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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course structure

For the students admitted to

B. Tech. Regular Four Year Degree Programme from the academic year 2020-21

and

B. Tech. Lateral Entry Scheme from the academic year 2021-22

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 Credits for 2020 (Regular) & 121 Credits for 2021(Lateral Entry) Admitted Batch
	163 Credits for 2021 (Regular) & 124 Credits 2022(Lateral Entry) Admitted Batch onwards

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

B. Tech Electrical and Electronics Engineering

R20- Curriculum Structure

I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	20ENG101	Professional English	3	0	0	3	3
2	BSC	20MAT105	Calculus and Differential Equations	3	1	0	4	4
3	BSC	20CHE101	Engineering Chemistry	3	0	0	3	3
4	ESC	20ME101	Engineering Graphics	2	0	2	4	3
5	ESC	20CSE101	Programming for Problem Solving (Python)	2	0	3	5	3.5
6	BSC	20CHE201	Chemistry Laboratory	0	0	3	3	1.5
7	ESC	20ME201	Workshop Practice	0	0	3	3	1.5
Total				**11**	**3**	**11**	**25**	**19.5**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	20MAT106	Linear Algebra and Transform Calculus	3	0	0	3	3
2	BSC	20PHY102	Applied Physics	3	1	0	4	4
3	ESC	20EEE101	Basic Electrical Engineering	3	1	0	4	4
4	ESC	20CSE102	C Programming and Data Structures	3	0	0	3	3
5	HSMC	20ENG201	English for Professional Purposes Laboratory	0	0	2	2	1
6	BSC	20PHY201	Physics Laboratory	0	0	3	3	1.5
7	ESC	20EEE201	Electrical Engineering Laboratory	0	0	3	3	1.5
8	ESC	20CSE201	C Programming and Data Structures Laboratory	0	0	3	3	1.5
Total				**14**	**0**	**11**	**25**	**19.5**

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

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II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	20HUM101	Economics and Financial Accounting for Engineers	3	0	0	3	3
2	BSC	20MAT103	Numerical Methods	3	0	0	3	3
3	PCC	20EEE102	Electrical Circuit Analysis	2	1	0	3	3
4	PCC	20EEE103	Analog Electronics	3	0	0	3	3
5	PCC	20EEE104	DC Machines and Transformers	3	0	0	3	3
6	PCC	20EEE202	Electrical Circuits and Simulation Laboratory	0	0	3	3	1.5
7	PCC	20EEE203	Analog Electronics Laboratory	0	0	3	3	1.5
8	PCC	20EEE204	DC Machines and Transformers Laboratory	0	0	3	3	1.5
9	SC	SOC – I	Skill Oriented Course – I (Refer Annexure - IV)	1	0	2	3	2
10	MC	20HUM901	Indian Constitution	2	0	0	2	0
Total				**17**	**1**	**11**	**29**	**21.5**

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	20MAT104	Probability and Statistics For Engineers	3	0	0	3	3
2	ESC	20EEE105	Electromagnetic Fields	2	1	0	3	3
3	PCC	20EEE106	Digital Electronics	3	0	0	3	3
4	PCC	20EEE107	Induction and Synchronous Machines	3	0	0	3	3
5	PCC	20EEE108	Control Systems	2	1	0	3	3
6	ESC/ PCC	20EEE205	Digital Electronics Laboratory	0	0	3	3	1.5
7	PCC	20EEE206	Induction and Synchronous Machines Laboratory	0	0	3	3	1.5
8	PCC	20EEE207	Control Systems Laboratory	0	0	3	3	1.5
9	SC	SOC-II	Skill Oriented Course- II (Refer Annexure - IV)	1	0	2	3	2
10	MC	20CHE901	Environmental Science	2	0	0	2	0
Total				**16**	**2**	**11**	**29**	**21.5**

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

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III Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	20EEE109	Power Systems – I	3	0	0	3	3
2	PCC	20EEE110	Power Electronics	3	0	0	3	3
3	PCC	20EEE111	Micro-controllers and Interfacing	3	0	0	3	3
4	OE		Open Elective-I	3	0	0	3	3
5	PE		Professional Elective-I	3	0	0	3	3
6	PCC	20EEE208	Power System – I Laboratory	0	0	3	3	1.5
7	PCC	20EEE209	Micro-controllers and Interfacing Laboratory	0	0	3	3	1.5
8	SC		Skill Oriented Course - III	1	0	2	3	2
9	MC	20HUM902**/ 20HUM102#	Universal Human Values	2/3	0	0	2/3	0/3
10	PROJ	20EEE701	Summer Internship-1*	0	0	3	3	1.5
Total				**18/19**	**0**	**11**	**29/30**	**21.5/24.5**

** 20HUM902 Universal Human Values is offered as non-credit mandatory course for 2020 (Regular) & 2021 (Lateral Entry) Admitted Batch

20HUM102 Universal Human Values is offered as three credit course for 2021 (Regular) & 2022(Lateral Entry) Admitted Batch onwards

* 2 Months internship during 2nd year summer vacation and to be evaluated in III Year I Semester

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	20EEE112	Measurements and Transducers	2	1	0	3	3
2	PCC	20EEE113	Signals and Systems	3	0	0	3	3
3	PCC	20EEE114	Power Systems – II (Analysis)	3	0	0	3	3
4	OE		Open Elective-II	3	0	0	3	3
5	PE		Professional Elective-II	3	0	0	3	3
6	PCC	20EEE210	Measurements and Transducers Laboratory	0	0	3	3	1.5
7	PCC	20EEE211	Power Systems – II Laboratory	0	0	3	3	1.5
8	PCC	20EEE212	Power Electronics Laboratory	0	0	3	3	1.5
9	SC		Skill Oriented Course - IV	1	0	2	3	2
10	MC	20CE901	Disaster Management	2	0	0	2	0
Total				**17**	**1**	**11**	**29**	**21.5**

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

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IV Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PE		Professional Elective-III	3	0	0	3	3
2	PE		Professional Elective-IV	3	0	0	3	3
3	PE		Professional Elective-V	3	0	0	3	3
4	OE		Open Elective-III	3	0	0	3	3
5	OE		Open Elective-IV	3	0	0	3	3
6	OE-HSMC		Open Elective-V (Taken from Humanities & Social Science)	3	0	0	3	3
7	SC		Skill Oriented Course - V	1	0	2	3	2
8	PROJ	20EEE702	Summer Internship-2*	0	0	6	6	3
Total				**19**	**0**	**8**	**27**	**23**

***** 2 Months' internship during 3nd year summer vacation and to be evaluated in IV Year I Semester

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PROJ	20EEE703	Project Work and Internship	0	0	24	24	12
Total				**0**	**0**	**24**	**24**	**12**

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

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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

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ANNEXURE - II

OPEN ELECTIVE – I (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM3M01	Project Management for Managers	Management Studies
2	20HUM3M02	Ethics in Engineering Practice	Management Studies
3	20HUM3M03	E – Business	Management Studies
4	20CE3M01	Integrated Waste Management for Smart City	Civil
5	20CE3M02	Soil and Water Conservation Engineering	Civil
6	20CE3M03	Plastic Waste Management	Civil
7	20CE3M04	Safety in Construction	Civil
8	20ME3M01	Operations Management	Mechanical
9	20ME3M02	Operations Research	Mechanical
10	20ME3M03	Design Thinking and Innovation	Mechanical
11	20ECE3M03	Semiconductor Opto-Electronics	ECE
12	20ECE3M04	System Design Through Verilog	ECE
13	20CSE3M01	Online Privacy	CSE
14	20CSE3M02	Privacy and Security in Online Social Media	CSE
15	20IE3M01	Intellectual Property Rights and Competition Law	Multidisciplinary
16	20IE3M02	Introduction to Research	Multidisciplinary
17	20IE3M03	Roadmap for Patent Creation	Multidisciplinary
18	20IE3M04	Energy Conversion Technologies (Biomass And Coal)	Multidisciplinary
19	20IE3M05	Research Methodology	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

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OPEN ELECTIVE – II (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20MAT302	Engineering Optimization	Mathematics
2	20PHY301	Optical Physics and its Applications	Physics
3	20PHY302	LASER Physics and Advanced LASER Technology	Physics
4	20CHE301	Introduction to Petroleum Industry	Chemistry
5	20CHE302	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
6	20CE301	Ground Improvement Techniques	Civil
7	20CE302	Environmental Impact Assessment	Civil
8	20CE303	Watershed Management	Civil
9	20ME301	Material Science for Engineers	Mechanical
10	20ME302	Elements of Mechanical Engineering	Mechanical
11	20ECE301	Bio-Medical Electronics	ECE
12	20ECE302	VLSI Design	ECE
13	20CSE301	JAVA Programming	CSE
14	20CSE302	Multimedia Technologies	CSE
15	20CST301	Operating Systems	CST
Any new Interdisciplinary courses can be appended in future.			

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OPEN ELECTIVE – III (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM3M04	Management Information System	Management Studies
2	20HUM3M05	Business Analytics & Text Mining Modeling Using Python	Management Studies
3	20CE3M05	Remote Sensing and GIS	Civil
4	20CE3M06	Wastewater Treatment and Recycling	Civil
5	20CE3M07	Building Materials And Composites	Civil
6	20ME3M04	Power Plant Engineering	Mechanical
7	20ME3M05	Mechatronics and Manufacturing Automation	Mechanical
8	20CSE3M05	Software Testing	CSE
9	20CSE3M06	Multi-Core Computer Architecture – Storage and Interconnects	CSE
10	20CSE3M07	Introduction to Machine Learning	CSE
11	20CSE3M08	Fundamentals of Artificial Intelligence	CSE
12	20CST3M01	Ethical Hacking	CST
13	20IE3M06	Learning Analytics Tools	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

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OPEN ELECTIVE – IV (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20PHY303	Thin Film Technology and its Applications	Physics
2	20CHE303	Introduction to Nano Science and Technology	Chemistry
3	20CHE304	Computational Methods in Materials Science and Engineering	Chemistry
4	20CE304	Green Buildings and Energy Conservation	Civil
5	20CE305	Environmental Engineering	Civil
6	20ME303	Total Quality Management	Mechanical
7	20ME304	Entrepreneurship	Mechanical
8	20ECE303	Embedded Systems	ECE
9	20ECE304	DSP Architecture	ECE
10	20ECE305	Community Radio Technology	ECE
11	20CSE303	Mobile Application Development	CSE
12	20CSE304	Software Project Management	CSE
13	20CST302	Cloud Computing	CST
Any new Interdisciplinary courses can be appended in future.			

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OPEN ELECTIVE – V (HUMANITIES) (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM301	Principles of Management	Humanities
2	20HUM302	Human Resource Development	Humanities
3	20HUM303	Soft Skills	Humanities
4	20HUM304	National Cadet Corps	Humanities
Any new Interdisciplinary courses can be appended in future.			

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ANNEXURE – III

Professional Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	20EEE401	Modern Control Systems
2.	20EEE402	Industrial Electrical Systems
3.	20EEE403	Special Electrical Machines
4.	20EEE404	Electrical Safety
Any advanced courses can be appended in future.		

Professional Elective – II (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1.	20EEE4M01	Computational Electromagnetics
2.	20EEE4M02	Computer Aided Power System Analysis
3.	20EEE4M03	Design of Power Electronics Converters
4.	20EEE4M04	Design of Photovoltaic Systems
5.	20EEE4M05	Electronics Equipment Integration and Prototype Building
6.	20EEE4M06	Non-Conventional Energy Resources
7.	20EEE4M07	Fuzzy Logic And Neural Networks
8.	20EEE4M08	Communication Networks
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

IV Year I Semester

Professional Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	20EEE405	Electrical and Hybrid Vehicles
2.	20EEE406	Electrical Drives and Control
3.	20EEE407	Energy Audit and Conservation Management
4.	20EEE408	Introduction to MEMS
Any advanced courses can be appended in future.		

Professional Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	20EEE409	Switch Gear and Protection
2.	20EEE410	Utilization of Electrical Energy
3.	20EEE411	HVDC and FACTS
4.	20EEE412	Digital Signal Processing
Any advanced courses can be appended in future.		

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Professional Elective – V		
Sl. No.	**Course Code**	**Course Title**
1.	20EEE413	Smart Power Grid
2.	20EEE414	Power System Operation and Control
3.	20EEE415	Wind and Solar Energy Systems
4.	20EEE416	Power Quality
Any advanced courses can be appended in future.		

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ANNEXURE - IV

List of Skill Oriented Course

Skill Oriented Course - I		
Sl. No.	**Course Code**	**Course Title**
1.	20ENG601	Corporate Communication
Any advanced courses can be appended in future.		

Skill Oriented Course – II		
Sl. No.	**Course Code**	**Course Title**
1.	20EEE601	Electrical Home
Any advanced courses can be appended in future.		

Skill Oriented Course – III		
Sl. No.	**Course Code**	**Course Title**
1.	20EEE602	Data Structures using Python
Any advanced courses can be appended in future.		

Skill Oriented Course - IV		
Sl. No.	**Course Code**	**Course Title**
1.	20EEE603	Internet of Things
Any advanced courses can be appended in future.		

Skill Oriented Course - V		
Sl. No.	**Course Code**	**Course Title**
1.	20EEE604	Programming For Electrical and Electronics Engineering
Any advanced courses can be appended in future.		

B. Tech Electrical and Electronics Engineering

Annexure V

Minor in Electrical and Electronics Engineering

Stream Name: Power Electronics and Instrumentation

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	**Professional Core Course**	20MDEEE101	Introduction to Electrical Power Generation System	3	0	0	3	3
2	**Professional Core Course**	20MDEEE102	Electrical Machines Technology	3	0	0	3	3
III Year II Semester								
3	**Professional Core Course**	20MDEEE103	Electrical Measurements and Instrumentation	3	0	0	3	3
4	**Professional Core Course**	20MDEEE104	Power Electronics	3	0	0	3	3
5	**Professional Core Course**	20MDEEE201	Power Electronics and Electrical Measurements Lab	0	0	4	4	2
IV Year I Semester								
6	**Professional Core Course**	20MDEEE105	Electrical and Hybrid Vehicles	3	0	0	3	3
7	**Professional Core Course**	20MDEEE106	Power System Operation and Control	3	0	0	3	3
			Total	**18**	**0**	**4**	**22**	**20**

Annexure VI

B. Tech Electrical and Electronics Engineering

Honors in Electrical and Electronics Engineering

S. 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)**	20HDEEE101	Renewable Energy Resources	3	0	0	3	3
2		20HDEEE102	Control Systems Design	3	0	0	3	3
3		20HDEEE103	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)**	20HDEEE104	Switched Mode Power Converters	3	0	0	3	3
5		20HDEEE105	Fuzzy logic, ANN and Introduction to GA	3	0	0	3	3
6		20HDEEE106	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 two from three courses)**	20HDEEE107	Power System Dynamics and Stability	3	0	0	3	3
8		20HDEEE108	Digital Protective Relaying	3	0	0	3	3
9		20HDEEE109	Power Apparatus and Networks	3	0	0	3	3
10	**SOC**	20HDEEE601	DSP Programming For Electrical Engineer	1	0	2	3	2
	Sub Total			**7**	**0**	**2**	**9**	**8**
	Total			**19**	**0**	**2**	**21**	**20**

I Year I Semester

B. Tech Electrical and Electronics Engineering

B. Tech I Year I Semester

20ENG101 PROFESSIONAL ENGLISH

L	T	P	C
3	0	0	3

Pre-requisite 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 9 hours

Grammar - Tense, Reported Speech, Modals, Conditionals; Vocabulary development - prefixes, suffixes, compound words, synonyms & antonyms.

UNIT II READING SKILLS & WRITTEN COMMUNICATION 9 hours

Reading - short comprehension passages, practice in skimming, scanning and predicting; Writing- completing sentences, developing hints; Paragraph writing- topic sentence, main ideas, coherence.

UNIT III VERBAL & NON-VERBAL ASPECTS 9 hours

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.

UNIT IV CONVERSATIONS 9 hours

Listening-short texts & conversing, formal and informal conversations, short group conversations, speaking about oneself, sharing information of a personal kind speaking about one's friend.

UNIT V BUSINESS ENVIRONMENT & ETIQUETTES 9 hours

Greeting & taking leave; Writing e-mails, memos, reports, etc.

Course Outcomes:

At the end of the course, students 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.

Text Books:

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 Books

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. http://www.cambridgeenglish.org/in/
9. https://www.rong-chang.com/
10. https://www.rong-chang.com/

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

B. Tech Electrical and Electronics Engineering

B. Tech I Year I Semester

20MAT105 CALCULUS AND DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

Pre-requisite 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: This course enables the student to –

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 12 hours

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.

UNIT II MULTIVARIABLE DIFFERENTIAL CALCULUS 12 hours

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

UNIT III MULTIVARIABLE INTEGRAL CALCULUS 12 hours

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), gradient, curl and divergence, Green's, Stokes and Gauss divergence theorems (without proofs).

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS OF FIRST AND HIGHER ORDER 12 hours

Linear Differential Equation, Exact and Bernoulli's equation, Second order linear differential equations with constant coefficients, Cauchy-Euler equation, Applications: LCR and spring mass system.

UNIT V SEQUENCES & SERIES AND PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER 12 hours

Convergence of sequence and series, tests for convergence (Integral test, Limit Comparison test, Ratio test, Root test, Alternating series test), radius of convergence in power series, solutions of first order linear and non-linear PDEs.

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. To 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, 42th Edition, 2012.
2. G. B. Thomas, Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas' Calculus Pearson education 11th Edition, 2004.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., Engineering Mathematics for first year, Tata 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", Laxmi Publications, 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, Mid Term Tests, End Semester Examination

B. Tech Electrical and Electronics Engineering

B. Tech I Year I Semester

20CHE101 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

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 **9 hours**

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), Estimation of Dissolved Oxygen by Winkler's method and its importance and Chlorides. Disadvantages (industry level) of using hard water (Boiler corrosion, Caustic embrittlement, Scale and Sludges). 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.

UNIT II PERIODIC PROPERTIES AND ORGANIC REACTIONS **7 hours**

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

UNIT III SPECTROSCOPY **8 hours**

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

UNIT IV THERMODYNAMICS AND ELECTROCHEMISTRY **11 hours**

Thermodynamics: Systems, State Functions, Thermodynamic Functions: Work, Energy, Entropy and Free energy. Estimations of Entropy in Isothermal, Isobaric and Isochoric processes. 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).

UNIT V ENGINEERING MATERIALS, NANOSCIENCE & NANOTECHNOLOGY **10 hours**

Engineering Materials: Cement Materials and Manufacturing Process. Reactions in setting and hardening of Cement. Lubricants – definition, Properties of lubricants – Viscosity, Viscosity Index, Flash Point and Pour Point. Nanomaterials: Introduction, Classes/Types, Chemical synthesis of Nanomaterials: Chemical Vapor Deposition method (Carbon Nanotubes), Characterization by powder XRD (Scherrer's equation). Applications of Nanomaterials: Solar Energy and Photocatalytic Dye Degradation (TiO_2).

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Course Outcomes:

At the end of the course, 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. C. N. Banwell, Fundamentals of Molecular Spectroscopy, Fourth Edition, (Tata McGraw Hill, 2008).
4. Dr. S. S. Dara and Dr. S. S. Umare, A Textbook of Engineering Chemistry,1 st Edition., (S. Chand & Company Ltd, 2000).
5. T. Pradeep, Nano: The Essentials, 1 st Edition, (Tata McGraw-Hill Publishing Company Limited, 2017).

Reference Books

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: Assignments, Mid Term Tests, End Semester Examination

B. Tech Electrical and Electronics Engineering

B. Tech I Year I Semester

20ME101 ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

Pre-requisite: 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 12 hours

Introduction to AutoCAD commands, simple drawings using AutoCAD, Introduction to orthographic Projections – Theory, techniques, first angle projections and third angle projections.

UNIT II PROJECTIONS OF POINTS & LINES 12 hours

Projections of points: Positions, notation system and projections. Projections of lines: Positions, terms used, different cases, traces of lines and finding true length.

UNIT III PROJECTIONS OF PLANES & SOLIDS 12 hours

Projections of planes: Positions, terms used, different cases and projections procedure.
Projections of Solids: Projections of Regular Solids inclined to one plane (resting only on HP).

UNIT IV SECTIONS AND DEVELOPMENTS OF SOLIDS 12 hours

Section of solids: Sectional view of right regular solids (Prism and cylinder), true shapes of the sections.
Development of Surfaces: Development of surfaces of right regular solids (Prism, Cylinder and their Sectional Parts).

UNIT V INTERSECTIONS & ISOMETRIC PROJECTIONS 12 hours

Intersections of surfaces of solids: Intersection between prism Vs prism, prism Vs cylinder, cylinder Vs cylinder.
Isometric Projections: Theory of isometric drawing and orthographic views, Conversion of isometric view into orthographic views.

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Course Outcomes:

Student will be able to

1. Identify various commands in AutoCAD software and apply AutoCAD skills to develop the new designs.
2. Draw the projections of points, straight lines using AutoCAD.
3. Draw the projections of the planes, solids using AutoCAD
4. Sketch the developments of solids, sections of solids using AutoCAD.
5. Draw the conversion of the isometric views to orthographic views and intersections of surfaces using AutoCAD.

Text Books:

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

2 N D Bhat, Engineering Drawing, Charotar Publishing House, Gujarath,15th Edition, 2010.

3 K.L. Narayana, P. Kanniah, Engineering Drawing, Scitech Publishers, 2nd Edition, 2010.

Reference Books:

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.

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

B. Tech Electrical and Electronics Engineering

B. Tech I Year I Semester

20CSE101 PROGRAMMING FOR PROBLEM SOLVING (PYTHON)

L	T	P	C
2	0	3	3.5

Pre-requisite: 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:

This course enables students to

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.
6. Getting exposed to the basics of Object Oriented Programming using Python

UNIT I: INTRODUCTION 12 hours

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?

UNIT II: OPERATORS AND EXPRESSIONS 12 hours

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.

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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.

UNIT-III: DATA STRUCTURES **12 hours**

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
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.

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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

UNIT-V:

Python packages: Predefined Packages and User-defined Packages, Package Creation.

