B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.
2. C. N. R. Rao, A. Muller, and A. K. Cheetham (Eds), The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
3. Kenneth J. Klabunde (Eds), Nanoscale Materials Science, John Wiley & Sons, InC, 2001.
4. C. S. S. R. Kumar, J. Hormes, and C. Leuschner, Nanofabrication towards biomedical applications, Wiley - VCH Verlag GmbH & Co, Weinheim, 2004.
5. T. Pradeep, Nano: The Essentials, Understanding Nanoscience and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

References:

1. W. Rainer, *Nano Electronics and information Technology*, Wiley, 2003.
2. K. E. Drexler, *Nano systems*, Wiley, 1992.
3. G. Cao, *Nanostructures and Nanomaterials: Synthesis, properties and applications*, Imperical College Press, 2004.
4. P. Yang, Chemistry of Nanostructured Materials, World Scientific Publishers, 2005.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective - IV

18CHE304 COMPUTATIONAL METHODS IN MATERIALS SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisite:

Exposure to Introductory engineering mathematics, introductory materials science and introductory programming courses is preferred.

Course Description:

This course deals with various computational approach and mathematical methods to understanding and apply different concepts in materials science and engineering.

Course Objectives:

1. To get exposed to the basic concepts in Materials Science and Engineering.
2. To understand the basic concepts of Programming and Graphical plotting.
3. To introduce the basic concepts of Data types and handling of various data.
4. To familiarize the basic concepts of modelling and simulation.
5. To acquire and apply the current knowledge and trends in the field of Computational Materials Science.

UNIT I: **INTRODUCTION TO COMPUTATIONAL MATERIALS SCIENCE AND ENGINEERING**

Concepts in materials science and engineering; use of computers and freely available open source software to: data handling; understand concepts and solve problems of engineering interest. **(9)**

UNIT II: PROGRAMMING AND PLOTTING

Introductions to the advanced concept C programming language; open source software for numerical computations and visualization (gnuplot, GNU Octave, Scilab); introduction to the LaTeX software for report preparation along with other miscellaneous software and programs. **(9)**

UNIT III: DATA TYPES AND HANDLING TECHNIQUES

Classification, and understanding of data properties, data handling - plotting, fitting, functional forms, interpolation, and integration. **(9)**

UNIT IV: COMPUTATIONAL MODELING AND SIMULATIONS

Understanding the materials properties; atomistic and electronic modelling of materials; concepts in molecular dynamics and its application using Quantum ESPRESSO. **(9)**

UNIT V: CURRENT TRENDS IN COMPUTATIONAL MATERIALS SCIENCE

Applied materials for various engineering field; research literature exploration; real-time application of computational methods in materials science and engineering, mini-project. **(9)**

Course Outcomes:

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

1. Understand the importance and applications of computational methods in Materials Science and Engineering.
2. Be familiarized with the tools of the trade, namely programming and graphical plotting.
3. Be able to understand and access the various types of data sets and appropriately handle it to productively work with it.
4. Get the knowledge about handling various open source computational tools and their effective usage to do computational modeling and simulations.
5. Be familiarized with up to date trends in computational materials science by taking up real time research problems and provide solutions.

Text Books:

1. Computational Materials Science: An Introduction, Second Edition 2nd Edition, by June Gunn Lee, 2014
2. Materials science and engineering: an introduction, William D Callister, Sixth edition, John Wiley & Sons, 2013.
3. The C programming language, Brian W Kernighan and Dennis M Ritchie, Second edition, PHI Learning Private Limited, 2010.
4. Materials science and engineering: a first course, V Raghavan, Fifth edition, PHI Private Limited, 2008.
5. Physical metallurgy principles, Robert E. Reed-Hill, Second edition, Affiliated East-West Press Pvt. Limited, 2008.
6. An introduction to materials science and engineering, Kenneth M Ralls, Thomas H Courtney, and John Wulff, Wiley India Pvt. Ltd., 2011.

References:

1. Materials Science and Engineering,V Raghavan,Prentice-Hall India, 2004
2. Advanced Engineering Mathematics, E Kreyzig, Wiley-India,1999.
3. A Review of Computational Methods in Materials Science, International Journal of Molecular Sciences 10(12):5135-216

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective- IV

18CE304 GREEN BUILDING AND ENERGY CONSERVATION

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description: The course covers various aspects of bioclimatic architecture like climate sensitive design, passive solar architecture, Water management, green building materials and construction techniques.

Course Objectives:

1. The course introduces concepts of sustainability and bioclimatic design in planning, construction and life of buildings.
2. This course intends to equip students with technical knowledge of energy-efficient green buildings
3. This course guide students, through projects, to apply concepts and ideas for the design of a green building by introducing them to green initiatives and ratings.
4. This course also initiates students in basics of functional design and drawing of the various buildings using the above concepts.

UNIT -I: GREEN BUILDING CONCEPTS

Introduction to bioclimatic architecture - Sustainability in building science and Functional planning - Orientation - Elements of building design and drawing – Building regulations and bylaws - Traditional and Vernacular Architecture - Climate zones - Design Charts - sun path diagram - Solar angles - Indices of thermal comfort - Vernacular buildings in different climate zones. **(9)**

UNIT-II: CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN

Introduction - various steps in Site planning - Plan form Building envelope Landform -Topography – vegetation - water bodies; Orientation - S/V ratio - P/A ratio - Walls, Fenestration - Roof and floors - Active and passive solar strategies - Passive solar architecture.

(9)

UNIT-III: THERMAL FLOW IN BUILDINGS

Calculation of thermal conductance - Heat flow through different building elements - Ventilation and day lighting - Design and placement of openings - Water management in buildings - Techniques to recycle, reuse and harvest water. **(9)**

UNIT IV: GREEN BUILDING MATERIALS AND CONSTRUCTION

Material properties - Energy efficiency using various materials - emerging new materials Construction techniques - Techniques for roof, wall and foundations. **(9)**

UNIT V: ECONOMY OF GREEN BUILDING
Cost of building - operation and maintenance - Green building rating system - Evaluation criteria of LEED - TERI GRIHA case studies - Case studies in different climate zones. **(9)**

Course Outcomes:
1. An understanding on green building materials and construction techniques.
2. Knowledge on renewable energy and energy conservation through material usage.
3. A thorough understanding on designing green buildings

Text books:

1. Krishnan, A., Baker, N., Yannas, S., &Szokolay, S. (Eds.). (2001). Climate responsive architecture, a design handbook for energy efficient buildings. New Delhi: Tata McGraw–Hill Publishing Company.
2. TERI & ICAEN (InstitutCatalad'Energia). (2004). Sustainable building design manual (Vol. II). New Delhi: The Energy and Resources Institute(TERI) Press.

References:

1. Bureau of Indian Standards. (1995). SP:41, Handbook on functional requirements of buildings (other than industrial buildings) (First reprint ed.). New Delhi: Bureau of Indian Standards.
2. Indian Green Building Council, LEED-India. (2011). LEED 2011 for India- Green building rating system, abridged reference guide for new construction and major renovations (LEED India NC). Hyderabad: Indian Green Building Council.
3. Koenigsberger, O., ingersoll, T. G., Mayhew, A., &Skozolay, S. V. (2011). Manual of Tropical Housing and Building. Hyderabad: Universities Press.
4. Prabhu, Balagopal T S, K Vincent Paul, and C Vijayan. Building Design and Drawing. Calicut: Spades Publishers, 2008.
5. Szokolay, S. V. (2008). Introduction to Architectural Science – The Basis of sustainable Design (Second ed.). Architectural Press/Elsevier.
6. The Energy and Resources Institute (TERI). (2011). Green Rating for Integrated Habitat Assessment (GRIHA) manual. New Delhi: TERI press.
7. Journals: Energy and Buildings, Building and Environment, Other relevant publications.
8. National Building Code, Bureau of Indian Standards: New Delhi. 2005; Building Bye laws and building rules of selected Indian urban and rural areas
9. Swamy, N. K., & Rao, A. K. (2013). Building planning and Drawing, New Delhi, Charothar Publishing House

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective- IV

18CE305 ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The course covers demand, quality, treatment and distribution of water along with characterization, collection, low cost treatment of waste water and household drainage. Similarly, air pollution, noise pollution and solid waste management are also included.

Course Objectives

1. To explain water quality standards, treatment, distribution of drinking water
2. To analyze the characteristics of wastewater and discuss about various units of sewage treatment system.
3. To explain various impacts of air and various methods to control air pollution
4. To describe about solid waste generation, characterization, impacts and various management techniques
5. To discuss about generation and management of electronic waste.

UNIT I: WATER TREATMENT

Water- Sources of Water, quality issues, health impacts of contaminated drinking water, water quality requirement for different beneficial uses, water quality standards, water quality indices, water safety plans, Layout of water Supply systems, components of water supply system; Distribution system, working principle of various units of surface water treatment plant layout **(9)**

UNIT II: SEWAGE TREATMENT

Quantity of Sewage, Sewage flow variations. Sewage pumping; Sewerage, Sewer appurtenances, Storm Water; sewage disposal standards, pollution due to improper disposal of sewage, wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage, zero liquid discharge **(9)**

UNIT III: URBAN AIR POLLUTION AND CONTROL TECHNIQUES

Air - Composition and properties of air, source and impacts of air pollution-on human, vegetation and strucutres, types of air pollutants various air pollution control laws, National Ambient Air Quality Standards, Air Quality Index, Air pollution meteorology and dispersion, Principles and working of various air pollution control equipment- gravity settling chamber, cyclone separators, fabric filters and electrostatic precipitators. **(9)**

UNIT IV: MUNICIPAL SOLID WASTE MANAGEMENT

Municipal Solid Waste-Characteristics and Quantities, MSW Rules, Municipal Solid Waste Collection, Transportation, Segregation and Processing, compositing, recycling, disposal-landfilling and incineration. **(9)**

UNIT V: ELECTRONIC WASTE MANAGEMENT

E-Waste Generation, E-Waste Rules, Techniques for Recycling and Recovery – glass, plastics, ferrous and non-ferrious materials **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Explain about impacts of drinking water contamination and various units of surface water treatment plant
2. Discuss about sewage generation and various methods of sewage treatment
3. Describe the impacts of air pollution and review various air control methods
4. Discuss about the impacts of solid waste and various solid waste management techniques
5. Explain the impacts and beneficial reuse of electronic waste

Text Books:

1. Birdie, G.S, Birdie, J.S., Water supply and sanitary Engineering, Including Environmental Engineering, Water and Air Pollution Laws and Ecology, Dhanpat Rai Publications, 1996.
2. Garg, S.K., Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 2008.
3. Rao M and Rao H.V.N. Air Pollution, McGraw Hill Education, 2017.
4. Jagbir Singh and Ramanathan A. L., Solid Waste Management: Present and Future Challenges, I K International Publishing House Pvt. Ltd., 2009

Reference Books:

1. Punmia, B.C, Ashok K Jain, Arun K Jain., Waste Water Engineering, Laxmi Publications, 1998.
2. Peavy, H., Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985
3. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
4. Metcalf & Eddy, Wastewater Engineering Treatment and Dispose, McGraw Hill Publication

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

Open Elective- IV

18ME304 INTERNET OF MANUFACTURING THINGS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
The manufacturing industries are the significant sustainable sources for the modern society. Traditional manufacturing systems and relative management approaches need constant review and upgrade to meet the demands of modern complex products. Internet of Things (IoT), has potential to collect, process, analyze and communicate real time data, while enhancing overall productivity within given time frame with higher flexibility and transparency. This course tries to provide the essential knowledge to bridge the IoT and Manufacturing systems.

Course Objectives:

1. To provide the basic knowledge and importance of IoT and its logic and applications in Manufacturing Industry.
2. To provide the basic knowledge of real time information sensing and cloud computing in manufacturing system.
3. To understand the concepts of IoT enabled smart trolleys and assembly systems.
4. To provide basic understanding of real-time production performance analysis methods. and scheduling system.
5. To provide basic understanding of real-time, information driven production scheduling system.

UNIT I:
Introduction- Concept of IoT, Existing manufacturing paradigms and their limitations, Applications of IoT in Manufacturing System (MS), The Concept of IoT-MS and its limitations. Overview of IoT-Enabled Manufacturing System- Overall architecture of IoT-MS, Integration framework of real-time manufacturing information, The work logic of IoT-MS, Core technologies in IoT-MS. **(9)**

UNIT II:
Real-Time (RT) Multisource Manufacturing Information Sensing System - Introduction, Overall Architecture of RT and multisource RMMISS, Deployment of multi-sensors, Multiple sensors manager, Multiple source manufacturing Information Capturing and Sharing, Case studies. Cloud Computing-Based Manufacturing – Introduction, Overall architecture, Cloud Machine Model, MS-UDDI, Task driven manufacturing service method. **(9)**

UNIT III:
IoT-Enabled Smart Assembly Station- Introduction, RFID based applications and assistant services in assembly line, Overall architecture, Real-time: Status Monitoring, Production Guiding, Data Sharing, Production Requeuing.

IoT Enabled Smart Trolley– Material handling and real time strategy, RT-data capturing in manufacturing field, overall architecture, Real-time: Information capturing, Encapsulation, Exchange, Workflow based guidance. Two stage combination optimization method. **(9)**

UNIT IV:
Real-Time (RT) Production Performances Analysis Method- Real-time: Production monitoring technique, KPI analysis, Anomaly analysis. Overall architecture, Even hierarchy of critical event, HTCPN analysis. Real time production anomaly diagnosis. **(9)**

UNIT V:
Real-Time Information Driven Production Scheduling System – Introduction, RT production scheduling, Agent technology, Manufacturing information monitor technology, Overall architecture, Equipment agent, Capability evaluation agent model, RT- scheduling agent model, Production execution monitor agent model. **(9)**

Course Outcomes:
The focus of this course is to study the inculcation of IoT in manufacturing systems and how the system turns smart. By the end of the course student should:

1. Be able to understand the fundamentals of IoT and its application in manufacturing systems.
2. Have a clear overall picture of multisource manufacturing information sensing system and cloud manufacturing.
3. Outline various methods of IoT enabled smart assembly systems and summarize the usage of smart trolleys
4. Make use of various RT- production performance analysis methods for test its applicability to real life problems.
5. Make use of various RT- information driven production scheduling system for test its applicability to real life problems.

Text Book:
1. Fei Tao, Y. Zhang, "Optimization of Manufacturing Systems Using the Internet of Things", 1st Edition, 2017, Academic Press, Elsevier.

Reference Book:
1. A. Gilchrist, "Industry 4.0: The Industry Internet of Things", 1st Edition, 2016, Apress.
2. M. Dastbaz, P. Cochrane, "Industry 4.0 and Engineering for a Sustainable Future", 1st Edition, 2019, Springer.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

Open Elective- IV

18ME305 ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course is designed to ignite the entrepreneurship idea into the young minds of engineers. Gives the complete details to setup an enterprise which includes the generating the business ideas, writing a business plan executing the plan successfully.

Course Objectives:

1. Understand the requirements of entrepreneurship as a profession.
2. Understand and develop the business plan.
3. Identify the various financial terms and conditions of new business venture.
4. Selection of plant location and choosing layout.
5. Analyse the market research for new ventures and small businesses.

UNIT I: INTRODUCTION
Introduction to Entrepreneurship Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision processes. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur. Case studies about successful Entrepreneur. **(9)**

UNIT II : CREATING AND STARTING THE VENTURE
Sources of new Ideas, Methods of generating ideas. The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities. Develop the business plan and evaluate with team. **(9)**

UNIT III: FINANCING AND MANAGING THE NEW VENTURE
Sources of capital, venture capital, angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising. New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Case studies about entrepreneur who success or failure in their business based on the financial control. **(9)**

UNIT IV: PLANT LAYOUT
Choosing location and layout, Issues related to Selection of layout. Production and Marketing Management, Selection of production Techniques, plant utilization and maintenance. Case study about selection of site and plant layout for new business venture. **(9)**

UNIT V: MARKET ANALYSIS

Designing the workplace, Inventory control, material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing. Case studies on market analysis on entrepreneur perspective.

(9)

Course Outcomes:

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

1. Describes the sources of new business ideas, methods to develop new ideas and use the problem solving techniques
2. Able to Write a business plan which includes Financial plan, Organizational Plan and Marketing Plan
3. Able to identify the financial sources for new business ventures
4. Able to select a plant layout and draw a plant layout
5. Design a work place and Analyze the market research for new business.

Text Books:

1. Entrepreneurship, Robert Hisrich, & Michael Peters, 5/e TMH.
2. Entrepreneurship, Dollinger, Pearson, 4/e, 2004.

References:

1. Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publ. House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, Robert J.Calvin, TMH, 2004.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective- IV

18ME306 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description

Total quality management (TQM) is a philosophy, methodology and system of tools aimed to create and maintain mechanism of organization's continuous improvement. It involves all departments and employees for the improvement of processes and products. It helps to reduce costs, exceed needs and expectations of customers and other stakeholders of an organization. TQM encompasses the concepts of business and social excellence that is sustainable approach to organization's competition, efficiency improvement, leadership and partnership.

Course Objectives:

The students will be able to:

1. Study comprehensive knowledge about the principles, practices, tools and techniques of total quality management.
2. Gain knowledge on leadership, customer satisfaction, addressing customer complaints, team work, employee involvement, related to customer and supplier partnership.
3. Gather information on various tools and techniques, concept on Six Sigma, bench marking and Failure Mode Effective Analysis (FMEA).
4. Know the importance of Quality circle, Quality Function Deployment, Taguchi design and case studies related to TQM.
5. To be aware of international/national Quality awards.

UNIT I: INTRODUCTION

Introduction - Need for quality - Evolution of quality - Definition of quality – Quality control, Quality management and Quality Assurance - Definition of TQM – Basic concepts of TQM - TQM Framework - Contributions by Deming, Juran and Crosby – Dimensions of quality – Benefits of quality and Barriers. **(9)**

UNIT II: TQM PRINCIPLES

TQM principles - Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – Supplier partnership – Partnering, Supplier selection, Supplier Rating. **(9)**

UNIT III: TOOLS AND TECHNQUES I

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA. **(9)**

UNIT IV: TQM TECHNIQUES
Quality circles – Quality Function Deployment (QFD) – Design of Experiments-Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.
(9)

UNIT V: IMPELMENTATION OF TQM
Steps for Implementation of TQM, KAIZEN, 5S, JIT, POKAYOKE, I - Introduction to Robust Design, ISO Standards, Need for ISO 9000 and 14000 series, Quality Systems and Case studies.
(9)

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

1. Understand the various principles and practices of TQM to achieve quality.
2. Identify the various statistical approaches for Total Quality Control.
3. Demonstrate the TQM tools for continuous process improvement.
4. Adopt the importance of ISO and Quality systems.
5. Make use of the concepts of TQM to solve case studies

Text Book:

1. Dale H. BesterField, et al., Total Quality Management, Pearson Education Asia, Third Edition, Indian Reprint (2003).

References:

1. James R. Evans and William M. Lindsay, The Management and Control of Quality, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition (2003).
3. Suganthi,L and Anand Samuel, Total Quality Management, Prentice Hall (India) Pvt. Ltd. (2006) Model.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective- IV

18EEE303 ROBOTICS

L	T	P	C
3	0	0	3

Course Prerequisite: Control Systems

Course Description:
Robotics is an interdisciplinary area ranging from mechanical & electrical component design to advanced sensor technology, incorporating computer systems and Artificial Intelligence (AI). With advances in AI-techniques & computational power in recent years, it has become one of the most interesting area for multidisciplinary research, with lots of commercial applications already in market.

Course Objectives:
1. To know the fundamentals of Robotics & its Applications.
2. To make students capable of handling robot manipulator tasks in real, as well as in simulation environment.
3. To know about kinetic and Jacobian modeling
4. To know about sensors and actuators.

UNIT I: INTRODUCTION & TRANSFORMATION AND MAPPING
Evolution of Robots and Robotics, Laws of Robotics, Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Robotic Programming and Future Prospects. Coordinate Frames, Object Description in Space, Transformation of Vectors, Inverting a homogenous transform, Fundamental Rotation Matrices. **(9)**

UNIT II: KINEMATIC MODELS
Direct Kinematic Model- Mechanical Structure and Notations, Description of links and joints, Kinematic modelling of the Manipulator, Denavit - Hartenberg notation, Kinematic relationship between Adjacent Links, Manipulator Transformation Matrix. Inverse Kinematic Model- Manipulator workspace, Solvability of Inverse Kinematic model, Solution Techniques, Closed form solution. **(9)**

UNIT III: JACOBIAN AND DYNAMIC MODELLING
Differential motion and statics- Linear and Angular Velocity of a Rigid Body, Relationship between Transformation, Mapping Velocity Vector, Velocity propogation along links, Manipulator Jacobian, Jacobian Inverse, Jacobian Singularities, Static Analysis. Dynamic modelling- Lagrangian mechanics, Lagrange-Euler formulation, Newton-Euler formulation, Comparison of Langrange-Euler and Newton-Euler formulation, Inverse Dynamics. **(9)**

UNIT IV: ROBOT MANIPULATOR CONTROL AND PATH PLANNING
Robot manipulator control- Introduction, Control of Puma Robot Arm, Computed Torque Technique, near minimum time control, Variable structure control, Non linear decoupled feedback control, Resolved motion control, Adaptive ControlPath/Trajectory Planning- Introduction, Joint space techniques, Cartesian space techniques, State space search, Problem reduction and use of predicate logic, Means-Ends analysis, Problem solving and robot learning, Robot Task Planning and Basic problems. **(9)**

UNIT V: SENSORS AND ACTUATORS
Range sensing, Proximity sensing, Touch sensors, Force and Torque sensing, Artificial Intelligence techniques using Neural Networks and Fuzzy control. **(9)**

Course Outcomes:
At the end of the course, students will able to
1. Understand the fundamentals of Robotics.
2. Analyze the mechanical structure and notations kinematic model.
3. Analyze the jacobian and dynamic modeling.
4. Explain the robot manipulator control and path planning.
5. Describe the various sensors and actuators.