Object Oriented Programming using Python: Introduction to OOP, Creating Classes and Objects in Python, Creating Methods in Python

Brief Tour of the Standard Library: Turtle

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) Create a class by name Student with instance variables such as roll_no, name, year_of_study, branch, section, and marks in any five subjects. The class should also contain one method for calculating the percentage of marks and the other method for printing a report as follows:

Roll No.	Name	Year	Section	Branch	M1	M2	M3	M4	M5	Percentage
101	abc	I	A	CSE	58	68	95	47	56	64.8

b) Write a python script to display following shapes using turtle.

Course Outcomes:

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

1. Understand problem solving techniques and their applications
2. Understand the syntax and semantics of python.
3. Demonstrate the use of Python lists and dictionaries.
4. Demonstrate the use of Python File processing, directories.
5. Describe and apply object-oriented programming methodology and Standard Library.

Text Books:

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/thinkpython/)

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

B. Tech Electrical and Electronics Engineering

B. Tech I Year I Semester

20CHE201 CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite Basic Chemistry at Intermediate or equivalent level.

Course Description:

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

Course Objectives:

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
5. highlighting the role of chemistry in engineering.

LIST OF EXPERIMENTS

1. Estimation of total, permanent and temporary hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of dissolved oxygen by Winkler's method.
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 by colorimetry.

Course Outcomes:

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.

Textbook:

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 Textbook 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

B. Tech Electrical and Electronics Engineering

B. Tech I Year I Semester

20ME201 WORKSHOP PRACTICE

L	T	P	C
0	0	3	1.5

Pre-requisite 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/Reference Books:

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 McGrawHill 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 McGrawHill House,2017.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

I Year II Semester

B. Tech Electrical and Electronics Engineering

B. Tech I Year II Semester

20MAT106 LINEAR ALGEBRA AND TRANSFORM CALCULUS

L	T	P	C
3	0	0	3

Pre-requisite 20MAT105

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, Laplace, 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 eigenvalues 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 **9 hours**

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

UNIT II COMPLEX VARIABLE **9 hours**

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.

UNIT III LAPLACE TRANSFORMS **9 hours**

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.

UNIT IV FOURIER TRANSFORMS **9 hours**

Introduction to Fourier transforms, sine and cosine transforms, properties of Fourier transforms, Inverse Fourier sine and cosine transforms, Applications to solve boundary value problems.

UNIT V Z – TRANSFORMS 9 hours

Introduction to Z-transform, properties of z- transform, Inverse z- transform, Applications to solve difference equations.

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 Books:

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

Reference Books:

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

B. Tech Electrical and Electronics Engineering

B. Tech I Year II Semester

20PHY102 APPLIED PHYSICS

L	T	P	C
3	1	0	4

Pre-requisite: Plus two level physics course

Course Description:

Applied Physics for Electrical, Electronics and Computer Engineers is a basic physics course which provides fundamental knowledge to understand the concepts of Waves, Optics, Quantum Mechanics, Semiconductors, Lasers and Fiber Optics.

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, Polarization and Lasers for testing of materials.
4. Develop knowledge and understanding the fundamental concepts of Quantum mechanics, Semiconductors and Fiber Optics.
5. Adaptability to new developments in science and technology.

UNIT I WAVES AND OSCILLATIONS 11 hours

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, reflection and transmission waves at boundary, standing waves, standing wave ratio.

UNIT II OPTICS 13 hours

Superposition of waves, interference of light by division of wavefront - Young's double slit experiment, 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 (Nslit). Polarization, Types of polarization, Polarization by reflection, refraction and double refraction, Nicol's prism. Half wave and Quarter wave plates.

UNIT III QUANTUM MECHANICS 12 hours

De Broglie's hypothesis, Uncertainty principle (Qualitative only), Postulates of quantum mechanics, Time-dependent and time-independent Schrodinger equations for wave function, Free-particle wave function and wave-packets (group velocity & phase velocity), 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.

UNIT IV FREE ELECTRON THEORY & SEMICONDUCTORS 12 hours

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), Drift and Diffusion Current, Hall effect.

UNIT V LASERS & FIBER OPTICS 12 hours

Introduction to lasers, characteristics of laser, spontaneous and stimulated emission, Einstein's coefficients; population inversion, excitation mechanisms, solid-state lasers – ruby laser, gas Lasers - He-Ne Laser, applications of lasers.
Fiber Optics: Principle, Construction and working of optical fiber, Acceptance angle, Numerical aperture, Types of fiber, Fiber optic communication system.

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

1. Describe a mathematical wave equation using the principles of waves and oscillations
2. Apply the knowledge for materials testing using Interference, Diffraction & Polarization 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. Acquire the basic knowledge of lasers and fiber optics.

Text Books:

1. Engineering Physics –Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering Physics –K. Thyagarajan, McGraw Hill Publishers.

Reference Books:

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. B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
4. Concepts of Modern Physics by Arthur Beiser, 7th Edition, 2017.

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

B. Tech Electrical and Electronics Engineering

B. Tech I Year II Semester

20EEE101 BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	1	0	4

Pre-requisite: 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 materials, 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 material 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 12 hours

Electrical circuit elements, 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.

UNIT II AC CIRCUIT ANALYSIS 12 hours

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.

UNIT III MAGNETIC MATERIALS AND TRANSFORMERS 12 hours

Magnetic materials, B-H characteristics, ideal and practical transformer, principle of operation, emf equation, equivalent circuit, losses in transformers, regulation and efficiency.

UNIT IV DC AND AC MACHINES 12 hours

Construction, working, emf equation of DC generator, methods of excitation, speed control of dc motor. Introduction to different types of AC motors, Three Phase Induction Motors - Generation of rotating magnetic fields, construction, working and starting methods: D.O.L, Autotransformer starter. Introduction to Alternators.

UNIT V RECTIFIERS AND ELECTRICAL INSTALLATIONS 12 hours

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 – Current carrying capability, Insulation Strength; Earthing.

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 understand magnetic materials and to analyze the transformers.
4. To study the working principles of electrical machines.
5. To create power converters for domestic applications with LT switchgear.

B. Tech Electrical and Electronics Engineering

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.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Reference Books:

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.

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

B. Tech Electrical and Electronics Engineering

B. Tech I Year II Semester

20CSE102 C PROGRAMMING AND DATA STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite: 20CSE101

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

Course Objectives:
1. To make the student understand fundamentals of C programming language and problem solving.
2. To understand the syntax and semantics of C programming language.
3. To develop algorithms for sorting, searching techniques.
4. To design and implement operations on stack, queue, and linked list.

UNIT I INTRODUCTION TO C PROGRAMMING 9 hours

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).

UNIT II FUNCTIONS & ARRAY 9 hours

Functions Introduction, User defined function, Function prototype, Function Definition and Function Call, Storage classes, Recursion **Arrays**: Defining an array, processing an array, one dimensional arrays, two dimensional arrays. Passing array as an argument to function. **Sorting:** Bubble Sort, Insertion Sort, selection sort. **Searching:** Linear and binary search.

UNIT III STRINGS & POINTERS 9 hours

Strings: Declaring and defining a string, Initialization of strings, Strings Library functions.
Pointers: Fundamentals of pointer, Pointer Declarations, Parameter passing: Pass by value, Pass by reference, Dynamic memory allocation.

UNIT IV STRUCTURES & FILES 9 hours

Structures: Defining a structure, processing a structure, Pointer to Structure, Unions.
Files: Opening and closing a data file, Reading and Writing a data file, File I/O Functions.

UNIT V DATA STRUCTURES 12 hours

Stack: stack operations, stack implementations using arrays.
Queue: queue operations, queue implementations using array, Applications of stack and queue.
Linked List: Single linked list operations.

Course Outcomes:

Upon successful completion of the course, students will be able to
1. Understand fundamentals of C programming language and its constructs.
2. Design and implement applications using functions, arrays, sorting and searching techniques.
3. Design and implement applications using strings and pointers.
4. Design and implement applications using structures and File processing.
5. Choose appropriate linear data structure depending on the problem to be solved.

B. Tech Electrical and Electronics Engineering

Text Books:

1. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2nd 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.

Reference Books:

1. Let us C, Yashavant Kanetkar, 15th Edition, BPB Publications, 2016.
2. Problem Solving & Program Design in C, Hanly, Jeri R and Elliot. B Koffman, Pearson Education, 5th edition, 2007.
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

B. Tech Electrical and Electronics Engineering

B. Tech I Year II Semester

20ENG201 ENGLISH FOR PROFESSIONAL PURPOSES LABORATORY
(Common to all branches)

L	T	P	C
0	0	2	1

Pre-requisite None

Course Description:

English language communication is a social phenomenon and students need to be able to function in the society at large as the communicators before entering the professional world. The present course equips the students with the basic functions of English language communication, which are required not only in their day-to-day lives but also profoundly significant for their future professional, academic training and their careers in the industry. The course mainly focuses on the achievement of communicative proficiency of the students coupled with the necessary linguistic inputs.

Course Objectives:

This course enables the student to –

1. Get aquatinted with the basic communicative functions.
2. Engage effectively in learning various functions of English language communication.
3. Enhance their narration abilities in past experiences and future plans and goals/events.
4. Develop their abilities in expressing opinion.
5. Provide speaking practice in speech.

Course contents:

Greeting and Introductions (L & S)

- Greeting on different occasions and responding to greetings **(L & S)**
- Wishing on various occasions, taking leave and saying goodbye **(L & S)**
- Introducing oneself and others **(L & S)**
- Asking for introduction and responding to introduction **(L & S)**
- Developing a short personal profile **(R &W)**

Describing: (L, S, R & W)

- Using adjectives **(Vocab)**
- Degrees of comparison **(Grammar)**
- Common words, phrases, and expressions used for description **(Vocab)**
- Describing people, places and objects **(L, S, R & W)**
- Reading and writing descriptive paragraphs **(R &W)**

Narrating (L, S, R & W)

- Talking about past experiences and events **(L & S)**
- Talking about memorable incidents or events **(L & S)**
- Techniques of narration and narrative tenses **(Grammar)**
- Composing and narrating a story **(R &W)**

Planning and Predicting (L, S, R & W)

- Talking about future events **(L & S)**
- Making promises and giving assurances **(L & S)**
- Predicting future events **(L & S)**
- Writing and organising a short plan of an event **(R &W)**

B. Tech Electrical and Electronics Engineering

Instructions and directions (L, S, R & W)
- Forming imperative sentences (Grammar)
- Reading and writing short instruction manuals **(R &W)**
- Writing a recipe/ procedure **(R &W)**
- Giving directions

Enquiring: (L, S, R & W)
- Open and closed ended questions **(Grammar)**
- Asking for information and giving information **(L & S)**
- Telephonic enquiry **(L & S)**
- Official enquiries through emails and letters **(R &W)**

Requesting: (L, S, R & W)
- Polite expressions
- Modal verbs and key phrases for requesting **(Grammar and vocab)**
- Official requests through emails and letters **(R &W)**

Comparing and contrasting: (L, S, R & W)
- Words and phrases used for comparison and contrast **(Vocab)**
- Comparing qualities/properties/quantities of people, places and objects **(L & S)**
- Composing comparison and contrast paragraphs **(R &W)**

Expressing opinion: (L, S, R & W)
- Language expressions used for expressing opinions **(Vocab)**
- Developing opinion based paragraphs **(R &W)**
- Discourse markers and linkers used in opinion based paragraphs **(R &W)**

Public Speaking: (L, S, R & W)
- Techniques and strategies required for public speaking **(L & S)**
- Developing and organising a short speech **(R &W)**
- Presentation skills required for public speaking **(L & S)**

Course Outcomes:

At the end of the course, students will be able to
1. Develop their confidence while giving introduction, describing a place, & giving directions. (3,4,5)
2. Use various functions of English like asking for & giving information**,** inviting people for events/occasions, & requesting people. (3,4,5)
3. Narrate the past experiences and events in speaking and wring (3,4,5)
4. Express their views and opinions logically and appropriately in spoken and written format. (3,4,5,6)
5. Deliver logically organized speeches and present them without hesitations. (3,4,5, 6)

Text Books:

1. Leo Jones; Functions of English, Published by: Cambridge University Press.
2. Leo Jones; Let's Talk Level 1, 2, 3, Published by: Cambridge University Press.
3. Adrian Doff, Craig Thaine, Herbert Puchta, et al; *Empower: Intermediate (B1+)*; Published by: Cambridge University Press.

References:

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: Continuous Internal Evaluation and End Semester Examination

B. Tech Electrical and Electronics Engineering

B. Tech I Year I Semester

20PHY201 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:

{Out of 17 experiments any 12 experiments (minimum 10) must be performed in a semester}

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. Thickness of a given wire - Wedge Method.
8. Dispersive power of prism – Spectrometer.
9. Frequency of the tuning fork - Melde's apparatus.
10. Determination of particle size using Laser.
11. Width of single slit - Diffraction due to Single Slit.
12. Torsional Pendulum.
13. Determination of the numerical aperture of a given optical fiber and hence to find its acceptance angle.
14. Measurement of *e/m* of electron (Thomson's method)
15. Energy gap of a material of p-n junction.
16. Determination of Planck's constant.
17. Ferroelectric hysteresis (B-H Curve).

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.

Reference Books:

1. Physics Laboratory Manual
2. Optics, A. Ghatak, 4th Edition, Tata McGraw-Hill, New Delhi 2011.
3. Fundamentals of Optics, F. A. Jenkins and H. E. White, 4th 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 and End Semester Examination

B. Tech Electrical and Electronics Engineering

B. Tech I Year II Semester

20EEE201 ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

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 multimeter, 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, wattmeter, 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 cut-out 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. Wavelength of the spectral lines - Diffraction Grating.
6. 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 voltage, current and power in a single-phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.
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.

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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 Electrical and Electronics Engineering

B. Tech I Year II Semester

20CSE201 C PROGRAMMING AND DATA STRUCTURES LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisite: 20CSE101

Course Description:

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

Course Objectives:

1. To make the student understand fundamentals of C programming language and problem solving.
2. To get hands-on practices with the syntax and semantics of C programming language.
3. To develop algorithms for sorting, searching techniques.
4. To design and implement operations on stacks, queues, and linked lists.

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:
i. Marks in Maths >=65
ii. Marks in Physics >=55
iii. Marks in Chemistry>=50
OR
iv. Total in all three subject >=180

2. a) Write a C program to compute the factorial of a given number.
b) Write a program that reads numbers which are in the range 0 to 100, till it encounters -1. Print the sum of all the integers that you have read before you encountered -1.

3. a) Write a C program to accept a coordinate point in a XY coordinate system and determine in which quadrant the coordinate point lies.
b) The digital root (also called repeated digital sum) of a number is a single digit value obtained by an iterative 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.

4. a) Write a C program to find the series of prime numbers in the given range.
b) Write a C program to generate Tribonacci numbers in the given range.

5. a) Write a C program to find sum of digits, Decimal to Binary conversion, reversal of numbers using functions.
b) Write a C program to find Factorial, Greatest Common Divisor, and Fibonacci using recursion.

6. 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

7. Implement the following sorting techniques.
a) Bubble sort b) Insertion sort c) Selection sort.

8. Implement the following searching techniques.
a) Linear Search b) Binary Search

9. a) Write a program in C to find the frequency of characters in a string.
b) Write a C program to implement all string operations (string length, string copy, string compare, string concatenation and string reverse) without using string library functions.

10. a) Write a C program to get *N* elements in an array and sort it using Pointer.
b) Write a C program to swap two integers using pass by reference.
c) Write a C program to find the largest element using Dynamic Memory Allocation.

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11. a) Write a program in C to count the number of vowels, consonants, digits, special symbols, words in a string using a pointer.
b) Write a C program to print all permutations of a given string using pointers.
12. a) Write a C program to add two distances in the inch-feet system using structures.
b) Write a C program to calculate difference between Two Time Periods (in *Hours, Minutes, Seconds* format) using structures.
13. Develop an application to match parenthesis of a given expression using Stack.
14. Develop an application to identify Palindrome string using Stack and Queue.
15. Develop an application to add two Polynomial equations using Linked List.

Course Outcomes:

Upon successful completion of the course, students will be able to
1. Understand fundamentals of C programming language and its constructs.
2. Design applications using functions, arrays, sorting and searching techniques.
3. Design and implement solutions using strings and pointers.
4. Design and develop solutions using structures and File processing.
5. Design and develop applications on stack, queue, and linked list depending on the problems to be solved.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year I Semester

B. Tech Electrical and Electronics Engineering

B. Tech II Year I Semester

20HUM101 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite NIL

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 positions of financial statements are explained to know the analysis of financial matters.

Course Objectives:

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 statement analysis and investment evaluation through ratios and capital budgeting techniques.

UNIT I DEMAND ANALYSIS 9 hours

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.

UNIT II PRODUCTION AND COST ANALYSIS 9 hours

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).

UNIT III MARKET STRUCTURE AND PRICING 9 hours

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

UNIT IV BASICS OF ACCOUNTING 9 hours

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).

UNIT V FINANCIAL RATIO ANALYSIS AND CAPITAL BUDGETING **9 hours**

Ratio Analysis - Liquidity, Leverage, Solvency, Activity and Profitability Ratios - Capital Budgeting. (Simple Problems).

Course Outcomes:

Upon successful completion 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. Exhibit the ability to apply knowledge of ratio analysis and capital budgeting techniques in financial statement analysis and investment evaluation respectively.

Text Book(s)

1 Case E. Karl & Ray C. Fair, "Principles of Economics", Pearson Education, 8th 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

Reference Books

1 Lipsey, R. G. & K. A. Chrystal , "Economics", Oxford University Press, 11th Edition, 2007

2 Samuelson P. A. & Nordhaus W. D. "Economics", Tata McGraw-Hill 18th 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.

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B. Tech II Year I Semester

20MAT103 NUMERICAL METHODS

L	T	P	C
3	0	0	3

Pre-requisite 20MAT105, 20MAT106

Course Description:

This course reviews and continues the study of computational techniques for solving system of algebraic and transcendental equations, interpolating the polynomials, evaluating the derivatives, integrals, ordinary differential equations and curve fitting. The course emphasizes on numerical and mathematical methods of solutions.

Course Objectives:

1. To introduce computation methods of solving algebraic and transcendental equations.
2. To familiarize the knowledge of interpolation.
3. To avail the basics of numerical techniques in calculus
4. To use numerical methods for solving ordinary differential equations.
5. To introduce the empirical techniques for fitting the various curves.

UNIT I SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS **9 hours**

Introduction-Bisection method - Regula-falsi method - Iterative method - Newton Raphson method, System of Algebraic equations: Gauss Jordan method - Gauss Seidal method.

UNIT II FINITE DIFFERENCES AND INTERPOLATION **9 hours**

Finite differences, Newton's forward and backward interpolation formulae - Lagrange's and Newton's divided difference formulae - Gauss forward and backward formulae, Stirling's formula, Bessel's formula.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION **9 hours**

Formulae for derivatives, Maxima and minima of a tabulated function. Numerical Integration: Trapezoidal rule - Simpson's 1/3 Rule - Simpson's 3/8 Rule

UNIT IV NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS **9 hours**

Picard's Method - Taylor's series method - Euler's method - Modified Euler's Method - Runge-Kutta Method.

UNIT V CURVE FITTING **9 hours**

Introduction - Graphical method - Principle of least squares - Method of least squares - Fitting of straight line and parabola - Fitting of exponential and power curves

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Course Outcomes:

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

1. Solve the system of algebraic and transcendental equations.
2. Interpolate the equal and unequal spaced arguments of function.
3. Apply the numerical techniques to find derivatives and integrals in the field of Engineering
4. Find the approximate numerical solutions to ordinary differential equations representing some Engineering problems.
5. Estimate the model parameters using the principles of least squares to a curve of best fit for the experimental observations.

Text Book(s)

1 Dr.B.S.Grewal, "Higher Engineering Mathematics", Khanna Publications, 42nd Edition, 2012.

Reference Books

1 Curtis F. Gerald, Patrich O. Wheatley, Applied Numerical Analysis, Pearson Education, 7th Edition, 2003.

2 S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005Burden and Faires, Numerical Analysis 7th ed., Thomson Learning, 2001.

3 Advanced Engineering Mathematics by E. Kreyszig, 10th ed., Wiley, 2010.

4 M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.

5 Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3rd ed., Mc Graw Hill, 2012.

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

B. Tech Electrical and Electronics Engineering

B. Tech II Year I Semester

20EEE102 ELECTRICAL CIRCUIT ANALYSIS

L	T	P	C
2	1	0	3

Pre-requisite 20EEE101

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 — 12 hours

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.

UNIT II SINUSOIDAL STEADY STATE ANALYSIS — 12 hours

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.

UNIT III SOLUTION OF FIRST AND SECOND ORDER NETWORKS — 12 hours

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.

UNIT IV TWO PORT NETWORKS — 12 hours

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, two port parameter conversions, interconnections of two port networks.

UNIT V ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS — 12 hours

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.

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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 Book(s)

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.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

B. Tech II Year I Semester

20EEE103 ANALOG ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101

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 diode and BJT
2. To learn the operation of FET, MOSFET , Operational Amplifier 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 9 hours

P-N junction diode-diode current- diode capacitance, I-V characteristics of a diode; Zener diodes-clamping and clipping circuits-BJT-Types of configuration-input, output characteristics-small signal model; biasing circuits- fixed bias , collector to base bias , self -bias - stability factor.

UNIT II FET, MOSFET AND OPERATIONAL AMPLIFIER CIRCUITS 9 hours

Introduction to FET–operation-characteristics-MOSFET structure-operation-characteristics; small signal model and biasing circuits, Introduction to operational amplifier-ideal op-amp-equivalent circuit-DC and AC characteristics-frequency response.

UNIT III APPLICATIONS OF OPERATIONAL AMPLIFIER 9 hours

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.

UNIT IV SIGNAL GENERATORS AND ACTIVE FILTERS 9 hours

Sinusoidal oscillator-RC phase shift-wein bridge oscillator-crystal oscillator-RC relaxation oscillator using operational amplifiers -555 timer-abatable operation-PWM generation-Active filters-first and second order-low pass and high pass filters-frequency response.