Text Book:

1. Mittal, R.K. and Nagrath, I.J., Robotic and Control, Tata McGraw Hill, New Delhi, 2003.

References:

1. Fu, K.S., Gonzalez, R.C., and Lee, C.S.G., Robotics Control, Sensing, Vision and Intelligence, McGraw Hill, 1988.
2. Craig, J.J., Introduction to Robotics: Mechanism & Control. Addison Wesley, 1986.
3. Paul, R.P., Robot Manipulator: Mathematics Programming & Control. MIT Press, 1981.
4. Pugh,A., RobotSensors, Vision Vol.-I.Springer Verlag, 1986.
5. Groover, M.P., Industrial Robotics Technology, programming & Application, McGraw Hill, 1986.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective – IV

18EEE304 ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

Course Prerequisite: BEE

Course Description:
To provide a comprehensive exposure to electrical hazards, various grounding techniques, safety procedures and various electrical maintenance techniques.

Course Objectives:
1. To impart knowledge on electrical hazards and safety equipment.
2. To analyze and apply various grounding and bonding techniques.
3. To select appropriate safety method for low, medium and high voltage equipment.
4. To understand how to participate in a safety team.
5. To carry out proper maintenance of electrical equipment by understanding various standards.

UNIT I: ELECTRICAL HAZARDS
Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection, head and eye protection-rubber insulating equipment, hot sticks, insulated tools, barriers and signs, safety tags, locking devices- voltage measuring instruments- proximity and contact testers-safety electrical one line diagram- electrician's safety kit. **(9)**

UNIT II: GROUNDING AND BONDING
General requirements for grounding and bonding- definitions- grounding of electrical equipment-bonding of electrically conducting materials and other equipment- connection of grounding and bonding equipment- system grounding- purpose of system grounding- grounding electrode system- grounding conductor connection to electrodes-use of grounded circuit conductor for grounding equipment- grounding of low voltage and high voltage systems.
(9)

UNIT III: SAFETY METHODS
The six step safety methods- pre job briefings- hot -work decision tree-safe switching of power system- lockout-tag out- flash hazard calculation and approach distances- calculating the required level of arc protection-safety equipment , procedure for low, medium and high voltage systems-the one minute safety audit. **(9)**

UNIT IV: SAFETY TEAM
Electrical safety programme structure, development- company safety team- safety policy-programme implementation- employee electrical safety teams- safety meetings- safety audit-accident prevention- first aid- rescue techniques-accident investigation. **(9)**

UNIT V: MAINTENANCE OF ELECTRICAL EQUIPMENT

Safety related case for electrical maintenance- reliability centered maintenance (RCM) - eight step maintenance programme- frequency of maintenance- maintenance requirement for specific equipment and location- regulatory bodies- national electrical safety code- standard for electrical safety in work place- occupational safety and health administration standards.

(9)

Course Outcomes:

At the end of the course, students will able to

1. Describe electrical hazards and safety equipment.
2. Analyze and apply various grounding and bonding techniques.
3. Select appropriate safety method for low, medium and high voltage equipment.
4. Participate in a safety team.
5. Carry out proper maintenance of electrical equipment by understanding various standards**.**

Text Book:

1. Dennis Neitzel, Al Winfield,'Electrical Safety Handbook', McGraw-Hill Education , 4th Edition,2012.

References:

1. John Cadick, 'Electrical Safety Handbook', McGraw-Hill School Education Group, 1994.
2. Maxwell Adams.J, "Electrical safety- a guide to the causes and prevention of electric hazards",The Institution of Electric Engineers, 1994.
3. Ray A. Jones, Jane G. Jones, 'Electrical safety in the workplace', Jones & Bartlett Learning, 2000.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective – IV

18ECE303 NANO ELECTRONICS

L	T	P	C
3	0	0	3

Course Prerequisite: CMOS VLSI Design, Electronic Devices

Course Description:
This course provides an overview of Semiconductor Physics and carrier transport phenomenon. It illustrates Quantum Mechanics, & Nano-materials, Nanoscale MOSFET Transistors and their characteristics.

Course Objectives:
1. Apply the knowledge of Quantum physics to illustrate energy band structure.
2. Understand the basic physics of Kronig Penny Model.
3. Understand the fundamentals of operation of the main semiconductor electronic devices.
4. Understand and utilize the mathematical models and characteristics of MOS transistors for circuits and systems.
5. Understand and appreciate the nano-materials process.

UNIT I: INTRODUCTION TO NANOTECHNOLOGY
Introduction to nanotechnology, meso-structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. **(9)**

UNIT II:
Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones. **(9)**

UNIT III:
Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.). **(9)**

UNIT IV:
Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics. **(9)**

UNIT V:
Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation. **(9)**

Course Outcomes:

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

1. Understand various aspects of nano-technology and the processes involved in makingnano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and theprocessesinvolved in making nano components and material.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems.

Text / Reference Books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson,2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH,2003.
3. K.E. Drexler, Nanosystems, Wiley,1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press,1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley,2003

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective- IV

18ECE304 WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course introduces the concept of Wireless Sensor Network (WSN) to the students. It articulates the classification of WSN and related issues & challenges. It also describes different types of routing, MAC, dissemination protocols and explains design principles of wireless sensor networks.

Course Objectives:
1. Understand the concept of WSN, issues and challenges, classification of WSN.
2. Analyze and learn the classification of routing and MAC protocols.
3. Understand Dissemination protocol for large sensor network.
4. Design principles of WSNs.
5. Learn the hardware components & design constraints and Operating systems used in WSNs.

UNIT I
Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks. Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks. **(9)**

UNIT II
Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee. **(9)**

UNIT III
Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. **(9)**

UNIT IV
Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. **(9)**

UNIT V
Single-node architecture, Hardware components& design constraints. Operating systems and execution environments, introduction to TinyOS and nesC. **(9)**

Course Outcomes:

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

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN

Text/Reference Books:

1. WaltenegusDargie , Christian Poellabauer, “ Fundamentals Of Wireless Sensor Networks Theory And Practice” , By John Wiley & Sons Publications ,2011
2. SabrieSoloman, “ Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, “ Wireless Sensor Networks”, Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, “ Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science.
5. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective – IV

18CSE304 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

Course Prerequisite: Java Programming and Basics of XML

Course Description:
This course is concerned with the development of applications on Android platform. Android is used as a basis for the development of mobile applications. This course starts with the basic concepts of Java, history of android and architecture. It introduces the major building blocks that are used to develop an android application with examples. It also covers the development of applications using widgets, events, networking. It provides ideas on sensors, their types and writing programs based on sensor classes for application development.

Course Objectives:
While studying this course student will be able to

1. Understand Android history and its fundamentals and know the building blocks of android
2. Get idea on the creation of android user interface and its testing mechanisms
3. Identify the usage of threads, broadcast receivers, indents, services and their working methodology
4. Know about the storage mechanism in android using SQLite and the usage of content providers
5. Recognize the usage of android widgets and sensors in android based applications

UNIT- I INTRODUCTION AND INSTALLATION OF ANDROID TOOLS
Android Overview – History – Android Versions - Android Flavors. **Android Stack**: Linux, Native Layer and Hardware Abstraction Layer (HAL) – ART - Application Framework: Native C++ Library – Applications: System and User Applications - **Installation and Use of Android Tools:** Installing the Android SDK - Anatomy of an Android Project - Drawable Resources – XML Introduction - Creating user interface using XML – Overview of Android Building Blocks – Logging Messages in Android . **(9)**

UNIT- II USER INTERACTION
Example. Input Components – Text View – Image View – List View and Alert Dialogues – Menus: Popup, Options and Context Menus – Screen Navigation through App Bar – Recycler View – Material Design – Testing the User Interface: Expresso – Screen Navigation using Intents: Definition – Usage of Intends – Creation of Indents with example program – Lists and Adapters– Types of Adapters – Examples using Adapters**.** **(9)**

UNIT- III THREADS, LOADERS AND ASYNCTASK LOADER, BROADCAST RECEIVERS, SERVICES

Threading in Android – AsyncTask – Loaders – AsyncTask Loader – Connecting to Internet: JSON - HTTP API, Apache HTTP Client, HTTP URL Connection - Broadcast Receivers: Custom Broadcasts – Broadcasting Intends and their related API - Boot Receiver - Alarms and system services – Examples on alarms and services – Services: Services Life Cycle – Intent Service – Implementing Intent Service – Notifications: Managing Notifications. **(9)**

UNIT IV: SAVING, RETRIEVING AND LOADING DATA:

Android File systems and Files - Action Bar: Preferences and Action Bar - Shared Preferences – App Settings - Databases on Android - SQLite - Status Contract Class, Update Refresh Service – Cursors – Backups - Content Providers: Overview – Role of Content Providers - Content Provider Example Program – Content Resolver **(9)**

UNIT-V APPLICATIONS WIDGETS, INTERACTION AND SENSORS

App Widgets: Creation of Application Widgets - Interaction and Animation: Live Wallpaper and Handlers - Sensors: Sensor API in Android - Motion Sensor, Position Sensor, Environmental Sensor, Sensor Values, Sensor Manager Class, Sensor Class, Sensor Event class, Sensor Event Listener interface, Compass Accelerometer and orientation Sensors, Sensor Examples **(9)**

Course Outcomes:

Upon successful completion of this course, students can able to:

1. Work on android basic components and Install android
2. Create User Interfaces with various Layouts and views using android building blocks
3. Work with Broadcast Receivers and Services
4. Create Database in Android, Store and Retrieve data using SQLite and Content Providers
5. Develop widgets, Wall papers for an android application and write programs based on Sensors

Text Books:

1. Android Programming-The Big Nerd Ranch Guide, Bill Philips, Christ Stewart, Kristin Mariscano, Big Nerd Ranch publishers, 3rd Edition
2. Android Programming for Beginners, John Horton, PACKT publishers
3. Learning Android , By Marko Gargenta& Masumi Nakamura, O'Reilly, II Edition
4. Android Application Development All in One for Dummies, Barry Burd, Wiley, 2nd Edition

Reference Books:

1. Android application Development-Black Book, Pradeep Kothari, dreamtech
2. Android Programming - Unleashed, B.M.Harwani, Pearson Education, 2013
3. Head First Android Development: A Brain-Friendly Guide, Dawn Griffiths and David Griffiths, O’Reilly, 2nd Edition
4. Android System Programming, Roger Ye, PACKT publishers
5. Programming Android,ByZigurdMednieks,LairdDornin,G.BlakeMeike& Masumi Nakamura, O'Reilly

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective – IV

18CSE305 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisite: Nil

Course Description:
Software Project Management is generally seen as a key component of successful software projects. Together with software techniques it can produce software of high quality. This course deals with the decisions and actions related to planning, organizing, leading, and controlling programs and projects. Students are expected to gain a comprehensive understanding of Strategy, organization and leadership in managing projects and understanding of Processes, methods and systems used to plan, schedule and monitor projects.

Course Objectives:
1. To understand the basic concepts and issues of software project management.
2. To understand successful software projects that support organization's strategic goals.
3. Develop the skills for tracking and controlling software deliverables.
4. Match organizational needs to the most effective software development model.
5. Create project plans that address real-world management challenges.

UNIT I SPM CONCEPTS
Definition – components of SPM – challenges and opportunities – tools and techniques – managing human resource and technical resource – costing and pricing of projects – training and development – project management techniques. **(9)**

UNIT II SOFTWARE MEASUREMENTS
Monitoring & measurement of SW development – cost, size and time metrics – methods and tools for metrics – issues of metrics in multiple projects. **(9)**

UNIT III SOFTWARE QUALITY
Quality in SW development – quality assurance – quality standards and certifications – the process and issues in obtaining certifications – the benefits and implications for the organization and its customers – change management. **(9)**

UNIT IV RISK ISSUES
The risk issues in SW development and implementation – identification of risks – resolving and avoiding risks – tools and methods for identifying risk management. **(9)**

UNIT V SPM TOOLS
Software project management using Primavera & Redmine and case study on SPM tools. **(9)**

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Maintain software projects and monitor software project process
2. Design and develop project modules and assign resources
3. Understand software quality and project management techniques
4. Comprehend, assess, and calculates the cost of risk involved in a project management
5. Use Primavera &Redmine software management tools.

Text Books:

1. Richard H. Thayer, “Software Engineering Project Management”, John Wiley & Sons, 2nd edition, 2001

2. Royce, Walker, “Software Project Management”, Pearson Education, 2002

3. Kelker, S. A., “Software Project Management”, Prentice Hall, 2003

References:

1. Software Project Management, Bob huges, Mike cotterell, Tata McGraw Hill, New Delhi,2002.

2. Software Project Management: A Concise Study, S. A. Kelkar, PHI.

3. Software Project Management, Joel Henry, Pearson Education.

4. Software Project Management in practice, PankajJalote, Pearson Education.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective – IV

18CSE306 SOFTWARE TESTING

L	T	P	C
3	0	0	3

Course Prerequisite: 20CSE112

Course Description:
This course aims to introduce the students to different methodologies in testing a program and its usage in building the testing tools. This course covers introduction to principles of software testing, path testing, transaction testing, dataflow testing, domain testing, path, path product, regular expressions with node reduction algorithm, functional testing, and logic based testing, state graph and its applications, graph matrices and its applications and case study of testing tools.

Course Objectives:
1. To study the Basic software debugging methods.
2. To enable the Students to understand various testing methodologies.
3. To study the procedure for designing test cases.
4. To enable the Students about the significance of software testing.

Unit I: Principles of Software Testing and Path Testing
Concepts and principles of software testing: Introduction: Purpose of Testing, Dichotomies, model for Testing, Consequences of Bugs, and taxonomy of Bugs. Structural Testing: Flow graphs and Path testing, Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing. **(9)**

Unit II: Transaction Flow Testing and Dataflow Testing
Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques. Dataflow testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing. **(9)**

Unit III: Domain Testing, Paths, Path Products and Regular Expressions
Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interface Testing, Domains and Testability Paths, Path products and Regular expressions: Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection. **(9)**

Unit IV: Functional Testing, State, State Graphs and Transition Testing
Functional Testing: Logic Predicates and Clauses, Logic Based Testing, Logic Expression Coverage Criteria, Active Clause Coverage, Inactive Clause Coverage, Infeasibility and Subsumption, Making a Clause Determine a Predicate, Structural Logic Coverage of Programs, Decision Tables, Path Expressions, KV Charts, and Specifications. State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, Testability Tips.
(**9)**

Unit V: Applications of Test Case Design
TestingObject-Oriented Software, Unique Issues with Testing OO Software, Types of Object-Oriented Faults , Testing Web Applications and Web Services, Testing Static Hyper Text Web Sites, Testing Dynamic Web Applications, Testing Web Services, symbolic testing, Concolic testing, Conclusions. **(9)**

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Understand the basic principles of testing, path testing and compare different path testing strategies.
2. Explain different transaction flow and data flow testing techniques.
3. Understand and identify various Domains testing strategies, methods and defining the method to find the regular expression used to find the testing paths.
4. Test the functions and state of the applications manually and by automation using different testing methods.
5. Apply and use software testing methods and various test tools.

Text Books:

1. Software testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing- Yogesh Singh, Camebridge.
3. Introduction to Software Testing, Paul Ammann and Jeff Offutt, Cambridge University Press, 2nd edition, 2016.

References:

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing, 3rd edition,P.C. Jorgensen, Aurbach Publications (Dist.by SPD).
3. Software Testing, N.Chauhan, Oxford University Press.
4. Effective methods of Software Testing, Perry, John Wiley, 2nd Edition, 1999.
6. Software Testing Concepts and Tools, P.Nageswara Rao, dreamtech Press.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

DISCIPLINE ELECTIVE – I

Discipline Elective - I

18EEE401 MODERN CONTROL SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE108

Course Description:
This subject deals with state space, describing function, phase plane and stability analysis including controllability and observability. It also deals with modern control and optimal control systems.

Course Objectives:
1. To analyze Linear Continuous time invariant model for physical systems
2. To test the controllability and observability of continuous time invariant systems
3. To understand the types of non linear system phenomenon
4. To investigate the stability of non linear system using phase plane analysis
5. To investigate the stability of continuous time invariant system using Lyapunov's method
6. To formulate the optimal control problems and Linear quadratic regulator

UNIT I: STATE VARIABLE ANALYSIS
Linear Continuous time model for physical systems, Existence and Uniqueness of Solutions to Continuous Time State Equations, Solutions to Linear Time Invariant Continuous Time State Equations, State transition matrix and it's properties.

(9)

UNIT II: CONTROLLABILITY AND OBSERVABILITY
General concept of Controllability, General concept of Observability, Controllability tests for Continuous Time Invariant systems, Observability tests for Continuous Time Invariant systems , Controllability and Observability of state model in Jordan Canonical form , Controllability and Observability Canonical forms of State model.

(9)

UNIT III: NON LINEAR SYSTEMS
Introduction to Non Linear Systems ,Types of Non-linearities, Saturation, Dead Zone, Backlash, Jump Phenomenon, Singular Points, Introduction to Linearization of nonlinear systems, properties of Non Linear Systems,Describing function, describing function analysis of nonlinear systems-Stability analysis of Non Linear systems through describing functions,Introduction to phase plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phaseplane analysis of nonlinear control systems.

(9)

UNIT IV: STABILITY ANALYSIS

Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov'sinstability theorems, Stability Analysis of the Linear Continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions, Variable gradient method.

(9)

UNIT V: OPTIMAL CONTROL

Introduction to optimal control ,Formulation of optimal control problems ,calculus of variations fundamental concepts, functional, variation of functional fundamental theorem of Calculus of variations, boundary conditions , constrained minimization , formulation using Hamiltonian method Linear quadratic regulator.

(9)

Course Outcomes:

At the end of the course, students will able to

1. Analyze the linear continuous time invariant model for physical system.
2. Measure the controllability and observability of continuous time invariant systems.
3. Analyze the different types of non-linearity and stability of the non-linear system.
4. Investigate the stability of continuous time invariant system using Lyapunov's method.
5. Analysis the optimal control problems and Linear quadratic regulator.

Text Book:

1. Control Systems Engineering by I.J. Nagrath and M.Gopal, New Age International (P) Ltd. 2007.

References:

1. Modern Control System Theory by M. Gopal, New Age International Publishers, 2nd edition, 1996.
2. Modern Control Engineering by K. Ogata, Prentice Hall of India, 3rd edition, 1998.
3. Digital Control and State Variable Methods by M. Gopal, Tata McGraw-Hill Companies, 1997.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination**.**

Discipline Elective - I

18EEE402 ADVANCED DIGITAL SYSTEM DESIGN

L	P	T	C
3	0	0	3

Course Description:

This course gives the introduction to the designing of synchronous and asynchronous sequential circuits. Fault diagnosis of circuit and testability of the design is analyzed. Designing of logic circuits using programmable devices and programming of logic circuits using VHDL also covered.

Course Objectives:

This course enables students to
1. Understand Sequential circuit design.
2. Know Asynchronous sequential circuit designing.
3. Introduce the need of Fault Diagnosis and Testability Algorithms.
4. Understand programming of PAL, PLA, CPLD and FPGA.
5. Know the designing of digital circuit using VHDL

UNIT I: Sequential Circuit Design
Analysis of Clocked Synchronous Sequential Networks (CSSN) Modeling of CSSN – State Stable Assignment and Reduction – Design of CSSN – Design of Iterative Circuits – ASM Chart – ASM Realization.

(9)

UNIT II: Asynchronous Sequential Circuit Design
Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment – Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Data Synchronizers – Designing Vending Machine Controller – Mixed Operating Mode Asynchronous Circuits

(9)

UNIT III: Fault Diagnosis and Testability Algorithms
Fault Table Method – Path Sensitization Method – Boolean Difference Method – D Algorithm – Tolerance Techniques – The Compact Algorithm – Practical PLA's – Fault in PLA – Test Generation –DFT Schemes – Built-in Self-Test- Boundary scan architecture

(9)

UNIT IV: Synchronous Design Using Programmable Devices

Programmable Logic Devices – Designing a Synchronous Sequential Circuit using a PAL – Realization State machine using PLD –Complex Programmable Logic Devices (CPLDs) - Altera FLEX architecture - FPGA – Xilinx FPGA –Xilinx 3000 - Xilinx 4000

(9)

UNIT V: System Design Using VHDL

VHDL Description of Combinational Circuits – Arrays – VHDL Operators – Compilation and Simulation of VHDL Code – Modeling using VHDL – Flip Flops – Registers – Counters – Sequential Machine – Combinational Logic Circuits - VHDL Code for – Serial Adder, Binary Multiplier – Binary Divider

(9)

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Analyze and design the synchronous sequential digital circuits
2. Analyze and design the Asynchronous sequential digital circuits
3. Understand importance of Fault diagnosis of circuit and testability algorithms.
4. Understand the programming of PAL, PLA, CPLD and FPGA
5. design the digital circuit using VHDL

Text Books:

1. Nelson V.P., Nagale H.T., Carroll B.D., and Irwin J.D., "Digital Logic Circuit Analysis and Design", Prentice Hall International Inc.1995.

2. Stephen Brown and Zvonk Vranesic "Fundamentals of Digital Logic with VHDL Design" Tata McGraw Hill, 2002.

References:

1. Navabi.Z. "VHDL Analysis and Modeling of Digital Systems. McGraw International, 1998.

2. Parag K Lala, "Digital System design using PLD" BS Publications, 2003.

3. Parag K Lala, "Digital Circuit Testing and Testability" Academic Press, 1997.

4. Mark Zwolinski, "Digital System Design with VHDL" Pearson Education, 2004.

5. Dueck R.K., "Digital Design with CPLD applications and VHDL" Thomson Delmer Learning, 2001.

6. Nripendra N Biswas "Logic Design Theory" Prentice Hall of India, 2001.

7. Charles H. Roth Jr. "Digital System Design using VHDL" Thomson Learning, 1998.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Discipline Elective - I

18EEE403 INDUSTRIAL ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course deals with basics of electrical wiring systems for residential, commercial and industrial consumers, and its representation with standard symbols and drawings, various components of industrial electrical systems and its sizing and control aspects of industrial electrical system using PLC and SCADA.

Course Objectives:
1. To understand the electrical wiring systems for residential, commercial and industrial consumers.
2. To learn the representation of systems with standard symbols and drawings.
3. To understand the various components of industrial electrical systems.
4. To analyze and select the proper size of several electrical system components.
5. To study the control aspects of industrial electrical system using PLC and SCADA

UNIT I: ELECTRICAL SYSTEM COMPONENTS
LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

(9)

UNIT II: 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, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

(8)

UNIT III: ILLUMINATION SYSTEMS
Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

(8)

UNIT IV: INDUSTRIAL SUBSTATION SYSTEMS
HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

(8)

UNIT V: INDUSTRIAL SYSTEM AUTOMATION
DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.
Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

(12)

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

1. Discuss the various component representation involved in the design of electrical wiring for Low Tension.
2. Understand the guidelines for wiring of household and commercial buildings.
3. Understand the various components of illumination in industrial electrical systems.
4. Select the proper size of various electrical system components required for designing different electrical wiring systems.
5. Understand the control aspects of industrial electrical system using PLC and SCADA.

Text Books:

1. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.
2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

Reference:

1. Web site for IS Standards.
2. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
3. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Discipline Elective - I

18EEE404 SPECIAL ELECTRICAL MACHINES

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18EEE104, 18EEE107

Course Description:
This course aims to give the exposures towards special electrical machines such as stepper motor, variable reluctance motor, switched reluctance motor, permanent magnet synchronous motor and permanent magnet DC motor.

Course Objectives:
1. To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
2. To impart knowledge on the Construction, principle of operation, control and performance of stepping motors.
3. To impart knowledge on the Construction, principle of operation, control and performance of switched reluctance motors.
4. To impart knowledge on the Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
5. To impart knowledge on the Construction, principle of operation and performance of permanent magnet synchronous motors.

UNIT I: STEPPER MOTOR
Constructional features – Types – hybrid stepping motor – Operating principles – very slow speed synchronous motor for servo control- different configurations for switching the phase windings-control circuits for stepping motor-open loop controller for a 2-phase stepping motor.
(9)

UNIT II: VARIABLE RELUCTANCE STEPPER MOTOR
Constructional features – Principle of operation – Variable reluctance motor – Single and multi stack configurations – open loop & closed loop control of 3-phase VR step motor-Torque equations – Modes of excitation – Characteristics – Drive circuits – Microprocessor control of stepper motors – Closed loop control–Applications.
(9)

UNIT III: SWITCHED RELUCTANCE MOTORS
Constructional features – Rotary and Linear SRM - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Sensor less operation – Characteristics and Closed loop control– Applications.
(9)

UNIT IV: PERMANENT MAGNET BRUSHLESS D.C. MOTORS

Permanent Magnet materials – Minor hysteresis loop and recoil line-Magnetic Characteristics – Permeance coefficient -Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations –Commutation - Power Converter Circuits and their controllers – Motor characteristics and control– Applications.

(9)

UNIT V: PERMANENT MAGNET SYNCHRONOUS MOTORS

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature MMF – Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements Applications.

(9)

Course Outcomes:

At the end of the course, students will able to

1. Analyze the Construction, principle of operation, control and performance of stepper motors.
2. Explain the Construction, principle of operation and performance of variable reluctance stepper motors.
3. Explain the Construction, principle of operation, control and performance of switched reluctance motors.
4. Explain the Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
5. Analyze the Construction, principle of operation and performance of permanent magnet synchronous motors.

Text Books:

1. K. Venkataratnam, ‘Special Electrical Machines’, Universities Press (India) Private Limited, 2008.
2. T.J.E. Miller, ‘Brushless Permanent Magnet and Reluctance Motor Drives’, Clarendon Press, Oxford, 1989.

References:

1. R.Krishnan, ‘Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application’, CRC Press, New York, 2001.
2. P. P. Aearnley, ‘Stepping Motors – A Guide to Motor Theory and Practice’, Peter Perengrinus London, 1982.
3. T. Kenjo and S. Nagamori, ‘Permanent Magnet and Brushless DC Motors’, Clarendon Press, London, 1988.
4. E.G. Janardanan, ‘Special electrical machines’, PHI learning Private Limited, Delhi, 2014.
5. T. Kenjo, ‘Stepping Motors and Their Microprocessor Controls’, Clarendon Press London, 1984.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Discipline Elective - I

18EEE405 ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
To provide a comprehensive exposure to electrical hazards, various grounding techniques, safety procedures and various electrical maintenance techniques.

Course Objectives:
1. To impart knowledge on electrical hazards and safety equipment.
2. To analyze and apply various grounding and bonding techniques.
3. To select appropriate safety method for low, medium and high voltage equipment.
4. To understand how to participate in a safety team.
5. To carry out proper maintenance of electrical equipment by understanding various standards.

UNIT I: ELECTRICAL HAZARDS
Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection, head and eye protection-rubber insulating equipment, hot sticks, insulated tools, barriers and signs, safety tags, Classification of insulating materials, locking devices- voltage measuring instruments- proximity and contact testers-safety electrical one-line diagram-electrician's safety kit.

(9)

UNIT II: GROUNDING AND BONDING
General requirements for grounding and bonding- definitions- grounding of electrical equipment-bonding of electrically conducting materials and other equipment- connection of grounding and bonding equipment- system grounding- purpose of system grounding- grounding electrode system- grounding conductor connection to electrodes-use of grounded circuit conductor for grounding equipment- grounding of low voltage and high voltage systems Ground resistance measurement using megger.

(9)

UNIT III: SAFETY METHODS
The six step safety methods- pre job briefings- hot -work decision tree-safe switching of power system- lockout-tag out- flash hazard calculation and approach distances- calculating the required level of arc protection-safety equipment, procedure for low, medium and high voltage systems-the one minute safety audit.

(9)

UNIT IV: SAFETY TEAM

Electrical safety programme structure, development- company safety team- safety policy- programme implementation- employee electrical safety teams- safety meetings- safety audit- accident prevention- first aid- rescue techniques-accident investigation.

(9)

UNIT V: MAINTENANCE OF ELECTRICAL EQUIPMENT

Safety related case for electrical maintenance- reliability centered maintenance (RCM) - eight-step maintenance programme- frequency of maintenance- maintenance requirement for specific equipment and location- regulatory bodies- national electrical safety code- Indian standard for electrical safety in work place- occupational safety and health administration standards.

(9)

Course Outcomes:

At the end of the course, students will able to

1. Understand various types of dielectric materials, their properties in various conditions.
2. Analyze and apply various grounding and bonding techniques.
3. Select appropriate safety method for low, medium and high voltage equipment.
4. Participate in a safety team.
5. Carry out proper maintenance of electrical equipment by understanding various standards**.**

Text Books:

1. Dennis Neitzel, Al Winfield, 'Electrical Safety Handbook', McGraw-Hill Education, 4th Edition,2012.

References:

1. John Cadick, 'Electrical Safety Handbook', McGraw-Hill School Education Group, 1994.
2. Maxwell Adams. J, "Electrical safety- a guide to the causes and prevention of electric hazards", The Institution of Electric Engineers, 1994.
3. Ray A. Jones, Jane G. Jones, 'Electrical safety in the workplace', Jones & Bartlett Learning, 2000.
4. Tareev, 'Electrical Engineering Materials', Verlag Technik, Berlin

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Discipline Elective - I

18EEE406 ELECTRICAL ENGINEERING MATERIALS

L	T	P	C
3	0	0	3

Course Prerequisite: Engineering chemistry and Engineering Physics

Course Description:
To understand the importance of various materials used in electrical engineering and obtain a qualitative analysis of their behavior and applications.

Course Objectives:
1. To know the fundamentals of Dielectric material
2. To know various Magnetic material and their properties.
3. To provide fundamental of semiconductor technology
4. To know the superconductor material
5. To know about the electric insulation materials.

UNIT I: DIELECTRIC MATERIALS
Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

(9)

UNIT II: MAGNETIC MATERIALS
Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis

(9)

UNIT III: SEMICONDUCTOR MATERIALS
Properties of semiconductors, Doped Semiconductors, carrier concentration, carrier generation and recombination, Einstein relation, non-equilibrium currents, pure diffusion currents, general band-bending and debye length, dielectric relaxation time, organic semiconductors. Silicon wafers, integration techniques.

(9)

UNIT IV: SUPER CONDUCTORS
Introduction, History of Superconductors, the Meissner effect, Quantum superconducting effects, flux quantization, type-1 superconductors, type-2 superconductors, high temperature superconductors, energy gap in superconductors as a function of temperature, vanadium heat

capacity, exponential heat capacity, superconductor terminology and the naming scheme, application of superconductors, typical superconductors and the future.

(9)

UNIT V: INSULATING MATERIALS

Introduction, dielectric properties of insulating materials, various types of polarization in dielectrics, thermal properties of insulators, chemical properties of insulators

(9)

Course Outcomes:

At the end of the course, students will able to

1. Understand various types of dielectric materials, their properties in various conditions.
2. Evaluate magnetic materials and their behaviour.
3. Evaluate semiconductor materials and technologies.
4. Evaluate superconductor materials and their behaviour
5. Acquire Knowledge on Insulating Materials used in electrical engineering

Text Books:

1. AdrianusJ.Dekker, Electrical Engineering Materials, PHI Publication, 2006.
2. T K Basak, " A course in Electrical Engineering Materials", New Age Science Publications 2009

References:

1. R K Rajput, " A course in Electrical Engineering Materials", Laxmi Publications, 2009.
2. TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2004.

Mode of Evaluation: Assignments, Internal Mid Examination, External End Examination.

DISCIPLINE ELECTIVE – III

Discipline Elective - III

18EEE407 ELECTRICAL DRIVES AND CONTROL

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18EEE107, 18EEE108, 18EEE109

Course Description:
This course aims to study about the power electronics converters required to control BLDC motors, Switched Reluctance Motors and PMSM.

Course objectives:
1. To study the operation of power converters and their control methods.
2. To understand the operation and control of induction motor using vector control.
3. To study the operation and control of BLDC motor drives.
4. To study the operation and control of SRM and implementation of controllers using DSP.

UNIT I: POWER CONVERTERS FOR AC DRIVES
PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H Bridge as a 4-Q drive.

(9)

UNIT II: INDUCTION MOTOR DRIVES
Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control (DTC).

(9)

UNIT III: SYNCHRONOUS MOTOR DRIVES
Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, self control - CSI fed synchronous motor drives- closed loop control – power factor control.

(9)

UNIT IV: PERMANENT MAGNET MOTOR DRIVES - Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.

(9)

UNIT V: SWITCHED RELUCTANCE MOTOR DRIVES - Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM. DSP based motion control (6 hours) Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control.

(9)

Course Outcomes:

At the end of this course, students will able to

1. Understand the operation of power electronic converters and their control strategies.
2. Understand the vector control strategies for ac motor drives
3. Understand the operation and control of Permanent magnet drives
4. Understand the operation and control of Switched reluctance motor
5. Understand the implementation of the control strategies using digital signal processors.

Text Books:

1. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.
2. R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, 2009

References:

1. P. C. Krause, O. Wasynczuk and S. D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.
2. G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
3. W. Leonhard, "Control of Electric Drives", Springer Science & Business Media, 2001.
4. H. A. Taliyat and S. G. Campbell, "DSP based Electromechanical Motion Control", CRC press, 2003.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Discipline Elective - III

18EEE408 CONTROL SYSTEMS DESIGN

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE108

Course Description:
This course provides an understanding about various design specifications, design of classical control systems in the time and frequency domain, design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators) and design of controllers using the state-space approach.

Course Objectives:
1. To understand various design specifications.
2. To design Classical Control Systems in the time main.
3. To design Classical Control Systems in the frequency domain
4. To design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).
5. To design controllers using the state-space approach.

UNIT I: DESIGN SPECIFICATIONS
Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

(8)

UNIT II: DESIGN OF CLASSICAL CONTROL SYSTEM IN THE TIME DOMAIN
Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

(8)

UNIT III: DESIGN OF CLASSICAL CONTROL SYSTEM IN FREQUENCY DOMAIN & DESIGN OF PID CONTROLLERS
Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.
Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

(11)

UNIT IV: CONTROL SYSTEM DESIGN IN STATE SPACE
Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

(9)

UNIT V: NONLINEARITIES AND ITS EFFECT ON SYSTEM PERFORMANCE
Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis.

(9)

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Understand various design specifications.
2. Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).
3. Design controllers using the state-space approach.

Text Books:
1. I. J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.
2. K. Ogata, "Modern Control Engineering", Prentice Hall, 2010.

References:

1. N. Nise, "Control system Engineering", John Wiley, 2000.
2. J. J. D'Azzo and C. H. Houpis, "Linear control system analysis and design (conventional and modern)", McGraw Hill, 1995.
3. R. T. Stefani and G. H. Hostetter, "Design of feedback Control Systems", Saunders College Pub, 1994.
4. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
5. B. C. Kuo, "Automatic Control system", Prentice Hall, 1995.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Discipline Elective - III

18EEE409 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101 & 18EEE103

Course Description:
This course introduces the basic principles of all measuring instruments. It deals with the principle and operation of voltage, current, power factor, power and energy meters. It also covers the digital storage oscilloscope, digital meters, active transducers, passive transducers, piezoelectric transducers and RTD.

Course Objectives:
1. To learn basic principles of all measuring instruments.
2. To enumerate the voltage, current, power factor, power and energy meters.
3. To analyze the digital storage oscilloscope and digital meters.
4. To understand the active and passive transducers.

UNIT I: MEASURING INSTRUMENTS & INSTRUMENT TRANSFORMERS
Classification – Deflecting, control and damping torques – Ammeters and Voltmeters – PMMC – Dynamometer – MI instruments – Errors and compensations – Calibration – Extension of range using shunts and series resistance – CT and PT – Ratio, phase angle errors and design considerations for CT and PT.

(9)

UNIT II: POWER FACTOR METERS & MEASUREMENT OF POWER AND ENERGY
Power factor meters: Dynamometer and moving iron type – Single-phase and three-phase meters. Power measurement: Single-phase dynamometer wattmeter – LPF wattmeter – Double element and three element dynamometer wattmeter. Measurement of Energy: Single-phase induction type energy meter – Driving and braking torques – Errors and compensations – Three-phase energy meter.

(9)

UNIT III: POTENTIOMETERS & BRIDGES
Principle and operation of D.C. Crompton's potentiometer – Standardization – Measurement of unknown resistance, current and voltage – A.C. Potentiometers: polar and coordinate type's – Standardization – Applications – Methods of measuring low, medium and high resistance – Wheatstone's bridge – Kelvin's double bridge – Loss of charge method – Measurement of inductance – Maxwell's bridge – Anderson's bridge – Measurement of capacitance and loss angle – De Sauty bridge – Schering Bridge – Wien's bridge.

(9)

UNIT IV: DIGITAL STORAGE OSCILLOSCOPE & DIGITAL METERS

DSO: Digital storage oscilloscope – Digital phosphor oscilloscope – Controls of an oscilloscope – Types of probes – Loading – Measurement effects. Digital meters: Digital voltmeter – Successive approximation, ramp and integrating type – Digital frequency meter – Digital multi-meter – Q-meter.

(9)

UNIT V: TRANSDUCERS

Definition of transducers – Classification of transducers – Characteristics and choice of transducers – Principle and operation of resistive, inductive, and capacitive transducers – LVDT and its applications – Strain Gauge – Thermistors – Thermocouples – RTD – Piezo electric transducers – Photo Conductive Cells – Photo Diodes.

(9)

Course Outcomes:

At the end of the course, students will able to

1. Describe basic requirements and the concepts of electrical measuring instruments and instrument transformers.
2. Measure the energy and power through energy meter and wattmeter.
3. Measure the resistance, inductance, capacitance and frequency.
4. Explain the principle and operation of DSO and digital meters.
5. Exhibit the classification and working of transducers.

Text Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C. Widdis, 5thEdition, Reem Publications.
2. Electrical & Electronic Measurement & Instruments by A.K.Sawhney,DhanpatRai& Co. Publications.

References:

1. Electrical Measurements by Buckingham and Price, Prentice–Hall.
2. Electrical Measurements: Fundamentals, Concepts, Applications by Reissland, M.U, New AgeInternational (P) Limited, Publishers.
3. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand& Co.
4. Electronic Instrumentation by H. S. Kalsi, Tata McGrawhill, 3rd Edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Discipline Elective - III

18EEE410 UTILIZATION OF ELECTRICAL ENERGY

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE102, 18EEE104, 18EEE109, 18EEE110

Course Description:
This course is designed to create an awareness onvarious Illumination techniques, basics of refrigeration, electrical energy utilization aspects, methods of electric heating and electric traction.

Course Objectives:
1. To learn about various illumination techniques for specific applications.
2. To understand the basics of refrigeration.
3. To learn about the domestic electrical energy utilization aspects.
4. To understand the different methods of heating for any particular application.
5. To create can awareness about the type of electric supply system and to evaluate the performance of a traction unit.

UNIT I: ILLUMINATION
Illumination – Terminology, Laws of illumination, Photometry, lighting calculations. Electric lamps – Different types of lamps, LED lighting and Energy efficient lamps. Design of lighting schemes - factory lighting - flood lighting – street lighting.

(9)

UNIT II: REFRIGERATION
Refrigeration- Domestic refrigerator and water coolers. Air-Conditioning - Various types of air conditioning system and their applications, smart air conditioning units. Energy Efficient motors: Standard motor efficiency, need for more efficient motors, Motor life cycle, Direct Savings and payback analysis, efficiency evaluation factor.

(9)

UNIT III: DOMESTIC UTILIZATION OF ELECTRICAL ENERGY
Domestic utilization of electrical energy – House wiring. Induction based appliances, Online and OFF line UPS, Batteries. Power quality aspects – nonlinear and domestic loads. Earthing – domestic, industrial and sub-station.

(9)

UNIT IV: ELECTRIC HEATING
Electric Heating- Types of heating and applications, Electric furnaces - Resistance, inductance and Arc Furnaces, Electric welding and sources of welding, Electrolytic processes – electro-metallurgy and electro-plating.

(9)

UNIT V: TRACTION SYSTEM

Traction system – power supply, traction drives, electric braking, tractive effort calculations and speed-time characteristics. Locomotives and train - recent trend in electric traction.

(9)

Course Outcomes:

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

1. Develop a clear idea on various Illumination techniques and hence design lighting scheme for specific applications.
2. Identify an appropriate method of heating for any particular industrial application.
3. Evaluate domestic wiring connection and debug any faults occurred.
4. Construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.
5. Realize the appropriate type of electric supply system as well as to evaluate the performance of a traction unit.

Text Books:

1. Dr. Uppal S.L. and Prof. S. Rao, 'Electrical Power Systems', Khanna publishers, New Delhi, 2009.
2. Gupta, J.B., 'Utilisation of Electrical Energy and Electric Traction', S.K.Kataria and sons, 10th Edition, 1990.

References:

1. Rajput R. K.,'Utilisation of Electrical Power', Laxmi publications, 1st Edition, 2007.
2. N. V. Suryanarayana, 'Utilisation of Electrical Power', New Age International publishers, Reprinted 2005.
3. C. L. Wadhwa, 'Generation Distribution and Utilization of Electrical Energy', New Age International publishers, 4th edition, 2011.
4. Energy Efficiency in Electrical Utilities, BEE guide book, 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Discipline Elective - III

18EEE411 SWITCHED MODE POWER CONVERTERS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE109

Course Description:
This course aims to cover DC – DC converters and their different modes of operation. This course covers DC – AC converters operated with PWM schemes. The analysis of resonant converter operation and modelling of switched mode power converters is included.

Course objectives:
1. To learn the different types of DC – DC switched mode power converters.
2. To understand the operation of different control strategies of DC – DC Converters.
3. To study about different switched mode DC – AC converters.
4. To learn the different modes of operation of resonant converters.
5. To study about modeling of switched mode power converters.

UNIT I: DC-DC CONVERTERS
Introduction to dc - dc switched mode power converters (SMPC) - continuous and discontinuous conduction mode operation of step down converters, step up converters, buck boost converter. - cuk dc-dc converter - full bridge dc-dc converter - dc-dc converter comparison.

(9)

UNIT II: CONTROL STRATEGIES OF DC - DC CONVERTERS
DC-DC converters with electrical isolation - flyback converters - forward converters - push pull converters Voltage mode control of SMPC - loop gain and stability considerations - Current mode control of SMPC - current mode control advantages - current mode Vs voltage mode of operations.

(9)

UNIT III: VOLTAGE SOURCE INVERTERS
Switch mode dc-ac converters - PWM switching scheme - square wave switching scheme - single phase inverters - half bridge and full bridge inverters - SPWM with bipolar and unipolar voltage switching - push pull inverters - three phase inverters - SPWM in three phase voltage source inverters - square wave operation - current regulated modulation –Introduction to Space Vector Pulse Width Modulation.

(11)

UNIT IV: RESONANT CONVERTERS
Introduction to resonant converters - classification of resonant converters - basic resonant circuit concepts - load resonant converter - resonant switch converter - zero voltage switching clamped voltage topologies - resonant DC link inverters with zero voltage switching - high frequency link integral half cycle converter.

(9)

UNIT V : MODELING OF SWITCHED MODE POWER CONVERTERS

Introduction to modeling of switched mode power converters - state space & circuit averaging methods- state space averaged models - equivalent circuits and small signal transfer functions for basic converters. **(7)**

Course Outcomes:

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

1. Understand different types of DC – DC switched mode power converters.
2. Analyze different control strategies of DC – DC Converters.
3. Analyze the different switched mode DC – AC converters.
4. Analyze the different modes of operation of resonant converters.
5. Understand the modeling of switched mode power converters.

Text Books:

1. Ned Mohan et al, Power Electronics, John Wiley ,1989
2. Otmar Kingenstein, Switched Mode Power Supplies in Practice, John Wiley, 1994.