UNIT V DATA CONVERTERS & APPLICATIONS 9 hours

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.

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Course Outcomes:

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

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 Book(s)

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.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

B. Tech II Year I Semester

20EEE104 DC MACHINES AND TRANSFORMERS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101, 20PHY102

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 — 9 hours

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.

UNIT II DC GENERATOR — 9 hours

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.

UNIT III DC MOTOR — 9 hours

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.

UNIT IV SINGLE PHASE TRANSFORMER AND AUTOTRANSFORMER **9 hours**

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.

UNIT V THREE-PHASE TRANSFORMER **9 hours**

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.

Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

B. Tech II Year I Semester

20EEE202 ELECTRICAL CIRCUITS AND SIMULATION LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE201

Course Description:

This course deals with the practical study various theorems by using PSPICE tool. And also gives information on analysis of RLC circuits, resonance and determining the transmission and hybrid parameters. The course also deals with the measurement power for the three phase loads.

Course Objectives:

1. To apply circuit theorems and concepts in engineering applications.
2. To design the Series and Parallel Resonance.
3. To measure active Power for Star and Delta Connected Balanced Loads.
4. To measure reactive power for Star and Delta Connected Balanced Loads.
5. To measure the 3-Phase Power by Two Wattmeter Method for Unbalanced Loads.

List of Experiments:

1. Verification of Thevenin's & Norton's Theorems and their validation using PSPICE
2. Verification of Superposition & Maximum Power Transfer Theorems and their validation using PSPICE
3. Verification of Compensation Theorem and its validation using PSPICE
4. Verification of Reciprocity & Millmann's Theorems and their validation using PSPICE
5. Transient analysis of R-L & R-C series circuits and their validation using PSPICE
6. Series and parallel resonance in R-L-C circuits
7. Determination of self-inductance, mutual inductance and coefficient of coupling
8. Determination of Z-parameter and Y-parameters
9. Determination of Transmission parameters and Hybrid parameters
10. Measurement of active power for Star and Delta connected balanced loads
11. Measurement of reactive power for Star and Delta connected balanced loads
12. Measurement of three-phase power by Two-Wattmeter method for unbalanced loads

Course Outcomes:

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

1. Apply circuit theorems and concepts in engineering applications.
2. Design the Series and Parallel Resonance.
3. Measure active Power for Star and Delta Connected Balanced Loads.
4. Measure reactive power for Star and Delta Connected Balanced Loads.
5. Measure the 3-Phase Power by Two-Wattmeter Method for Unbalanced Loads.

Text Book(s)

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.

Reference Books

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: Continuous Internal Evaluation and End Semester Examination

B. Tech Electrical and Electronics Engineering

B. Tech II Year I Semester

20EEE203 ANALOG ELECTRONICS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE201

Course Description:

This course gives practical knowledge about the characteristics of various semiconductor devices. The course also deals with the practical study of operational amplifiers, Filter circuits, PLL, Oscillators and also voltage regulators.

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

Course Outcomes:

Upon successful completion of the course, students will be 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.

Text Book(s)

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.

Reference Books

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: Continuous Internal Evaluation and End Semester Examination

B. Tech Electrical and Electronics Engineering

B. Tech II Year I Semester

20EEE204 DC MACHINES AND TRANSFORMERS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE201

Course Description:

This course gives practical knowledge on conduction of various tests on the transformer and DC Machines. The course also deals with the study of characteristics on DC machines. And also gives information on the regulation and efficiency of a transformer.

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 separately excited 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 compound generator. Determination of characteristics.
8. Field's test on DC series machines. Predetermination of efficiency
9. Brake test on DC shunt motor and DC Compound motor. Determination of performance curves.
10. Load test on single-phase transformer.
11. Parallel operation of single-phase transformers
12. Retardation test on DC shunt motor. Determination of losses at rated speed.

Course Outcomes:

Upon successful completion of the course, students will be 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.

Text Book(s)

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.

Reference Books

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: Continuous Internal Evaluation and End Semester Examination

B. Tech Electrical and Electronics Engineering

Mandatory Course
B. Tech. II Year I Semester

20HUM901 INDIAN CONSTITUTION

L	T	P	C
2	0	0	0

Pre-requisite NIL

Course Description:

The Constitution of India is the supreme law of India. Parliament of India can not make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state.

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 **6 hours**

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.

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT **6 hours**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT **6 hours**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature –Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS **6 hours**

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments –Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V INDIAN SOCIETY **6 hours**

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.

B. Tech Electrical and Electronics Engineering

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.

Reference Books:

1. **S**harma, 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

B. Tech II Year II Semester

B. Tech Electrical and Electronics Engineering

B. Tech II Year II Semester

20MAT104 PROBABILITY AND STATISTICS FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite 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:

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

UNIT I PROBABILITY AND RANDOM VARIABLES — 9 hours

Introduction to Probability, sample space and events, Axioms of probability, theorems on probability, conditional probability, multiplication theorem and independence of events, Bayes theorem.
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.

UNIT II PROBABILITY DISTRIBUTIONS — 9 hours

Discrete Distributions: Bernoulli trail, Binomial distribution, Poisson approximation to the binomial distribution, Poisson distribution and Hyper geometric distribution –properties.
Continuous Distributions: Uniform, Exponential distribution, Gamma distribution, Normal distribution. Normal probability rule and Chebyshev's inequality

UNIT III JOINT DISTRIBUTIONS — 9 hours

Joint Densities and Independence - Marginal Distributions (discrete & continuous)- Expectation and Covariance, Correlation, Conditional densities and Regression, Curves of Regression.

UNIT IV HYPOTHESIS TESTING — 9 hours

Population, sampling, formulation of null hypothesis, alternative hypothesis, level of significance, types of errors and power of the test. Large Sample Tests: Test for single mean, single proportion, difference of means, difference of proportions, Confidence interval for parameters in one sample and two sample problems, t test for single mean, difference of means, test for ratio of variances.

UNIT V ANALYSIS OF VARIANCE AND DESIGN OF EXPERIMENTS — 9 hours

Analysis of Variance: One-way and two-way classifications. Principles experimental design, Randomized Block Design (RBD) and Latin Square Design.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

Upon successful completion of the course, students 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. Perform test of hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.
5. Analyse the statistical experimental designs for various engineering problems.

Text Book(s)

1 J.S. Milton and J.C. Arnold, Introduction to Probability and Statistics, 4th edition, 2003 Tata McGraw-Hill Publications.

2 Dr.B.S.Grewal, "Higher Engineering Mathematics", Khanna Publications, 42nd Edition.

Reference Books

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

2 Walpole, R.E., Myers R.H., Myer S.L., Ye. K: Probability and Statistics for Engineers and Scientists, 8th ed., Pearson Education, 2008.

3 Johnson, R.A. Miller Freund's: Probability and Statistics, 7th Edition, PHI, 2005.

4 Sheldon Ross: A First Course in Probability, 6th Edition, Pearson Education, 2002.

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

B. Tech Electrical and Electronics Engineering

B. Tech II Year II Semester

20EEE105 ELECTROMAGNETIC FIELDS

L	T	P	C
2	1	0	3

Pre-requisite 20EEE101, 20PHY102

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 **9 hours**

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.

UNIT II ELECTROSTATICS **9 hours**

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

UNIT III MAGNETOSTATICS **9 hours**

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.

UNIT IV TIME VARYING FIELDS AND MAXWELL'S EQUATIONS **9 hours**

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.

UNIT V ELECTROMAGNETIC WAVES 9 hours

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.

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 Book(s)

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.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

B. Tech II Year II Semester

20EEE106 DIGITAL ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101, 20EEE103

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 — 9 hours

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.

UNIT II COMBINATIONAL DIGITAL CIRCUITS — 9 hours

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, Digital comparator, Parity checker/generator, Code converters, Priority encoders, Decoders.

UNIT III SEQUENTIAL CIRCUITS AND SYSTEMS — 9 hours

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.

UNIT IV DIGITAL LOGIC FAMILIES — 9 hours

Digital Logic Families – Introduction to RTL, DTL, TTL, ECL and MOSL families –operation, characteristics of digital logic family – comparison of different logic families.

UNIT V SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES **9 hours**

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), HDL description.

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 logic circuits.
3. Design and implement Sequential logic circuits.
4. Understand the digital logic families and their operation.
5. Use PLDs to implement the given logical problem.

Text Book(s)

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.

Reference Books

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 Electrical and Electronics Engineering

B. Tech II Year II Semester

20EEE107 INDUCTION AND SYNCHRONOUS MACHINES

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101, 20PHY102

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 9 hours

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.

UNIT II SYNCHRONOUS GENERATOR 9 hours

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.

UNIT III SYNCHRONOUS MOTOR 9 hours

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.

UNIT IV INDUCTION MOTORS 9 hours

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.

UNIT V SINGLE PHASE AND SPECIAL MACHINES 9 hours

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

Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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.

Reference Books

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, Mid Term Tests, End Semester Examination.

B. Tech Electrical and Electronics Engineering

B. Tech II Year II Semester

20EEE108 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101, 20MAT105, 20MAT106

Course Description:

The course gives the information on basic concepts of control system and its types, Mathematical modelling of physical systems, Obtaining transfer function by Block diagram reduction technique and signal flow graph. The course also deals with the time response and frequency response of a system, Design of compensators and controllers and State space representation of a continuous system.

Course Objectives:

1. To understand the applications of control system and use of transfer function models for the analysis of physical systems.
2. To provide adequate knowledge in the time response of second order system and steady state analysis.
3. To understand the stability of a system by root locus technique.
4. To understand the stability of a system by analysis of frequency response and design of compensators.
5. To obtain the knowledge about design of controllers and state variable analysis.

UNIT I INTRODUCTION TO CONTROL SYSTEMS AND SYSTEM MODELING **9 hours**

Introduction, Types of Control Systems, Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Industrial applications, Mathematical modelling of Translational and Rotational mechanical systems, and Electrical Systems, Analogous systems, Control hardware and their models, Transfer function models of LTI systems - Block diagram reduction technique, Signal Flow Graph.

UNIT II TIME RESPONSE ANALYSIS **9 hours**

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

UNIT III CONCEPT OF STABILITY AND ROOT LOCUS **9 hours**

Concept of stability, Routh-Hurwitz criteria, Relative stability analysis, limitations of Routh's stability, Root locus technique construction of root locus, Effect of addition of open loop poles and zeros on the stability of the system.

UNIT IV FREQUENCY RESPONSE ANALYSIS AND COMPENSATORS **9 hours**

Relationship between time and frequency response, Phase Margin, Gain Margin, Stability analysis using Polar Plot and Bode Plot. Nyquist stability criterion, Stability analysis by Nyquist plot. Closed loop frequency response, Introduction to lead, lag and lead-lag compensators.

UNIT V CONTROLLERS AND STATE VARIABLE ANALYSIS 9 hours

Need of controller, Design of Proportional, Integral, Derivative, PI, PD and PID controllers. Concept of state variables, state-space model, State transition matrix, Solution of state equations, Eigen values and stability analysis.

Course Outcomes:

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

1. Analyse the modeling of the physical systems and develop the transfer function by block diagram and signal flow graph techniques.
2. Analyse the time response of a second order system and study of effect of controllers on time response.
3. Analyse the stability of a system in time domain by RH criterion and Root Locus.
4. Analyse the stability of a system in frequency domain by suitable techniques and design of compensators.
5. Design the controllers and analyze state space model of a system.

Text Book(s)

1. M Gopal, "Control Systems: Principals and Design", McGraw Hill Education, 4th Edition 2012.
2. I J Nagrath and M Gopal, "Control Systems Engineering", New Age International, 2009.
3. A Anand Kumar, "Control Systems", PHI publications, 2nd Edition, 2014.
4. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell, Pearson.

Reference Books

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. B C Kuo, "Advanced Control Systems", wiley Publishers, 9th Edition 2010.
3. Control Systems 3rd Edition, Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, Schaum's Mc Graw Hill Education.

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

B. Tech Electrical and Electronics Engineering

B. Tech II Year II Semester

20EEE205 DIGITAL ELECTRONICS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE202

Course Description:

This course imparts practical knowledge of the basics of digital circuits and practical implementation of adder and Subtractor circuits. This course also deals with the Binary to Gray, Analog to digital and vice versa code conversions. And gives practical information on the design of counters, shift registers and flip flops. The course also gives information on realization of Mux, demux, coders and PLD's.

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 and Digital to Analog converter.
11. Realisation of logic gates/logic functions using universal gates.
12. Realisation MUX, DEMUX, Encoders, Decoders.

Course Outcomes:

Upon successful completion of the course, students will be 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.

Text Book(s)

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.

Reference Books

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: Continuous Internal Evaluation and End Semester Examination.

B. Tech Electrical and Electronics Engineering

B. Tech II Year II Semester

20EEE206 INDUCTION AND SYNCHRONOUS MACHINES LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE201, 20EEE203

Course Description:

This course gives practical knowledge of different tests on the single phase induction motor and synchronous machines. Gives information on regulation and efficiency of a alternator and also on synchronization.

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 of single-phase induction motor
2. Load test on single-phase induction motor
3. No load and Blocked rotor test on 3 phase squirrel cage induction motor
4. Load test on 3 phase squirrel cage induction motor
5. Load test on Slip ring induction motor.
6. Speed Control on three phase induction motor
7. Regulation of three phase alternator by EMF and MMF methods
8. Synchronization of three phase alternator with infinite bus bar
9. V and inverted V-curves of synchronous motor
10. Determination of X_d and X_q of a salient pole synchronous machine / slip test salient pole synchronous machine.
11. Efficiency of a three-phase alternator.
12. Parallel operation of three phase alternators.

Course Outcomes:

Upon successful completion of the course, students will be 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.

Text Book(s)

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.

Reference Books

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: Continuous Internal Evaluation and End Semester Examination.

B. Tech Electrical and Electronics Engineering

B. Tech II Year II Semester

20EEE207 CONTROL SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE201, 20EEE203

Course Description:

The course deals with the practical study on determining transfer function of the DC motor and also simulating the model in the Simulink. And also discuss about the design of controllers and compensators for the feedback systems. The course gives information on practical knowledge of characteristics of servomotors. Gives information on stability analysis of system by using Root Locus and Bode plot.

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 Simulation Software
2. Stability analysis (Bode, Root Locus, Nyquist) of LTI system using Simulation Software
3. Compensator design and simulation using Simulation Software - PI and PID controllers
4. State feedback Controller design for Inverted-pendulum using Simulation Software
5. Study of stable and unstable limit cycle behaviour of nonlinear systems using Simulation Software

Course Outcomes:

Upon successful completion of the course, students will be 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.

Text Book(s)

1. M Gopal, “Control Systems: Principals and Design”, McGraw Hill Education, 4th Edition 2012.
2. I J Nagrath and M Gopal, “Control Systems Engineering”, New Age International, 2009.
3. A Anand Kumar, “Control Systems”, PHI publications, 2nd Edition, 2014.
4. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell, Pearson.

Reference Books

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. B C Kuo, “Advanced Control Systems”, wiley Publishers, 9th Edition 2010.
3. Control Systems 3rd Edition, Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, Schaum's Mc Graw Hill Education.

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

B. Tech Electrical and Electronics Engineering

Mandatory Course
B. Tech. II Year II Semester

20CHE901 ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

Pre-requisite 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 **6 hours**

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.

UNIT II ECOSYSTEMS **6 hours**

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.

UNIT III BIODIVERSITY AND ITS CONSERVATION **6 hours**

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.

UNIT IV ENVIRONMENTAL POLLUTION **6 hours**

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.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT **6 hours**

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.

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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.
3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

Mode of Evaluation: Assignments and Mid Term Tests

III Year I Semester

B. Tech Electrical and Electronics Engineering

B. Tech III Year I Semester

20EEE109 POWER SYSTEMS – I

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101, 20EEE102, 20EEE105

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.
5. To impart knowledge on basic concepts of cables.

UNIT I STRUCTURE AND BASIC CONCEPTS OF POWER SYSTEMS — 9 hours

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). Introduction to EHVAC and HVDC

UNIT II TRANSMISSION LINE PARAMETERS — 9 hours

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.

UNIT III PERFORMANCE OF TRANSMISSION LINES — 9 hours

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.

UNIT IV MECHANICAL DESIGN OF TRANSMISSION LINE — 9 hours

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.

UNIT V CABLES 9 hours

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

Course Outcomes:

Upon successful completion of the course, students will be able 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.
5. Interpret various types of cables and perform the grading of cables.

Text Book(s)

1 D.P.Kothari , I.J. Nagarath, _Power System Engineering‘, Tata McGraw-Hill Publishing Company limited, New Delhi, Second Edition, 2008.

2 J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.

Reference Books

1 Singh, S.N., Electric Power Generation, Transmission and Distribution, Prentice Hall of India (P) Ltd, New Delhi, 2006.

2 C. L. Wadhwa –Generation, Distribution and Utilization of Electrical Energy, Second Edition, New Age International, 2009

3 O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.

4 B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power Systems”, Wiley, 2012.

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

B. Tech Electrical and Electronics Engineering

B. Tech III Year I Semester

20EEE110 POWER ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101, 20EEE103

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 — 9 hours

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. Introduction to silicon carbide switches

UNIT II THYRISTOR RECTIFIERS — 9 hours

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.

UNIT III DC TO DC CONVERTERS — 9 hours

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.

UNIT IV DC TO AC CONVERTERS — 9 hours

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.

UNIT V AC TO AC CONVERTERS — 9 hours

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.

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Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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.

Reference Books

1 P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.

2 M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.

3 R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.

4 L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

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

B. Tech Electrical and Electronics Engineering

B. Tech III Year I Semester

20EEE111 MICRO-CONTROLLERS AND INTERFACING

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101, 20EEE103, 20EEE106

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 — 9 hours

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.

UNIT II THE 8051 ARCHITECTURE — 9 hours

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.

UNIT III INSTRUCTION SET AND PROGRAMMING — 9 hours

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.

UNIT IV MEMORY AND I/O INTERFACING — 9 hours

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.

UNIT V EXTERNAL COMMUNICATION INTERFACE AND APPLICATIONS — 9 hours

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.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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.

Reference 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.

B. Tech Electrical and Electronics Engineering

B. Tech III Year I Semester

20EEE208 POWER SYSTEM – I LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE109

Course Description:

This course gives practical knowledge about testing of insulators and transmission line models. The course also deals with the simulation study of transmission systems and renewable energy sources like solar PV and wind systems.

Course Objectives:

1. To understand the insulator properties
2. To evaluate the parameters of transmission line model.
3. To determine the performance of transmission line.
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 Outcomes:

Upon successful completion of the course, students will be 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

B. Tech Electrical and Electronics Engineering

B. Tech III Year I Semester

20EEE209 MICRO-CONTROLLERS AND INTERFACING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE111

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:

Upon successful completion of the course, students will be 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 Electrical and Electronics Engineering

Mandatory Course
B. Tech III Year I Semester

20HUM902[**] /20HUM102[#] UNIVERSAL HUMAN VALUES

L	T	P	C
2[**]/3[#]	0	0	0[**]/3[#]

Pre-requisite None.

Course Description:

This course discusses students' role in their family and briefly touches issues related to their role in the society and the nature.

Course Objectives:

This course enables students to

1. Understand Happiness and Prosperity correctly and basic Human Aspirations
2. Able to self-verify the Harmony in the Human Being
3. Visualize a universal harmonious order in society which leads to Undivided Society at Universal Order- from family to world family.
4. Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
5. Implicate the UHV in professional ethics.

UNIT I THE PROCESS FOR VALUE EDUCATION - BASIC HUMAN ASPIRATIONS

L1: Purpose and motivation for the course, recapitulation from Universal Human Values-I

L2: Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration

L3: Continuous Happiness and Prosperity- A look at basic Human Aspirations

L4: Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

L5: Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

L6: Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

T1 & T2: Discussion on natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

L7: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

L8: Understanding the needs of Self ('I') and 'Body' - happiness and physical facility

L9: Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

L10: Understanding the characteristics and activities of 'I' and harmony in 'I'

L11: Understanding the harmony of I with the Body: Self-regulation and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

L12: Programs to ensure Self-regulation and Health.

T3 & T4: Discussion on the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for \ ensuring health vs dealing with disease

UNIT III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY

L13: Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

L14: Understanding the meaning of Trust; Difference between intention and competence

L15: Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

L16: Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

L17: Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

T5 & T6: Reflection on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

UNIT IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE

L18: Understanding the harmony in the Nature

L19: Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature

L20: Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

L21: Holistic perception of harmony at all levels of existence.

T7 & T8: Discussion on human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V IMPLICATIONS OF HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

L22: Natural acceptance of human values

L23: Definitiveness of Ethical Human Conduct

L24: Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

L25; Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

L26: Case studies of typical holistic technologies, management models and production systems

L27: Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

L28: Sum up.

T9-T14: Exercises and Case Studies For e.g. Individual discussion on the conduct as an engineer or scientist etc.

Course Outcomes:

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

1. Understood the natural acceptance in human being as the innate acceptance,
2. More aware of themselves,
3. Maintain harmony with family and society by recognizing Harmony in Human-Human Relationship,
4. Try to get Harmony in the Nature and Existence by realizing existence as Coexistence
5. More responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind with better critical ability.

Text Book(s)

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

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

III Year II Semester

B. Tech Electrical and Electronics Engineering

B. Tech III Year II Semester

20EEE112 MEASUREMENTS AND TRANSDUCERS

L	T	P	C
2	1	0	3

Pre-requisite None

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 **9 hours**

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.

UNIT II POWER FACTOR METERS & MEASUREMENT OF POWER AND ENERGY **9 hours**

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.

UNIT III POTENTIOMETERS & BRIDGES **9 hours**

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.

UNIT IV DIGITAL STORAGE OSCILLOSCOPE & DIGITAL METERS **9 hours**

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

UNIT V TRANSDUCERS **9 hours**

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.

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

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.

Reference Books

1 Electrical Measurements: Fundamentals, Concepts, Applications by Reissland, M.U, New AgeInternational (P) Limited, Publishers.

2 Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2nd Edition, S. Chand& Co.