References:

1. Billings K.H., Handbook of Switched Mode Power Supplies, McGraw Hill, 1989.
2. Nave M.J, Power Line Filter Design for Switched-Mode Power Supplies, Van Nostrand Reinhold, 1991.
3. Mitchell D.M, DC-DC Switching Regulator Analysis, McGraw Hill ,1988
4. Pressman A.I, Switching Power Supply Design, McGraw Hill, 2nd edition, 1999.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Discipline Elective - III

18EEE412 ELECTRICAL MACHINE DESIGN

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE104, 18EEE107

Course Description:
This course is designed to obtain thorough knowledge on performance and control of transformers, induction machines, dc machines, fractional HP and miniature motors during normal and extreme working conditions. Course covers Theory, performance, testing, applications and control of electromechanical energy converters like Transformers, Induction machines, DC machines, synchronous machines, Fractional HP and miniature motors. To have hands-on experience by testing transformers and electric machines to evaluate their performance.

Course Objectives:
1. To study major considerations for electrical machine design
2. To study the design of Transformer.
3. To understand the design criteria and mathematical calculations involved in design of Induction motor.
4. To analyse the sizing and construction design of synchronous machine.
5. To emphasize the application of computer aided electrical machine design software platform.

UNIT I: INTRODUCTION
Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

(9)

UNIT II: TRANSFORMERS
Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

(9)

UNIT III: INDUCTION MOTORS
Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

(9)

UNIT IV: SYNCHRONOUS MACHINES

Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding.

(9)

UNIT V: THREE-PHASE TRANSFORMER

Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to **c**omplex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

(9)

Course Outcomes:

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

1. Understand the construction and performance characteristics of electrical machines.
2. Comprehend the construction, performance characteristics and design of Transformers.
3. Cognize the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines
4. Grasp the principles of electrical machine design and carry out a basic design of an ac machine.
5. Use software tools for design calculations.

Text Books:

1. K. Sawhney, “A Course in Electrical Machine Design”, Dhanpat Rai and Sons, 1970.
2. M.G. Say, “Theory & Performance & Design of A.C. Machines”, ELBS London.
3. S. K. Sen, “Principles of Electrical Machine Design with computer programmes”, Oxford and IBH Publishing, 2006.
4. K. L. Narang, “A Text Book of Electrical Engineering Drawings”, SatyaPrakashan, 1969.
5. K. M. V. Murthy, “Computer Aided Design of Electrical Machines”, B.S. Publications, 2008.

References:

1. A. Shanmugasundaram, G. Gangadharan and R. Palani, “Electrical Machine Design Data Book”, New Age International, 1979.
2. Electrical machines and equipment design exercise examples using Ansoft’s Maxwell 2Dmachine design package.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

DISCIPLINE ELECTIVE-IV

Discipline Elective-IV

18EEE413 ELECTRICAL ENERGY CONSERVATION AND AUDITING

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course deals with concept of electrical energy conservation and energy management, and energy efficiency of electrical systems.

Course Objectives:
1. To understand the current energy scenario and importance of energy conservation.
2. To learn the concepts of energy management.
3. To study the methods of improving energy efficiency in different electrical systems.
4. To understand the concepts of different energy efficient devices.

UNIT I: ENERGY SCENARIO
Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features. **(6)**

UNIT II: BASICS OF ENERGY AND ITS VARIOUS FORMS
Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion. **(8)**

UNIT III: ENERGY MANAGEMENT & AUDIT
Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams. **(8)**

UNIT IV: ENERGY EFFICIENCY IN ELECTRICAL & INDUSTRIAL SYSTEMS
Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. **(14)**

UNIT V: ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS
Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology. **(9)**

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Understand the current energy scenario and importance of energy conservation.
2. Understand the concepts of energy management.
3. Understand the methods of improving energy efficiency in different electrical systems.
4. Understand the concepts of different energy efficient devices.

Text Books:

1. Guide books for National Certification Examination for Energy Manager / EnergyAuditors Book-1, General Aspects (available online).
2. Guide books for National Certification Examination for Energy Manager / EnergyAuditors Book-3, Electrical Utilities (available online)
1. S. C. Tripathy, “Utilization of Electrical Energy and Conservation”, McGraw Hill, 1991.

Reference:

1. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective-IV

18EEE414 LINE COMMUTATED AND ACTIVE RECTIFIERS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE110

Course Description:
This course deals with operation and analysis of uncontrolled and controlled rectifier circuits, operation of line-commutated multi-pulse rectifiers, AC-DC boost and flyback converters and its operation in rectification and regeneration modes and lagging, leading and unity power factor mode.

Course Objectives:

6. To understand and analyse uncontrolled rectifier circuits.
7. To understand and analyse controlled rectifier circuits.
8. To understand the operation of line-commutated rectifiers – 6 pulse and multi-pulseconfigurations.
9. To learn the operation of AC-DC boost converters – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.
10. To learn the operation of AC-DC flyback converters – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.

UNIT I: DIODE RECTIFIERS WITH PASSIVE FILTERING
Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input current waveshape, effect of source inductance; commutation overlap. **(7)**

UNIT II: THYRISTOR RECTIFIERS WITH PASSIVE FILTERING
Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LCfilter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuousconduction, input current waveshape. **(7)**

UNIT III: MULTI-PULSE CONVERTER
Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6- pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation. **(7)**

UNIT IV: SINGLE-PHASE AC-DC BOOST CONVERTERS
Review of DC-DC boost converter, power circuit of single-switch AC-DC converter, steady state analysis, unity power factor operation, closed-loop control structure.
Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase AC-DC boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.
(14)

UNIT V: ISOLATED SINGLE-PHASE AC-DC FLYBACK CONVERTER
DC-DC flyback converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of AC-DC flyback converter, steady state analysis, unity power factor operation, closed loop control structure. **(10)**

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Analyse controlled rectifier circuits.
2. Understand the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations.
3. Understand the operation of PWM rectifiers – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.

Text Books:
1. G. De, "Principles of Thyristorised Converters", Oxford & IBH Publishing Co, 1988.
2. J.G. Kassakian, M. F. Schlecht and G. C. Verghese, "Principles of Power Electronics", Addison-Wesley, 1991.
3. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
4. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2001.

References:
1. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective-IV

18EEE415 ELECTRIC AND HYBRID VEHICLES

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE104, 18EEE107

Course Description:
This course introduces the fundamental concepts, principles and analysis of hybrid and electric vehicles.

Course Objectives:
1. To study the various aspects of hybrid and electric vehicles.
2. To learn the selection of electrical machines for hybrid and electric vehicles.
3. To understand the basic concept of electric traction.
4. To study the various energy storage technologies for hybrid and electric vehicles.
5. To understand the energy management techniques for hybrid and electric vehicles.

UNIT I: HISTORY AND CONCEPT OF HYBRIDIZATION
Environmental impact and history of modern transportation, air pollution, global warming, Sustainable Transportation, A Brief History of HEVs, Why EVs Emerged and Failed in the 1990s, Architectures of HEVs, State of the Art of HEVs: Review of Toyota Prius. Challenges and Key Technology of HEVs. Concept of Hybridization of the Automobile: Vehicle Basics, Basics of the EV, Basics of the HEV, Basics of Plug-In Hybrid Electric Vehicle (PHEV), Basics of Fuel Cell Vehicles (FCVs). **(9)**

UNIT II: FUNDAMENTALS OF VEHICLE PROPULSION AND BRAKING
Basics of Vehicle Propulsion and Braking: General Description of Vehicle Movement, Vehicle Resistance, Rolling Resistance, Aerodynamic Drag, Grading Resistance, Dynamic Equation, Tire–Ground Adhesion and Maximum Tractive Effort, Power Train Tractive Effort and Vehicle Speed, Vehicle Performance, Operating Fuel Economy, Brake Performance. **(9)**

UNIT III: ELECTRIC VEHICLES AND HYBRID ELECTRIC VEHICLES
Electric Vehicles: Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving, Energy Consumption. Hybrid Electric Vehicles: Concept of Hybrid Electric Drivetrains, Architectures of Hybrid Electric Drivetrains, Series Hybrid Electric Drivetrains (Electrical Coupling), Parallel Hybrid Electric Drivetrains (Mechanical Coupling). **(9)**

UNIT IV: ELECTRIC PROPULSION SYSTEMS
Permanent Magnetic BLDC Motor Drives: Basic Principles of BLDC Motor Drives, BLDC Machine Construction and Classification, Properties of PM Materials, Performance Analysis and Control of BLDC Machines, Extend Speed Technology, Sensorless Techniques. SRM Drives: Basic Magnetic Structure, Torque Production, SRM Drive Converter, Modes of Operation, Generating Mode of Operation (Regenerative Braking), Sensorless Control, Self-Tuning Techniques of SRM Drives, Vibration and Acoustic Noise in SRM, SRM Design. **(9)**

UNIT V: PEAKING POWER SOURCES AND ENERGY STORAGE

Electrochemical Batteries: Electrochemical Reactions, Thermodynamic Voltage, Specific Energy, Specific Power, Energy Efficiency, Battery Technologies. Ultracapacitors: Features, Basic Principles, Performance, Ultracapacitor Technologies. Ultra-High-Speed Flywheels: Operation Principles, Power Capacity of Flywheel Systems, Flywheel Technologies. Hybridization of Energy Storages: Concept of Hybrid Energy Storage, Passive and Active Hybrid Energy Storage with Battery and Ultracapacitor, Battery and Ultracapacitor Size Design. **(9)**

Course Outcomes:

At the end of this course, students will able to

1. Understand the various aspects of hybrid and electric vehicles.
2. Plan the selection of electrical machines for hybrid and electric vehicles.
3. Understand the principles and control of Electric trains.
4. Select various energy storage technologies for hybrid and electric vehicles.
5. Implement energy management techniques for hybrid and electric vehicles.

Text Books:

1. C. Mi, M. A. Masrur and D. W. Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, John Wiley & Sons, 2011.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.

References:

1. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.
2. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016.
3. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Husain, 2nd Edition, CRC Press, 2011.
4. G. K. Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall, 1989.
5. Ali Emadi, Mehrdad Ehsani, John M. Miller ‘Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles’.
6. Ion Boldea and S.A Nasar, ‘Electric drives’, CRC Press, 2005.
7. Sandeep Dhameja, ‘Electric Vehicle Battery Systems’

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective-IV

18EEE416 POWER SYSTEM RESTRUCTURING AND DEREGULATION

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE114

Course Description:
The course deals with power system operation and control in deregulated electricity market environment, market design and auction mechanisms, price formation, generation scheduling in deregulation, transmission pricing paradigms, congestion management, firm transmission rights, ancillary services classifications, procurement and pricing, and security management in deregulation.

Course Objectives:
To understand the electricity power business and technical issues in a restructured power system in both Indian and world scenario.

UNIT I: ELECTRICITY MARKETS
Introduction – Market Models – Entities – Key issues in regulated and deregulated power markets; Market equilibrium- Market clearing price- Electricity markets around the world. **(9)**

UNIT II: OPERATIONS AND PLANNING
Operational and planning activities of a Genco - Electricity Pricing and Forecasting -Price Based Unit Commitment Design - Security Constrained Unit Commitment design. – Ancillary Services - Automatic Generation Control (AGC). **(9)**

UNIT III: RESTRUCTURED POWER SYSTEM
Introduction-Components of restructured system-Transmission pricing in Open- access system – Open transmission system operation; Congestion management in Open-access transmission systems FACTS in congestion management - Open-access Coordination Strategies; Power Wheeling Transmission Cost Allocation Methods. **(9)**

UNIT IV: DISTRIBUTION PLANNING
Open Access Distribution - Changes in Distribution Operations- The Development of Competition – Maintaining Distribution Planning. **(9)**

UNIT V: POWER MARKET- INDIAN SCENARIO
Power Market Development – Electricity Act, 2003 - Key issues and solution; Developing power exchanges suited to the Indian market - Challenges and synergies in the use of IT in power Competition- Indian power market- Indian energy exchange- Indian power exchange- Infrastructure model for power exchanges- Congestion Management-Day Ahead Market- Online power trading. **(9)**

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Explain and differentiate the key issues involved in the regulator and de-regulated power markets.
2. Describe the operational activities in Generation, Transmission and Distribution system in the restructured environment.
3. Illustrate and Solve problems in the de-regulated power System.
4. Explain and analyze the restructuring activities in Indian Power System

Text Books:

1. Loi Lei Lai, ‘Power System Restructuring and Deregulation’, John Wiley & son LTD, New York, HRD Edition, 2001.
2. Mohammad Shahidehpour, HatimYamin,’ Market operations in Electric power systems’, John Wiley & son LTD, Publication, 2002.
3. Lorrin Philipson, H. Lee Willis, ‘Understanding Electric Utilities and Deregulation’, Taylor & Francis, New York, 2nd Edition, 2006.

Reference:

1. Mohammad Shahidehpour, MuwaffaqAlomoush, ‘Restructured Electrical Power Systems’,” Dekker, INC., New York, 1st Edition, 2001

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective-V

18EEE417 STATIC RELAYS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE103, 18EEE106, 18EEE116

Course Description:
This course is designed to obtain thorough knowledge on power system protection and its requirements, to design various electronic circuits to implement various static relaying functions including microprocessor based relays.

Course Objectives:
1. To learn about power system protection and its requirements.
2. To distinguish between the conventional electro-mechanical relays and static relays.
3. To study the operation of static relay circuits.
4. To design various electronic circuits to implement various relaying functions.
5. To implement microprocessor based relays.

UNIT I: INTRODUCTION TO STATIC RELAYS
Power system protection and its requirements – conventional Vs static relays - steady state and transient performance of signal deriving elements, signal mixing techniques and measuring techniques. **(9)**

UNIT II: OVER CURRENT PROTECTION
Over current protection - instantaneous over current relay – directional over current relay – applications – differential relays - generator and transmission line protection. **(9)**

UNIT III: STATIC RELAY CIRCUITS I
Static relay circuits for generator loss of field, under frequency, distance, impedance, reactance, mho and special characteristics - reverse power relays. **(9)**

UNIT IV: STATIC RELAY CIRCUITS II
Static relay circuits for carrier protection and testing of relays - Static relay circuits - tripping circuits using thyristor. **(9)**

UNIT V: MICROPROCESSOR/MICROCONTROLLER BASED RELAYS
Microprocessor/Microcontroller based Relays-Hardware and software for the measurements of voltage, current, frequency and phase angle- implementation of over current, directional, impedance and mho relays. **(9)**

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Distinguish between the conventional electro-mechanical relays and static relays.
2. Design various electronic circuits to implement various relaying functions.
3. Implement microprocessor based relays.

Text Book:

1. Madhava Rao T.S., 'Power System Protection - Static Relays', McGraw Hill, New Delhi, 2nd Edition, 21st reprinted, 2008**.**

References:

1. Ram.B. `Fundamentals of Microprocessors and Microcomputers', M/s. Dhanpat Rai & sons, New Delhi, 2011.
2. Van.C.Warrington, 'Protective Relays - Their Theory and Practice', Vols. I & II, Chapman & Hall Ltd. London, 2nd Edition, 1994.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

DISCIPLINE ELECTIVE-V

Discipline Elective-V

18EEE418 DISCRETE TIME SIGNAL PROCESSING

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE113

Course Description:

This course deals with the design of analog filters like Butterworth, Chebyshev, and Elliptic. Digital filter design for both IIR & FIR filters. Different filter structures for the realization of digital filters will be discussed. Finite word length effects and Multirate DSP will be introduced. DSP Processor architecture and implementation of DSP algorithms will be part of the course, which will be emphasized upon.

Course Objectives:

1. To enumerate the theoretical and practical aspects of modern signal processing in a digital environment.
2. To discuss application areas with particular stress on speech and image data.

UNIT I: INTRODUCTION

Discrete time Signal and Systems in Time Domain: Characterization and analysis of discrete time signals, LTI systems and Correlation of Signals. DSP Architectures: Numeric representation used in DSP, Architectural details of a typical DSP processor. **(9)**

UNIT II: FOURIER AND Z-TRANSFORMS

Discrete time Signal in the Transform –Domain: The Discrete time Fourier Transform, Discrete Fourier Transform, Phase and group delay. Finite length discrete transform: DFT, FFT. Z-Transform, Inverse Z-Transform, Z-Transform uses for analysis of LTI. **(9)**

UNIT III: ANALOG FILTERS

Analog Filter Design: Butterworth filters, Chebyshev filters, Elliptic & Bessel Filters, Design of HP, BP and BS Filters. Digital Processing of Continuous Time signals: Sampling of signals, Analog Low pass & High passFilters, A/D converter, D/A Converter.

LTI Discrete –Time Systems in Transform domain: Types of TF, Digital Filters, All pass Transferfunction, Inverse systems. **(12)**

UNIT IV: DIGITAL FILTERS

Digital Filter Structures: FIR, IIR Digital filters. Digital Filter Design: Bilinear Transformation of IIRfilter, Low pass & High pass IIR filter, FIR filter, Realization of IIR filters.

Analysis of Finite word length Effects: Quantization, A/D conversion noise analysis, Signal to noiseratio in Low order IIR filter, Low sensitivity Digital filters, Round off Errors. **(9)**

UNIT V: APPLICATIONS

Multi rate DSP: Decimators & Interpolators, Multistage implementation, Polyphase implementation. Applications of DSP. **(6)**

Course Outcomes:

At the end of the course, students will able to

1. Enumerate the theoretical and practical aspects of modern signal processing in a digital environment.
2. Understand the application areas with particular stress on speech and image data.

Text Book:

1. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.

References:

1. J. G. Proakis and D. G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003.
2. Emmanuel C. Ifeachor and Barrie W. Jervis, "Digital Signal Processing: A Practical Approach, Second Edition", Pearson education.
3. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning, 2014.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective-V

18EEE419 POWER SYSTEM OPERATION AND CONTROL

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE103, 18EEE106, 18EEE116

Course Description:
This course is designed to obtain thorough knowledge on power system operation and its control.

Course Objectives:
1. To have an overview of power system operation and control.
2. To model power-frequency dynamics and to design power-frequency controller.
3. To model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
4. To study the economic operation of power system.
5. To teach about SCADA and its application for real time operation and control of power systems.

UNIT I: PRELIMINARY CONCEPTS, OPTIMAL OPERATION OF POWER SYSTEMS

Power scenario in India, Evolution of national grid, requirements of good power system, necessity of voltage and frequency regulation, real power vs frequency and reactive power vs voltage control loops.

Economic dispatch problem, input and output characteristics of thermal plant, incremental cost curve, optimal operation of thermal units without and with transmission losses, statement of unit commitment (UC) problem, constraints on UC problem, solution of UC problem using priority list. **(9)**

UNIT II: MODELLING OF TURBINE AND GOVERNOR

Modeling of turbine: First order turbine model, Block diagram representation of steam turbines and approximate linear models. Modeling of governor: Mathematical modeling of speed governing system, Derivation of small signal transfer function, Block diagram. Modelling of LFC for Solar and wind energy systems by droop control. **(9)**

UNIT III: LOAD FREQUENCY CONTROL

Definitions of Control area, Single area control, Block diagram representation of an isolated power system, Steady state analysis, Dynamic response, Uncontrolled case. Load frequency control of 2-area system uncontrolled case and controlled case, tie line bias control. Load frequency control and economic dispatch control. **(9)**

UNIT IV: REACTIVE POWER CONTROL

Overview of Reactive Power control, Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers. Load compensation, Specifications of load compensator. **(9)**

UNIT V: COMPUTER CONTROL OF POWER SYSTEMS

Need for computer control of power systems, concept of energy control centre, System monitoring, Data acquisition and control, System hardware configuration, SCADA and EMS functions, Network topology, State estimation, Weighted Least Square Estimation (WLSE). **(9)**

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Schedule the thermal power generators economically and optimally
2. Model various components of power systems.
3. Model and analyze load frequency control of single and two area sysems
4. Understand the use of various controller for reactive power control
5. Apply computer control for the optimal operation of power systems

Text Book:

1. Abhijit Chakrabarti, Sunita Halder, ‘Power System Analysis Operation and Control’, PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.
2. Nagrath I.J. and Kothari D.P., ‘Modern Power System Analysis’, Tata McGraw-Hill, Fourth Edition, 2011.
3. Hadi Saadat, ‘Power System Analysis’, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

References:

1. Kundur P., ‘Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
2. N.V.Ramana, “Power System Operation and Control,” Pearson, 2011.
3. C.A.Gross, “Power System Analysis,” Wiley India, 2011.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective-V

18EEE420 HVDC AND FACTS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE110, 18EEE116

Course Description:
This course covers the HVDC transmission systems and basic concepts of FACTS controller.

Course Objective:
This subject deals with the importance of HVDC transmission, analysis of HVDC converters, Harmonics and Filters, Reactive power control and Power factor improvements of the system. it also deals with basic FACTS concepts, static shunt and series compensation and combined compensation techniques.

UNIT – I: INTRODUCTION
Comparison of AC and DC transmission systems, application of DC transmission, types of DC links, typical layout of a HVDC converter station. HVDC converters, pulse number, analysis of Gratez circuit with and without overlap, converter bridge characteristics, equivalent circuits or rectifier and inverter configurations of twelve pulse converters. **(9)**

UNIT – II: CONVERTER & HVDC SYSTEM CONTROL
Principles of DC Link Control — Converters Control Characteristics — system control hierarchy, firing angle control, current and extinction angle control, starting and stopping of DC link. **(9)**

UNIT – III: HARMONICS, FILTERS AND REACTIVE POWER CONTROL
Introduction, generation of harmonics, AC and DC filters. Reactive Power Requirements in steady state, sources of reactive power, static VAR systems. **(6)**

UNIT – IV: INTRODUCTION TO FACTS &STATIC SHUNT COMPENSATORS
Flow of power in AC parallel paths and meshed systems, basic types of FACTS controllers, brief description and definitions of FACTS controllers.
Objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators, SVC and STATCOM, comparison between SVC and STATCOM. **(10)**

UNIT - V: STATIC SERIES COMPENSATORS& COMBINED COMPENSATORS
Objectives of series compensation, variable impedance type-thyristor switched series capacitors (TCSC), and switching converter type series compensators, static series synchronous compensator (SSSC)-power angle characteristics-basic operating control schemes.
Introduction, unified power flow controller (UPFC), basic operating principle, independent real and reactive power flow controller. **(11)**

Course Outcomes:

At the end of the course, students will able to

1. understand the advantages & applications of HVDC Transmission Systems
2. learn converter control characteristics and their control schemes
3. learn sources of harmonics and harmonics filters reactive power control.
4. understand the importance of controllable parameters and benefits of FACTS controllers
5. know the significance of shunt and series compensation through various static m compensators

Text Books:

1. HVDC Transmission, S. Kamakshaiah, V. Kamaraju, The Mc — Graw Hill Companies.

2. Understanding FACTS, Concepts and Technology of Flexible AC Transmission Systems, Narain. G. Hingorani, Laszlo Gyugyi, IEEE Press, Wiley India.

References:

1. HVDC and Facts Controllers Applications of Static Converters in Power Systems, Vijay K. Sood, Kiuwer Academic Publishers.

2. HVDC Power Transmission Systems: Technology and system Interactions, K.R.Padiyar, New Age International (P) Limited.

3. Thyristor — Based Conrollers for Electrical Transmission Systems, R.Mohan Mathur, Rajiv K. Varma.Wiley India.

4. FACTS Modeling and Simulation in Power Networks, Enrique Acha, Wiley India Distributed by BSP Books Pvt. Ltd.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective-V

18EEE421 WIND AND SOLAR ENERGY SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18EEE104, 18EEE107 & 18EEEE109

Course Description:
To give exposure to the students about the concepts of solar and wind energy systems and various techniques for the conversion of solar and wind energy into electrical energy.

Course Objectives:
1. To impart knowledge on the basic types and mechanical characteristics of a wind turbine.
2. To understand the operation of various wind-driven electrical generators.
3. To understand the various power electronic converters used for hybrid systems.
4. To understand the characteristics of a solar PV cell.
5. To develop the model of a PV system for different applications.

UNIT I: WIND GENERATION SYSTEMS
Wind source – wind statistics - energy in the wind – turbine power characteristics - aerodynamics - rotor types – parts of wind turbines – braking systems – tower - control and monitoring system. **(10)**

UNIT II: WIND GENERATORS
General characteristics of induction generators – grid-connected and self-excited systems – steady-state equivalent circuit - performance predetermination–permanent magnet alternators – steady-state performance. **(10)**

UNIT III: POWER CONVERTERS FOR WIND POWER GENERATION AND HYBRID SYSTEMS
Power electronic converters for interfacing wind electric generators – power quality issues - hybrid systems-wind-diesel systems – wind-solar systems. **(7)**

UNIT IV: BASICS OF SOLAR PV POWER GENERATION
Basic characteristics of sunlight – solar spectrum – isolation specifics – irradiance and irradiation - pyranometer - solar energy statics - Solar PV cell – I-V characteristics – P-V characteristics – fill factor-Modeling of solar cell – maximum power point tracking. **(8)**

UNIT V: SOLAR PV SYSTEMS
PV module – blocking diode and bypass diodes – composite characteristics of PV module – PV array – PV system – PV- powered fan – PV fan with battery backup – PV-powered pumping system – PV powered lighting systems – Grid- connected PV systems. **(10)**

Course Outcomes:
At the end of the course, students will able to
1. Describe the basic types and mechanical characteristics of a wind turbine.
2. Understand the operation of various wind-driven electrical generators.
3. Understand various power electronic converters used for hybrid systems.
4. Understand the characteristics of a solar PV cell.
5. Develop the model of a PV system for different applications.

Text Books:

1. S N Bhadra, S Banerjee and D Kastha, ‘Wind Electrical Systems’, Oxford University Press, 1st Edition, 2005.
2. Chetan Singh Solanki, ‘Solar Photovoltaic’s: Fundamentals, Technologies and Applications’ PHI Learning Publications, 2nd Edition, 2011.

References:

1. Roger A. Messenger and Jerry Ventre, ‘Photovoltaic systems engineering’, Taylor and Francis Group Publications, 2nd Edition, 2003.
2. M. Godoy Simoes and Felix A. Farret, ‘Alternative Energy Systems: Design and Analysis with Induction Generators’, CRC press, 2nd, 2008.
3. Ion Boldea, ‘The electric generators hand book - Variable speed generators’, CRC press, 2010.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective-V

18EEE422 ILLUMINATION ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course aims to give the exposures towards basics and need for good illumination, electric light sources and their operating characteristics, entities and their units and design of energy efficient lighting systems.

Course Objectives:
1. To impart knowledge on illumination.
2. To understand the basics and need for good illumination.
3. To create awareness about the electric light sources and their operating characteristics.
4. To study the entities in illumination systems and their units.
5. To design of energy efficient lighting systems.

UNIT I: INTRODUCTION TO ILLUMINATION
Introduction: State the need for Illumination, Define good Illumination, Radiation - Eye and Vision - The purkinje effect- Laws of Illumination –Candela- Frechner's law - Inverse Square Law - Lambert's Cosine Law of Incidence Photometry and spectrophotometry. **(10)**

UNIT II: LIGHT SOURCES AND OPERATING CHARACTERISTICS
Electric light sources and their operating characteristics: Incandescent lamps: ratings, operating characteristics vapor lamps- mercury vapor lamps- sodium vapor lamps-Fluorescent lamps: fundamentals, ratings, cathode types- starters- ballasts- operating characteristics- CFL- Bulb Temperature Vs Light output - Lumen Maintenance Curve. **(10)**

UNIT III: ENTITIES IN ILLUMINATION SYSTEMS
Entities in the illumination systems and their units: Illumination, intensity, brightness, soild angle relationships, luminous flux-luminosity-measurement of illumination- determination of total luminous flux emitted by a plane source, circular disc source, rectangular source, strip source.
(10)

UNIT IV: DESIGN OF LIGHTING SYSTEMS I
Design of lighting systems- Interior Lighting -Sports Lighting -Road Lighting -Street lighting-Factory outdoor lighting- Flood lighting -Maintenance of lighting system and Lighting Calculations considering day light. **(9)**

UNIT V: DESIGN OF LIGHTING SYSTEMS I
Design of Energy efficient lighting systems. **(6)**

Course Outcomes:

At the end of the course, students will able to

1. Understand the basics and need for good illumination.
2. Identify the electric light sources and their operating characteristics.
3. List the entities in illumination systems and their units.
4. Design of energy efficient lighting systems.

Text Books:

1. Prathab H, "Art and Science of Utilization of Electrical Energy", Dhanapat Rai & Sons, Delhi
2. Boast W.B, Illumination Engineering, Mc Graw Hill Book Company, 1953.
3. Cotton H, Principles of Illumination, John Wiley and Sons, 1960.

Reference:

1. Steffy G, "Architectural Lighting Design", 3rd Edition, John Wiley & Sons, 2008

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

DISCIPLINE ELECTIVE-VI

Discipline Elective – VI

18EEE423 ROBOTICS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE108

Course Description:
Robotics is an interdisciplinary area ranging from mechanical & electrical component design toadvanced sensor technology, incorporating computer systems and Artificial Intelligence (AI). Withadvances in AI-techniques & computational power in recent years, it has become one of the mostinteresting area for multidisciplinary research, with lots of commercial applications already in market.

Course Objectives:
5. To know the fundamentals of Robotics & its Applications.
6. To make students capable of handling robot manipulator tasks in real, as well as in simulationenvironment.
7. To know about kinetic and Jacobian modeling
8. To know about sensors and actuators.

UNIT I: INTRODUCTION, TRANSFORMATION AND MAPPING
Evolution of Robots and Robotics, Laws of Robotics, Advancement in Robots, Robot Anatomy, HumanArm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, RoboticProgramming and Future Prospects
Coordinate Frames, Object Description in Space, Transformation of Vectors, Inverting a homogenoustransform, Fundamental Rotation Matrices. **(9)**

UNIT II: KINEMATIC MODELS
Direct Kinematic Model- Mechanical Structure and Notations, Description of links and joints,Kinematic modelling of the Manipulator, Denavit - Hartenberg notation, Kinematic relationship betweenAdjacent Links, Manipulator Transformation Matrix
Inverse Kinematic Model- Manipulator workspace, Solvability of Inverse Kinematic model, SolutionTechniques, Closed form solution. **(9)**

UNIT III: JACOBIAN AND DYNAMIC MODELLING
Differential motion and statics- Linear and Angular Velocity of a Rigid Body, Relationship betweenTransformation, Mapping Velocity Vector, Velocity propogation along links, Manipulator Jacobian,Jacobian Inverse, Jacobian Singularities, Static Analysis.
Dynamic modeling - Lagrangian mechanics, Lagrange-Euler formulation, Newton-Euler formulation, Comparison of Langrange-Euler and Newton-Euler formulation, Inverse Dynamics**.**
(9)

UNIT IV: ROBOT MANIPULATOR CONTROL AND PATH PLANNING

Robot manipulator control- Introduction, Control of Puma Robot Arm, Computed Torque Technique, near minimum time control, Variable structure control, Non linear decoupled feedback control, Resolved motion control, Adaptive Control Path/Trajectory Planning- Introduction, Joint space techniques, Cartesian space techniques, State space search, Problem reduction and use of predicate logic, Means-Ends analysis, Problem solving and robot learning, Robot Task Planning and Basic problems. **(10)**

UNIT V: SENSORS AND ACTUATORS

Range sensing, Proximity sensing, Touch sensors, Force and Torque sensing, Artificial Intelligence techniques using Neural Networks and Fuzzy control. **(8)**

Course Outcomes:

At the end of the course, students will able to

6. Understand the fundamentals of Robotics.
7. Analyze the mechanical structure and notations kinematic model.
8. Analyze the jacobian and dynamic modeling.
9. Explain the robot manipulator control and path planning.
10. Describe the various sensors and actuators.

Text Book:

2. Mittal, R. K. and Nagrath, I.J., Robotic and Control, Tata McGraw Hill, New Delhi, 2003.

References:

6. Fu, K.S., Gonzalez, R.C., and Lee, C.S.G., Robotics Control, Sensing, Vision and Intelligence, McGraw Hill, 1988.
7. Craig, J.J., Introduction to Robotics: Mechanism & Control. Addison Wesley, 1986.
8. Paul, R.P., Robot Manipulator: Mathematics Programming & Control. MIT Press, 1981.
9. Pugh, A., Robot Sensors, Vision Vol.-I. Springer Verlag, 1986.
10. Groover, M.P., Industrial Robotics Technology, programming & Application, McGraw Hill, 1986.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective – VI

18EEE424 SMART POWER GRID

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE112

Course Description:
This course deals with concept of smart grid, smart metering techniques, wide area measurement techniques, integration of distributed generation & its solution through smart grid.

Course Objectives:
1. To understand the concept of smart grid and its advantages over conventional grid
2. To learn the smart metering techniques
3. To study the wide area measurement techniques
4. To understand the problems associated with integration of distributed generation & its solution through smart grid.

UNIT I: SMART GRID
Introduction to Smart Grid, Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Concept of Robust & Self Healing Grid Present development & International policies in Smart Grid. **(9)**

UNIT II: SMART METERING
Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation Smart Substations, Substation Automation, Feeder Automation. **(9)**

UNIT III: SMART STORAGE AND WIDE AREA MEASUREMENTS
Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU). **(9)**

UNIT IV: MICRO-GRID
Concept of micro-grid, need & applications of micro-grid, formation of micro-grid, Issues of interconnection, protection & control of micro-grid, Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel-cells, micro-turbines Captive power plants, Integration of renewable energy sources. **(9)**

UNIT V: POWER QUALITY
Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit, Advanced Metering Infrastructure (AMI), Basics of CLOUD Computing & Cyber Security for Smart Grid. **(9)**

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Appreciate the difference between smart grid & conventional grid.
2. Apply smart metering concepts to industrial and commercial installations.
3. Formulate solutions in the areas of smart substations, distributed generation and wide area measurements.
4. Come up with smart grid solutions using modern communication technologies.

Text Books

1. Ali Keyhani, “Design of smart power grid renewable energy systems”, Wiley IEEE, 2011
2. Clark W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response, CRC Press, 2009
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, “Smart Grid: Technology and Applications”, Wiley 2012

References:

1. Stuart Borlase, “Smart Grid: Infrastructure, Technology and solutions”, CRC Press
2. A.G. Phadke, “Synchronized Phasor Measurement and their Applications”, Springer

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective – VI

18EEE425 HIGH VOLTAGE ENGINEERING

Course Prerequisite: 18EEE112

L	T	P	C
3	0	0	3

Course Description:
This course deals with basic of different insulating materials, generation and measurement of D. C., A.C., & Impulse voltages, testing of H. V. equipment and insulating materials, over-voltages and its protection aspects in a power system.

Course Objectives:
1. To understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
2. To gain knowledge in generation and measurement of D. C., A.C., & Impulse voltages.
3. To learn the testing of H. V. equipment and insulating materials, as per the standards.
4. To understand how over-voltages arise in a power system.
5. To study the protection aspects against over-voltages.

UNIT I: BREAKDOWN IN GASES
Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge **(8)**

UNIT II: BREAKDOWN IN LIQUID AND SOLID INSULATING MATERIALS
Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials. **(7)**

UNIT III: GENERATION OF HIGH VOLTAGES AND MEASUREMENTS OF HIGH VOLTAGES AND CURRENTS
Generation of high voltages, generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.
Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements. **(14)**

UNIT IV: LIGHTNING AND SWITCHING OVER-VOLTAGES
Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching overvoltages, Protection against over-voltages, Surge diverters, Surge modifiers. **(8)**

UNIT V: HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS

Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs. **(8)**

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Understand the various breakdown processes in insulating materials.
2. Interpret the generation and measurement of D. C., A.C., & Impulse voltages.
3. Test the H. V. equipment and insulating materials, as per the standards.
4. Understand the reason for over-voltages in a power system.
5. Suggest the protection aspects required against over-voltages.

Text Books:

1. M. S. Naidu and V. Kamaraju, “High Voltage Engineering”, McGraw Hill Education, 2013.
2. C. L. Wadhwa, “High Voltage Engineering”, New Age International Publishers, 2007.
3. E. Kuffel, W. S. Zaengl and J. Kuffel, “High Voltage Engineering Fundamentals”, Newnes Publication, 2000.
4. R. Arora and W. Mosch “High Voltage and Electrical Insulation Engineering”, John Wiley & Sons, 2011.

References:

1. D. V. Razevig (Translated by Dr. M. P. Chourasia), “High Voltage Engineering Fundamentals”, Khanna Publishers, 1993.
2. Various IS standards for HV Laboratory Techniques and Testing

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective – VI

18EEE426 POWER QUALITY

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE109

Course Description: This course deals with the basic concepts of power quality and the methods to improve power quality.

Course Objectives:
1. To understand the various power quality issues.
2. To understand the concept of power and power factor in single phase and three phase systems supplying nonlinear loads
3. To understand the conventional compensation techniques used for power factor correction and load voltage regulation.
4. To understand the active compensation techniques used for power factor correction
5. To understand the active compensation techniques used for load voltage regulation

UNIT I INTRODUCTION

Introduction – Characterisation of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards **(9)**

UNIT II ANALYSIS OF SINGLE PHASE AND THREE PHASE SYSTEM

Single phase linear and non linear loads –single phase sinusoidal, non sinusoidal source – supplying linear and nonlinear load – three phase Balance system – three phase unbalanced system – three phase unbalanced and distorted source supplying non linear loads – concept of pf – three phase three wire – three phase four wire system. **(9)**

UNIT III CONVENTIONAL LOAD COMPENSATION METHODS

Principle of load compensation and voltage regulation – classical load balancing problem : open loop balancing – closed loop balancing, current balancing – harmonic reduction and voltage sag reduction – analysis of unbalance – instantaneous of real and reactive powers – Extraction of fundamental sequence component from measured. **(9)**

UNIT IV LOAD COMPENSATION USING DSTATCOM

Compensating single – phase loads – Ideal three phase shunt compensator structure – generating reference currents using instantaneous PQ theory – Instantaneous symmetrical components theory – Generating reference currents when the source is unbalanced – Realization and control of DSTATCOM – DSTATCOM in Voltage control mode. **(9)**

UNIT V SERIES COMPENSATION OF POWER DISTRIBUTION SYSTEM

Rectifier supported DVR – DC Capacitor supported DVR – DVR Structure – voltage Restoration – Series Active Filter – Unified power quality conditioner. **(9)**

Course Outcomes:

Upon successful completion of the course, students will be able to

1. classify power quality disturbances, their causes , detrimental effects and knowledge about national and international Power quality standards
2. assess the impact of harmonics in single phase and three phase distribution systems
3. adopt passive harmonic mitigation techniques for load compensation and voltage regulation.
4. employ dynamic harmonic current compensation methods in distribution systems
5. employ dynamic voltage regulation methods in distribution systems

Text Books:

1. Arindam Ghosh “Power Quality Enhancement Using Custom Power Devices”, Kluwer Academic Publishers, 2002
2. R. C. Dugan, “Electrical Power Systems Quality”, McGraw Hill Education, 2012.
3. G. T. Heydt, “Electric Power Quality”, Stars in a Circle Publications, 1991.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Discipline Elective-VI

18EEE427 EHVAC TRANSMISSION

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE112, 18EEE116

Course Description:

This course deals the topics of EHVAC transmission line trends, calculation of line parameters, ground parameters and electrostatic cum magnetic fields of EHVAC lines. This course covers the concept of Corona in EHV lines and its effects. It also covers Power Frequency Voltage control and over voltages in EHV lines as well as design factors of EHV lines.

Course Objectives:

- To provide the in-depth knowledge of EHV AC lines and their evaluation of line & ground parameters
- To analyze the Electrostatic field and Electromagnetic field in energized and un-energized lines
- To familiarize the effects of corona and their measurements and to comprehend the concept of designing of EHV AC lines based on steady state and transient limits.

UNIT-I: EHVAC LINE TRENDS AND CALCULATION OF LINE & GROUND PARAMETERS

E.H.V.A.C. transmission line trends and preliminary aspects – standard transmission voltages – power handling capacity and line loss – mechanical considerations in line performance – estimation at line and ground parameters – bundled conductors: properties, inductance and capacitance of E.H.V. lines – positive, negative and zero sequence impedance – line parameters for modes of propagation. **(9)**

UNIT-II: ELECTROSTATIC & MAGNETIC FIELD OF EHVAC LINES

Electrostatic field and voltage gradients – calculations of electrostatic field of AC lines – effect high electrostatic field on biological organisms and human beings surface voltage gradients and maximum gradients of actual transmission lines – electrostatic induction in un-energized lines – measurements of field and voltage gradients for three phase single and double circuit lines. **(9)**

UNIT-III: POWER FREQUENCY VOLTAGE CONTROL IN EHV LINES

Introduction – problems at power frequency – no-load voltage conditions and charging current – voltage control – shunt and series compensation – static VAR compensation – SSR phenomenon in series capacitor compensated lines. **(9)**

UNIT-IV: CORONA EFFECTS

Corona in E.H.V. lines – Corona loss formulae – attenuation of traveling waves due to Corona – audible noise – measurements of audible noise – radio interference due to Corona – limits for RI fields – frequency spectrum of RI fields – measurements of RI and RIV. **(9)**

UNIT-V: DESIGN OF EHVAC LINES

Design of EHV lines based on steady state and transient limits: design factors **–** design examples **–** EHV cables and their characteristics. **(9)**

Course Outcomes:

After Completion of this course students will be able to

1. describe transmission line trends, preliminaries and evaluate line parameters
2. evaluate the electrostatic and magnetic fields of EHVAC lines
3. explain the power frequency voltage control in EHV lines
4. investigate the corona and its effects in EHV lines
5. design EHV lines based on steady state and transient limits

TEXT BOOKS:

1. Extra High Voltage AC Transmission Engineering – Rokosh Das Begamudre, Wiley Eastern Ltd, New Delhi – Fourth Edition -2014.
2. EHV Transmission line reference Books – Edison Electric Institution (GEC 1968).

REFERENCES:

1. S. Rao. EHVAC, HVDC Transmission and Distribution Engineering, Khanna Publishers, 2008.
2. Transmission Line Reference Book 345 kV and Above, Electrical Power Research Institute (EPRI) 1982.
3. Alston, L.L.: High Voltage Technology. Oxford University Press, 1968. (Harwell Post-Graduate Series).

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

MANDATORY NON-CREDIT COURSES

Mandatory Course

18CHE901 ENVIRONMENTAL SCIENCES

L	T	P	C
2	0	0	0

Course Prerequisites: Basic knowledge about sciences up to intermediate or equivalent level.

Course Description: The course deals with basic concepts of environment, its impact on human, universe, consumption of energy sources, effects, controlling methods for pollution and the environmental ethics to be followed by human beings.

Course Objectives:

1. To make the students aware about the environment and its inter-disciplinary nature and to emphasize the importance of the renewable energy sources.
2. To familiarize the concept of Ecosystem and their importance.
3. To bring the awareness among students about the importance of biodiversity and the need for its conservation.
4. To make the students understand the adverse effects of environmental pollution, its causes and measures to control it.
5. To introduce the environmental ethics and emphasize the urgency of rain water harvesting along with water shed management.

UNIT I:MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, Scope and Importance – Need for Public Awareness. Renewable energy Resources: Solar energy - solar cells, wind energy, tidal energy. Non-renewable energy resources: LPG, water gas, producer gas. Overgrazing, effects of modern agriculture – fertilizer and pesticides.

(6)

UNIT II: ECOSYSTEMS

Concept of an ecosystem. Structure – functions – Producers, Consumers and Decomposers – Ecological succession – Food chains, Food webs and Ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystems: Forest, Desert and Lake.