3 Electronic Instrumentation by H. S. Kalsi, Tata McGrawhill, 3rd Edition.

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

B. Tech Electrical and Electronics Engineering

B. Tech III Year II Semester

20EEE113 SIGNALS AND SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite 20MAT105, 20MAT106

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. To understand the concepts of continuous time and discrete time systems
3. To analyse systems in complex frequency domain.
4. To characterize LTI systems in the Time domain and various Transform domains.
5. To understand sampling theorem and its implications.

UNIT I INTRODUCTION TO SIGNALS AND SYSTEMS — 9 hours

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.

UNIT II BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS — 9 hours

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.

UNIT III FOURIER, AND FFT ALGORITHMS — 9 hours

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.

UNIT IV LAPLACE and Z-TRANSFORM — 9 hours

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.

UNIT V SAMPLING AND RECONSTRUCTION — 9 hours

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.

Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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.

Reference 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, 200

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.

B. Tech Electrical and Electronics Engineering

B. Tech III Year II Semester

20EEE114 POWER SYSTEMS – II (ANALYSIS)

L	T	P	C
3	0	0	3

Pre-requisite 20EEE102, 20EEE107, 20EEE109

Course Description:
This course is designed to provide basic understanding of analysis of power system. This course covers representation of power system components, load flow analysis, fault analysis and basics of power system stability analysis.

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 **9 hours**

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.

UNIT II LOAD FLOW ANALYSIS **9 hours**

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.

UNIT III SYMMETRICAL FAULT ANALYSIS **9 hours**

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.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS **9 hours**

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.

UNIT V POWER SYSTEM STABILITY ANALYSIS **9 hours**

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

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

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.

Reference Books

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 Hadi Scadat "Power System Analysis", Tata Mc Graw Hill Pub. Co. 2002

4 A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

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

B. Tech Electrical and Electronics Engineering

B. Tech III Year II Semester

20EEE210 MEASUREMENTS AND TRANSDUCERS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE111

Course Objectives:

1. Calibration of various electrical measuring instruments
2. Accurate determination of inductance and capacitance using AC Bridges
3. Measurement of coefficient of coupling between two coupled coils
4. Measurement of resistance for different range of resistors using bridges

List of Experiments:

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and voltmeter
4. Kelvin's double Bridge – Measurement of low resistance – Determination of Tolerance
5. Determination of Capacitance using Schering Bridge
6. Determination of Inductance using Anderson bridge
7. Measurement of parameters of a choke coil using 3-voltmeter and 3-ammeter methods
8. Calibration of LPF wattmeter – by Phantom loading
9. LVDT and capacitance pickup – characteristics and Calibration
10. Resistance strain gauge – strain measurement and Calibration

Course Outcomes:

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

1. Calibrate various electrical measuring instruments
2. Accurately determine the values of inductance and capacitance using AC bridges
3. Compute the coefficient of coupling between two coupled coils
4. Accurately determine the values of very low resistances

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech Electrical and Electronics Engineering

B. Tech III Year II Semester

20EEE212 POWER ELECTRONICS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE110

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.
13. Study of Characteristics of SCR, MOSFET& IGBT.

Course Outcomes:

Upon successful completion of the course, students will be 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

B. Tech Electrical and Electronics Engineering

B. Tech III Year II Semester

20EEE211 POWER SYSTEMS – II LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE114

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 Outcomes:

Upon successful completion of the course, students will be 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 Electrical and Electronics Engineering

Mandatory Course
B. Tech III Year II Semester

20CE901 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Pre-requisite **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:

This course enables students to

1. Make aware the students about disasters and their impact on living beings
2. 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 **6 hours**

Introduction, Etymology of disaster, Concepts and definitions: disaster, hazard, vulnerability, risks, Resilience, prevention and mitigation.

UNIT II TYPES OF DISASTERS **6 hours**

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.

UNIT III DISASTER IMPACTS **6 hours**

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health, psychosocial issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT IV DISASTER RISK MITIGATION MEASURES **6 hours**

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.

UNIT V IMPACT OF DEVELOPMENTAL ACTIVITIES 6 hours

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.

Course Outcomes:

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

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 Book(s)

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/%20(National%20Disaster%20management%20in%20India,%20Ministry%20of%20Home%20Affairs).
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

Open Elective - II

B. Tech Electrical and Electronics Engineering

Open Elective - II

20MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

Pre-requisite: 20MAT101, 20MAT106, 20MAT104, 20MAT108, 20MAT109, 20MAT110.

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 solve dynamic programming problem using recursive relations.
5. Analyze the techniques of project management and queuing models.

UNIT I CLASSICAL OPTIMIZATION 9 hours

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.

UNIT II LINEAR PROGRAMMING PROBLEM 9 hours

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.

UNIT III TRANSPORTATION PROBLEM AND ASSIGNMENT PROBLEM 9 hours

Transportation problem: definition and algorithm, transshipment problem. Assignment problem, travelling salesman problem.

UNIT IV DYNAMIC PROGRAMMING 9 hours

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

UNIT V PROJECT MANAGEMENT AND QUEUING MODELS 9 hours

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).

Course Outcomes:

At the end of the course, students will be 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 and assignment problems in engineering situations.
4. Apply the Bellman principle of optimality to solve dynamic 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.

Reference Books

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, 2nd edition.

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

B. Tech Electrical and Electronics Engineering

Open Elective - II

20PHY301 OPTICAL PHYSICS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

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

Course Objectives:
Students will

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 9 hours

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

UNIT II ABERRATIONS AND OPTICAL INSTRUMENTS 9 hours

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.

UNIT III WAVE OPTICS & INTERFERENCE 9 hours

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).

UNIT IV DIFFRACTION & POLARISATION 9 hours

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.

UNIT V FIBER OPTICS 9 hours

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.

Course Outcomes:
At the end of the course, students will 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.

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Text Books:

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20PHY302 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: 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 9 hours

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.

UNIT II GASES AND LIQUIDS LASING MEDIUM 9 hours

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.

UNIT III SOLID STATE LASERS 9 hours

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);

UNIT IV PULSED OPERATION OF LASERS 9 hours

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.

UNIT V LASER APPLICATIONS 9 hours

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.

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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
3. Femtosecond Laser Pulses Principles and Experiments: Claude Rulli`ere, Springer
4. Principles of Laser: O. Svelto
5. Laser Physics: Peter W Miloni, Joseph H Eberly.

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

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

B. Tech Electrical and Electronics Engineering

Open Elective - II

20CHE301 INTRODUCTION TO PETROLEUM INDUSTRY

L	T	P	C
3	0	0	3

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

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

Course Objectives:
Students will

1. To understand the basic concepts of crude oil, distillation process, internals, petroleum products and their properties, Instruments used for fuel testing.
2. To understand the type of chemicals and their application in petroleum industry.
3. To introduce the basic principles of hydroprocessing and fluid catalytic cracking and familiarize the processes involved there.
4. To familiarize the basic concepts of catalysis, bioprocesses in the refinery.
5. Health, environment, process safety and management in petroleum companies.

UNIT I BASIC PROCESSES IN PETROLEUM REFINING AND FUEL TESTING **9 hours**

Source of Crude oils and types, Overview of refinery process, Atmospheric Distillation, Vacuum distillation, Desalter, Desulphurization, Cracking, catalysis, Effluent treatment plant. Density, viscosity, pour point, flashpoint, octane number, cetane number, Fire point, Chromatography, Ductility, Water content, Sulphur analysis, MCRT, SARA, HFRR, calorofic value etc.

UNIT II CHEMICALS AND THEIR IMPORTANCE IN PETROLEUM INDUSTRY **9 hours**

Types of products in the refinery and their structural properties, Netralizing amines, Corrosion inhibitors, Multifunctional additives, viscosity improvers, drag reducing agents, antioxidants, Lubricity improvers, Antifoam additives, Oil spill absorbers, Dispersants and their applications, Types of Catalysts used in the refinery, Chemicals for ETP plant.

UNIT III ROLE OF HYDROPROCESSING AND FLUID CATALYTIC CRACKING IN PETROLEUM INDUSTRY **9 hours**

Objectives, Hydrocracking Reactions, Hydrocracking feedstocks, Modes of Hydrocracking, Effects of process variables, Hydro treating process and catalysts Resid hydro processing, FCC Cracking, Catalyst coking and regeneration, Design concepts, New Designs for Fluidized-Bed Catalytic Cracking Units

UNIT IV ROLE OF CATALYSTS, BIOPROCESSES IN PETROLEUM INDUSTRY **9 hours**

Types of catalyst and their importance, Design of catalyst, selection of catalyst, Catalytic processes. Introduction to biotechnology, oil recovery from reservoirs, refining of petroleum using biodesulphurisation, Bioremediation, commercial processes for bioethanol, propanol.

UNIT V HEALTH, ENVIRONMENT, PROCESS SAFETY AND MANAGEMENT IN PETROLEUM INDUSTRY **9 hours**

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, precautions safety, Occupational safety and management, different elements and their role.

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Course Outcomes:

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

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, Amal Elkilani, Fundamentals of Petroleum Refining, Elsevier,2009
2. David T Day, Handbook of the Petroleum Industry, Volume 1, ISBN: 137595962X, CHIZINE PUBN, 2017
3. S. P. Srivastava Jenő Hancsók, *Fuels and fuel additives*, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
4. Robert O. Anderson, *Fundamentals of the Petroleum Industry*–University of Oklahoma Pres, 1987.
5. James G.Speight, *Handbook of Petroleum Product Analysis*, John Wiley & Sons, Inc, 2015
6. Physical Chemistry by G.W. Castellan (Addison Wesley Publishing Company)

Reference Books

1. Sankara Papavinasam, Corrosion Control in the Oil and Gas Industry, Elsevier, 2013
2. Petroleum Engineering Handbook (Vol. 1 through 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.

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L	T	P	C
3	0	0	3

Pre-requisite: Basic Chemistry at Intermediate 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 and solvents and green processes for Nanoscience.

Course Objectives:

Students will

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 9 hours

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.

UNIT II CATALYSIS AND GREEN CHEMISTRY 9 hours

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.

UNIT III ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS 9 hours

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

UNIT IV EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES 9 hours

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell), Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions(caprolactum), Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry.

UNIT V GREEN PROCESSES FOR GREEN NANOSCIENCE 9 hours

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green 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

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

Reference Books

1. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20CE301 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Identification of problematic soils; ground improvement techniques; densification in granular soils; densification in cohesive soils; soil stabilization; confinement; reinforced earth; geo-synthetics; improvement of expansive soils.

Course Objectives:
Students will
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 9 hours

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.

UNIT II DENSIFICATION 9 hours

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.

UNIT III STABILIZATION 9 hours

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

UNIT IV REINFORCED EARTH & GEOSYNTHETICS 9 hours

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.

UNIT V EXPANSIVE SOILS 9 hours

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

Course Outcomes:

After successful completion of the course, student will be able to
1. Evaluate 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. Choose the best method for stabilizing the soil for a given soil condition.
4. Choose-the best geosynthetic materials in different engineering applications.
5. Assessing various 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.

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20CE302 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

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

Course Objectives:
Students will
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 9 hours

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.

UNIT II IMPACT OF DEVELOPMENTAL ACTIVITIES 9 hours

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.

UNIT III IMPACT ON VEGETATION AND WILD LIFE 9 hours

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

UNIT IV ENVIRONMENTAL AUDIT 9 hours

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.

UNIT V ENVIRONMENTAL POLLUTION ACTS 9 hours

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.

Course Outcomes:

The students after completing the course will be able to:
1. Apply the various methods used in predicting environmental impacts.
2. Apply site information to interpret impacts on land and groundwater.
3. Evaluate environmental impacts of various development activities on existing ecosystem.
4. Apply the procedures and various protocols involved in preparation of environmental audit report.
5. Apply 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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20CE303 WATERSHED MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Topic covers basic concepts of watershed, sustainable watershed management approached and practices, integrated watershed management and modelling, social aspect in watershed 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 9 hours

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. 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.

UNIT II WATERSHED MODELING 9 hours

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.

UNIT III EROSION AND SEDIMENTATION 9 hours

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 - Prevention And Control To Erosion: contour techniques - ploughing - furrowing- trenching - bunding - terracing - gully control - rockfill dams - check dams - brushwood dam - Gabion structure.

UNIT IV WATER HARVESTING 9 hours

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 modelling- environmental guidelines for water quality.

UNIT V COVER MANAGEMENT **9 hours**

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.

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

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20ME301 MATERIAL SCIENCE FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

1. To understand the relation between structure and properties of metallic materials.
2. To understand the strengthening mechanism of metals
3. To comprehend the various electrical and electronic properties of materials.
4. To understand origins and various types of magnetism and its applications.
5. To comprehend the transmission of light in various solids and study of photonic behavior.

UNIT I STRUCTURE OF MATERIALS 9 hours

Introduction: Historical prospective - importance of materials - Classification of Materials and its Properties. Bonding in solids: bonding forces and energies - primary and secondary bonding. Crystallography and Metallic structures: Unit cell - Crystallographic directions and planes, FCC, BCC, HCP, SC and other structure – miller indices, Linear and planar densities - close- packed crystal structures. Packing of atoms in solids. Packing factor

UNIT II CRYSTAL IMPERFECTIONS AND DIFFUSION 9 hours

Crystal Imperfections: Types, Vacancies and interstitials, Dislocations, and grain boundaries. Diffusion: Fick's Law of diffusion – Diffusion mechanism – Steady state and non-steady state, factors affecting diffusion.

UNIT III ELECTRICAL PROPERTIES OF MATERIALS 9 hours

Introduction and Electrical Conduction: Ohm's Law, Electrical Conductivity, Electronic and Ionic Conduction - Energy Band Structures in Solids, Electron Mobility - Electrical Resistivity of Metals Semi conductivity: Intrinsic and Extrinsic Semiconduction - Temperature Dependence of Carrier Concentration, Factors that Affect Carrier Mobility, The Hall Effect, Semiconductor Devices. Conduction in Ionic Materials, Electrical Properties of Polymers. Dielectric Materials: Capacitance, Ferroelectric Materials, Piezoelectric Materials.

UNIT IV MAGNETIC PROPERTIES OF MATERIALS 9 hours

Introduction and Basic Concepts, Diamagnetism, Paramagnetism, Ferromagnetism, Anti ferromagnetism, Ferrimagnetism, Influence of Temperature on Magnetic Behavior, Domains and Hysteresis, Magnetic Anisotropy, Soft and Hard Magnetic Materials, Magnetic Storage, Superconductivity.

UNIT V PHOTONIC MATERIALS 9 hours

Introduction, Electronic Radiation in Vacuum; Reflection, Refraction, and absorption in materials; Absorption and Chemical Bonding: Color, X-Ray absorption, Photon absorption Devices - Photon Emission: X-Ray Emission, Emission of electromagnetic radiation and devices: LED's, OLEDs and LASERs. Optical Fibers in communication

B. Tech Electrical and Electronics Engineering

Course Outcomes:

At the end of the course students will be able:

1. To develop deep knowledge of crystal structure and effect of structure on the properties of the materials
2. To demonstrate knowledge of various imperfections in crystal, and diffusion mechanism in materials
3. To explain the origins of various electronic and electrical properties in the materials
4. To understand the concept of magnetism, its origin and types, while choosing the right material for the given application
5. To summarize various optical properties of the material and light's transmission behavior

Text Books:

1. W. Callister, "Materials Science and Engineering", Wiley, 7th Edition, 2007.
2. Charles M. Gilmore, "Materials Science and Engineering Properties", Cengage Learning, SI Edition, 2016

Reference Books

1. Donald R. Askeland, Pradeep P. Phule, "The Science and Engineering of Materials", Cengage Learning, 5th Edition, 2006.

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20ME302 ELEMENTS OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: None

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 THERMODYNAMICS 9 hours

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.

UNIT II BOILERS, TURBINES AND PUMPS 9 hours

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.

UNIT III IC ENGINES AND REFRIGERATION SYSTEMS 9 hours

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.

UNIT IV MATERIALS, CASTING AND TRANSMISSION 9 hours

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.

UNIT V TOOLS AND MANUFACTURING SYSTEMS 9 hours

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.

B. Tech Electrical and Electronics Engineering

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 Books:

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

Reference Books

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20ECE301 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite: 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 9 hours

Introduction to human physiology - Biomedical transducers for measuring displacement, velocity, force, acceleration, potential, dissolved ions and gases.

UNIT II BIO-ELECTRODES AND AMPLIFIERS 9 hours

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.

UNIT III BIOMEDICAL MEASURING INSTRUMENTS 9 hours

Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography.

UNIT IV MEDICAL IMAGING 9 hours

X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging.

UNIT V PROSTHESES AND AIDS 9 hours

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

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. LeslieCromwell,"BiomedicalInstrumentationandMeasurement",Prentice-Hall, New Delhi, 2011.

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20ECE302 VLSI DESIGN

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course describes about various VLSI design methodologies, fundamentals of CMOS technology. It incorporates basics of MOSFET models, CMOS design rules, Design of VLSI Systems, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives:
This course enables students to

1. Study the fundamentals of CMOS circuits and its characteristics
2. Learn the design and realization of combinational digital circuits.
3. Learn the design and realization of sequential digital circuits.
4. Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
5. Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I INTRODUCTION TO MOS TRANSISTOR 9 hours

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9 hours

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.
Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN 9 hours

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.
Timing Issues: Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9 hours

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9 hours

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan

B. Tech Electrical and Electronics Engineering

Course Outcomes:

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

1. Realize the concepts of digital building blocks using MOS transistor.
2. Design combinational MOS circuits and power strategies
3. Design and construct Sequential Circuits and Timing systems.
4. Design arithmetic building blocks and memory subsystems.
5. Apply and implement FPGA design flow and testing.

Text Books:

1. Neil H.E. Weste, David Money Harris "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson , 2017.
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, "Digital Integrated Circuits:A Design perspective", Second Edition , Pearson , 2016.

Reference Books

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition2009. Pearson education.
2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20CST301 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20CSE101, 20CSE102

Course Description:
Student will understand Modern Operating System and their principles. The course will cover theory as well as practice aspects of a subject through scheduled lectures and labs, course will cover details of processes, CPU scheduling, memory management, file system, storage subsystem, and input/output management.

Course Objectives:

1. To understand the basic concepts and functions of operating systems
2. To understand Processes and Threads
3. To analyze Scheduling algorithms
4. To understand the concept of Deadlocks
5. To analyze various memory management schemes
6. To understand I/O management and File systems

UNIT I OPERATING SYSTEMS OVERVIEW 9 hours

Operating system overview: Objectives – functions - Computer System Organization-Operating System Structure - Operating System Operations- System Calls, System Programs.

UNIT II PROCESS MANAGEMENT 9 hours

Processes: Process Concept - Process Scheduling - Operations on Processes – Inter process Communication. Process Synchronization: The Critical-Section Problem - Semaphores - Classic Problems of Synchronization – Monitors. Case Study: Windows 10 operating system

UNIT III SCHEDULING AND DEADLOCK MANAGEMENT 9 hours

CPU Scheduling: Scheduling Criteria - Scheduling Algorithms. Deadlocks: Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock. Case Study: MAC operating system

UNIT IV STORAGE MANAGEMENT 9 hours

Main Memory: Swapping - Contiguous Memory Allocation, Segmentation, Paging. Virtual Memory: Demand Paging - Page Replacement - Allocation of Frames - Thrashing. Case Study: Android operating system

UNIT V MASS STORAGE MANAGEMENT 9 hours

Mass Storage Structure: Disk Structure - Disk Scheduling - Disk Management. File-System Interface: File Concepts, Directory Structure - File Sharing – Protection. File System. Case Study: Linux operating system

B. Tech Electrical and Electronics Engineering

Course Outcomes:

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

1. Understand operating system program, structures and operations with system calls.
2. Apply the process management concept for real time problems
3. Illustrate CPU scheduling algorithms and to handle the deadlock for the given situation.
4. Explain the concepts of various memory management techniques
5. Summarize the storage concepts of disk and file.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2020.
2. Richard Petersen, "Linux: The Complete Reference", 6th Edition, Tata McGraw-Hill, 2008

Reference Books

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition2009. Pearson education.
2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20CSE301 JAVA PROGRAMMING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Basics of Object-Oriented Programming - objects, classes, polymorphism, inheritance, static and dynamic binding. Object Oriented Programming using Java-classes, interfaces, inheritance, polymorphism, method dispatch, features for encapsulation and modularity.

Course Objectives:
1. Understand object-oriented programming concepts, and apply them in solving problems.
2. Learn the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes.
3. To Introduce the implementation of packages and interfaces.
4. Learn the concepts of exception handling and multithreading.
5. Learn the design of Graphical User Interface using applets and swing controls.

UNIT I INTRODUCTION TO OOPS CONCEPTS AND CLASSES 9 hours

Introduction to Object Oriented Programming, Java buzzwords, Java Programming Basics, Sample programs, Data types and operators, Control statements.
Classes: Classes, Objects, Methods, Constructors, this and static keywords, Method and Constructor Overloading, Access modifiers, Polymorphism
Arrays: One Dimensional and multi-dimensional arrays.

UNIT II STRINGS, INHERITANCE, INTERFACES, AND PACKAGES 9 hours

Strings: Strings, String Handling - Inheritance: Basics, Usage of Super, Multi-level hierarchy, Method overriding, Abstract class, Final keyword. - Interfaces: Creating, Implementing, Using, Extending, and Nesting of interfaces - Packages: Defining, Finding and Importing packages, Member Access.

UNIT III EXCEPTION HANDLING &MULTI-THREADING 9 hours

Exception Handling: Fundamentals, Types, Multiple catch clauses, Nested try blocks, Thrown Class, Using Finally and Throws, Built-in exceptions, User-defined exceptions.
Multi-threading: Thread Class, Runnable interface, creating multiple threads, life cycle of thread, thread properties, synchronization, thread communication, suspending, resuming and stopping threads.

UNIT IV I/O STREAMS AND COLLECTION FRAME WORK CLASSES 9 hours

I/O Streams: Byte Stream Classes and Character Stream Classes.

Collection Frame work : Hierarchy of collection framework, Array-List, Linked-List, Vector, Stack, Queue, Priority Queue, Hash Set, Linked Hash Set, Tree Set.

UNIT V GUI PROGRAMMING AND EVENT HANDLING 9 hours

Swing – Introduction, limitations of AWT, MVC architecture, components, containers, Event Handling-Handling mouse and keyboard events, Exploring Swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables. JDBC: Connecting to Database, querying a database and processing the results, updating data with JDBC.

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Course Outcomes:

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

1. Choose object-oriented programming concepts for problem solving.
2. Create and use packages and interfaces.
3. Develop multithreaded applications with synchronization.
4. Provide computed based solutions by using java collection framework and I/O classes.
5. Design GUI based applications.

Text Books:

1. Java The Complete Reference, Herbert Schildt, MC GRAW HILL Education, 9thEdition, 2016.

Reference Books

1. Core Java Volume I – Fundamentals, by Cay S. Horstmann, Gary Cornell Pearson Education Ninth Edition
2. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
3. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.
4. "Thinking in Java", Bruce Eckel, Pearson Education.
5. Java and Object Orientation, an introduction, John Hunt, second edition, Springer.

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

B. Tech Electrical and Electronics Engineering

Open Elective – II

20CSE302 MULTIMEDIA TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course aims to introduce the students to Multimedia technologies and their usage in real world applications. This course covers introduction to multimedia, different image, video and audio formats, image coding and compression techniques, I/O technologies, Multimedia network and Multimedia Security and Forensics.

Course Objectives:
1. To provide the foundation knowledge of multimedia technologies.
2. To provide the knowledge about media characteristics, compression standards, multimedia representation, data formats, multimedia technology development.
3. To understand Multimedia security and forensics.
4. To understand multimedia components efficiently
5. To develop integrated, collaborative multimedia systems

UNIT I INTRODUCTION 9 hours

Introduction to Multimedia: Multimedia Elements – Multimedia applications – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases, Multimedia Architecture – Multimedia Documents

UNIT II COMPRESSION, ANIMATION , FILE FORMATS 9 hours

Compression, Decompression, Binary Image Compression Schemes, Types of Compression, Image Compression, Video Compression, Audio Compression. Principles of animation, 2D, 3D animation.
File formats: Rich Text Format – TIFF File Format – Resource Interface File Format – MIDI File Format - JPEG DIB File Format.

UNIT III MULTIMEDIA TECHNOLOGIES 9 hours

Multimedia I/O Technologies: Image Scanners – Digital Voice and Audio – Digital Camera – Video Images – Full Motion Video -Video Motion Analysis.

UNIT IV MULTIMEDIA PROTOCOLS 9 hours

Protocol - QOS Issues - RTP, RTCP, RTSP, SIP - Media on demand –ITV - STB Broadcast Schemes for VoD Buffer Management- Multimedia over wireless networks.

UNIT V SECURITY ATTACKS 9 hours

Multimedia encryption - Digital Watermarking. Security Attacks- Digital Forensics taxonomy, goals/requirements - Forensic Data Acquisition -Forensics Analysis and Validation.

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Course Outcomes:

Upon completion of this course, students should be able to

1. Understand the characteristics of different media and the representations of different multimedia data formats.
2. Understand the characteristics of Image, Audio and Video systems and takes into considerations in multimedia techniques design and implementation.
3. Describe different coding and compression principles and compare different compression techniques.
4. Design multimedia components efficiently
5. Develop integrated, collaborative multimedia system

Text Books:

1. Li, Ze-Nian and Mark S. Drew, "Fundamentals of Multimedia", Prentice Hall of India, 2004.

2. Steinmetz Ralf and K. Nahrstedt "Multimedia: Computing, Communications & Applications",Pearson Education, 1995.

Reference Books

1. Ralf Steinmetz and Klara, "Multimedia Computing, Communications and Applications", Pearson Education, 2009
2. Chun-Shien Lu, "Multimedia Security : Steganography and Digital Watermarking techniques for Protection of Intellectual Property", Springer Inc 2007

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

Open Elective - IV

B. Tech Electrical and Electronics Engineering

Open Elective - IV

20PHY303 THIN FILM TECHNOLOGY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: 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 8 hours

Introduction - Role of thin films in devices - Thin film definition - Crystalline and amorphous films - Crystal defects - Nucleation and growth - film formation.

UNIT II THIN FILM DEPOSITION TECHNIQUES 10 hours

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.

UNIT III PROPERTIES OF THIN FILMS 8 hours

Structural-Optical-Electrical-Magnetic-Mechanical and Thermal properties of thin films.

UNIT IV CHARACTERIZATION OF THIN FILMS 10 hours

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).

UNIT V APPLICATIONS OF THIN FILMS 9 hours

Transparent conducting coating - Optical coating – Solar cells – Photocatalytic – Sensors - Superconductivity- Superhard coatings – Thin film transistors.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

At the end of the course, 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.

Reference Books:

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. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.
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 Tests, End Semester Examination

B. Tech Electrical and Electronics Engineering

Open Elective - IV

20CHE303 INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: None

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.

Course 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 **8 hours**

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.

UNIT II TYPES AND SYNTHESIS OF NANOSTRUCTURES **10 hours**

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).

UNIT III PROPERTIES OF NANOMATERIAL **8 hours**

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.

UNIT IV CHARACTERIZATION OF NANOMATERIALS **10 hours**

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).

UNIT V APPLICATIONS OF NANOMATERIALS **9 hours**

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.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

At the end of the course, 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.

Reference Books

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 Tests, End Semester Examination

B. Tech Electrical and Electronics Engineering

Open Elective - IV

20CHE304 COMPUTATIONAL METHODS IN MATERIALS SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: 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 **9 hours**

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.

UNIT II PROGRAMMING AND PLOTTING **9 hours**

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.

UNIT III DATA TYPES AND HANDLING TECHNIQUES **9 hours**

Classification, and understanding of data properties, data handling - plotting, fitting, functional forms, interpolation, and integration.

UNIT IV COMPUTATIONAL MODELING AND SIMULATIONS **9 hours**

Understanding the materials properties; atomistic and electronic modelling of materials; concepts in molecular dynamics and its application using Quantum ESPRESSO.

UNIT V CURRENT TRENDS IN COMPUTATIONAL MATERIALS SCIENCE **9 hours**

Applied materials for various engineering field; research literature exploration; real-time application of computational methods in materials science and engineering, mini-project.

Course Outcomes:

At the end of the course, 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.

Reference Books

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 Tests, End Semester Examination

B. Tech Electrical and Electronics Engineering

Open Elective - IV

20CE304 GREEN BUILDINGS AND ENERGY CONSERVATION

L	T	P	C
3	0	0	3

Pre-requisite: 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 9 hours

Introduction to bioclimatic architecture - Sustainability in building science and Functional planning - Orientation - Elements of building design and drawing - Building regulations and bylaws - Traditional and VernacularArchitecture - Climate zones - Design Charts - sun path diagram - Solar angles - Indices of thermal comfort - Vernacular buildings in different climate zones.

UNIT II CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN 9 hours

Introduction - various steps in Site planning - Plan form Building envelope Land form -Topography - vegetation - water bodies; Orientation - S/V ratio - P/A ratio - Walls, Fenestration - Roof and floors - Active and passive solar strategies - Passive solar architecture.

UNIT III THERMAL FLOW IN BUILDINGS 9 hours

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.

UNIT IV GREEN BUILDING MATERIALS AND CONSTRUCTION 9 hours

Material properties - Energy efficiency using various materials - emerging new materials Construction techniques- Techniques for roof, wall and foundations.

UNIT V ECONOMY OF GREEN BUILDING 9 hours

Cost of building - operation and maintenance - Green building rating system - Evaluation criteria of LEED - TERI GRIHA case studies - Case studies in different climate zones.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

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

1. Use various regulations and by laws for green building construction0.
2. Do site planning for Green Building.
3. Compute thermal flow through different building elements
4. Identify energy efficient building materials
5. Compute cost of building/operation and maintenance

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.

Reference Books

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, CharotharPublishing House

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

B. Tech Electrical and Electronics Engineering

Open Elective - IV

20CE305 ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
The course covers demand, quality and treatment of water along with characterization, water and wastewater treatment plant units and design , low cost treatment of wastewater and household drainage. Similarly, air pollution, noise pollution and solid waste management are also included. Further the course also covers basic laboratory

Course Objectives:

1. To explain different sources of water, water quality standards, water demands, distribution of water, population forecast, characteristics of water.
2. To analyze various water treatment plant units and their design considerations, advanced water treatment systems.
3. To explain the generation and collection of wastewater; wastewater treatment plant design, various wastewater treatment units and sludge treatment.
4. To explain various impacts of air and noise pollution and various methods to control them air and noise pollution
5. To describe about solid waste generation, characterization, impacts and various management techniques

UNIT I WATER SUPPLY ENGINEERING 9 hours

Water- Sources of Water, Water quality standards, Quantity of water: water demands, percapita demand, design period, population forecast, fluctuation in demand. General requirement for water supply: Sources, Types of intakes, Pumping and distribution of water; Quality of water: Physical, chemical, and biological characteristics of water and significance, necessity of treatment, water quality standards for various water uses.

UNIT II WATER TREATMENT 9 hours

Engineering system for water purification: Aeration, Screening, Coagulation and Flocculation, Sedimentation, Softening, Filtration, Disinfection; Methods of treatment: Removal of color, tastes and odor control, removal of iron and manganese, fluoridation and defluorination. Advanced water treatment: Ion exchange, electro-dialysis, RO (principles only.

UNIT III WASTEWATER TREATMENT 9 hours

Generation and collection of wastewaters- sanitary, storm and combined sewerage systems, quantities of sanitary wastes and storm water, design of sewerage system. Engineered system for wastewater treatment: Primary treatment, Screening, Grit removal, Sedimentation, Sedimentation aided with coagulation. Secondary treatment: Basis of microbiology, Growth and food utilization, Suspended growth systems, Attached growth systems, Secondary clarification, Disinfections of effluents; Sludge treatment and disposal: Sludge characteristics, thickening, disposal.

UNIT IV AIR AND NOISE POLLUTION 9 hours

Air - Composition and properties of air, urban air pollution, Air quality standards, Measures and major equipment for air pollution control, Noise - Basic concept, measurement, and various noise control methods.

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UNIT V SOLID WASTE MANAGEMENT 9 hours

Solid waste management-Municipal solid waste, Composition, and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment, and disposal of MSW. Effects of solid waste on environment: effects on air, soil, water surface and ground, health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle, Disposal methods.

Course Outcomes:

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

1. Estimate water demand and population forecasting and characteristics of water
2. Estimate water generation and perform basic design of the unit operations that are used in water treatment plants.
3. Explain various wastewater generation sources and different units of wastewater treatment and sludge treatment techniques
4. Describe the impacts of air and noise pollution and review various air and noise pollution control methods
5. Discuss about the impacts of solid waste and various solid waste management techniques

Text Books:

1. Environmenatal Engineering (Volume I & II) by S. K. Garg-Khanna Publishers.
2. Rao M and Rao H. V. N. Air Pollution, McGraw Hill Education, 2017.
3. Jagbir Singh and Ramanathan A. L., Solid Waste Management: Present and Future Challenges, I K International Publishing House Pvt. Ltd., 2009
4. Environmental Engineering by H. S. Peavy, D.R. Rowe and G. Tchobanoglous, MGH.

Reference 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. Punmia, B.C, Ashok Kr Jain, Arun Kr Jain., Waste Water Engineering, Laxmi Publications, 1998.
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 Tests, End Semester Examination

B. Tech Electrical and Electronics Engineering

Open Elective - IV

20ME303 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: 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. TQM encompasses various principles, techniques, and tools for identifying and solving problems, fostering a culture of quality, promoting teamwork, and striving for excellence in all areas of the organization. The goal of TQM is to achieve sustainable and long-term success by consistently delivering high-quality products and services that meet or exceed customer expectations while improving overall organizational performance.

Course Objectives:

Students will

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. Facilitate the understanding of standards of quality.

UNIT I INTRODUCTION 9 hours

Introduction - Evolution of Quality - Historical Perspective, Basic Concepts of Quality – Quality control, Quality management and Quality Assurance - Definition of TQM – Basic concepts of TQM - TQM Framework - Contributions by Deming, Juran, Crosby and Feigenbaum – Dimensions of product and service quality

UNIT II TQM PRINCIPLES 9 hours

TQM principles - Strategic quality planning, Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Role of Leadership and Commitment in Quality Deployment, Team Building, Motivation and Rewards, Total Employee Empowerment, Performance appraisal - Continuous process improvement – Supplier partnership – Partnering, Supplier selection,

UNIT III TOOLS OF TQM 9 hours

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 – KAIZEN, 5S, JIT, Documentation – Failure mode and Effect Analysis (FMEA)

UNIT IV TQM TECHNIQUES 9 hours

Quality circles – Quality Function Deployment (QFD) – House of Quality – Design of Experiments – Taguchi quality engineering – Orthogonal Arrays – Signal to Noise Ratio – TPM – Concepts, improvement needs – Cost of Quality – Performance measures

UNIT V IMPELMENTATION OF TQM 9 hours

Introduction – Benefits of ISO Registration – ISO 9000 Series of Standards –Implementation – Environmental Management System: Introduction – ISO 14000 Series Standards – Concepts of ISO 14001 – Requirements of ISO 14001, Case studies on TQM principles followed by Indian Industries.

Course Outcomes:

At the end of the course, students 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 Books:

1. Dale H. Besterfield, et al., Total Quality Management, Pearson Education Asia, Third Edition, Indian Reprint (2003).

Reference Books

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 Tests, End Semester Examination

B. Tech Electrical and Electronics Engineering

Open Elective – II

20ME304 ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course is designed to ignite the entrepreneurship idea into the young minds of engineers. This course gives the complete details to setup an enterprise which includes the generating business ideas, writing business plan and 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 9 hours

Introduction to Entrepreneurship, history of entrepreneurship development, social Entrepreneurship, Intrapreneurship, 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. Realities & Case studies about successful Entrepreneur

UNIT II CREATING AND STARTING THE VENTURE 9 hours

Sources of new Ideas, Methods of generating ideas. The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, implementation of business plans. Case studies of successful business plan, Marketing plan, financial plan, and organizational plan, Launching formalities. Developing business plan and evaluation with team.

UNIT III FINANCING AND MANAGING THE NEW VENTURE 9 hours

Sources of capital, venture capital, angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. Ecommerce 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

UNIT IV PLANT LAYOUT 9 hours

Definition of plant layout and its types, 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.

UNIT V MARKET ANALYSIS AND PROJECT MANAGEMENT 9 hours

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. Project Organization- Project Planning, Monitoring, Control and Learning. Detailed life cycle and post-mortem analysis, Resource allocation, Risk and uncertainty, Budget constraints, Project feasibility.

Course Outcomes:

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

1. Describe the sources of new business ideas, methods to develop new ideas and use the problem-solving techniques.
2. Write a business plan which includes financial plan, organizational plan and marketing plan.
3. Identify the financial sources for new business ventures.
4. Select a plant layout and draw a plant layout.
5. Design a workplace and analyse the market research for new business.

Text Books:

1. Entrepreneurship, Robert Hisrich, & Michael Peters, 5/e TMH.
2. Entrepreneurship, Dollinger, Pearson, 4/e, 2004.

Reference Books

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 Tests, End Semester Examination

B. Tech Electrical and Electronics Engineering

Open Elective – IV

20ECE303 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:
The course will provide strong foundation on embedded system design. The course covers theory and logic to develop programming expertise. Student will understand application of embedded microcontrollers ARM.

Course Objectives:
This course enables students to

1. To provide knowledge on the basics, building blocks of Embedded System.
2. To provide basic of operating system and Real time programming languages
3. To teach automation using scheduling algorithms and Real time operating system.
4. To understand firmware design and Architectural Support for Operating Systems for various applications
5. To discuss on different Phases & Modeling of a new embedded product.

UNIT I THE CONCEPT OF EMBEDDED SYSTEMS 9 hours

Embedded System Design, Introduction to Embedded Hardware Elements, Sensors and Actuators, Embedded Processors, Memory Architectures. Embedded System vs. General Purpose computing systems, Examples of embedded systems, Embedded memories, Embedded microcontroller cores

UNIT II SOFTWARE ASPECTS OF EMBEDDED SYSTEMS – I 9 hours

Operating System Basics, types of Operating Systems, Task and Task States, Semaphores and shared Data, RTOS services and design using RTOS, Tasks, Process and Threads, Multiprocessing and Multitasking, Real time programming languages.

UNIT III SOFTWARE ASPECTS OF EMBEDDED SYSTEMS- II 9 hours

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication Synchronization Issues, Task Synchronization Techniques, Device Drivers, how to Choose an RTOS, Integrated Development Environment (IDE).

UNIT IV FIRMWARE AND ARCHITECTURAL SUPPORT FOR OPERATING SYSTEMS 9 hours

Firmware and Bootloader, an introduction to operating systems, The ARM system control coprocessor Embedded ARM Applications, CP15 protection unit registers, CP15 MMU registers, ARM MMU architecture, Synchronization, Context switching, Input/Output, Example and exercises, The ARM7500 and ARM7500FE.

UNIT V MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHES 9 hours

Modelling embedded systems- embedded software development approach -Overview of UML modelling with UML, UML Diagrams-Hardware/Software Partitioning, Co-Design Approaches for System Specification and modelling- Co-Synthesis- features comparing Single-processor Architectures & Multi-Processor Architectures-design approach on parallelism in uniprocessors & Multiprocessors.

Course Outcomes:

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

1. To understand the functionalities of processor internal blocks, with their requirement
2. Understand the basics of operating systems and then to learn the programming language used for real time operating system.
3. systems and related terms.
4. Understand the role and features of RT operating system, that makes multitask execution possible by processors.
5. Understand that using multiple CPU based on either hard-core or softcore helps data overhead management with processing.

Text Book(s)

1. M.A. Mazdi & J.G. Mazdi, The 8051 Microcontroller and Embedded System, Pearson Education India , 2013
2. Andrew N. Sloss & Dominic Symes, ARM System Developer's Guide Designing and Optimizing System Software, Morgan Kaufmann Publisher, 2004.

Reference Books

1. Steve Furber, Arm System-On-Chip Architecture, 2000.
2. J.K. Peckol, Embedded Systems A contemporary Design Tool, Wiley Student Edition , 2008
3. K J Ayala, The 8051 Microcontroller Architecture, Programming and Application, Penram International Publishing (India)
4. S. Heath, Embedded Systems Design, Elsevier, 2009

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

B. Tech Electrical and Electronics Engineering

Open Elective – IV

20ECE304 DSP ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite 20ECE110

Course Description:

The course will provide an insight into the architectures of DSP processors for handling the bottlenecks in executing DSP algorithms. On the application side the students can develop FPGA based DSP Systems and can understand the concept of multicore DSP as HPC infrastructure

Course Objectives:

This course enables students to

1. Understand the programmable digital signal processing hardware.
2. study the architecture of TMS320CX processor and block diagram
3. Know syntax and write the assembly language programming for digital signal processors.
4. Study the architecture of FPGA based DSP for various applications.
5. Study about High-Performance Computing using P-DSP.

UNIT I PROGRAMMABLE DSP HARDWARE 9 hours

Introduction: Digital signal-processing system, discrete Fourier Transform (DFT) and fast Fourier transform (FFT), differences between DSP and other microprocessor architectures. Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating-Point Computations, Special Architectures, Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.

UNIT II STRUCTURAL AND ARCHITECTURAL CONSIDERATIONS 9 hours

Parallelism in DSP processing, Commercial digital Signal-processing Devices, Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, Data Addressing Modes of TMS32OC54xx., TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

UNIT III VLIW ARCHITECTURE 9 hours

Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Optimizations, Heuristics. Replacement of MAC unit by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed C and Assembly Language programming, On-chip peripherals, Simple application developments as an embedded environment.

UNIT IV FPGA BASED DSP SYSTEMS 9 hours

Limitations of P-DSPs, FPGA based signal processing design-case study of a complete design of DSP processor.

UNIT V HIGH PERFORMANCE COMPUTING USING P-DSP 9 hours

Modified bus structures and memory access in PDSPs, special addressing modes in PDSPs, Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure.

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Course Outcomes:

After completing this Unit, students will be able to
1. Identify and formalize architectural level characterization of DSP hardware.
2. Design and test various digital signal processors.
3. Write assembly language programming for various digital signal processors.
4. Utilize FPGA based DSP hardware for Control, Audio and Video Signal processing applications.
5. Understand the High-Performance Computing using P-DSP.

Text Book(s)

1. B. Venkataramani, M. Bhaskar, "Digital Signal Processors: Architecture, Programming and Applications", Tata McGraw-Hill Education Private Limited, 2011.

2. Phil Lapsley; Jeff Bier; Amit Shoham; Edward A. Lee, "DSP Processor Fundamentals: Architectures and Features", Wiley-IEEE Press, 1997.

Reference Books

1. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing: A practical approach", Pearson-Education, PHI, 2002.

2. Sen M. Kuo, Woon-Seng S. Gan, "Digital Signal Processors: Architectures, Implementations, And Applications", Pearson/Prentice Hall, 2005.

3. Peter Pirsch, "Architectures for Digital Signal Processing", John Wiley & Sons, 2009

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

B. Tech Electrical and Electronics Engineering

Open Elective – IV

20ECE305 COMMUNITY RADIO TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite

Course Description:

This course offers a comprehensive exploration of Community Radio, from foundational concepts to practical implementation. It begins with an introduction to the principles of Community Radio and guides students through the process of establishing a Community Radio Station (CRS). Key topics include Studio Technology, Operations and Management along with detailed instruction in Audio Pre-Production and Post-production techniques. Students will also gain essential knowledge of Radio Transmission technology, including the setup of an FM transmitter. By the end of the course, students will have a thorough understanding of Community Radio principles and the Practical skills required to effectively operate a Community Radio station.

Course Objectives:

This course enables students to

1. Associate the concept of fundamentals in Community Radio in Local Communication and development.
2. Gain knowledge of Studio technology and operations including Soundboards, Microphones, Recording, scheduling, content creation, and team coordination.
3. Develop skills in Audio Pre-production and post-production such as recording, editing, and mixing audio content.
4. Categorize the Radio Transmission Technology comprising signal requirements aligning with factors affecting Coverage and Shadow Areas.
5. Explore Radio Transmission technology essentials and understand the technical aspects of setting up and maintaining an FM transmitter.

UNIT I COMMUNITY RADIO FUNDAMENTALS AND SETUP 9 hours

Introduction to Radio Broadcasting in India - Community Radio: Evolution - Community Radio Policy – Technical principles; Components of a CR Station - Radio Waves and Spectrum - Basics of Electricity - Power Backup and Voltage Stabilization

UNIT II STUDIO TECHNOLOGY & OPERATIONAL PRACTICES 9 hours

Basics of Sound - Analog and Digital Audio - Components of the Audio Chain - Studio Acoustics; Good Engineering Practices for Studio Setup - Studio Equipment: Preventive & Corrective Maintenance - Content Distribution: Alternative Mechanisms

UNIT III AUDIO PRE & POST PRODUCTION 9 hours

Audio Hardware and Field Recording – Microphones - Audio Cables and Connectors - Free and Open-Source Software - Telephony for Radio - Landline Systems - GSM/CDMA - Voice Over Internet Protocol (VoIP); Sound Recording and Editing - Mixing and Mastering - File Formats and Compression Transmission - Storing and Retrieval

UNIT IV RADIO TRANSMISSION TECHNOLOGY 9 hours

Transmission Chain Overview – Live and Pre-recorded Transmission - Principles of FM Transmission – FM Transmitter console- Antenna System - Types of Mast/Towers - Layers of Atmosphere and Radio Wave Propagation - Factors Affecting Coverage and Shadow Areas - Signal Requirements and Coverage Planning Parameters

UNIT V FM TRANSMITTER SETUP 9 hours

Connecting Audio Feed to the Transmitter - Back Panel Connectors - Mounting and Connecting the Transmitter - Probable Causes of Failure of Transmitters - Fault Diagnostics and Corrective Maintenance - Transmitter Operation and Upkeep Issues

Course Outcomes:

Upon the completion of the course, Student will be able to

1. Interpret the evolution with a framework of Community Radio with Technical Principles and essential Radio Spectrums.
2. Apply Studio Technology and Operational practices with the components of the Audio Chain including Acoustics and Equipment maintenance.
3. Conduct Comprehensive Audio Pre & Post-production to operate field Recordings with Hardware and Open-source software to manage sound recording, editing, mixing, mastering, and file compression.
4. Infer the principles of FM transmission, Antenna systems, Radio wave propagation and factors affecting coverage.
5. Demonstrate knowledge of the connecting audio feeds for Transmitter setup by resolving operational Issues with corrective maintenance.

Text Book(s)

1. Pooja Murada R. Sreedher, “Community Radio in India”, Aakar Books, 2019.
2. Prof. Raj Misra , “Community Radio By the people, For the People”, Orange Books Publication, 2022
   Fraser, Colin, and Sonia Restrepo Estrada, “Community radio handbook”. Paris: Unesco, 2001.

Reference Books

1. Juliet Fox, “Community Radio’s Amplification of Communication for Social Change”, 7th Edition, Palgrave Macmillan (Springer International Publishing.), 2019.
2. Kanchan K. Malik, Vinod Pavarala, “Community Radio in South Asia: Reclaiming the Airwaves”, Routledge India, 2020.
3. Vinod Pavarala and Kanchan K. Malik, “Other voices: the struggle for community radio in India”,Sage Publications India Pvt Ltd, 2007.
4. Michael C. Keith, “The Radio Station: Broadcast, Satellite & Internet”, 7th Edition, Focal Press (Elsevier Inc.), 2007.
5. “Certificate in Community Radio Technology (CCRT)”
   https://www.cemca.org/resources/certificate-community-radio-technology-ccrt-0

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

B. Tech Electrical and Electronics Engineering

Open Elective - IV

20CSE303 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

Pre-requisite NIL

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:

This course enables students 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 — 9 hours

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

UNIT II USER INTERACTION — 9 hours

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

UNIT III THREADS, LOADERS AND ASYNCTASK LOADER, BROADCAST RECEIVERS, SERVICES — 9 hours

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

UNIT IV SAVING, RETRIEVING AND LOADING DATA 9 hours

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

UNIT V APPLICATIONS WIDGETS, INTERACTION AND SENSORS 9 hours

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.

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

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, By Zigurd Mednieks, Laird Dornin, G.Blake Meike & Masumi Nakamura, O'Reilly

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

B. Tech Electrical and Electronics Engineering

Open Elective - IV

20CSE304 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite 20CSE115

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:

This course enables students to

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. Understand and assess the cost of risk involved in a project management
5. Understand the various software management tools.

UNIT I SPM CONCEPTS 9 hours

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.

Agile Methodology: Theories for Agile Management-Agile Software Development-Traditional Model Vs Agile Model-Classification of Agile Methods-Lean Production-SCRUM.

UNIT II SOFTWARE MEASUREMENTS 9 hours

Monitoring & measurement of Software development – cost, size and time metrics – methods and tools for metrics – issues of metrics in multiple projects.

UNIT III SOFTWARE QUALITY 9 hours

Quality in Software 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.

UNIT IV RISK ISSUES 9 hours

The risk issues in Software development and implementation – identification of risks – resolving and avoiding risks – tools and methods for identifying risk management.

UNIT V SPM TOOLS 9 hours

Software project management using Primavera & Redmine - Case study on SPM tools.

B. Tech Electrical and Electronics Engineering

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 Book(s)

1. Richard H. Thayer, "Software Engineering Project Management", John Wiley & Sons, 2nd Edition-2001
2. Royce, Walker, "Software Project Management", Pearson Education, 2002 4. Kelker, S. A., "Software Project Management", Prentice Hall, 2003

Reference Books

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, Pankaj Jalote, Pearson Education.
5. David J. Anderson and Eli Schragenheim, ―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.

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

B. Tech Electrical and Electronics Engineering

Open Elective - IV

20CST302 CLOUD COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite -

Course Description:
This course will cover a top-down view of cloud computing, from applications and administration to programming and infrastructure. The aim is to provide skills and knowledge about operations and management in cloud technologies and design cloud infrastructure to meet the business needs.

Course Objectives:

1. To learn the design and development process involved in creating a cloud-based application.
2. To implement and use parallel programming using various tools.
3. To learn Various service models such as IaaS and PaaS and deployment models such as private, public, hybrid, and community.
4. To provide skills to design suitable cloud infrastructure that meets the business services and customer needs.
5. To identify various security and privacy issues in cloud.

UNIT I INTRODUCTION TO CLOUD COMPUTING 9 hours

Inception and need for cloud computing: Motivations from distributed computing predecessors - Evolution - Characteristics - Business Benefits – Challenges in cloud computing - Exploring the Cloud Computing Stack - Fundamental Cloud Architectures – Advanced Cloud Architectures - Specialized Cloud Architectures

UNIT II SERVICE DELIVERY AND DEPLOYMENT MODELS 9 hours

Service Models (XaaS): Infrastructure as a Service (IaaS) - Platform as a Service (PaaS) – Software as a Service(SaaS) - Deployment Models: Types of cloud - Public cloud - Private cloud – Hybrid cloud – Service level agreements - Types of SLA – Lifecycle of SLA- SLA Management.

UNIT III VIRTUALIZATION 9 hours

Virtualization as Foundation of Cloud – Understanding Hypervisors – Understanding Machine Image and Instances - Managing Instances – Virtual Machine Provisioning and Service Migrations

UNIT IV CLOUD COMPUTING: APPLICATIONS AND PARADIGMS 9 hours

Existing Cloud Applications and Opportunities for New Applications - Architectural Styles for Cloud Applications - Workflows: Coordination of Multiple Activities - Coordination Based on a State Machine Model: The ZooKeeper - The Map Reduce Programming Model - A Case Study: The GrepTheWeb Application

B. Tech Electrical and Electronics Engineering

UNIT V CLOUD PLATFORMS AND SECURITY 9 hours

Comparing Amazon web services, Google AppEngine, Microsoft Azure from the perspective of architecture (Compute, Storage Communication) services and cost models. Cloud application development using third party APIs, Working with EC2. Security Clouds

Course Outcomes:

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

1. Understand the evolution, principles, and benefits of Cloud Computing in order to assess existing cloud infrastructures to choose an appropriate architecture that meets business needs.
2. Decide a suitable model to capture the business needs by interpreting different service delivery and deployment models.
3. Understand virtualization foundations to cater the needs of elasticity, portability and resilience by cloud service providers.
4. Infer architectural style, workflow of real-world applications and to implement the cloud applications using map reduce programming models.
5. Design a cloud framework with appropriate resource management policies and mechanism

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej, M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 1st Edition, 2013.
2. Dongarra, Jack, Fox, Geoffrey, Hwang, Kai,"Distributed and Cloud Computing",.1st Edition, Morgan Kaufmann, 2013.
3. Marinescu, Dan C. Cloud Computing: Theory and Practice. Morgan Kaufmann, 2017.

Reference Books:

1. Buyya, Rajkumar, Christian Vecchiola, and S. Thamarai Selvi. Mastering Cloud Computing: Foundations and Applications Programming, Tata Mcgraw Hill, 1st Edition, 2017.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Mc Graw Hill Education, 1st Edition, 2017.

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

Open Elective - V

B. Tech Electrical and Electronics Engineering

Open Elective - V

20HUM301 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite NIL

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; and

5. Explain controlling, operations management, value chain management and management audit.

UNIT I INTRODUCTION **9 hours**

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.

UNIT II PLANNING **9 hours**

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.

UNIT III ORGANIZING **9 hours**

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

UNIT IV COMMUNICATION, MOTIVATION AND LEADING **9 hours**

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

UNIT V CONTROLLING 9 hours

Process of Control – Problems of Control Process-Types of Control – Techniques of Control-Essential conditions for effective control- Contemporary issues in control – Strategic role of Operations Management - Value Chain Management.

Management Audit: Objectives-Importance-Activities of Management Auditor.

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, management audit and apply to achieve the corporate objectives.

Text Book(s)

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

2. P. Subba Rao “Management and Organizational Behavior”, Himalaya Publishing House.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Open Elective - V

20HUM302 HUMAN RESOURCE DEVELOPMENT

L	T	P	C
3	0	0	3

Pre-requisite NIL

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, compensation management and
5. Explain the trade unions, industrial relations and grievance.

UNIT I INTRODUCTION 9 hours

Understanding the nature and scope of Human Resource Management- Definition, Evolution of HRD, Functions - objectives, organization of department. Human Resource Management v/s Personnel Management, Role and responsibility of HRM.

UNIT II HUMAN RESOURCE PLANNING 9 hours

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.

UNIT III RECRUITMENT, SELECTION AND PERFORMANCE APPRAISAL 9 hours

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

UNIT IV TRAINING AND DEVELOPMENT 9 hours

Meaning – importance and benefits of Training and Development, Training v/s Development – Training Methods - challenges in training - Career development: Definition-objectives—importance of career development – Reward Management – Compensation Management: Nature-Objectives-Components of Compensation- Theories of Compensation-Factors influencing employee compensation.

UNIT V INDUSTRIAL RELATIONS, TRADE UNIONS 9 hours

Trade Unions: Importance-Objectives- Functions and Structure of the Trade Unions- Trade Union movement in India- Industrial Relations: Nature--Importance- Approaches-essential conditions for sound IR. Industrial Disputes: Meaning – Types- Causes-Industrial disputes settlement machinery. Grievance: Sources and Process of Redressal,

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, compensation management and
5. Examine the trade unions, industrial relations and grievance.

Text Book(s)

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.
3 VSP Rao, Human Resource Management-Text & Cases, Excel Books.

Reference Books

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.

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

B. Tech Electrical and Electronics Engineering

Open Elective - V

20HUM303 SOFT SKILLS

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

Soft skills are the personal attributes that make a student a valuable employee and a wholesome personality. They include aspects like communication, teamwork, problem-solving, and time management. Employers are increasingly looking for employees with strong soft skills, as they are essential for success in the workplace. This course will help students analyze themselves and build soft skills needed for their personal and career success.

Course Objectives:

The course is intended to:

1. Analyze their strengths and skills, and build confidence in presenting themselves
2. Work seamlessly as a team and negotiate for solutions
3. Think laterally and critically to evaluate a situation and present it with clarity
4. Write business emails effectively
5. Prepare holistically for a job interview

UNIT I SELF ANALYSIS AND DEVELOPMENT 10 hours

Personal ethics (politeness, empathy, and honesty); self-motivation / building confidence and assertiveness; identifying one's unique selling points (USPs) through skills introspection and recognizing strengths and weaknesses; nurturing strengths and fixing weaknesses; self-introduction.

UNIT II TEAM WORKING AND DYNAMICS 12 hours

Brainstorming techniques, team building, collaboration, and negotiation skills; team role plays (involving negotiation and decision making); group discussion etiquette (greetings and body language), idea generation, and common GD phrases; group discussion practice

UNIT III THINKING AND REASONING SKILLS 6 hours

Lateral thinking, critical thinking and logical reasoning through texts, images, and videos; Speaking activities (e.g. JAM) involving lateral thinking and reasoning through thought-provoking pictures, videos, cartoons, comic strips or articles.

UNIT IV PRESENTATION SKILLS 7 hours

Presentation etiquette; slides design; and presentation practice.

UNIT V INTERVIEW SKILLS 10 hours

Preparing resume and cover letter for job interviews; interview etiquette: dress code, body language, tone, and greeting; HR interviews: answering common interview questions, practice for HR interviews.

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Course Outcomes:

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

1. Understand and express themselves with confidence
2. Work as an active team member
3. Think and express their views logically and speak on varied topics without hesitations.
4. Prepare business presentations and emails effectively
5. Attend job interviews with confidence

Text Book(s)

1. Sabina Pillai and Agna Fernandez; Soft Skills and Employability Skills; Cambridge University Press, 2018.

2. Archana Ram, PlaceMentor, 2018, Oxford University Press

Reference Books

1. Karen Kindrachuk, Introspection, 2010, 1st Edition

2 Karen Hough, The Improvisation Edge: Secrets to Building Trust and Radical Collaboration at work, 2011, Berrett-Koehler Publishers

3. Colin Swatridge, Oxford Guide to Effective Argument and Critical Thinking 1st Edition, Oxford University Press

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

B. Tech Electrical and Electronics Engineering

Open Elective - V

20HUM304 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.

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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

Professional Elective - I

B. Tech Electrical and Electronics Engineering

Professional Elective - I

20EEE401 MODERN CONTROL SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE108

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 **9 hours**

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.

UNIT II CONTROLLABILITY AND OBSERVABILITY **9 hours**

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.

UNIT III NON LINEAR SYSTEMS **9 hours**

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, phase plane analysis of nonlinear control systems.

UNIT IV STABILITY ANALYSIS **9 hours**

Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov's instability theorems, Stability Analysis of the Linear Continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions, Variable gradient method.

UNIT V OPTIMAL CONTROL **9 hours**

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

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Course Outcomes:

Upon successful completion of the course, students will be 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(s)

1 Control Systems Engineering by I.J. Nagrath and M.Gopal, New Age International (P) Ltd. 2007.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Professional Elective - I

20EEE402 INDUSTRIAL ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101

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 9 hours

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.

UNIT II RESIDENTIAL AND COMMERCIAL ELECTRICAL SYSTEMS 9 hours

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.

UNIT III ILLUMINATION SYSTEMS 9 hours

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.

UNIT IV INDUSTRIAL SUBSTATION SYSTEMS 9 hours

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.

UNIT V INDUSTRIAL SYSTEM AUTOMATION 9 hours

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.

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 Book(s)

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 Books

1 S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.

2 H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

3 https://www.bis.gov.in/

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

B. Tech Electrical and Electronics Engineering

Professional Elective - I

20EEE403 SPECIAL ELECTRICAL MACHINES

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101, 20EEE104, 20EEE107

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 **9 hours**

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.

UNIT II VARIABLE RELUCTANCE STEPPER MOTOR **9 hours**

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.

UNIT III SWITCHED RELUCTANCE MOTORS **9 hours**

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.

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS **9 hours**

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.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS **9 hours**

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.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

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.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Professional Elective - I

20EEE404 ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101

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 9 hours

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.

UNIT II GROUNDING AND BONDING 9 hours

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.

UNIT III SAFETY METHODS 9 hours

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.

UNIT IV SAFETY TEAM 9 hours

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.

UNIT V MAINTENANCE OF ELECTRICAL EQUIPMENT 9 hours

Safety related case for electrical maintenance- reliability centred 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.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

1 Dennis Neitzel, Al Winfield, 'Electrical Safety Handbook', McGraw-Hill Education, 4th Edition,2012.

Reference Books

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.

Professional Elective - III

B. Tech Electrical and Electronics Engineering

Professional Elective - III

20EEE405 ELECTRICAL AND HYBRID VEHICLES

L	T	P	C
3	0	0	3

Pre-requisite 20EEE104, 20EEE107

Course Description:

This course introduces the fundamental concepts, principles and analysis of hybrid and electric vehicles.

Course Objectives:

This course enables students to

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 9 hours

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).

UNIT II FUNDAMENTALS OF VEHICLE PROPULSION AND BRAKING 9 hours

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.

UNIT III ELECTRIC VEHICLES AND HYBRID ELECTRIC VEHICLES 9 hours

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).

UNIT IV ELECTRIC PROPULSION SYSTEMS 9 hours

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.

UNIT V PEAKING POWER SOURCES AND ENERGY STORAGE 9 hours

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.

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applicationswith Practical Perspectives", John Wiley & Sons, 2011.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel CellVehicles: Fundamentals, Theory, and Design", CRC Press, 2004.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Professional Elective - III

20EE406 ELECTRICAL DRIVES AND CONTROL

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101, 20EEE107, 20EEE108, 20EEE109

Course Description:

This course aims to study about the power electronics converters required to control BLDC motors, Switched Reluctance Motors and PMSM.

Course Objectives:

This course enables students to

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 9 hours

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.

UNIT II INDUCTION MOTOR DRIVES 9 hours

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).

UNIT III SYNCHRONOUS MOTOR DRIVES 9 hours

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.

UNIT IV PERMANENT MAGNET MOTOR DRIVES 9 hours

Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.

UNIT V SWITCHED RELUCTANCE MOTOR DRIVES 9 hours

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.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

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

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Professional Elective - III

20EEE407 ENERGY AUDIT AND CONSERVATION MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101

Course Description:
This course deals with concept of electrical energy conservation and energy management, and energy efficiency of electrical systems.

Course Objectives:

This course enables students to

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 **6 hours**

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

UNIT II BASICS OF ENERGY AND ITS VARIOUS FORMS **8 hours**

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

UNIT III ENERGY MANAGEMENT & AUDIT **8 hours**

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, Procedure for energy audit. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

UNIT IV ENERGY EFFICIENCY IN ELECTRICAL & INDUSTRIAL SYSTEMS **14 hours**

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.

UNIT V ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS **9 hours**

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.

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.

. Understand the concepts of different energy efficient devices.

Text Book(s)

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online).
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)
3. S. C. Tripathy, “Utilization of Electrical Energy and Conservation”, McGraw Hill, 1991.

Reference Books

1. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

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

B. Tech Electrical and Electronics Engineering

Professional Elective - III

20EEE408 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101

Course Description:
This course describes about manufacturing, modeling and applications of MEMS.

Course Objectives:
This course enables students to

1. To know the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices.
2. To know various MEMS microfabrication technologies.
3. To provide various MEMS technology for mechanical, optical, and chemical sensors and actuator

UNIT I INTRODUCTION **9 hours**

Overview – History and industry perspectives – Working principles – Mechanics and dynamics — Scaling law

UNIT II MICRO SENSORS & ACTUATORS **9 hours**

Micro sensors: Pressure sensors, accelerometers, gyroscopes-Micro actuators: comb drive actuators – Micro-electromechanical systems.

UNIT III MICRO MANUFACTURING **9 hours**

Materials for MEMS and Microsystems- Micro fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition- Physical Vapour Deposition, Micro manufacturing: Bulk micromachining, surface micromachining, LIGA Process- Packaging.

UNIT IV MODELING IN MEMS **9 hours**

Micro system design: Finite Element Methods-– Modeling of simulation – piezoelectric, Gyroscope

UNIT V MEMS APPLICATIONS **9 hours**

Micro fluids-sensors for turbulence measurement and control, micro-actuators for flow control, RFMEMS- filters, Oscillators and phase shifters, Optical MEMS, micro robotics – Case studies

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

1. Explain the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices.
2. Analyze the Micro sensors and actuators and its fabrication.
3. Explain the materials for MEMS and Microsystems.
4. Design MEMS using microfabrication techniques.
5. Explain the advantages of MEMS technology for mechanical, optical, and chemical sensors and actuator

Text Book(s)

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006

2. G.K. Ananthsuresh et al ,'Micro and Smart Systems', Wiley, India, 2010

Reference Books

1. NadimMaluf, "An introduction to Micro electro mechanical system design", ArtechHouse, 2000

2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2000.

3. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

4. Stephen D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001

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

Professional Elective – IV

B. Tech Electrical and Electronics Engineering

Professional Elective - IV

20EEE409 SWITCH GEAR AND PROTECTION

L	T	P	C
3	0	0	3

Pre-requisite 20EEE104, 20EEE107, 20EEE109 & 20EEE114

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:

This course enables students to

1. To learn the operation of Static and Digital 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 STATIC RELAYS 9 hours

Evolution of power system protection- Basic Requirements of Relays – Primary and Backup protection –protection zone. Static Relays –Basics for static relay development, Advantages and Disadvantages – Definite time, Inverse and IDMT static relays –Comparators – Amplitude and Phase comparators. Numerical Relay, Microprocessor based relay, Introduction to digital filtering.

UNIT II PRINCIPLES OF FUSING CHARACTERISTICS AND CIRCUIT BREAKER 9 hours

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

UNIT III OPERATION OF DIFFERENT TYPES OF CIRCUIT BREAKERS 8 hours

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

UNIT IV POWER SYSTEM EQUIPMENT PROTECTION 10 hours

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.

UNIT V OVER VOLTAGE PROTECTION AND DIGITAL PROTECTION **9 hours**

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: Digital Signal Processing basics and architecture of Numerical relays. Digital filter design – FIR filter

Course Outcomes:

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

1. Analyze the operation of Static and Digital 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 design of Digital protection

Text Book(s)

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.
3. Digital Power System Protection by S. R. Bhide, PHI, 2014.

Reference Books

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, Wiley Eastern (P) Ltd., 2001.

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

B. Tech Electrical and Electronics Engineering

Professional Elective - IV

20EEE410 UTILIZATION OF ELECTRICAL ENERGY

L	T	P	C
3	0	0	3

Pre-requisite 20EEE102, 20EEE104, 20EEE109. 20EEE110

Course Description:

This course is designed to create an awareness on various Illumination techniques, basics of refrigeration, electrical energy utilization aspects, methods of electric heating and electric traction.

Course Objectives:

This course enables students to

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 9 hours

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.

UNIT II REFRIGERATION 9 hours

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.

UNIT III DOMESTIC UTILIZATION OF ELECTRICAL ENERGY 9 hours

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.

UNIT IV ELECTRIC HEATING 9 hours

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.

UNIT V TRACTION SYSTEM 9 hours

Traction system – power supply, traction drives, electric braking, tractive effort calculations and speed-time characteristics. Locomotives and train - recent trend in electric traction.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Professional Elective - IV

20EEE411 HVDC AND FACTS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE110

Course Description:

This course covers the HVDC transmission systems and basic concepts of FACTS controller.

Course Objectives:

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 **9 hours**

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.

UNIT II CONVERTER & HVDC SYSTEM CONTROL **9 hours**

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.

UNIT III HARMONICS, FILTERS AND REACTIVE POWER CONTROL **6 hours**

Introduction, generation of harmonics, AC and DC filters. Reactive Power Requirements in steady state, sources of reactive power, static VAR systems.

UNIT IV INTRODUCTION TO FACTS & STATIC SHUNT COMPENSATOR **10 hours**

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.

UNIT V STATIC SERIES COMPENSATORS& COMBINED COMPENSATORS **11 hours**

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

B. Tech Electrical and Electronics Engineering

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

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.

Reference Books

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, Mid Term Tests, End Semester Examination.

B. Tech Electrical and Electronics Engineering

Professional Elective - IV

20EEE412 DIGITAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite 20EEE108 & 20EEE113

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 Multi rate 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:

This course enables students to

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 **9 hours**

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.

UNIT II FOURIER AND Z-TRANSFORMS **9 hours**

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 ZTransform, Z-Transform uses for analysis of L

UNIT III ANALOG FILTERS **9 hours**

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 pass Filters, A/D converter, D/A Converter. LTI Discrete –Time Systems in Transform domain: Types of TF, Digital Filters, All pass Transfer function, Inverse systems.

UNIT IV DIGITAL FILTERS **9 hours**

Digital Filter Structures: FIR, IIR Digital filters. Digital Filter Design: Bilinear Transformation of IIR filter, 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 noise ratio in Low order IIR filter, Low sensitivity Digital filters, Round off Errors

UNIT V APPLICATIONS **9 hours**

Multi rate DSP: Decimators & Interpolators, Multistage implementation, Polyphase implementation.

Electrical Power system Applications of DSP

B. Tech Electrical and Electronics Engineering

Course Outcomes:

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

1. Explain the basic concepts and techniques for processing signals on a computer.
2. Analyze the discrete-time signals analytically and visualize them in the time domain.
3. Write the meaning and implications of the properties of systems and signals.
4. Define and analyze the digital Filter Structures
5. Summarize the application of DSP systems.

Text Book(s)

1. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.

Reference Books

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 educatio
3. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning, 2014

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

Professional Elective – V

B. Tech Electrical and Electronics Engineering

Professional Elective - V

20EEE413 SMART POWER GRID

L	T	P	C
3	0	0	3

Pre-requisite 20EEE109, 20EEE112, 20EEE114

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:

This course enables students to

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 **9 hours**

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.

UNIT II MICRO-GRID **9 hours**

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.

UNIT III SMART STORAGE AND WIDE AREA MEASUREMENTS **9 hours**

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).

UNIT IV SMART METERING **9 hours**

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.

UNIT V POWER QUALITY **9 hours**

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.

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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.

Textbook(s)

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 E k a n a y a k e , Nick Jenkins, Kithsiri Liyanage, "Smart Grid: Technology and Applications", Wiley 2012.

Reference Books

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, Mid Term Tests, End Semester Examination.

B. Tech Electrical and Electronics Engineering

Professional Elective -V

20EEE414 Power System Operation and Control

L	T	P	C
3	0	0	3

Pre-requisite 20EEE103, 20EEE106

Course Description:

This course is designed to obtain thorough knowledge on power system operation and its control.

Course Objectives:

This course enables students.

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 — 9 hours

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.

UNIT II MODELLING OF TURBINE AND GOVERNOR — 9 hours

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.

UNIT III LOAD FREQUENCY CONTROL — 9 hours

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.

UNIT IV REACTIVE POWER CONTROL — 9 hours

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.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9 hours

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).

Course Outcomes:

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

1. Schedule the thermal power generators economically and optimally
2. Model various components of power systems.
3. Model and analyse load frequency control of single and two area systems
4. Understand the use of various controller for reactive power control
5. Apply computer control for the optimal operation of power systems.

Textbook(s)

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.

Reference Books

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, Mid Term Tests, End Semester Examination.

B. Tech Electrical and Electronics Engineering

Professional Elective - V

20EEE415 WIND AND SOLAR ENERGY SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101, 20EEE104, 21EEE107 & 20EEEE109

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:

This course enables students.

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 10 hours

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.

UNIT II WIND GENERATORS 10 hours

General characteristics of induction generators – grid-connected and self-excited systems – steady-state equivalent circuit - performance predetermination–permanent magnet alternators – steady-state performance.

UNIT III POWER CONVERTERS FOR WIND POWER GENERATION AND HYBRID SYSTEMS 7 hours

Power electronic converters for interfacing wind electric generators – power quality issues – hybrid systems-wind-diesel systems – wind-solar systems.

UNIT IV BASICS OF SOLAR PV POWER GENERATION 8 hours

Basic characteristics of sunlight – solar spectrum – isolation specifics – irradiance and radiation - pyranometer - solar energy statics - Solar PV cell – I-V characteristics – P-V characteristics – fill factor-Modeling of solar cell – maximum power point tracking.

UNIT V SOLAR PV SYSTEMS 10 hours

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.

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

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.

Reference Books

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 handbook - Variable speed generators', CRC press, 2010.

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

B. Tech Electrical and Electronics Engineering

Professional Elective -V

20EEE416 POWER QUALITY

L	T	P	C
3	0	0	3

Pre-requisite 20EEE109, 20EEE110, 20EEE112

Course Description:

This course deals with the basic concepts of power quality and the methods to improve power quality.

Course Objectives:

This course enables students to

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 9 hours

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

UNIT II ANALYSIS OF SINGLE PHASE AND THREE PHASE SYSTEM 9 hours

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.

UNIT III CONVENTIONAL LOAD COMPENSATION METHODS 9 hours

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.

UNIT IV LOAD COMPENSATION USING DSTATCOM 9 hours

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

UNIT V **SERIES COMPENSATION OF POWER DISTRIBUTION SYSTEM** **9 hours**

Rectifier supported DVR – DC Capacitor supported DVR – DVR Structure – voltage Restoration – Series Active Filter – Unified power quality conditioner.

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 Book(s)

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, Mid Term Tests, End Semester Examination.

B. Tech Electrical and Electronics Engineering

SKILL ORIENTED COURSE

B. Tech Electrical and Electronics Engineering

Skill Oriented Course – I
B. Tech. II Year I Semester

20ENG601 CORPORATE COMMUNICATION

L	T	P	C
1	0	2	2

Pre-requisite: 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. This lab will be accompanied by a practical lab component.

Course Objectives:
This course enables the students to –

1. Focus on their interactive skills
2. Develop their communicative competency
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 SKILLS 8 hours

Listening/watching interviews, conversations, documentaries, etc.; Listening to lectures, discussions from TV/Radio/Podcast.

UNIT II SPEAKING 10 hours

Articulation of sounds; Intonation; Conversational skills (Formal and Informal); Group Discussion; Making effective Oral presentations**:** Role play.

UNIT III READING SKILLS 8 hours

Reading for main ideas; Applying background knowledge to predict content; Skimming; Scanning; Making inferences; Reading different genres of texts ranging from newspapers to creative writing; Reading Comprehension.

UNIT IV WRITING SKILLS 9 hours

Writing an introduction; Essay structure; Descriptive paragraphs; Writing a conclusion.
Writing job applications and resume; Emails; Letters; Memorandum; Reports; Writing abstracts and summaries; Interpreting visual texts.

UNIT V INTERVIEW SKILLS 10 hours

Different types of interviews: Answering questions and offering information; Mock interviews; Body Language.

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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, draft Reports and personal letters and emails in English.

Text Books:

1. Sanjay Kumar and Pushp Lata; Communication Skills; Oxford University Press, 2012.
2. Sabina Pillai and Agna Fernandez; Soft Skills and Employability Skills; Cambridge University Press, 2018.
3. S.P. Dhanavel; English and Communication Skills for Students of Science and Engineering; Orient Blackswan, 2009.
4. M. Ashraf Rizvi; Effective Technical Communication; Tata Mc Graw Hill Co. ltd, 2005.

Reference:

1. Dr. M.Adithan; Study Skills for Professional Students in Higher Education; S.Chand & Co. Pvt., 2014.
2. Guy Brook Hart & Vanessa Jakeman; Complete IELTS: Cambridge University Press, 2014.
3. Vanessa Jakeman & Clare Mcdowell; Action Plan for IELTS: Cambridge University Press, 2006.
4. Guy Brook Hart; Instant IELTS; Cambridge University Press, 2004.
5. S.P.Bakshi & Richa Sharma; Descriptive General English; Arihant Publications, 2012.
6. Charles Browne, Brent Culligan 7 Joseph Phillips; In Focus (level 2); Cambridge University Press.
7. Steven Gershon; Present Yourself 2 (second edition); Cambridge University Press.
8. Leo Jones; Let's Talk 3 (second edition); Cambridge University Press.
9. Nutall J. C.; Reading Comprehension; Orient Blackswan.
10 www.cambridgeenglish.org/in/
11. https://learnenglish.britishcouncil.org/en/english-grammar
12. https://www.rong-chang.com/

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

B. Tech Electrical and Electronics Engineering

Skill Oriented Course – II

B.Tech. II Year II Semester

20EEE601 ELECTRICAL HOME

L	T	P	C
1	0	2	2

Pre-requisite 20EEE201

Course Objectives:

1. To provide hands on experience in electrical wiring of various equipment's
2. To get exposure with AC and DC motor starters.
3. To get hands on experience with winding of AC and DC machines.
4. To get acquainted with the repair and maintenance of domestic appliances.
5. To understand the operation of various measuring instruments.

UNIT I INTRODUCTION OF TOOLS AND ELECTRICAL WIRING 9 hours

Introduction of tools, electrical materials, various types of wires, switches, fuses and other LT switchgear used in electrical wiring.

1. Godown Wiring
2. Electrical wiring circuit with fuse, energy meter & main switch
3. Wiring circuit of Mercury vapor lamp and fluorescent lamp
4. Wiring circuit for 3-phase induction motor using DOL starter

UNIT II AC AND DC MOTOR STARTERS 9 hours

Introduction to working of AC and DC starters like, 2-point, 3-point, DOL, RDOL, Star-delta, Soft starters etc.

1. Study of two point and three-point starters
2. Study of DOL, RDOL and Star-Delta starters
3. Study of Soft starters
4. Study of variable frequency drive

UNIT III WINDING AND TROUBLESHOOTING OF DC AND AC MACHINES 9 hours

Introduction to wiring of various equipment's like Transformer, DC Machines, AC Machines

1. Construction of two winding transformer
2. Overhauling of a DC machine
3. Over hauling of a single-phase induction motor
4. Fault location – testing and repair of AC single phase Motors

UNIT IV REPAIR AND TROUBLESHOOTING OF DOMESTIC APPLIANCES 9 hours

Principle of operation and working various domestic appliances

1. Overhauling of a Table fan and a ceiling fan
2. Repair and troubleshooting of Electric Iron, Electric Kettle and Water Heater (Geyser)
3. Repair and troubleshooting of Mixer Grinder and Wet Grinder

UNIT V MEASURING INSTRUMENTS 9 hours

Introduction to Moving Iron and Moving coil meters. Digital meters. Digital Storage oscilloscope. Earth resistance measurement

1. Calibration of single-phase energy meter
2. Measurement of time period and frequency using DSO
3. Study of various functions digital meter
4. Earth resistance measurement using digital earth resistance tester

Course Outcomes:

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

1. Design electrical wiring circuit with various switchgear components.
2. Illustrate the operation and working of DC and AC starters.
3. Demonstrate the rewinding of DC and AC machines.
4. Troubleshoot electrical issues with home appliances.
5. Differentiate various electrical measuring instruments.

Reference Books

1. Electrical work shop By R.P.Singh
2. Electrical Design Estimating And Costing By K.B. Raina & S.K.Bhattacharya
3. Industrial Safety management by Deshmukh -TMH
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. Electrical & Electronic Measurement & Instruments by A.K.Sawhney, DhanpatRai& Co. Publications.

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

B. Tech Electrical and Electronics Engineering

Skill Oriented Course – III

B.Tech. III Year I Semester

20EEE602 DATA STRUCTURES USING PYTHON

L	T	P	C
1	0	2	2

Pre-requisite None

Course Objectives:

1. To provide basic knowledge on Object Oriented programming concepts
2. To acquire basic knowledge on Python programming language.
3. Understanding how linear and non-linear data structures works
4. To Understand Lists, Dictionaries and Regular expressions in Python.
5. Understanding how linked list concepts are working with python implementation.

UNIT I OBJECT ORIENTED PROGRAMMING 6 hours

Oops Concepts- class, object, constructors, types of variables, types of methods.
Inheritance: single, multiple, multi-level, hierarchical, hybrid, **Polymorphism:** with functions and objects, with class methods, with inheritance, **Abstraction:** abstract classes.

1. Programs that introduce class, objects and constructors
2. Programs that illustrate Inheritance: single, multiple etc.
3. Programs that introduce polymorphism with functions and objects with class methods

UNIT II INTRODUCTION TO PYTHON 6 hours

History of Python, features of Python Programming, Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. **Data Types -** Integers, Strings, Boolean.

1. Implement Python program to find sum of natural numbers
2. Develop a program that performs arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers.
3. Implement Python Script to generate prime numbers series up to N. Given a number x, determine whether it is Armstrong number or not.

UNIT III PYTHON SPECIFIC DATA STRUCTURES 4 hours

Data Structures – Definition, Linear Data Structures, Non-Linear Data Structures

Python Specific Data Structures: List, Tuples, Set, Dictionaries, Comprehensions and its Types, Strings, slicing.

1. Programs to create Lists and use some methods on those Lists (Del, Append, Extend, Insert, Pop, Remove, Reverse, Sort, Etc.)
2. Programs to create Tuples and use some operations on those Tuples
3. Programs to create Sets and to perform basic operations on Sets
4. Programs to create Dictionaries and perform operations on those Key-Value pairs
5. Programs on python sequence operations and functions (Indexing, Slicing, Adding/Concatenation, Multiplying, Checking membership, Iterating, Length, Min, Max, Sum, Sorted, Count, Index)

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UNIT IV ARRAYS, SEARCHING AND SORTING 7 hours

Arrays - Overview, Types of Arrays, Operations on Arrays, Arrays vs List.

Searching -Linear Search and Binary Search.

Sorting - Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort.

1. Program to import Array module and to create Array.
2. Create Arrays using NumPy module

Programs on different types of Sorting (Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort)

UNIT V LINKED LISTS, STACKS AND QUEUES 7 hours

Linked Lists – Implementation of Singly Linked Lists, Doubly Linked Lists, Circular Linked Lists.

Stacks - Overview of Stack, Implementation of Stack (List & Linked list), Applications of Stack

Queues: Overview of Queue, Implementation of Queue (List & Linked list), Applications of Queues, Priority Queues.

1. Program to create an instance of Linked List, append data to it and display the list
2. Python code to demonstrate Implementing stack using list
3. Program to create Queue using List and Linked List

Course Outcomes:

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

1. Interpret the concepts of Object-Oriented Programming as used in Python.
2. Understand basic Data types, Syntax, Semantics of Python
3. Create, run and manipulate Python Programs using core data structures like Lists, Tuples, Sets etc.
4. Apply Sorting techniques using Python
5. Implement Linked Lists, Stacks, Queues using Python

Reference Books

1. Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition by Dr. Basant Agarwal, Benjamin Baka.

2. Data Structures and Algorithms with Python by Kent D. Lee and Steve Hubbard.

3. Problem Solving with Algorithms and Data Structures Using Python by Bradley N Miller and David L. Ranum.

4. Core Python Programming -Second Edition, R. Nageswara Rao, Dreamtech Press

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

B. Tech Electrical and Electronics Engineering

Skill Oriented Course – IV
B.Tech. III Year II Semester

20EEE603 INTERNET OF THINGS

L	T	P	C
1	0	2	2

Pre-requisite None

Course Objectives:

1. To Introduce the basic understanding IoT system
2. To Expose the student to a variety of embedded system and interfaces
3. To Create a basic understanding of the communication protocols in IoT communications.
4. To Familiarize the student with networking and application program interfaces for IoT.
5. To Enable students to create various use cases of IoT.

UNIT I INTRODUCTION TO INTERNET OF THINGS (IoT) 6 hours

Introduction, Concept and History: IOT History, IoT Applications, Requirements of IoT, Understanding IoT fundamentals, IOT Architecture and IOT challenges. Major functional components of IoT, IoT enabling technologies IoT, Standards IoT Entities, Overview of Sensors, Categorization of sensors and their working, Actuators, Gateways, Cloud and Web of technology.

1. Study on IoT Platform a) Getting information and study of IOT microcontrollers (Arduino, Raspberry-pi)
2. Study on IoT Platform a) Getting information about Sensors (IR, temperature, pressure, gas sensor) b) Getting information about actuators. (Piezoelectric actuator, pneumatic actuator)

UNIT II EMBEDDED SYSTEM (ARDUINO AND RASPBERRY PI) AND PERIPHERAL INTERFACES 6 hours

Embedded Computing Basics; Microcontrollers; System-on-Chips. ARM Architecture, Arduino Board development platform and Raspberry PI development platform. IoT with Arduino General Purpose I/O(GPIO) Serial Communication Interfaces: RS-232/485 Synchronous Peripheral Interfaces: I2C, SPI Sensors interfacing with Raspberry PI , IoT Real Time Operating Systems, General Purpose I/O(GPIO) Serial Communication Interfaces: RS-232/485 Synchronous Peripheral Interfaces, I2C,SPI Sensors Interfacing with Raspberry Pi, Introduction of Arduino Python programming for IOT.

1. 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
2. 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.
3. Programming with Resperrypi a) Displaying Date on Serial Monitor b) Automated Door Opening System

B. Tech Electrical and Electronics Engineering

UNIT III COMMUNICATION PROTOCOL FOR IOT 6 hours

Wireless Sensor Networks & Protocols, Machine to Machine Communication, Wired Communication Protocols. Ethernet Serial Communications, Wireless Communication protocols: Wifi, RF, IPV4/V6, 6LOWPAN, ZigBee (IEEE802.15.4) BLE, GSM(2G/3G/LTE),NFC, RF Comm and z wave and MAC Addresses, Application of MQTT/MQTT-SN, HTTP REST, XMPP and AMQP.

1. 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
2. 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.
3. 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.

UNIT V NETWORKING FOR IOT 6 hours

Network Layer Model (OSI or TCP/IP), Network Topologies, Clouding computing, fog computing and big data technology, data handling and analytics, Introduction of Software define networking, Introduction of API and how to define new API.

1. 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
2. Data analysis and Visualization Access the data pushed from sensor to cloud and apply any data analytics or visualization services.
1. social media with IoT Creating Program for Local host Web Server for controlling devices and update status on Twitter through Arduino.

UNIT V USE CASES OF IOT 6 hours

Case study of IOT applications

Introduction, models, technology used: Industrial internet of things, connected vehicles, Agriculture and IOT. Heath care and IOT, Smart grid system, Smart cities IoT Wearables, Health care systems and Allied sectors.

1. 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:

Upon successful completion of the course, 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 with cloud and TCP/IP Model.

Reference Books

1. Hanes, David, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Henry. IoT fundamentals: Networking technologies, protocols, and use cases for the internet of things. Cisco Press, 2017.
2. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach. Vpt, 2014.
3. NPTEL Course on: Introduction of Internet of Things. By Prof. Sudip Misra | IIT Kharagpur
4. Raj, Pethuru, and Anupama C. Raman. The Internet of Things: Enabling technologies, platforms, and use cases. Auerbach Publications, 2017.
5. Richardson, Matt, and Shawn Wallace. Getting started with raspberry PI. " O'Reilly Media, Inc.", 2012.

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

B. Tech Electrical and Electronics Engineering

Skill Oriented Course – V

20EEE602 PROGRAMMING FOR ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
1	0	2	2

Pre-requisites: 20EEE101, 20EEE102, 20EEE108, 20EEE109, 20EEE110, 20EEE114

Course Description: This course introduces students to MATLAB programming and demonstrates its use for scientific computations. The applications of MATLAB Simulink in the field of Electrical and Electronics engineering will be discussed.

Course Objectives:

This course enables students to;

1. Design the basic programs in MATLAB software.
2. Design the Programming structure, functions and basics of Simulink Modelling.
3. Design the Simulation models for applications in Electric Circuit Analysis.
4. Design the Simulation models of Renewable Energy Sources & applications.
5. Design the Simulation software applications in Power Electronics and Power Systems.

Unit-I: INTRODUCTION AND BASIC CONCEPTS OF SIMULATION SOFTWARE

Introduction, Installation and Dependencies, MATLAB Environment, Features, Scripts, Saving, Running. Conditional Statements and Loops, User-Defined Functions, Creating User-Defined Functions, Solve Quadratic Equations Using Functions, MATLAB Programs on Conditional Statements and Loops, User-Defined Functions.

1. Design a user defined program to generate the transfer function of the DC motor.
2. Design a user friendly program to generate the transfer function of the AC motor.
3. Design a program for Economic load dispatch without inequality constraints.
4. Design a program for Economic load dispatch with inequality constraints.

Unit-II: SIMULINK AND PHYSICAL MODELLING

Introduction to Simulink- Basic Elements, Simulink Library Browser, building a Model in Simulink, Physical System Modelling, Simulate a Model in Simulink Data Import and Export.

1. Design the SIMULINK model to Data import from feedback controller.
2. Design mathematical modelling of DC motor.
3. Design Automatic Generation Control (AGC) model.
4. Design a program to build the trained neural network from imported data.

Unit-III: APPLICATIONS OF MATLAB IN ELECTRIC CIRCUIT ANALYSIS

Introduction-DC Circuit Analysis - Ohm's Law, Equivalent Resistance, Delta-Wye Conversion- Kirchhoff's Laws, Voltage Divider and Current Divider Laws, Thevenin's Theorem, Maximum Power Transfer Theorem. RLC Circuit Analysis.

1. Write a program to verify Thevenin's theorem for given circuit.
2. Write a program to verify Maximum Power Transfer theorem for a given circuit.
3. Design a program to obtain the loop currents of any circuit.
4. Design a program to obtain the node voltages of any given circuit.

Unit-IV: APPLICATIONS OF SIMULINK IN RENEWABLE ENERGY SOURCES

Solar Photovoltaic: Mathematical Model of PV Cell, PV Panel Design, Case Study: Grid-Connected PV Array. Wind Turbine: Model Wind Turbine-Based Generator in Simulink-Case Study: Grid-Connected Wind Turbine

Generator, Battery: Battery Cell Implementation in Simulink- Battery Modelling of Different Types in Simulink, Case Study: Battery Pack Design Using Battery Cells.

1. Develop a program for battery charging comparison: PID control vs constant current method.
2. Design a shadow effect and diode based solution in solar PV system.
3. Develop a program for battery health estimation based on cycle life data.
4. Design the model for grid to vehicle using SIMULINK.

Unit-V: APPLICATIONS OF SIMULINK IN POWER ELECTRONICS

Simulink in Power Electronics: Control Devices: Pulse Generation, Controlled rectification with SCR. Modelling of Converters: DC-DC, AC-DC, AC-AC, DC-AC.

1. Design the model of Cycloconverter using SIMULINK.
2. Design the model of Single Phase AC Voltage Controller using SIMULINK.
3. Design the model of Cuk converter using SIMULINK.
4. Design the model of SEPIC converter using SIMULINK.

A Mini Project Identify a problem which can be solved by integrating the things learned so far and create a software model in simulation software to solve it.

Course Outcomes:

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

1. To design basic commands and different data types of Simulation software.
2. To design the models of Simulation software.
3. To develop Simulation Software Models in the concepts of Electric Circuit Analysis.
4. To develop the Simulation software applications in Renewable Energy Sources.
5. To develop Simulation Software Models in the domain of Power Electronics and Power Systems.

Text Book:

1. MATLAB and Simulink Crash Course for Engineers, Eklas Hossain, Springer Publications, 2022.

Reference Book:

1. Introduction to MATLAB for Engineering Students, David Houcque, Northwestern University, August 2005.

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

MINOR
IN
ELECTRICAL AND ELECTRONICS ENGINEERING

Stream Name: Power Electronics and Instrumentation

B. Tech Electrical and Electronics Engineering

Minor

20MDEEE101 INTRODUCTION TO ELECTRICAL POWER GENERATION SYSTEM

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101

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 **9 hours**

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.

UNIT II HYDRO-ELECTRIC AND THERMAL POWER PLANTS **9 hours**

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.

UNIT III NUCLEAR POWER PLANTS **9 hours**

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.

UNIT IV RENEWABLE POWER PLANTS **9 hours**

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.

UNIT V COMBINED OPERATION OF POWER PLANTS **9 hours**

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.

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

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.

B. Tech Electrical and Electronics Engineering

Minor

20MDEEE102 ELECTRICAL MACHINES TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101

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 — 9 hours

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

UNIT II DC MACHINES — 9 hours

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.

UNIT III INDUCTION MOTORS — 9 hours

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.

UNIT IV SYNCHRONOUS MACHINES — 9 hours

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

UNIT V FRACTIONAL HORSEPOWER MACHINES — 9 hours

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

B. Tech Electrical and Electronics Engineering

Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Minor

20MDEEE103 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101

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 9 hours

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.

UNIT II POWER FACTOR METERS & MEASUREMENT OF POWER AND ENERGY 9 hours

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.

UNIT III POTENTIOMETERS & BRIDGES 9 hours

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.

UNIT IV DIGITAL STORAGE OSCILLOSCOPE & DIGITAL METERS 9 hours

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.

UNIT V TRANSDUCERS 9 hours

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.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

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.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Minor

20MDEEE104 POWER ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE101

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 **9 hours**

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.

UNIT II PHASE CONTROLLED CONVERTERS **9 hours**

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.

UNIT III DC-DC CONVERTERS **9 hours**

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.

UNIT IV INVERTERS **9 hours**

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 – 1200, 1800 conduction, Harmonics analysis.

UNIT V CYCLOCONVERTER & STATIC SWITCHES **9 hours**

Types of Cycloconverter, Single-Phase Cycloconverter, Three-Phase Cycloconverter, speed control of AC motors, operation and design of static switches and relays

B. Tech Electrical and Electronics Engineering

Course Outcomes:

Upon successful completion of the course, students will be 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.

Text Book(s)

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.

B. Tech Electrical and Electronics Engineering

Minor

20MDEEE201 POWER ELECTRONICS AND ELECTRICAL MEASUREMENTS LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite 20EEE101

Course Description:

This practical course provide hands on experience with various electrical parameters measurement and power electronic converter design and testing

Course Objectives:

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:

Upon successful completion of the course, students will be 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: Assignments, Mid Term Tests, End Semester Examination.

B. Tech Electrical and Electronics Engineering

Minor

20MDEEE105 ELECTRICAL AND HYBRID VEHICLES

L	T	P	C
3	0	0	3

Pre-requisite 20EEE104, 20EEE107

Course Description:

This course introduces the fundamental concepts, principles and analysis of hybrid and electric vehicles.

Course Objectives:

This course enables students to

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 9 hours

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).

UNIT II FUNDAMENTALS OF VEHICLE PROPULSION AND BRAKING 9 hours

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.

UNIT III ELECTRIC VEHICLES AND HYBRID ELECTRIC VEHICLES 9 hours

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).

UNIT IV ELECTRIC PROPULSION SYSTEMS 9 hours

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.

UNIT V PEAKING POWER SOURCES AND ENERGY STORAGE 9 hours

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.

Course Outcomes:

Upon successful completion of the course, students will be 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 Book(s)

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applicationswith Practical Perspectives", John Wiley & Sons, 2011.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel CellVehicles: Fundamentals, Theory, and Design", CRC Press, 2004.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Minor

20MDEEE106 POWER SYSTEM OPERATION AND CONTROL

L	T	P	C
3	0	0	3

Pre-requisite 20EEE103, 20EEE106

Course Description:

This course is designed to obtain thorough knowledge on power system operation and its control.

Course Objectives:

This course enables students.

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 **9 hours**

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.

UNIT II MODELLING OF TURBINE AND GOVERNOR **9 hours**

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.

UNIT III LOAD FREQUENCY CONTROL **9 hours**

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.

UNIT IV REACTIVE POWER CONTROL **9 hours**

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.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9 hours

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).

Course Outcomes:

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

1. Schedule the thermal power generators economically and optimally
2. Model various components of power systems.
3. Model and analyse load frequency control of single and two area systems
4. Understand the use of various controller for reactive power control
5. Apply computer control for the optimal operation of power systems.

Textbook(s)

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.

Reference Books

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, Mid Term Tests, End Semester Examination.

HONORS
IN
ELECTRICAL AND ELECTRONICS ENGINEERING

B. Tech Electrical and Electronics Engineering

Honors

20HDEEE101 RENEWABLE ENERGY RESOURCES

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:
This course aims to understand the role of various renewable energies such as, solar, wind, tidal, ocean, geothermal and biomass.

Course Objectives:

1. To get insights of world and Indian energy scenarios.
2. To understand the importance of solar energy and its applications.
3. To understand the operation of wind energy conversion and various types.
4. To study the working principles of tidal, ocean, geothermal and biomass energies.

UNIT I INTRODUCTION ABOUT ENERGY RESOURCES — 9 hours

Introduction, Energy science and Technology, Forms of Energy, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Roles, and responsibility of Ministry of New and Renewable Energy Sources, Needs of renewable energy, Classification of Energy Resources, Conventional Energy Resources, Non-Conventional Energy Resources, World Energy Scenario, Indian Energy Scenario-forecasting of Renewable Energy sources by 2030.

UNIT II SOLAR ENERGY AND IT'S APPLICATIONS — 9 hours

Introduction-Conversion of Solar energy into Electricity - Photovoltaic Effect, Solar photovoltaic cell and its working principle, Different types of Solar cells, Series and parallel connections, Introduction to Shading and tracking Mechanism- Photovoltaic applications: Battery chargers, domestic lighting, street lighting and water Pumping Solar Thermal Systems Principle of conversion of solar radiation into heat, Collectors used for solar thermal conversion: Flat plate collectors and Concentrating collectors-Maximum Energy Efficiency calculation.

UNIT III WIND ENERGY — 9 hours

Introduction to wind energy, Wind energy conversion principles, Components of wind energy Conversion Systems (WECS), Classification of WECS, Horizontal Axis Wind Turbine (HAWT) & Vertical Axis Wind Turbine (VAWT), stall Control, Pitch control, Yaw control-Power Developed, Maximum power coefficient (Betz Limit), Efficiency. Wind electric generators: Synchronous generators, Induction generators, Variable speed generators, DFIG.

UNIT IV TIDAL AND OCEAN ENERGY — 9 hours

Tidal Energy from tides and waves- working principles of tidal plants-tidal power generations.
Ocean Energy: Introduction, Principle of ocean thermal energy conversion (OTEC)-Structural diagram, Tidal power generation, Tidal energy technologies, Energy from waves, Wave energy conversion, Wave energy technologies, advantages and disadvantages.

UNIT V GEOTHERMAL ENERGY& BIOMASS ENERGY — 9 hours

Geothermal energy-principle of working of geothermal power plants-Types of Geothermal Energy - Applications.
Bio energy: Energy from bio mass-biogas plants-various types-industrial wastes-municipal wastes-burning plants-energy from the agricultural wastes- Gas production-industrial utility-application.

B. Tech Electrical and Electronics Engineering

Course Outcomes:

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

1. Understand the importance of Renewable energy resources.
2. Demonstrate the Generation of Electricity from Solar energy system.
3. Understand the Wind Energy Conversion system.
4. Illustrate the Tidal and Ocean Energy Power generation system.
5. Understand the role of geothermal Energy and biomass in the Energy generation.

Text Book(s)

1 Rai.G. D, "Non-conventional resources of energy", Khanna publishers, Fourth edition, 2010.

2 Khan.B.H, "Non-Conventional Energy Resources", The McGraw Hills, Second edition, 2009.

Reference Books

1 S.P. Sukhatme, Solar Energy, (principles of thermal collection and storage), Tata McGraw-Hill Publishers, Fourth print-February 1989

2 Garg. H.P, Prakash, Solar Energy, Tata McGraw Hill, New Delhi, 2000

3 Abbasi S.A, Abbasi Naseema, Renewable Energy Resources & Their Environmental Impact, Prentice Hall of India, 2001

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

B. Tech Electrical and Electronics Engineering

Honors

20HDEEE102 CONTROL SYSTEMS DESIGN

L	T	P	C
3	0	0	3

Pre-requisite 20EEE108

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 **9 hours**

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.

UNIT II DESIGN OF CLASSICAL CONTROL SYSTEM IN THE TIME DOMAIN **9 hours**

Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

UNIT III DESIGN OF CLASSICAL CONTROL SYSTEM IN FREQUENCY DOMAIN & DESIGN OF PID CONTROLLERS **9 hours**

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.

UNIT IV CONTROL SYSTEM DESIGN IN STATE SPACE **9 hours**

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.

UNIT V NONLINEARITIES AND ITS EFFECT ON SYSTEM PERFORMANCE **9 hours**

Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis.

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 Book(s)

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.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Honors

20HDEEE103 ELECTRICAL MACHINE DESIGN

L	T	P	C
3	0	0	3

Pre-requisite 20EEE104, 20EEE107

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 **9 hours**

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.

UNIT II TRANSFORMERS **9 hours**

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.

UNIT III INDUCTION MOTORS **9 hours**

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.

UNIT IV SYNCHRONOUS MACHINES **9 hours**

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.

UNIT V THREE-PHASE TRANSFORMER **9 hours**

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 complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

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Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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.

B. Tech Electrical and Electronics Engineering

Honors

20HDEEE104 SWITCHED MODE POWER CONVERTERS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE109

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 **9 hours**

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.

UNIT II CONTROL STRATEGIES OF DC - DC CONVERTERS **9 hours**

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.

UNIT III DC - AC CONVERTERS **9 hours**

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

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UNIT IV RESONANT CONVERTERS **9 hours**

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.

UNIT V MODELING OF SWITCHED MODE POWER CONVERTERS **9 hours**

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.

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Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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.

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Honors

20HDEEE105 FUZZY LOGIC, ANN AND INTRODUCTION TO GA

L	T	P	C
3	0	0	3

Pre-requisite 20EEE108

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 **7 hours**

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.

UNIT II FUZZY CONTROL BASICS **11 hours**

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.

UNIT III INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS **9 hours**

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.

UNIT IV NEURAL NETWORK ARCHITECTURE **11 hours**

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.

UNIT V INTRODUCTION TO GENETIC ALGORITHMS **7 hours**

Genetic Algorithms- basic structure-coding steps of GA, convergence characteristics, applications.

Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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.

B. Tech Electrical and Electronics Engineering

Honors

20HDEEE106 STATIC VAR COMPENSATION AND HARMONIC FILTERING

L	T	P	C
3	0	0	3

Pre-requisite 20EEE109

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 **9 hours**

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.

UNIT II REACTIVE POWER COMPENSATORS **9 hours**

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.

UNIT III CONVERTERS FOR STATIC COMPENSATION **9 hours**

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.

UNIT IV MULTI-LEVEL INVERTERS **9 hours**

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.

UNIT V PASSIVE AND ACTIVE HARMONIC FILTERING **9 hours**

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.

Course Outcomes:

Upon successful completion of the course, students will be able 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 Book(s)

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 Books

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.

B. Tech Electrical and Electronics Engineering

Honors

20HDEEE107 POWER SYSTEM DYNAMICS AND STABILITY

L	T	P	C
3	0	0	3

Pre-requisite 20EEE114

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:

This course enables students.

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 II INTRODUCTION TO POWER SYSTEM OPERATIONS AND ANALYSIS **9 hours**

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.

UNIT II MODELING OF SYNCHRONOUS MACHINES AND ASSOCIATED CONTROLLERS **9 hours**

Modeling of synchronous machine: Physical Characteristics. Rotor position dependent model. DQ 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.

UNIT III MODELING OF OTHER POWER SYSTEM COMPONENTS **9 hours**

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.

UNIT IV STABILITY ANALYSIS **9 hours**

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.

UNIT V ENHANCING SYSTEM STABILITY **9 hours**

Planning Measures. Stabilizing Controllers (Power System Stabilizers). Operational Measures Preventive Control. Emergency Control.

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Course Outcomes:

Upon successful completion of the course, students will be 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.

Textbook(s)

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.

B. Tech Electrical and Electronics Engineering

Honors

20HDEEE108 DIGITAL PROTECTIVE RELAYING

L	T	P	C
3	0	0	3

Pre-requisite 20EEE109, 20EEE114

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:

This course enables students.

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 9 hours

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.

UNIT II BASIC OF RELAY UNITS 9 hours

Basic relay units-sequence networks-fault sensing data processing units- FFT and Wavelet based algorithms Phase& Amplitude Comparators-. Duality - Zero Crossing / Level Detectors.

UNIT III RELAY SCHEMATICS AND ANALYSIS 9 hours

Relay Schematics and Analysis Over Current Relay- Instantaneous/Inverse Time –IDMT Characteristics; Directional Relays; Differential Relays- Restraining Characteristics; Distance Relays: Types- Characteristics

UNIT IV PROTECTION OF POWER SYSTEM EQUIPMENTS 9 hours

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-losing and synchronizing

UNIT V NUMERICAL RELAYS AND CHARACTERISTICS 9 hours

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.

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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.

Textbook(s)

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

Reference Books

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.

B. Tech Electrical and Electronics Engineering

Honors

20HDEEE109 POWER APPARATUS AND NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite 20EEE109, 20EEE114

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:

This course enables students

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 **9 hours**

Overview of power systems and changing landscape; sources of electrical energy and environmental consequences; the Indian power industry

UNIT II FUNDAMENTAL PRINCIPLES OF POWER NETWORKS **9 hours**

Magnetic prerequisites. Apparatus in power networks: transformers; synchronous generators; transmission lines, cables, HVDC; loads and power quality.

UNIT III ANALYSIS AND OPERATION **9 hours**

Power flow; rotor angle and voltage stability; control of large, interconnected power networks.

UNIT IV PROTECTION **9 hours**

Fault calculations, relay co-ordination and circuit breakers; transient over voltages, protection by surge arrestors, and insulation co-ordination.

UNIT V DEREGULATION **9 hours**

Management of vertical utilities, utility deregulation and open access: operational economics of the power industry, privatization; deregulation and energy markets.

Course Outcomes:

Upon successful completion of the course, students will be 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.

Textbook(s)

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.

Reference Books

1. W. D. Stevenson, Elements of power systems analysis, McGraw Hill International Book Company, fourth or subsequent editions.
2. Prabha Kundur, Power System Stability and Control, Tata McGraw-Hill, 2006

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

B. Tech Electrical and Electronics Engineering

Honors

20HDEEE601 DSP PROGRAMMING FOR ELECTRICAL ENGINEER

L	T	P	C
1	0	2	2

Pre-requisite 20ECE110

Course Description:

This course is designed to help the students in implementing basic DSP algorithms using DSP processor. This laboratory starts with the introduction of DSP processor Kit and its architecture. Followed by generation of signals using DSP Kit. Various convolutions are also studied and implemented using DSP Kit. Subsequently, design of IIR and FIR filters is illustrated for low-pass and high-pass filtering. Finite Word Length Effect is studied for as an application of DSP for multi rate digital signal processing.

Course Objectives:

1. Understand various digital signal processor's architecture and tools.
2. Ability to apply knowledge of mathematics, science and engineering: Generation of signals using DSP Kit
3. Implement various convolutions using DSP Kit.
4. Understand the basic concepts of discrete signal representation such as Fourier transforms, discrete time representations. And design and implementations of IIR and FIR filtering algorithms and structures.

Understand the concept of Multi-rate signal processing and sample rate conversion.

UNIT I STUDY OF DSP PROCESSOR AND ITS ARCHITECTURE 6 hours

Architecture and DSP tools, features and instructions of fixed point and floating point processors. (TMS 320C25 and TMS320300), Applications of DSP, basics of speech and image processing.

- Introduction to the Digital Signal Processing Kit (DSK) and the Code Composer Studio (CCS)
- MAC operation using various addressing modes

UNIT II REVIEW OF SIGNALS AND SYSTEMS 6 hours

Review of signals and systems: Z-Transformation, properties, Inverse Z-transformation; Transform analysis of LTI System. Basic Signals

- Generation of signals and sequences using TMS320C6713DSK

UNIT III DISCRETE FOURIER TRANSFORM 6 hours

Properties of DFT: Linearity, Circular shift of a sequence, Symmetry properties, Circular convolution, Linear Convolution using DFT

- Linear Convolution using DSP Kit

Circular Convolution using DSP Kit

UNIT IV IIR AND FIR FILTER DESIGN 6 hours

Design of IIR filters from analog filters, Design based on numerical solution of differential equations, bilinear transformations. Properties of FIR digital filters, Different types of windows: Rectangular, Barlett, Hanning, Hamming, Blackman and Kaiser windows, Design of FIR filters using above windows, A comparison of FIR and IIR filters.

- FFT Implementation using DSP Kit
- IIR & FIR Implementation using DSP Kit
-

UNIT V FINITE WORD LENGTH EFFECTS IN FIR AND IIR DIGITAL FILTERS: **6 hours**

Quantization, round off errors and overflow errors. Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators.

- Study of Finite Word Length Effect using DSP Kit

Course Outcomes:

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

1. Understand various DSP processor's architecture and tools.
2. Generate various signals using DSP Kit.
3. Realize various convolutions using DSP Kit.
4. Analyse spectrum of DT signals using transform domain mathematical tools such as DFT, FFT. And also Design and Realize IIR filters and FIR filters for Filtering Application
5. Analyse Multirate Structures for Sampling Rate Conversion (Interpolation, Decimation, Fractional Rate Conversion)

Textbook(s)

1. Sen M. Kuo, Woon-Seng S. Gan, "Digital Signal Processors – Architectures, Implementations and Applications", Pearson/Prentice Hall, 2005
2. Rulph Chassaing, Donald Reay, "Digital Signal Processing and Applications with TMS320C6713 and TMS320C6416 DSK", 2nd Edition, Wiley India, 2014.

Reference Books

1. S. K. Mitra, "Digital Signal Processing: A Computer based Approach", 4th Edition, McGraw Hill, 2013.
2. J. G. Proakis, D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, Pearson Education Asia/Prentice Hall of India, 2014.
3. Emmanuel Ifeachor, Barrie W. Jervis, "Digital Signal Processing: A Practical Approach", 2nd Edition, Pearson Education, 2002

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