(6)

UNIT III: BIODIVERSITY AND ITS CONSERVATION

Introduction, Definition: Value of biodiversity: consumptive use, productive use, social, ethical and aesthetic values. Biogeographical zones of India. Threats to biodiversity: habitat loss, poaching of wildlife, Endangered and Endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

(6)

UNIT IV: ENVIRONMENTAL POLLUTION

Definition, Cause, effects and control measures of pollution – Air, Water, Soil and Noise. Solid Waste Management: Effects and control measures of urban and industrial wastes.

(6)

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT

Urban problems related to Water conservation, rain water harvesting and watershed management; Climate changes: global warming, acid rain, ozone layer depletion, nuclear accidents. Case Studies: Population growth, variation among nations and population explosion.

(6)

Course Outcomes:

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

1. Ability to understand the natural environment, its relationship with human activities and need of the day to realize the importance of the renewable energy sources.
2. The knowledge of various ecosystems and their importance along with the concepts of food chains, food webs and ecological pyramids.
3. Familiarity with biodiversity, its importance and the measures for the conservation of biodiversity.
4. The knowledge about the causes, effects and controlling methods for environmental pollution, along with disaster management and solid waste management.
5. Awareness about the sustainable development, environmental ethics, social issues arising due to the environmental disorders.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press, 2005.
2. Environmental Studies by R. J. Ranjith Daniels and Jagdish Krishnaswamy, (Wiley Re-print version 2014).
3. Chemistry for Environmental Engineering/C.N. Sawyer, P.L. McCarty, G.F. Parkin (TataMcGraw Hill, Fifth Edition, 2003).
4. Environmental Chemistry by B.K. Sharma, (Goel Publishing House, 2014).
5. Environmental Studies by Benny Joseph (TataMcGraw Hill, Second Edition, 2009).

Reference Books:

1. Environmental Science & Engineering by Dr. A. Ravikrishnan, Hitech Publishing Company Pvt. Ltd. 2013.
2. Perspectives in Environmental Studies, Second edition, Anubha Koushik and C.P. Koushik, New Age International (P) Limited, Publishers, 2004.

Mode of Evaluation: Assignments and Mid Term Tests

Mandatory Course

18HUM902 INDIAN CONSTITUTION

L	T	P	C
2	0	0	0

Course Prerequisites:

Course Objectives:

The course is intended to:

1. To know about Indian constitution;
2. To know about central and state government functionalities in India; and
3. To know about Indian society.

UNIT I: INTRODUCTION

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

(6)

UNIT II: STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

(6)

UNIT III: STRUCTURE AND FUNCTION OF STATE GOVERNMENT

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature –Judicial System in States – High Courts and other Subordinate Courts.

(6)

UNIT IV CONSTITUTION FUNCTIONS

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments –Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

(6)

UNIT V INDIAN SOCIETY

Society: Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

(6)

Course Outcomes:

Upon completion of the course, students will be able to:

1. Understand the functions of the Indian government; and
2. Understand and abide the rules of the Indian constitution.

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
2. R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.
3. Maciver and Page, " Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
4. K.L.Sharma, (1997) "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi.

References:

1. Sharma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2. U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

Mode of Evaluation: Assignments and Mid Term Tests

Mandatory Course

18HUM903 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

L	T	P	C
2	0	0	0

Course Prerequisite:
Basic understanding on Indian culture, traditions, and beliefs. Logistic approach towards learning.

Course Description:
This course deals with introducing and elaborating the importance and capabilities of the ancient, Indian Traditional Knowledge System in achieving heights of success and well-being towards humanity.

Course Objectives:
1. To get exposed to the basics of ITKS;
2. To understand the types and techniques used in Traditional Indian Medicine;
3. To introduce and elaborate the kind of art, architecture along with Vaastu Shashtra knowledge systems. To elucidate the product and construction technologies;
4. To familiarize the basic knowledge in ancient and traditional Astronomy and astrology along with aviation technologies in traditional knowledge systems; and
5. To acquire the knowledge on ancient contemporary world and IT revolution.

UNIT I: Indian Traditional Knowledge Systems (TKS) – Indian monuments; British Impact; Basics sciences - Philosophy and physical science; Indian physics; story of Kanada; Indian Chemistry; Indian Mathematics.

(6)

UNIT II: (Traditional Medicine)
Ayurveda – origin, texts, the three greater classics, three lesser classics, concepts; manifestation of creation; mental constitution; three Doshas; individual constitution, clinical process and proceedings; sushruta Samhita and its contents; shastrakarma; Yoga; and siddha.

(6)

UNIT III: Production and construction Technology; Art, Architecture and VastuShashtra; crafts and trade – Impact of Technology on society

(6)

UNIT IV: Astronomy and Astrology; Aviation technology in Ancient India - Vedic Astronomy; Eclipses, calculations using earths circumferences; Heliocentric theory of Gravitaton; vedic Astrology; Vaimanika Sastra and its ancient notes.

(6)

UNIT V: Information Technology in India – trends – Contemporary issues of IT Industry – Impact of IT on Indian society

(6)

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

1. Understand the basics of Indian Traditional Knowledge System and the origin of basic science and Mathematics,
2. Get familiarized with various traditional medical methods and their implications in the human betterment,
3. Understand various production and construction technologies along with art and architectural implications in TKS,
4. Get the knowledge Vedic astronomy and astrology and get to know the ancient aviation technologies, and
5. Understand the outreach of the TKS to the contemporary world and gain the Indian action in protecting the TKS along with IT revolution.

Text Books:
1. Traditional Knowledge System in India, Amit Jha, Atlantic publishers, 2009. ISBN: 978-81-269-1223-0.
2. Traditional Knowledge System & Technology In India, Basanta Kumar Mohantra, Pratibha Prakashan (2012), ISBN-10: 8177023101

References:
1. Online Materials

Mode of Evaluation: Assignments and Mid Term Tests

Mandatory Course

18CE904 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Course Prerequisite: None

Course Description:
The goal of this course is to expose the under graduate students regarding different types of disasters and preparedness needed to mitigate their effects. The course matrix will cover various natural, biological, chemical and emerging hazards and risks that may cause property, loss of lives, and livestock's. Thus, the future engineers will understand the social responsibility for the preparedness and mitigation of the damages caused by the disasters.

Course Objectives:
1. To make aware the students about disasters and their impact on living beings.
2. To ensure the students for the understanding on vulnerability, disasters, disaster prevention and risk reduction.
3. To gain a preliminary understanding of approaches for the Disaster Risk Reduction (DRR)
4. To enhance awareness of institutional processes available in the country for the disaster risk mitigation.
5. To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I: INTRODUCTION

Introduction, Etymology of disaster, Concepts and definitions: disaster, hazard, vulnerability, risks, Resilience, prevention and mitigation.

(6)

UNIT II: TYPES OF DISASTERS

Types of Disaster; natural disasters (earthquakes, volcanoes, forest fires and explosions, heat and cold waves, floods, draught, cyclones, tsunami, landslides, soil erosion); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.), hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

(6)

UNIT III: DISASTER IMPACTS (6)

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

(6)

UNIT IV: DISASTER RISK MITIGATION MEASURES

Disaster Risk Reduction (DRR) - Disaster management- four phase approach; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications), DRR programmers in India and the activities of National Disaster Management Authority. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction,

(6)

UNIT V: IMPACT OF DEVELOPMENTAL ACTIVITIES

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

(6)

Course Outcomes:

The student will develop competencies in:

1. Understanding on the nature of disasters
2. Application of Disaster Concepts to Management
3. Analyzing Relationship between Development and Disasters.
4. Ability to understand Categories of Disasters
5. Realization of the responsibilities to society

Text

1. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
6. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Mode of Evaluation: Assignments and Mid Term Tests

Honors in Electrical & Electronics Engineering

Honors in Electrical & Electronics Engineering
B. Tech III Year I Semester

18HDEEE101 ADVANCED ELECTRIC DRIVES

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18EEE107, 18EEE108, 18EEE109

Course Description:
This course aims to study about the power electronics converters required to control BLDC motors, Switched Reluctance Motors and PMSM.

Course objectives:
1. To study the operation of power converters and their control methods.
2. To understand the operation and control of induction motor using vector control.
3. To study the operation and control of BLDC motor drives.
4. To study the operation and control of SRM and implementation of controllers using DSP.

UNIT I: POWER CONVERTERS FOR AC DRIVES
PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H Bridge as a 4-Q drive.

(9)

UNIT II: INDUCTION MOTOR DRIVES
Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control (DTC).

(9)

UNIT III: SYNCHRONOUS MOTOR DRIVES
Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, self control - CSI fed synchronous motor drives- closed loop control – power factor control.

(9)

UNIT IV: PERMANENT MAGNET MOTOR DRIVES
Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.

(9)

UNIT V: SWITCHED RELUCTANCE MOTOR DRIVES - Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM. DSP based motion control (6 hours) Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control. **(9)**

Course Outcomes:

At the end of this course, students will able to

1. Understand the operation of power electronic converters and their control strategies.
2. Understand the vector control strategies for ac motor drives
3. Understand the operation and control of Permanent magnet drives
4. Understand the operation and control of Switched reluctance motor
5. Understand the implementation of the control strategies using digital signal processors.

Text Books:

1. B. K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education, Asia, 2003.
2. H. A. Taliyat and S. G. Campbell, “DSP based Electromechanical Motion Control”, CRC press, 2003.
3. R. Krishnan, “Permanent Magnet Synchronous and Brushless DC motor Drives”, CRC Press, 2009

References:

1. P. C. Krause, O. Wasynczuk and S. D. Sudhoff, “Analysis of Electric Machinery and Drive Systems”, John Wiley & Sons, 2013.
2. G. K. Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall, 1989.
3. W. Leonhard, “Control of Electric Drives”, Springer Science & Business Media, 2001.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Honors in Electrical & Electronics Engineering
B. Tech III Year I Semester

18HDEEE102 CONTROL SYSTEMS DESIGN

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE108

Course Description:
This course provides an understanding about various design specifications, design of classical control systems in the time and frequency domain, design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators) and design of controllers using the state-space approach.

Course Objectives:
1. To understand various design specifications.
2. To design Classical Control Systems in the time main.
3. To design Classical Control Systems in the frequency domain
4. To design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).
5. To design controllers using the state-space approach.

UNIT I: DESIGN SPECIFICATIONS
Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

(6)

UNIT II: DESIGN OF CLASSICAL CONTROL SYSTEM IN THE TIME DOMAIN
Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

(8)

UNIT III: DESIGN OF CLASSICAL CONTROL SYSTEM IN FREQUENCY DOMAIN & DESIGN OF PID CONTROLLERS
Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.
Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

(14)

UNIT IV: CONTROL SYSTEM DESIGN IN STATE SPACE

Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

(8)

UNIT V: NONLINEARITIES AND ITS EFFECT ON SYSTEM PERFORMANCE

Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis.

(9)

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Understand various design specifications.
2. Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).
3. Design controllers using the state-space approach.

Text Books:

1. I. J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.
2. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
3. K. Ogata, "Modern Control Engineering", Prentice Hall, 2010.
4. B. C. Kuo, "Automatic Control system", Prentice Hall, 1995.

References:

1. N. Nise, "Control system Engineering", John Wiley, 2000.
2. J. J. D'Azzo and C. H. Houpis, "Linear control system analysis and design (conventional and modern)", McGraw Hill, 1995.
3. R. T. Stefani and G. H. Hostetter, "Design of feedback Control Systems", Saunders College Pub, 1994.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Honors in Electrical & Electronics Engineering
B. Tech III Year I Semester

18HDEEE103 ELECTRICAL MACHINE DESIGN

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE104, 18EEE107

Course Description:
This course is designed to obtain thorough knowledge on performance and control of transformers, induction machines, dc machines, fractional HP and miniature motors during normal and extreme working conditions. Course covers Theory, performance, testing, applications and control of electromechanical energy converters like Transformers, Induction machines, DC machines, synchronous machines, Fractional HP and miniature motors. To have hands-on experience by testing transformers and electric machines to evaluate their performance.

Course Objectives:
1. To study major considerations for electrical machine design
2. To study the design of Transformer.
3. To understand the design criteria and mathematical calculations involved in design of Induction motor.
4. To analyse the sizing and construction design of synchronous machine.
5. To emphasize the application of computer aided electrical machine design software platform.

UNIT I: INTRODUCTION
Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

(9)

UNIT II: TRANSFORMERS
Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

(9)

UNIT III: INDUCTION MOTORS
Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

(9)

UNIT IV: SYNCHRONOUS MACHINES

Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding.

(9)

UNIT V: THREE-PHASE TRANSFORMER

Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to **c**omplex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines. **(9)**

Course Outcomes:

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

1. Understand the construction and performance characteristics of electrical machines.
2. Comprehend the construction, performance characteristics and design of Transformers.
3. Cognize the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines
4. Grasp the principles of electrical machine design and carry out a basic design of an ac machine.
5. Use software tools for design calculations.

Text Books:

1. K. Sawhney, “A Course in Electrical Machine Design”, Dhanpat Rai and Sons, 1970.
2. M.G. Say, “Theory & Performance & Design of A.C. Machines”, ELBS London.
3. S. K. Sen, “Principles of Electrical Machine Design with computer programmes”, Oxford and IBH Publishing, 2006.
4. K. L. Narang, “A Text Book of Electrical Engineering Drawings”, SatyaPrakashan, 1969.
5. K. M. V. Murthy, “Computer Aided Design of Electrical Machines”, B.S. Publications, 2008.

Reference Books:

1. A. Shanmugasundaram, G. Gangadharan and R. Palani, “Electrical Machine Design Data Book”, New Age International, 1979.
2. Electrical machines and equipment design exercise examples using Ansoft’s Maxwell 2Dmachine design package.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Honors in Electrical & Electronics Engineering
B. Tech III Year II Semester

18HDEEE104 SWITCHED MODE POWER CONVERTERS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE109

Course Description:
This course aims to cover DC – DC converters and their different modes of operation. This course covers DC – AC converters operated with PWM schemes. The analysis of resonant converter operation and modelling of switched mode power converters is included.

Course objectives:
6. To learn the different types of DC – DC switched mode power converters.
7. To understand the operation of different control strategies of DC – DC Converters.
8. To study about different switched mode DC – AC converters.
9. To learn the different modes of operation of resonant converters.
10. To study about modeling of switched mode power converters.

UNIT I: DC-DC CONVERTERS
Introduction to dc - dc switched mode power converters (SMPC) - continuous and discontinuous conduction mode operation of step down converters, step up converters, buck boost converter. - cuk dc-dc converter - full bridge dc-dc converter - PWM with bipolar and unipolar voltage switching - dc-dc converter comparison.

(9)

UNIT II: CONTROL STRATEGIES OF DC - DC CONVERTERS
DC-DC converters with electrical isolation - flyback converters - forward converters - push pull converters Voltage mode control of SMPC - loop gain and stability considerations - Current mode control of SMPC - current mode control advantages - current mode Vs voltage mode of operations.

(9)

UNIT III: DC - AC CONVERTERS
Switch mode dc-ac converters - PWM switching scheme - square wave switching scheme - single phase inverters - half bridge and full bridge inverters - SPWM with bipolar and unipolar voltage switching - push pull inverters - three phase inverters - SPWM in three phase voltage source inverters - square wave operation - current regulated modulation - Single Phase Switched Mode Rectifier and its control.

(11)

UNIT IV: RESONANT CONVERTERS
Introduction to resonant converters - classification of resonant converters - basic resonant circuit concepts - load resonant converter - resonant switch converter - zero voltage switching clamped voltage topologies - resonant DC link inverters with zero voltage switching - high frequency link integral half cycle converter.
(9)

UNIT 5: MODELING OF SWITCHED MODE POWER CONVERTERS
Introduction to modeling of switched mode power converters - state space averaging - state space averaged models - equivalent circuits and small signal transfer functions for basic converters. **(7)**

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. Understand different types of DC – DC switched mode power converters.
2. Analyze different control strategies of DC – DC Converters.
3. Analyze the different switched mode DC – AC converters.
4. Analyze the different modes of operation of resonant converters.
5. Understand the modeling of switched mode power converters.

Text Books:
1. Pressman A.I, Switching Power Supply Design, McGraw Hill, 2nd edition, 1999.
2. Mitchell D.M, DC-DC Switching Regulator Analysis, McGraw Hill ,1988
3. Ned Mohan et al, Power Electronics, John Wiley ,1989
4. Otmar Kingenstein, Switched Mode Power Supplies in Practice, John Wiley, 1994.

References:
1. Billings K.H., Handbook of Switched Mode Power Supplies, McGraw Hill, 1989.
2. Nave M.J, Power Line Filter Design for Switched-Mode Power Supplies, Van Nostrand Reinhold, 1991.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Honors in Electrical & Electronics Engineering
B. Tech III Year II Semester

18HDEEE105 FUZZY LOGIC, ANN AND INTRODUCTION TO GA

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE108

Course Description:
This course is designed to introduce the concepts associated with Fuzzy logic, ANN and Genetic Algorithms.

Course Objectives:

1. To expose fuzzy methods of analyzing problems which involve incomplete or vague criteria rather than crisp values.
2. To investigate requirements analysis, logical design, and technical design of components for fuzzy systems development.
3. To understand the concepts associated with Fuzzy logic.
4. To study the concepts of ANN.
5. To understand the concepts of Genetic Algorithms.

UNIT – I: INTRODUCTION TO FUZZY SYSTEMS
Different faces of imprecision – inexactness, ambiguity, undecidability, Fuzziness and certainty, Fuzzy sets and crisp sets.Intersections of Fuzzy sets, Union of Fuzzy sets the complement of Fuzzy sets-Fuzzy reasoning.

(7)

UNIT II: FUZZY CONTROL BASICS
Linguistic variables, Fuzzy propositions, Fuzzy compositional rules of inference- Methods of decompositions and defuzzification.
Methodology of fuzzy design - Direct & Indirect methods with single and multiple experts, Applications -Fuzzy controllers - Control and Estimation.

(11)

UNIT III: INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS
Introduction to Artificial Neural Networks - Biological neurons. Computational models of neuron-McCulloch - Pitts model - types of activation function. Introduction to network architectures - knowledge representation - Learning process. Learning algorithms- - error-correction learning. Boltzmann learning-Hebbian learning, competitive learning- Learning paradigms- supervised learning - unsupervised learning - method of steepest descent - least mean square algorithms - Adaline/medaline units. Perceptrons- derivation of the back propagation algorithm-Adavnces in Learning strategies-Computer based simulation of simple Network Structures.

(9)

UNIT IV: NEURAL NETWORK ARCHITECTURE
Neural Network Architectures-MLFFN-Recurrent NN- RBF Network structure - separability of patterns – RBF learning strategies - comparison of RBF, RNN and MLP networks- Hopfield

networks- associative memory energy function - spurious states - error performance - simulated annealing - applications of neural networks .
Forecasting-the XOR problem - traveling salesman problem - image compression using MLPs – character retrieval using Hopfield networks-Advances in ANN Theory- Computer based simulation.

(11)

UNIT V: INTRODUCTION TO GENETIC ALGORITHMS
Genetic Algorithms- basic structure-coding steps of GA, convergence characteristics, applications.

(7)

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Understand the fundamentals of Fuzzy logic theory.
2. Apply and analyze the concept of Fuzzy logic to existing systems.
3. Design Fuzzy logic Systems for engineering applications.
4. Apply ANN logic to existing systems.
5. Understand the basics of genetic algorithms.

Text Books:
1. Zimmermann H.J., 'Fuzzy set theory and its applications', Springer pvt Limited, 4th edition, 2012.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', John Wiley & Sons Ltd Publications, 3rd edition, 2010.
3. Simon Haykin, Neural Network – A Comprehensive Foundation, 2nd Ed, Pearson Education, 2002.
4. Zurada J.M., Introduction to Artificial Neural Systems, Jaico Publishers,2003.
5. Hassoun Mohammed H, Fundamentals of Artificial Neural Networks, Prentice Hall of India, 2002
6. M. Mitchell, 'Introduction to Genetic Algorithms", Indian reprint, MIT press Cambridge, 2nd edition, 2002.
7. Goldberg D.E., Genetic Algorithms in Search Optimization and Machine Learning, Addison Wesley,1989

References:
1. John Yen, Reza Langari, 'Fuzzy Logic, Intelligence, Control & Information', Pearson Education Inc., 1st edition, 2002.
2. Zdenko Kovacic, Stjepan Bogdan, 'Fuzzy Controller Design Theory and Applications', CRC Press, 1st edition, 2006.
3. Riza C. Berkaan, Sheldon L. Trubatch, 'Fuzzy Systems Design Principles – Building Fuzzy IF THEN Rule Based', IEEE Press,1st edition, 1997.
4. Bart Kosko, Neural Network and Fuzzy Systems, Prentice Hall of India, 2002.
5. Suran Goonatilake & Sukhdev Khebbal (Eds.), Intelligent Hybrid Systems., John Wiley,1995.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Honors in Electrical & Electronics Engineering
B. Tech III Year II Semester

18HDEEE106 STATIC VAR COMPENSATION AND HARMONIC FILTERING

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE109

Course Description:
This course is designed to create awareness on power quality issues, sources of harmonics in distribution systems and their effects, reactive power compensators and their control, sub-synchronous resonance, standard modulation strategies, Multi-Level Inverters, and passive and active harmonic filtering.

Course Objectives:
1. To understand the power quality issues and sources of harmonics in distribution systems.
2. To study about different reactive power compensators and their control.
3. To study about Multi-Level Inverters.
4. To learn the passive and active harmonic filtering methods.

UNIT I: FUNDAMENTALS OF LOAD COMPENSATION AND POWER QUALITY
Fundamentals of Load Compensation, Steady-State Reactive Power Control in Electric Transmission Systems, Reactive Power Compensation and Dynamic Performance of Transmission Systems.
Power Quality Issues- Sags, Swells, Unbalance, Flicker, Distortion, Current Harmonics - Sources of Harmonics in Distribution Systems and Ill Effects.

(9)

UNIT II: REACTIVE POWER COMPENSATORS
Static Reactive Power Compensators and their control. Shunt Compensators, SVCs of Thyristor Switched and Thyristor Controlled types and their control, STATCOMs and their control, Series Compensators of Thyristor Switched and Controlled Type and their Control, SSSC and its Control, Sub-Synchronous Resonance and damping, Use of STATCOMs and SSSCs for Transient and Dynamic Stability Improvement in Power Systems.

(11)

UNIT III: CONVERTERS FOR STATIC COMPENSATION
Converters for Static Compensation - Single Phase and Three Phase Converters and Standard Modulation Strategies (Programmed Harmonic Elimination and SPWM). GTO Inverters. Multi-Pulse Converters and Interface Magnetics.

(8)

UNIT IV: MULTI-LEVEL INVERTERS

Multi-Level Inverters of Diode Clamped Type and Flying Capacitor Type and suitable modulation strategies (includes SVM). Multi-level inverters of Cascade Type and their modulation. Current Control of Inverters.

(8)

UNIT V: PASSIVE AND ACTIVE HARMONIC FILTERING

Passive Harmonic Filtering. Single Phase Shunt Current Injection Type Filter and its Control, Three PhaseThree-wire Shunt Active Filtering and their control using p-q theory and d-q modeling. Three-phase four-wire shunt active filters. Hybrid Filtering using Shunt Active Filters. Series Active Filtering in Harmonic Cancellation Mode. Series Active Filtering in Harmonic Isolation Mode. Dynamic Voltage Restorer and its control. Power Quality Conditioner.

(9)

Course Outcomes:

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

1. Understand the power quality issues and sources of harmonics in distribution systems.
2. Study about different reactive power compensators and their control.
3. Learn about Multi-Level Inverters.
4. Design passive and active harmonic filters.

Text Books:

1. T. J. E Miller, “Reactive Power Control in Electric Systems”, John Wiley & Sons,1982.
2. N.G. Hingorani & L. Gyugyi, “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems”, IEEE Press, 2000.
3. Ned Mohan et.al, “Power Electronics”, John Wiley and Sons 2006
4. R. Sastry Vedam & Mulukutla S. Sarma, “Power quality VAR compensation in power systems”, CRC press, 2009.
5. K.R. Padiyar, “FACTS controllers in power transmission and distribution”, New age international publications, 2008.

Reference:

1. Hirofumi akagi, Edson hirokazu watanabe, Mauricio aredes, “Instantaneous power theory and applications to power conditioning” Wiley Inter Science, 2007.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Honors in Electrical & Electronics Engineering
B. Tech IV Year I Semester

18HDEEE107 POWER SYSTEM DYNAMICS AND STABILITY

Course Prerequisite: 18EEE112, 18EEE114

L	T	P	C
3	0	0	3

Course Description:
This course deals with power system stability and its impact on the system, modeling of different power system components for stability studies and methods to improve stability.

Course Objectives:
1. To understand the concept of power system stability and its impact on the system.
2. To analyse linear dynamical systems and use of numerical integration methods.
3. To model different power system components for the study of stability.
4. To understand the methods to improve stability.

UNIT I: INTRODUCTION TO POWER SYSTEM OPERATIONS AND ANALYSIS
Introduction to power system stability. Power System Operations and Control. Stability problems in Power System. Impact on Power System Operations and control.
Analysis of dynamical System, Concept of Equilibrium, Small and Large Disturbance Stability. Modal Analysis of Linear System. Analysis using Numerical Integration Techniques. Issues in Modeling: Slow and Fast Transients, Stiff System.

(9)

UNIT II: MODELING OF SYNCHRONOUS MACHINES AND ASSOCIATED CONTROLLERS
Modeling of synchronous machine: Physical Characteristics. Rotor position dependent model. D-Q Transformation. Model with Standard Parameters. Steady State Analysis of Synchronous Machine. Short Circuit Transient Analysis of a Synchronous Machine.
Synchronization of Synchronous Machine to an Infinite Bus. Modeling of Excitation and Prime Mover Systems. Physical Characteristics and Models. Excitation System Control. Automatic Voltage Regulator. Prime Mover Control Systems. Speed Governors.

(10)

UNIT III: MODELING OF OTHER POWER SYSTEM COMPONENTS
Modeling of Transmission Lines and Loads. Transmission Line Physical Characteristics. Transmission Line Modeling. Load Models - induction machine model. Frequency and Voltage Dependence of Loads. Other Subsystems – HVDC and FACTS controllers, Wind Energy Systems.

(9)

UNIT IV: STABILITY ANALYSIS

Angular stability analysis in Single Machine Infinite Bus System. Angular Stability in multimachine systems – Intra-plant, Local and Inter-area modes. Frequency Stability: Centre ofInertia Motion. Load Sharing: Governor droop. Single Machine Load Bus System: Voltage Stability. Introduction to Torsional Oscillations and the SSR phenomenon. Stability Analysis Tools: Transient Stability Programs, Small Signal Analysis Programs.

(10)

UNIT V: ENHANCING SYSTEM STABILITY

Planning Measures. Stabilizing Controllers (Power System Stabilizers). Operational Measures-Preventive Control. Emergency Control.

(7)

Course Outcomes:

At the end of the course, students will able to

1. Understand the problem of power system stability and its impact on the system.
2. Analyse linear dynamical systems and use of numerical integration methods.
3. Model different power system components for the study of stability.
4. Understand the methods to improve stability.

Text Books:

1. K.R. Padiyar, "Power System Dynamics, Stability and Control", B. S. Publications, 2002.
2. P. Kundur, "Power System Stability and Control", McGraw Hill, 1995.
3. P. Sauer and M. A. Pai, "Power System Dynamics and Stability", Prentice Hall, 1997.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Honors in Electrical & Electronics Engineering
B. Tech IV Year I Semester

18HDEEE108 DIGITAL PROTECTIVE RELAYING

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE109, 18EEE114

Course Description:
This course deals with digital relays required for power system protection. It includes Digital distance relay, Digital protection of rotating machines, Digital protection of transformers, Digital bus bar protection, integration of protection and control in substations and recent topics in digital protection.

Course Objectives:
1. To give an overview of power system protection requirements.
2. To give an overview of digital protection using different types of digital relays, its application to modern power system and apparatus.
3. To study the operation of relays using microcontrollers.

UNIT I:PROTECTIVE RELAYING
Protective Relaying - Qualities of relaying - Definitions - Codes- Standards; Characteristic Functions; Classification –analog-digital- numerical; schemes and design-factors affecting performance –zones and degree of protection; faults-types and evaluation; Instrument transformers for protection.

(9)

UNIT II:BASIC OF RELAY UNITS
Basic relay units-sequence networks-fault sensing data processing units- FFT and Wavelet based algorithms Phase& Amplitude Comparators-. Duality - Zero Crossing / Level Detectors.

(9)

UNIT III:RELAY SCHEMATICS AND ANALYSIS
Relay Schematics and Analysis Over Current Relay- Instantaneous/Inverse Time –IDMT Characteristics; Directional Relays; Differential Relays- Restraining Characteristics; Distance Relays: Types- Characteristics

(9)

UNIT IV:PROTECTION OF POWER SYSTEM EQUIPMENTS
Protection of Power System Equipment - Generator, Transformer, Generator- Transformer Units, Transmission Systems, Busbars, Motors; Pilotwire and Carrier Current Schemes; System grounding –ground faults and protection; Load shedding and frequency relaying; Out of step relaying; Re-closing and synchronizing

(9)

UNIT V: NUMERICAL RELAYS AND CHARACTERISTICS

Numerical relays -Characteristics -Functional Diagrams-architecture - algorithms -Microprocessor & DSP based relays- sampling –aliasing –filter principles; Integrated and multifunction protection schemes -SCADA based protection systems- FTA; Testing of Relays.

(9)

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Understand the digital relays and its types.
2. Analyze the digital protection schemes for transmission lines, generators and transformers.
3. Simulate the protection schemes for radial and mesh connected systems.
4. Realize relaying algorithms with different relay settings and on microcontrollers or microprocessors.

Text Books:

1. C.R. Mason, The art and science of protective relaying, John Wiley &sons.
2. A.R. Warrington, Protective Relays, vol. 1 & 2, Chapman and Hall.
3. T.S. Madhav Rao, Power system protection static relays with microprocessor applications, Tata McGraw Hill Publication

References:

1. Power System Protection Vol. I, II, III & IV, the Institution of Electrical Engineers, Electricity Association Services Ltd., 1995
2. Helmut Ungrad, Wilibald Winkler, Andrzej Wiszniewski, Protection techniques in electrical energy systems, Marcel Dekker, Inc.
3. Badri Ram, D.N. Vishwakarma, Power system protection and switch gear, Tata McGraw Hill.
4. Blackburn, J. Lewis, Protective Relaying, Principles and Applications, Marcel Dekker, Inc., 1986.
5. Anderson, P.M, Power System Protection, McGraw-Hill, 1999
6. Singh L.P, Digital Protection, Protective Relaying from Electromechanical to Microprocessor, John Wiley & Sons, 1994

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Honors in Electrical & Electronics Engineering
B. Tech IV Year I Semester

18HDEEE109 POWER APPARATUS & NETWORKS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE109, 18EEE114

Course Description:
This course is designed to provide knowledge in power apparatus and fundamental principles of power networks.
Course covers apparatus in power networks like transformers, synchronous generators; transmission lines, cables etc. It also covers stability, protection and deregulation of large interconnected power networks.

Course Objectives:
1. To understand the overview of power systems and changing landscape
2. To infer the constructional details, the principle of operation of apparatus in power networks
3. To comprehend the stability phenomenon of large interconnected power network
4. To interpret the protection aspects of power system.
5. To impart knowledge on deregulation of power industry.

UNIT I: ESSENTIAL FUNDAMENTALS OF POWER NETWORKS
Overview of power systems and changing landscape; sources of electrical energy and environmental consequences; the Indian power industry

(9)

UNIT II: FUNDAMENTAL PRINCIPLES OF POWER NETWORKS
Magnetic prerequisites. Apparatus in power networks: transformers; synchronous generators; transmission lines, cables, HVDC; loads and power quality.

(9)

UNIT III: ANALYSIS AND OPERATION
Power flow; rotor angle and voltage stability; control of large interconnected power networks.

(9)

UNIT IV: PROTECTION
Fault calculations, relay co-ordination and circuit breakers; transient overvoltages, protection by surge arrestors, and insulation co-ordination.

(9)

UNIT V: DEREGULATION
Management of vertical utilities, utility deregulation and open access: operational economics of the power industry, privatization; deregulation and energy markets.

(9)

Course Outcomes:

At the end of the course, students will able to

1. Identify different energy sources and its utilization
2. Apply the electrical apparatus to practical circuits
3. Classify the power system stability problems
4. Design the protection system for large interconnected network
5. Analyze the deregulated power industry.

Text Books:

1. G. L. Kusic, Computer Aided Power Systems Analysis. Prentice Hall of India Private Limited, 2003.
2. S. Roy, Simulation Experiments on Power Apparatus & Networks. EDD Laboratory Manual.

References:

1. W. D. Stevenson, Elements of power systems analysis, McGraw Hill International Book Company, fourth or subsequent editions.
2. PrabhaKundur, Power System Stability and Control, Tata McGraw-Hill, 2006

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

MINORS

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

Stream Name: Electrical Machines and Control

Minors in Electrical & Electronics Engineering
B. Tech III Year I Semester

18MDEEE101 ELECTRIC CIRCUIT ANALYSIS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18MAT105, 18MAT106

Course Description:
This course deals with analysis techniques that can applied to all circuits from tiny ones in integrated circuits in mobile phones, to giant ones that carry power to our homes. Course covers various network theorems, steady state and transient state response of RLC circuits, single-phase and three-phase AC Systems, Two Port Networks and Laplace transform applications to network analysis.

Course Objectives:
11. To understand the various network theorems for the analysis of electrical circuits.
12. To gain knowledge about single phase and three phase circuits
13. To know the transient and steady-state response of electrical circuits
14. To calculate the various two port network parameters and to know interconnections.
15. To understand the application of Laplace transforms in network analysis.

UNIT I: NETWORK THEOREMS
Node and Mesh Analysis, Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources.

(9)

UNIT II: SINUSOIDAL STEADY STATE ANALYSIS
Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances. AC circuit analysis - effective or RMS values, average power and complex power. Three-phase circuits, Analysis of balanced three phase circuits, Analysis of three Phase unbalanced circuits.

(9)

UNIT III: SOLUTION OF FIRST AND SECOND ORDER NETWORKS
Solution of first and second order differential equations for Series R-L, R-C, RL-C circuits (DC and Sinusoidal excitation), initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

(9)

UNIT IV: TWO PORT NETWORKS
Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

(9)

UNIT V: ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Series and parallel resonances.

(9)

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Apply network theorems for the analysis of electrical circuits.
2. Obtain various parameters pertaining to single-phase and three-phase systems.
3. Obtain the transient and steady-state response of electrical circuits.
4. Calculate the different two port circuit parameters.
5. Make use of Laplace transforms for analyzing the circuits

Text Books:

1. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
2. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.

References:

1. Abhijit Chakrabarti, "Circuit Theory: Analysis and Synthesis", Dhanpat Rai & Co., 2014.
2. Sudhakar and Shyammohan S Palli, "Network Analysis", Tata McGraw- Hill publications, 2007.
3. N.C. Jagan and C. Lakshmi Narayana "Network Ananlysis", BS Publications, 2nd edition, 2005
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
6. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Minors in Electrical & Electronics Engineering
B. Tech III Year I Semester

18MDEEE102 ELECTRICAL MACHINES

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course covers three phase supply systems, DC and AC machines and transformers.

Course Objectives:
1. To learn various types of DC machines and their working principles
2. To impart knowledge on three phase transformers.
3. To understand the construction and working of alternators.
4. To know the working and principle of operation of induction motors.
5. To understand the operation and working of single-phase induction motors and special machines

UNIT I: TRANSFORMERS
Transformer on no-load, ideal transformer, real transformer and equivalent circuit, transformer losses, transformer testing, efficiency and voltage regulation, excitation phenomenon in transformers, autotransformers, variable frequency transformer, three-phase transformers, parallel operation of transformers, three-winding transformers, phase conversion, tap changing transformers, voltage and current transformers

(9)

UNIT II: DC MACHINES
Armature winding and commutator, EMF and torque, circuit model, armature reaction, compensating winding, commutation, methods of excitation, operating characteristics of dc generator, characteristics of dc motors, starting of dc motors, speed control of dc motors, braking of dc motors, efficiency and testing, DC machine applications.

(9)

UNIT III: SYNCHRONOUS MACHINES
Basic synchronous machine model, circuit model of synchronous machine, determination of the synchronous reactance, MMF method, determination of armature reaction ampere-turns and leakage reactance of a synchronous machine - potier method, ASA (american standards association) method, nature of armature reaction, synchronizing to infinite bus-bars, operating characteristics, efficiency of synchronous machines, power flow (transfer) equations, parallel operation of synchronous generators, hunting in synchronous machines

(9)

UNIT IV: INDUCTION MOTORS

Flux and MMF waves in induction motor, principle of operation, development of circuit model (equivalent circuit), power across air-gap, torque and power output, tests to determine circuit-model parameters, the circle diagram (approximate), starting, cogging and crawling, speed control.

(9)

UNIT V: SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors

(9)

Course Outcomes:

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

1. Demonstrate various types of transformers and their operation.
2. Describe operational characteristics of a DC machine.
3. Interpret the operation of synchronous machine.
4. Analyze the three-phase induction motors.
5. Analyze the single-phase Induction machines and special machines

Text Books:

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

2. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

References:

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

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

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

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minors in Electrical & Electronics Engineering

B. Tech III Year II Semester

18MDEEE103 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course introduces the basic principles of all measuring instruments. It deals with the principle and operation of voltage, current, power factor, power and energy meters. It also covers the digital storage oscilloscope, digital meters, active transducers, passive transducers, piezoelectric transducers and RTD.

Course Objectives:
5. To learn basic principles of all measuring instruments.
6. To enumerate the voltage, current, power factor, power and energy meters.
7. To analyze the digital storage oscilloscope and digital meters.
8. To understand the active and passive transducers.

UNIT I: MEASURING INSTRUMENTS & INSTRUMENT TRANSFORMERS
Classification – Deflecting, control and damping torques – Ammeters and Voltmeters – PMMC – Dynamometer – MI instruments – Errors and compensations – Calibration – Extension of range using shunts and series resistance – CT and PT – Ratio, phase angle errors and design considerations for CT and PT.

(9)

UNIT II: POWER FACTOR METERS & MEASUREMENT OF POWER AND ENERGY
Power factor meters: Dynamometer and moving iron type – Single-phase and three-phase meters. Power measurement: Single-phase dynamometer wattmeter – LPF wattmeter – Double element and three element dynamometer wattmeter.
Measurement of Energy: Single-phase induction type energy meter – Driving and braking torques – Errors and compensations – Three-phase energy meter.

(9)

UNIT III: POTENTIOMETERS & BRIDGES
Principle and operation of D.C. Crompton's potentiometer – Standardization – Measurement of unknown resistance, current and voltage – A.C. Potentiometers: polar and coordinate type's – Standardization – Applications – Methods of measuring low, medium and high resistance – Wheatstone's bridge – Kelvin's double bridge – Loss of charge method – Measurement of

inductance – Maxwell's bridge – Anderson's bridge – Measurement of capacitance and loss angle – De Sauty bridge – Schering Bridge – Wien's bridge.

(9)

UNIT IV: DIGITAL STORAGE OSCILLOSCOPE & DIGITAL METERS

DSO: Digital storage oscilloscope – Digital phosphor oscilloscope – Controls of an oscilloscope – Types of probes – Loading – Measurement effects.

Digital meters: Digital voltmeter – Successive approximation, ramp and integrating type – Digital frequency meter – Digital multi-meter – Q-meter.

(9)

UNIT V: TRANSDUCERS

Definition of transducers – Classification of transducers – Characteristics and choice of transducers – Principle and operation of resistive, inductive, and capacitive transducers – LVDT and its applications – Strain Gauge – Thermistors – Thermocouples – RTD – Piezo electric transducers – Photo Conductive Cells – Photo Diodes.

(9)

Course Outcomes:

At the end of the course, students will able to

1. Describe basic requirements and the concepts of electrical measuring instruments and instrument transformers.
2. Measure the energy and power through energy meter and wattmeter.
3. Measure the resistance, inductance, capacitance and frequency.
4. Explain the principle and operation of DSO and digital meters.
5. Exhibit the classification and working of transducers.

Text Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C. Widdis, 5thEdition, Reem Publications.
2. Electrical & Electronic Measurement & Instruments by A. K. Sawhney, Dhanpat Rai & Co. Publications.

References:

1. Electrical Measurements by Buckingham and Price, Prentice–Hall.
2. Electrical Measurements: Fundamentals, Concepts, Applications by Reissland, M.U, New AgeInternational (P) Limited, Publishers.
3. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand& Co.
4. Electronic Instrumentation by H. S. Kalsi, Tata McGrawhill, 3rd Edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minors in Electrical & Electronics Engineering

B. Tech III Year II Semester

18MDEEE104 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101, 18MAT105, 18MAT106

Course Description:

This course tries to bring out the basic principles of Feedback Control Systems. Course covers modelling of various physical systems, block diagram reduction techniques, signal flow graph, time domain analysis of continuous systems, role of different controllers, bode plot, Nyquist criterion, lag, lead and lag-lead compensators design using bode plot and root locus, Routh stability criterion, state space representation of continuous systems.

Course Objectives:

1. To understand the use of transfer function models for analysis physical systems and introduce the control system components.
2. To provide adequate knowledge in the time response of systems and steady state error analysis.
3. To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
4. To introduce stability analysis and design of compensators.
5. To introduce state variable representation of physical systems and study the effect of state feedback

UNIT I: INTRODUCTION TO CONTROL PROBLEM AND SYSTEM MODELING

Industrial Control examples. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Transfer function models of linear time-invariant systems. Control hardware and their models. Block diagrams and Signal flow graphs.

(9)

UNIT II: TIME RESPONSE ANALYSIS

Standard test signals. Time response of first and second order systems for standard test inputs. Steady state response - Steady state errors and error constants. Application of Proportional, Integral and Derivative Controllers.

(9)

UNIT III: CONCEPT OF STABLITY AND ROOT LOCUS

Concept of Stability, Routh-Hurwitz Criteria. Relative Stability analysis, Root-Locus technique. Construction of Root-loci. Design specifications for second-order systems based on the time-response.

(9)

UNIT IV: FREQUENCY-RESPONSE ANALYSIS

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response. Lead and Lag compensation in designs.

(9)

UNIT V: STATE VARIABLE ANALYSIS

Concepts of state variables. State space model. State transition matrix. Solution of state equations. Eigenvalues and Stability Analysis.

(9)

Course Outcomes:

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

1. Apply the knowledge of engineering fundamentals to form mathematical model and obtain transfer function.
2. Solve to get time domain response of LTI system.
3. Analyse stability of the system in time domain using classical techniques.
4. Analyse stability of the system in frequency domain using classical techniques.
5. Model and analyse the control system in state space.

Text Books:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009

References:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minors in Electrical & Electronics Engineering

B. Tech III Year II Semester

18MDEEE201 ELECTRICAL MACHINES AND CONTROL SYSTEM LABORATORY

L	T	P	C
0	0	4	2

Course Prerequisite:

Course Objective:

1. To conduct various tests on transformers.
2. To analyse the Open circuit and load. Characteristics of DC separately excited shunt generator.
3. To obtain the Transfer Function of separately excited D.C. Machine.
4. To study the effect of feedback on a DC Servo Motor and also to determine the characteristics of an AC Servo Motor.
5. To learn the effect of controllers on Second Order Systems and placement of compensators.

List of Experiments

1. Scott connection.
2. Sumner's test on transformer.
3. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
4. Equivalent circuit and Load test on single phase induction motor
5. No load, blocked rotor and load test on 3 phase squirrel cage induction motor
6. Transfer Function of separately excited D.C. Machine
7. Effect of Feedback on DC Servo Motor
8. Characteristics of AC Servo Motor
9. Effect of P, PD, PI, PID Controller on a Second Order Systems
10. Lag and Lead Compensation – Magnitude and Phase Plot

Course Outcomes:

At the end of the course, students will able to

1. Start and control the Different DC Machines.
2. Assess the performance of different machines using different testing methods
3. Obtain the Transfer Function of separately excited D.C. Machine.
4. Understand the effect of feedback on a DC Servo Motor and also to determine the characteristics of an AC Servo Motor.
5. Learn the effect of controllers on Second Order Systems and placement of compensators.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minors in Electrical & Electronics Engineering

B. Tech IV Year I Semester

18MDEEE105 ELECTRICAL AND HYBRID VEHICLES

L	T	P	C
3	0	0	3

Course Prerequisite: 18MDEEE102 or 18MDEEE107 , 18MDEEE103

Course Description:
This course introduces the fundamental concepts, principles and analysis of hybrid and electric vehicles.

Course Objectives:
1. To study the various aspects of hybrid and electric vehicles.
2. To learn the selection of electrical machines for hybrid and electric vehicles.
3. To understand the basic concept of electric traction.
4. To study the various energy storage technologies for hybrid and electric vehicles.
5. To understand the energy management techniques for hybrid and electric vehicles.

UNIT I: HISTORY AND CONCEPT OF HYBRIDIZATION
Environmental impact and history of modern transportation, air pollution, global warming, Sustainable Transportation, A Brief History of HEVs, Why EVs Emerged and Failed in the 1990s, Architectures of HEVs, State of the Art of HEVs: Review of Toyota Prius. Challenges and Key Technology of HEVs. Concept of Hybridization of the Automobile: Vehicle Basics, Basics of the EV, Basics of the HEV, Basics of Plug-In Hybrid Electric Vehicle (PHEV), Basics of Fuel Cell Vehicles (FCVs).

(9)

UNIT II: FUNDAMENTALS OF VEHICLE PROPULSION AND BRAKING
Basics of Vehicle Propulsion and Braking: General Description of Vehicle Movement, Vehicle Resistance, Rolling Resistance, Aerodynamic Drag, Grading Resistance, Dynamic Equation, Tire–Ground Adhesion and Maximum Tractive Effort, Power Train Tractive Effort and Vehicle Speed, Vehicle Performance, Operating Fuel Economy, Brake Performance.

(9)

UNIT III: ELECTRIC VEHICLES AND HYBRID ELECTRIC VEHICLES
Electric Vehicles: Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving, Energy Consumption. Hybrid Electric Vehicles: Concept of Hybrid Electric Drivetrains, Architectures of Hybrid Electric Drivetrains, Series Hybrid Electric Drivetrains (Electrical Coupling), Parallel Hybrid Electric Drivetrains (Mechanical Coupling).

(9)

UNIT IV: ELECTRIC PROPULSION SYSTEMS

Permanent Magnetic BLDC Motor Drives: Basic Principles of BLDC Motor Drives, BLDC Machine Construction and Classification, Properties of PM Materials, Performance Analysis and Control of BLDC Machines, Extend Speed Technology, Sensorless Techniques. SRM Drives: Basic Magnetic Structure, Torque Production, SRM Drive Converter, Modes of Operation, Generating Mode of Operation (Regenerative Braking), Sensorless Control, Self-Tuning Techniques of SRM Drives, Vibration and Acoustic Noise in SRM, SRM Design.

(9)

UNIT V: PEAKING POWER SOURCES AND ENERGY STORAGE

Electrochemical Batteries: Electrochemical Reactions, Thermodynamic Voltage, Specific Energy, Specific Power, Energy Efficiency, Battery Technologies. Ultracapacitors: Features, Basic Principles, Performance, Ultracapacitor Technologies. Ultra-High-Speed Flywheels: Operation Principles, Power Capacity of Flywheel Systems, Flywheel Technologies. Hybridization of Energy Storages: Concept of Hybrid Energy Storage, Passive and Active Hybrid Energy Storage with Battery and Ultracapacitor, Battery and Ultracapacitor Size Design.

(9)

Course Outcomes:

At the end of this course, students will able to

1. Understand the various aspects of hybrid and electric vehicles.
2. Plan the selection of electrical machines for hybrid and electric vehicles.
3. Understand the principles and control of Electric trains.
4. Select various energy storage technologies for hybrid and electric vehicles.
5. Implement energy management techniques for hybrid and electric vehicles.

Text Books:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.

References:

1. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.
3. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Husain, 2nd Edition, CRC Press, 2011.
4. G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
5. Ali Emadi, Mehrdad Ehsani, John M. Miller 'Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles'.
6. Ion Boldea and S.A Nasar, 'Electric drives', CRC Press, 2005.
7. Sandeep Dhameja, 'Electric Vehicle Battery Systems'

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

MINORS
IN
ELECTRICAL AND ELECTRONICS ENGINEERING

Stream Name: Power Electronics and Instrumentation

Minors in Electrical & Electronics Engineering

B. Tech III Year I Semester

18MDEEE106 INTRODUCTION TO ELECTRICAL POWER GENERATION SYSTEM

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course covers introduction to power system structure, various power generation systems layout and working.

Course Objectives:
1. To study the basic structure and concepts of power systems.
2. To impart knowledge on hydro and thermal power generation plants
3. To understand the working of nuclear power plants.
4. To learn various renewable power generation techniques.
5. To impart knowledge on combined operation of power plants.

UNIT I: INTRODUCTION AND BASIC CONCEPTS OF POWER SYSTEMS
Evolution of Power Systems and Present-Day Scenario. Indian power sector, evolution of national grid. Structure of a power system - system load - load characteristics - load curves - load factor - diversity factor-plant factor. Various sources of energy – classification – Environmental considerations. **(9)**

UNIT II: HYDRO-ELECTRIC AND THERMAL POWER PLANTS
Hydro-electric power plants – selection of site, elements of power plant, classification, water turbines, governor action, hydro-electric generator, plant layout, pumped storage plants.

Thermal Steam power plants – selection of site, elements and operational circuits of the power plant, turbo-alternators, plant layout, steam turbines, controls and auxiliaries. **(9)**

UNIT III: NUCLEAR POWER PLANTS
Nuclear power plants – selection of site, nuclear reaction – fission process and chain reaction, constituents of power plant and layout, nuclear reactor – working, classification, control, shielding and waste disposal, safety and environmental considerations. **(9)**

UNIT IV: RENEWABLE POWER PLANTS
Solar power generation – Photo-voltaic and solar thermal generation – solar concentrators, Wind power generation – types of wind mills, wind generators, tidal, biomass, geothermal and magneto-hydro dynamic power generation, micro-hydel power plants, fuel cells and diesel and gas power plants. **(9)**

UNIT V: COMBINED OPERATION OF POWER PLANTS
Plant selection, choice of size and number of generator units, interconnected systems, real and reactive power exchange among interconnected systems. Major electrical equipment in power plants, DC systems in power plants, station control - switch yard and control room. Economic considerations – types of costs, tariff and consumers. **(9)**

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Illustrate the basic concepts and structure of power systems.
2. Describe the layout and working of hydro and thermal power plants.
3. Classify various types of nuclear power plants and their working.
4. Demonstrate the working of different types of renewable power plants.
5. Interpret the operation of interconnected power systems.

Text Books:

1. Chakrabarti A., Soni M.L., Gupta P.V., and Bhatnagar U.S., 'A text book on Power Systems Engg.', Dhanpat Rai and Sons, New Delhi, 2nd revised edition, 2010.
2. J.B.Gupta, ‘A course in Power Systems’, S.K.Kataria and sons, reprint 2010-2011.

Reference Books:

1. Wadhwa, C.L., ‘Generation Distribution and Utilisation of Electrical Energy', New Age International publishers, 3rd edition, 2010.
2. Deshpande M.V, `Elements of Electrical Power systems Design’, Pitman, New Delhi, PHI Learning Private Limited, 1st edition, 2009.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minors in Electrical & Electronics Engineering

B. Tech III Year I Semester

18MDEEE107 ELECTRICAL MACHINE TECHNOLOGY

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course covers three phase supply systems, DC and AC machines and transformers.

Course Objectives:
1. To impart knowledge on three phase transformers.
2. To learn various types of DC machines and their working principles
3. To know the working and principle of operation of induction motors.
4. To understand the construction and working of alternators.
5. To understand operation, construction and types of single-phase motors and their applications in household appliances and control systems.

UNIT I: TRANSFORMERS
Transformer on no-load, ideal transformer, real transformer and equivalent circuit, transformer losses, transformer testing, efficiency and voltage regulation, excitation phenomenon in transformers, autotransformers, variable frequency transformer, three-phase transformers, parallel operation of transformers, three-winding transformers, phase conversion, tap changing transformers, voltage and current transformers

(9)

UNIT II: DC MACHINES
Armature winding and commutator, EMF and torque, circuit model, armature reaction, compensating winding, commutation, methods of excitation, operating characteristics of dc generator, characteristics of dc motors, starting of dc motors, speed control of dc motors, braking of dc motors, efficiency and testing, DC machine applications.

(9)

UNIT III: INDUCTION MOTORS
Flux and MMF waves in induction motor, principle of operation, development of circuit model (equivalent circuit), power across air-gap, torque and power output, tests to determine circuit-model parameters, the circle diagram (approximate), starting, cogging and crawling, speed control. single-phase induction motors, classification, construction and working.

(9)

UNIT IV: SYNCHRONOUS MACHINES

Basic synchronous machine model, circuit model of synchronous machine, determination of the synchronous reactance, MMF method, determination of armature reaction ampere-turns and leakage reactance of a synchronous machine - potier method, ASA (american standards association) method, nature of armature reaction, synchronizing to infinite bus-bars, operating characteristics, efficiency of synchronous machines, power flow (transfer) equations, parallel operation of synchronous generators, hunting in synchronous machines

(9)

UNIT V: FRACTIONAL HORSEPOWER MACHINES

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications, Introduction to BLDC, SRM, Stepper Motors.

(9)

Course Outcomes:

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

1. Demonstrate various types of transformers and their operation.
2. Describe operational characteristics of a DC machine.
3. Analyze the three phase induction motors.
4. Interpret the operation of synchronous machine.
5. Understand the operation of special electrical machines

Text Books:

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

2. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

References:

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

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

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

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minors in Electrical & Electronics Engineering

B. Tech III Year II Semester

18MDEEE103 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course introduces the basic principles of all measuring instruments. It deals with the principle and operation of voltage, current, power factor, power and energy meters. It also covers the digital storage oscilloscope, digital meters, active transducers, passive transducers, piezoelectric transducers and RTD.

Course Objectives:

1. To learn basic principles of all measuring instruments.
2. To enumerate the voltage, current, power factor, power and energy meters.
3. To analyze the digital storage oscilloscope and digital meters.
4. To understand the active and passive transducers.

UNIT I: MEASURING INSTRUMENTS & INSTRUMENT TRANSFORMERS
Classification – Deflecting, control and damping torques – Ammeters and Voltmeters – PMMC – Dynamometer – MI instruments – Errors and compensations – Calibration – Extension of range using shunts and series resistance – CT and PT – Ratio, phase angle errors and design considerations for CT and PT.

(9)

UNIT II: POWER FACTOR METERS & MEASUREMENT OF POWER AND ENERGY
Power factor meters: Dynamometer and moving iron type – Single-phase and three-phase meters.
Power measurement: Single-phase dynamometer wattmeter – LPF wattmeter – Double element and three element dynamometer wattmeter.
Measurement of Energy: Single-phase induction type energy meter – Driving and braking torques – Errors and compensations – Three-phase energy meter.

(9)

UNIT III: POTENTIOMETERS & BRIDGES
Principle and operation of D.C. Crompton's potentiometer – Standardization – Measurement of unknown resistance, current and voltage – A.C. Potentiometers: polar and coordinate type's – Standardization – Applications – Methods of measuring low, medium and high resistance – Wheatstone's bridge – Kelvin's double bridge – Loss of charge method – Measurement of inductance – Maxwell's bridge – Anderson's bridge – Measurement of capacitance and loss angle – De Sauty bridge – Schering Bridge – Wien's bridge.

(9)

UNIT IV: DIGITAL STORAGE OSCILLOSCOPE & DIGITAL METERS

DSO: Digital storage oscilloscope – Digital phosphor oscilloscope – Controls of an oscilloscope – Types of probes – Loading – Measurement effects.

Digital meters: Digital voltmeter – Successive approximation, ramp and integrating type – Digital frequency meter – Digital multi-meter – Q-meter.

(9)

UNIT V: TRANSDUCERS

Definition of transducers – Classification of transducers – Characteristics and choice of transducers – Principle and operation of resistive, inductive, and capacitive transducers – LVDT and its applications – Strain Gauge – Thermistors – Thermocouples – RTD – Piezo electric transducers – Photo Conductive Cells – Photo Diodes.

(9)

Course Outcomes:

At the end of the course, students will able to

1. Describe basic requirements and the concepts of electrical measuring instruments and instrument transformers.
2. Measure the energy and power through energy meter and wattmeter.
3. Measure the resistance, inductance, capacitance and frequency.
4. Explain the principle and operation of DSO and digital meters.
5. Exhibit the classification and working of transducers.

Text Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C. Widdis, 5th Edition, Reem Publications.
2. Electrical & Electronic Measurement & Instruments by A. K. Sawhney, Dhanpat Rai & Co. Publications.

References:

1. Electrical Measurements by Buckingham and Price, Prentice–Hall.
2. Electrical Measurements: Fundamentals, Concepts, Applications by Reissland, M.U, New AgeInternational (P) Limited, Publishers.
3. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand& Co.
4. Electronic Instrumentation by H. S. Kalsi, Tata McGrawhill, 3rd Edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minors in Electrical & Electronics Engineering

B. Tech III Year II Semester

18MDEEE108 POWER ELECTRONICS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course aims to cover the basics of power semiconductor devices and operational behavior of various power electronic components.
This course covers power semiconductor devices and their characteristics, Single phase half wave controlled rectifier, Single phase and three phase dual converters, step-down chopper buck, boost, buck-boost, cuk, full-bridge converters, inverters, voltage controllers, cyclo converters and static switches.

Course objectives:
1. To get an overview of different types of power semiconductor devices and their switching characteristics.
2. To understand the operation, characteristics and performance parameters of controlled rectifiers
3. To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
4. To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
5. To study the operation of AC voltage controller and various configurations.

UNIT I: POWER SEMICONDUCTOR DEVICES
Power semiconductor devices their symbols and static characteristics, Characteristics and specifications of switches, types of power electronic circuits operation, steady state and switch characteristics & switching limits of Power Transistor Operation and steady state characteristics of Power MOSFET and IGBT, Thyristor – Operation V- I characteristics, two transistor model, methods of turn-on Operation of GTO, MCT and TRIAC. **(9)**

UNIT II: PHASE CONTROLLED CONVERTERS
Single phase half-wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode. Single phase fully controlled and half controlled bridge converters, Performance Parameters Three phase half wave converters, Three phase fully controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters, Numerical problems.

(9)

UNIT III: DC-DC CONVERTERS

Principles of step-down chopper, step down chopper with R-L load Principle of step-up chopper, and operation with RL load, classification of choppers, operation and design issues of buck, boost, buck-boost converters.

(9)

UNIT IV: INVERTERS

Types of DC to AC Converters, Single Phase Inverter – Principle of operation, performance parameters; Voltage Control of single-phase pulse width modulated inverter; Harmonics analysis of single-phase inverter; Three Phase Inverter – 120^0, 180^0 conduction, Harmonics analysis.

(9)

UNIT V: CYCLOCONVERTER & STATIC SWITCHES

Types of Cycloconverter, Single-Phase Cycloconverter, Three-Phase Cycloconverter, speed control of AC motors, operation and design of static switches and relays

(9)

Course Outcomes:

At the end of the course, students will able to

1. Explain the different types of power semiconductor devices and their switching characteristics.
2. Analyze the operation, characteristics and performance parameters of controlled rectifiers.
3. Analyze the operation, switching techniques and basics topologies of DC-DC switching regulators.
4. Analyze the operation of AC to DC Converters.
5. Explain the operation of AC voltage controller and various configurations.

Textbooks:

1. Muhammad H Rashid: "Power Electronics: Circuits, Devices, and Applications", 3rd Edition; Pearson
2. P. C. Sen, "Power Electronics" TMH – 2nd Edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minors in Electrical & Electronics Engineering

B. Tech III Year II Semester

18MDEEE202 POWER ELECTRONICS AND ELECTRICAL MEASUREMENT LABORATORY

L	T	P	C
0	0	4	2

Course Prerequisite:

Course Description:
This practical course provide hands on experience with various electrical parameters measurement and power electronic converter design and testing

Course Objective:

1. To understand the functionality of electrical measuring instruments
2. To analyze the operation of various methods of determination of inductance and capacitance values
3. To analyze the Characteristics of SCR, MOSFET&IGBT
4. To design the single-phase AC voltage controller with R and RL Loads
5. To analyze the different converter circuits.

List of Experiments

1. Kelvin’s double Bridge – Measurement of low resistance – Determination of Tolerance
2. Schering Bridge & Anderson bridge.
3. Resistance strain gauge – strain measurement and Calibration
4. A.C. Potentiometer – Calibration of AC Voltmeter, Parameters of Choke coil.
5. Study of Characteristics of SCR, MOSFET& IGBT
6. Gate firing circuits for SCR‘s
7. Single Phase AC Voltage Controller with R and RL Loads
8. Single Phase fully controlled bridge converter with R and RL loads
9. Single Phase Cycloconverter with R and RL loads
10. Three Phase half-controlled bridge converter with R-load

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

1. Calibrate various electrical measuring instruments
2. Accurately determine the values of inductance and capacitance using a.c bridges.
3. Analyze the Characteristics of SCR, MOSFET&IGBT
4. Design the single-phase AC voltage controller with R and RL Loads
5. Analyze the different converter circuits.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

Minors in Electrical & Electronics Engineering

B. Tech IV Year I Semester

18MDEEE105 ELECTRICAL AND HYBRID VEHICLES

L	T	P	C
3	0	0	3

Course Prerequisite: 18MDEEE102 or 18MDEEE107, 18MDEEE103

Course Description:
This course introduces the fundamental concepts, principles and analysis of hybrid and electric vehicles.

Course Objectives:
1. To study the various aspects of hybrid and electric vehicles.
2. To learn the selection of electrical machines for hybrid and electric vehicles.
3. To understand the basic concept of electric traction.
4. To study the various energy storage technologies for hybrid and electric vehicles.
5. To understand the energy management techniques for hybrid and electric vehicles.

UNIT I: HISTORY AND CONCEPT OF HYBRIDIZATION
Environmental impact and history of modern transportation, air pollution, global warming, Sustainable Transportation, A Brief History of HEVs, Why EVs Emerged and Failed in the 1990s, Architectures of HEVs, State of the Art of HEVs: Review of Toyota Prius. Challenges and Key Technology of HEVs. Concept of Hybridization of the Automobile: Vehicle Basics, Basics of the EV, Basics of the HEV, Basics of Plug-In Hybrid Electric Vehicle (PHEV), Basics of Fuel Cell Vehicles (FCVs).

(9)

UNIT II: FUNDAMENTALS OF VEHICLE PROPULSION AND BRAKING
Basics of Vehicle Propulsion and Braking: General Description of Vehicle Movement, Vehicle Resistance, Rolling Resistance, Aerodynamic Drag, Grading Resistance, Dynamic Equation, Tire–Ground Adhesion and Maximum Tractive Effort, Power Train Tractive Effort and Vehicle Speed, Vehicle Performance, Operating Fuel Economy, Brake Performance.

(9)

UNIT III: ELECTRIC VEHICLES AND HYBRID ELECTRIC VEHICLES
Electric Vehicles: Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving, Energy Consumption. Hybrid Electric Vehicles: Concept of Hybrid Electric Drivetrains, Architectures of Hybrid Electric Drivetrains, Series Hybrid Electric Drivetrains (Electrical Coupling), Parallel Hybrid Electric Drivetrains (Mechanical Coupling).

(9)

UNIT IV: ELECTRIC PROPULSION SYSTEMS

Permanent Magnetic BLDC Motor Drives: Basic Principles of BLDC Motor Drives, BLDC Machine Construction and Classification, Properties of PM Materials, Performance Analysis and Control of BLDC Machines, Extend Speed Technology, Sensorless Techniques. SRM Drives: Basic Magnetic Structure, Torque Production, SRM Drive Converter, Modes of Operation, Generating Mode of Operation (Regenerative Braking), Sensorless Control, Self-Tuning Techniques of SRM Drives, Vibration and Acoustic Noise in SRM, SRM Design.

(9)

UNIT V: PEAKING POWER SOURCES AND ENERGY STORAGE

Electrochemical Batteries: Electrochemical Reactions, Thermodynamic Voltage, Specific Energy, Specific Power, Energy Efficiency, Battery Technologies. Ultracapacitors: Features, Basic Principles, Performance, Ultracapacitor Technologies. Ultra-High-Speed Flywheels: Operation Principles, Power Capacity of Flywheel Systems, Flywheel Technologies. Hybridization of Energy Storages: Concept of Hybrid Energy Storage, Passive and Active Hybrid Energy Storage with Battery and Ultracapacitor, Battery and Ultracapacitor Size Design.

(9)

Course Outcomes:

At the end of this course, students will able to

1. Understand the various aspects of hybrid and electric vehicles.
2. Plan the selection of electrical machines for hybrid and electric vehicles.
3. Understand the principles and control of Electric trains.
4. Select various energy storage technologies for hybrid and electric vehicles.
5. Implement energy management techniques for hybrid and electric vehicles.

Text Books:

1. C. Mi, M. A. Masrur and D. W. Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, John Wiley & Sons, 2011.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.

References:

1. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.
2. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016.
3. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Husain, 2nd Edition, CRC Press, 2011.
4. G. K. Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall, 1989.

5. Ali Emadi, Mehrdad Ehsani, John M. Miller 'Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles'.
6. Ion Boldea and S.A Nasar, 'Electric drives', CRC Press, 2005.
7. Sandeep Dhameja, 'Electric Vehicle Battery Systems'

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination