DIT UNIVERSITY

Dehradun

Detailed Course Structure & Syllabus

of

B.Tech. – Electrical Engineering

(Fully Flexible Choice Based Credit System)

Approved by the Academic Council at its 14th Meeting held on 22.04.2020

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

Introduction

The Ministry of Human Resource Development (MHRD), Govt. of India, has initiated development of a New Education Policy (NEP) to bring out comprehensive reforms in the Indian education system.

The University Grants Commission (UGC) has subsequently initiated several steps to foster academic excellence through introduction of paradigm shift in learning and teaching pedagogy, innovation and improvement in course curricula, examination and education system.

While a majority of education institutions have started following the semester-based system of education, it has been observed that this new system is still producing graduates who lack knowledge, values, and skills and are not job ready professional. The reason for this lacking could be attributed to the rigidity of our program structures and lack of flexibility to have choices among core subject education, liberal arts, ability enhancement, skill development, etc., that is fundamental to overall development and employability of these graduates.

To make this possible, a fully flexible choice-based credit system (FFCBCS), a well-established internationally known system, is proposed. This fully flexible choice-based credit system allows students the flexibility to learn at their own pace, and register for both core subjects and a variety of courses from other areas, leading to holistic development of an individual. The FFCBCS will facilitate us to bench mark our programs with best international liberal arts based academic programs.

Advantages of the FFCBCS structure:

- Shift in focus from the teacher-centric to student-centric education. Student can curve out their program structure by choosing minimum number of credits from well-defined baskets.
- Student may undertake as many credits as they can cope with.
- FFCBCS allows students to choose courses from various baskets of inter-disciplinary, intra-disciplinary, skill oriented, ability enhancing, and from other disciplines.

Features unique to DIT University FFCBCS structure

1. A minimum of 150-160 credits has to be earned by a student to be eligible for an Under Graduate degree in Engineering. Each department will decide their total credits for each program, and it can vary across disciplines.

2. Courses are categorized into 11 baskets, and a student will have the option to choose courses in most baskets and earn ***minimum number of credits*** required in each basket for the award of his/her degree. For each basket, Engineering departments have the flexibility to identify course(s) which will be a core requirement for their program.

3. In certain disciplines, students may choose a ***Specialization*** by earning 18 credits of Discipline Elective courses towards a particular area of that discipline (intradisciplinary). In addition to this, brighter students will have the option to receive (a) a ***Certificate***by earning *additional* 9 credits towards a particular area either inside or outside their discipline, or (b) ***Minor*** by earning additional 18 credits towards a particular area outside their discipline. Certificates and Minors can be earned through either University courses, or with MOOCs from providers as identified by the University. Each department will design the structures and eligibility conditions for registration to its certificates or minor program, which may be reviewed annually, to keep the ***Certificates*** and ***Minors*** contemporary and relevant to latest changes.

4. An FFCBCS council may be formed comprising all HoDs and one representative each from respective departments. FFCBCS council will meet at the end of every semester after the completion

of Board of Examination meeting to discuss and finalize course offerings by respective departments in the upcoming semester. FFCBCS council will be chaired by the Dean Academic Affairs.

5. To provide sufficient flexibility and room during the program for additional ***Certificates***, ***Specializations, and Minors***, 8-week summer semesters (Summer 1, Summer 2, and Summer 3) may have to run. Summer semesters are critical for implementing a fully flexible system. Each department will decide *a priori* which courses to offer in the summer semester and get them finalized at the FFCBCS council meeting.

6. Project based learning has to be incorporated as a core component of evaluation in each course, and depending on the level and type of the course, the project can be of several types - Study Oriented Project, Lab Oriented Project, Design Oriented Project, Computer Oriented Project, Projects of Organizational Aspects, Research Projects, or Entrepreneurship and Start Up Projects. A Capstone Project has been introduced in the 8th semester for all Bachelor of Technology students.

7. Courses under each basket may be updated on an annual basis.

8. Each student will be advised by a faculty advisor of his/her department for registration of courses from each basket in the beginning of semester, depending upon the availability of seats. A student advising centre may be formed where students will have access to department faculty advisers. Faculty advisers should have complete access to view individual student's academic transcript for advising purposes.

9. A student getting an F grade in a core course (departmental or otherwise) at the end of the semester will have to earn those credits by registering for the same course whenever it is offered in subsequent semesters. If the course is not a core course, the student may choose to register for any other course next semester in that basket as advised by the department faculty adviser. Additional fees for those number of credits may apply.

10. Students may opt for summer training/internships/industrial tours as advised by the department. However, these activities will not have credits.

Baskets of FFCBCS

11 baskets of courses have been identified to provide student comprehensive exposure to a large number of areas, leading to the holistic development of an individual. These baskets are as follows:

1. **Language and Literature:** These include courses related to English or other popular languages worldwide, communication skills, and literature. These courses are of 3 credits each.
2. **Core Science:** These courses include science courses from the disciplines of Physics and Chemistry. These courses are of 5 credits each.
3. **Core Mathematics:** This basket includes courses from Mathematics department, crafted for engineering students. These courses are of 4 credits each.
4. **Engineering Sciences:** This basket includes introductory courses from various disciplines of Engineering designed to provide the student solid foundation to the domain of engineering. These courses are of 4 credits each.
5. **Discipline Core:** This basket includes compulsory courses in the discipline in which the student is admitted to the University. These courses are of 4 credits each.
6. **Discipline Elective:** This basket provides students courses other than discipline core, and are normally in certain specialized areas. These courses are of 3 credits each.
7. **Humanities and Liberal Arts:** This basket includes liberal arts courses in various disciplines like psychology, management, economics, etc., and are of 3 credits each.

8. **Skill Enhancement:** Courses in this basket are primarily hands-on and aims to allow students acquire skills required in certain disciplines that are currently in high demand in the job market. These courses are of 2 credits each.
9. **Ability Enhancement:** These coursesaim to enhance knowledge and ability of an individual in certain required areas related to national and societal interest. Courses in this basket are of 2 credits each.
10. **Free Electives:** Student can register for any three courses outside their department of his/her choice. These courses can also be taken from MOOCs, and Courses in this basket are of 3 credits each.
11. **Capstone Project:** Capstone project is a semester long multifaceted experimental/research assignment that serves as a culminating academic and intellectual experience for students, taken in the last semester of study. It is of 12 credits and may be done groups of not more than three students, and in three modes as follows:
    - **Mode A**: Project with a department faculty.
    - **Mode B**: Project as part of Industry Internship arranged only by the career and placement service of the University. Students securing this assignment on their own will not be allowed, unless the project is secured at a well-known industry, and duly approved by the department. The department's decision in all such cases will be final.
    - **Mode C**: Semester long project in an academic institute/lab of National/International Importance, secured by students on their own. The department's decision to allow in all such cases will be final.

A separate rule booklet will be released for implementation of Capstone Project.

DIT University FFCBCS

Basket/Area	DIT Credits
Language and Literature (LL)	6
Core Sciences (CAS)	10
Core Mathematics (CM)	12
Engineering Sciences (ES)	20
Discipline Core (DC)	48
Discipline Elective (DE)	21
Humanities and Social Sciences (HSS)	6
Skill Enhancement Courses (SEC)	8
Ability Enhancement Courses (AEC)	8
Free Electives (FE)	9
Projects (PRJ)	12
Total	**160**

Course Structure & Syllabus of B.Tech.– Electrical Engineering
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Structure of the Undergraduate program in Electrical Engineering

Basket/Area	Min Credits To be taken	Credit per course	Courses
Language and Literature (LL) Core: Professional Communication Elective: Choose any 1 more LL course	6	3	2
Core Sciences (CAS) Core: Wave & Optics and Introduction to Quantum Mechanics, Elective: Choose any one more Core science	10	5	2
Core Mathematics (CM) Core: Engineering Mathematics I, Engineering Mathematics II & Engineering Mathematics III Elective: None	12	4	3
Engineering Sciences (ES) Core: Programming for Problem Solving, Basic Electrical Engineering, Fundamentals of Electronics Engineering, Data Structures Elective: Choose any 1 more ES Course	20	4	5
Discipline Core (DC) Core: EM & WP, CAS, EMEC-I, ADE, M&I, EMEC-II, EPS,PSA, , Control System, SGP, Electric Drives, Elective: None	48	4	12
Discipline Elective (DE) Core: None Elective: Choose 6 as per the prerequisites	21	3	7
Humanities and Social Sciences (HSS) Core: Principles of Management Elective: Choose any 1 HSS course	6	3	2
Skill Enhancement Courses (SEC) Core: None Elective: Choose any 2 SEC Course	8	4	2
Ability Enhancement Courses (AEC)	8	2	4
Free Electives (FE) Core: None Elective: Choose any 3 courses across University course offerings	9	3	3
Thesis Project (TP) Mode A: Project with a department faculty Mode B: Project as part of Industry Internship Mode C: Project in an academic institute/lab of National Importance. All Modes must be semester long	12	12	1
Mandatory Non Credit Courses - Environmental Science, Induction Training,	0		
Total Credits	**160**		

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Course Structure & Syllabus of B.Tech.– Electrical Engineering
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Course Baskets: University FFCBCS Baskets (other than DC/DE) for B.Tech Programs. A * against a course means it is a core course for all B.Tech students.

Course Code	FFCBCS Baskets (other than DC/DE)				
	Language and Literature (min 6 credits to be taken)	**Credits**			
	Name of Courses	L	T	P	C
LAF181	Professional Communication*	2	0	2	3
LAF182	Indian English Literature	3	0	0	3
LAF183	English Language Teaching	3	0	0	3
	Core Sciences (min 10 credits to be taken)				
	Name of Courses	L	T	P	C
CHF101	Engineering Chemistry (For CS/IT/EE/ECE)	3	1	2	5
CHF102	Applied Engineering Chemistry (for ME/CE/PE)	3	1	2	5
PYF101	Wave & Optics and Introduction to Quantum Mechanics*	3	1	2	5
PYF102	Introduction to Mechanics	3	1	2	5
PYF103	Electricity & Magnetism	3	1	2	5
	Core Mathematics (min 12 credits to be taken)				
	Name of Courses	L	T	P	C
MAF101	Engineering Mathematics I *	3	1	0	4
MAF102	Engineering Mathematics II*	3	1	0	4
MAF201	Engineering Mathematics III (EE, ME, CE)	3	1	0	4
MAF202	Probability and Statistics (CSE, IT, ECE, PE)	3	1	0	4
	Engineering Sciences (min 20 credits to be taken)				
	Name of Courses	L	T	P	C
ECF101	Fundamental of Electronics Engineering.*	3	0	2	4
EEF101	Basic Electrical Engineering *	3	0	2	4
EEF143	Electrical and Electronics Engineering Practice (non EE/EECE)	3	0	2	4
MEF101	Thermodynamics	3	1	0	4
CSF101	Programming for Problem Solving*	3	0	2	4
CSF102	Data Structures*	3	0	2	4
MEF102	Engineering Graphics	2	0	4	4
MEF103	Engineering Mechanics	2	1	2	4
MEF201	Mechanical Engineering Materials	3	0	2	4
PEF204	Fluid Mechanics	3	0	2	4
EEF141	Electrical Engineering Materials	3	1	0	4
ECF142	Fundamental of Semiconductor Electronics	3	1	0	4
	Skill Enhancement (min 8 credits to be taken)				
	Name of Courses	L	T	P	C
EEFXXX	Technical Training 1	0	0	4	2
EEFXXX	Technical Training 2	0	0	4	2

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EEFXXX	Value Added Training 1	0	0	4	2
EEFXXX	Value Added Training 2	0	0	4	2
SWAYXXX	MOOCS Courses (as advised by the departments)	2	0	0	0
	Ability Enhancement (min 8 credits to be taken)				
	Name of Courses	L	T	P	C
CHF201	Environmental Science*	2	0	0	2
LAF285	Indian Constitution*	2	0	0	2
MEF483	Entrepreneurship and Start-ups*	0	0	4	2
UCF201	Aptitude and Soft Skills*	2	0	0	2
	Humanities and Liberal Arts (min 6 credits to be taken)				
	Name of Courses	L	T	P	C
LAF281	Introduction to Psychology	3	0	0	3
LAF381	Positive Psychology & Living	3	0	0	3
LAF481	Application of Psychology	3	0	0	3
LAF282	Human Values	3	0	0	3
LAF283	Literature, Language & Society	3	0	0	3
LAF284	Principles of Management	3	0	0	3
LAF482	Intellectual Property Rights	3	0	0	3
LAF382	Engineering Economics	3	0	0	3
	Free Electives (min 9 credits to be taken)				
	Name of Courses	L	T	P	C
EEF343	MATLAB for Engineers	1	0	4	3
EEF342	Energy Management System	3	0	0	3
EEF354	New and Renewable Energy Sources	3	0	0	3
EEF455	Optimization Techniques	2	0	2	3
EEF457	ANN & Fuzzy Logic	2	0	2	3
EEF458	Solar PV System	3	0	0	3
EEF459	Basic Instrumentation & Process Control	3	0	0	3
ECF481	Analog Electronics (ECE)	2	0	2	3
ECF482	Cellular Communication Network (ECE)	2	0	2	3
ECF381	Microcontroller (ECE)	2	0	2	3
ECF382	Bio Medical Instrumentation (ECE)	2	0	2	3
ECF483	Digital Image processing (ECE)	2	0	2	3
CSF381	Software Project Management	3	0	0	3
CSF345	Introduction to Data Science	3	0	0	3
CSF482	Introduction to Cybersecurity	3	0	0	3
MEF381	Composites materials	3	0	0	3
MEF481	Total Quality Management	3	0	0	3
MEF482	Renewable Energy Sources	3	0	0	3
PEF 381	Carbon Capture and Sequestration	3	0	0	3

PEF 491	Polymer Technology		3	0	0	3
PEF 492	Health, Safety and Environment in Industry		3	0	0	3
CEF281	Properties of Materials		3	0	0	3
CEF382	Disaster Preparedness Planning & Management		3	0	0	3
CEF481	Environmental Management & Sustainability		3	0	0	3
CEF482	Natural Dynamics		3	0	0	3
CEF483	GIS		3	0	0	3
CEF484	Resource Dynamics and Economic Implications		3	0	0	3
	Project (12 credits)					
UCF439	Capstone Project		0	0	24	12
	Discipline Core (48 credits)					
	Name of Courses	**Pre-Requisite**				
ECF205	EM and WP	None	3	1	0	4
ECF209	Analog & Digital Electronics	FEE	3	0	2	4
EEF201	Circuit Analysis & Synthesis	BEE, Maths I, Maths II	3	0	2	4
EEF202	Electromechanical Energy Conversion - I	BEE	3	0	2	4
EEF203	Measurements & Instrumentation	BEE	3	0	2	4
EEF204	Electromechanical Energy Conversion - II	BEE, EMEC-I	3	0	2	4
EEF205	Elements of Power System	None	3	0	2	4
EEF301	Power System Analysis	EPS, EMEC-I	3	0	2	4
EEF303	Control System	CAS, Signal & Systems	3	0	2	4
EEF304	Power Electronics	ADE	3	0	2	4
EEF305	Switchgear and Protection	EMEC-I, EPS	3	0	2	4
EEF401	Electric Drives	EMEC-I, EMEC-II, PE	3	0	2	4
	Discipline Electives (21 credits)					
	Name of Courses	**Pre-Requisite**				
EEF251	Signal & Systems	None	3	0	0	3
EEF252	Electrical Power Generation	None	3	0	0	3
ECF348	Biomedical Instrumentation	None	2	0	2	3
EEF341	Solar Thermal System	None	3	0	0	3
EEF 342	Electric Power Generation	EMEC-I, EMEC-II	3	0	0	3
EEF343	MATLAB for Engineers	None	1	0	4	3
EEF344	Wind and Solar Energy System	Basic Physics,EMEC-1	2	0	2	3
EEF345	Power Station Practice	EPS, EMEC-I	3	0	0	3
EEF346	Special Electrical Machine	None	3	0	0	3
EEF347	Transducers and Instrumentation	EPS	2	0	2	3
EEF348	Industrial Electrical Systems	Control System	3	0	0	3
EEF349	Digital Control System	Signal & Systems	3	0	0	3
EEF350	Dynamic System Analysis	None	3	0	0	3
EEF351	Non Conventional Energy Resources	None	3	0	0	3
EEF352	Reliability Engineering	None	3	0	0	3
EEF353	Introduction to Artificial Intelligence	None	3	0	0	3
EEF354	New and Renewable Energy Sources	BEE, EMEC- I	3	0	0	3

EEF355	Utilization of Electrical Energy & Traction	PSA	3	0	0	3
EEF357	Microprocessor	ADE	2	0	2	3
EEF441	Computer Methods in Power System Analysis	EPS, PSA, PSOC	2	0	2	3
EEF442	Digital Simulation of Power System	Basic Phy, EPS,	3	0	0	3
EEF443	EHV A.C. & D.C. Transmission	None	3	0	0	3
EEF444	Electrical Energy Conservation and Auditing	EMFT, EPS, EMEC-I & II	3	0	0	3
EEF445	High Voltage Engineering	None	3	0	0	3
EEF446	Power System Deregulation	EPS, EMEC-I, Control System	3	0	0	3
EEF447	Power System Operation & Control	EPS	3	0	0	3
EEF448	Power Quality	PE	3	0	0	3
EEF449	Power Semiconductor Controllers	M&I, Transducers	2	0	2	3
EEF450	Digital Instrumentation Techniques	M&I, Transducers	3	0	0	3
EEF451	Instrumentation for Solar Energy System	None	3	0	0	3
EEF452	Power System Stability	None	3	0	0	3
EEF453	Wind & Small Hydro Plant (SHP)Energy System	None	3	0	0	3
EEF454	Automotive Electronics	None	3	0	0	3
EEF455	Optimization Techniques	Control System	2	0	2	3
EEF456	Modern Control System	None	2	0	2	3
EEF457	ANN & Fuzzy Logic	None	2	0	2	3
EEF458	Solar PV System	None	3	0	0	3
EEF459	Basic Instrumentation & Process Control	None	3	0	0	3
EEF460	Electrical Machine Design	EMEC-I, EMEC-II	2	0	2	3
EEF461	Solar Thermal Systems	None	3	0	0	3

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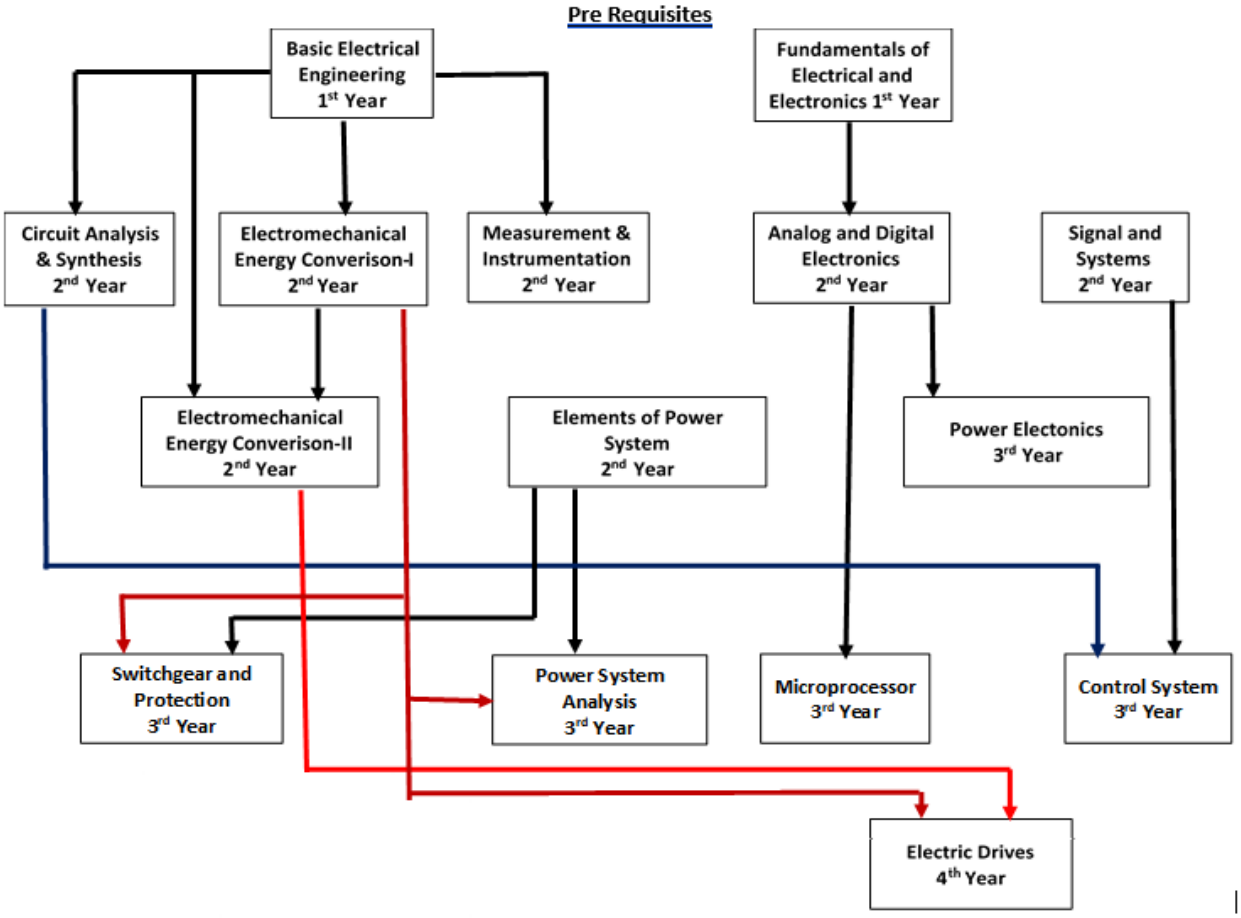

Flow of Actions for implementing FFCBCS every semester

After release of Final Exam results, FFCBCS council meets to decide & finalize course offerings in each basket

⬇

Courses are created in ERP and in LMS with required number of seats

⬇

Registrar announces the date for Registration

⬇

Students get advised and registers for courses in the Student Advising Centre

⬇

List of students gets added in LMS

⬇

Class Starts

Approved by the Academic Council at its 14th Meeting held on 22.04.2020

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UNDERGRADUATE COURSE DESCRIPTION DOCUMENT

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF181**
3. Course Title	**Professional Communication**
4. Credits (L:T:P:C)	**2:0:2:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Language and Literature**

8. Course Summary

This course is to enhance the Communication Skills of the students. It also focuses on Basic facets of communication. It introduces the students to LSRW and Non-verbal Language and how to master these aspects to be an effective communicator.

9. Course Objectives

The course aims at developing the LSRW skills of students for effective communication. Also to equip them for a business environment. It also focusses at preparing the students understand and present themselves effectively.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Communicate smoothly
2. Greater self-confidence and knowledge of life skills helps them to develop healthier interpersonal relationships.
3. Present themselves effectively
4. Prepares the students to face future challenges and excel in their personal and professional lives.

11. Curriculum Content

Unit 1: Communication

Communication: Meaning, Types of Communication: General & Technical Communication Knowledge and adoption of Non Verbal cues of communication: Kinesics, Proxemics, Chronemics, Oculesics, Haptics, Paralinguistics, Barriers to Communication, Overcoming strategies.

Unit 2: Listening & Speaking Skills

Listening Comprehension: identifying General & Specific information, Note taking and drawing inferences

Introduction to Phonetics: Articulation of consonants and vowel sounds.

Unit 3: Reading Skills & Technical Writing Skills

Reading Strategies and Vocabulary Building Reading Comprehension, Paragraph development, Intra office Correspondence: Notice, Agenda, Minutes and Memorandum Technical Proposal & Report

Unit 4: Communication at Work

Business Letter Writing, Job Application Letter & Resume, Interview Skills, Impression Management, SWOT Analysis (Identifying Strength & Weakness), EQ and Its Dimensions

Textbook(s)

1. Rizvi, Ashraf. Effective Technical Communication, McGraw Hill, New Delhi. 2005.
2. Raman, Meenakshi and Sangeeta Sharma,. Technical Communication: Principles and Practice, 2nd Edition. New Delhi: Oxford University Press. 2011.

Reference Books

1. Aslam, Mohammad. Introduction to English Phonetics and Phonology Cambridge.2003.
2. Ford A, Ruther. Basic Communication Skills; Pearson Education, New Delhi.2013.
3. Gupta, Ruby. Basic Technical Communication, Cambridge University Press, New Delhi.2012.
4. Kameswari, Y. Successful Career Soft Skills and Business English, BS Publications,
5. Hyderabad.2010.
6. Tyagi, Kavita& Padma Misra. Basic Technical Communication, PHI, New Delhi. 2011.
7. Ghosh, B. N. Managing Soft skills for Personality development,Laxmi Publications Ltd., New Delhi, 2013.
8. Elizabeth B. Hurlock. Personality Development , TMH Publication,2010

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Assignments, Class Tests etc. will be done. Various teaching methods like Discussion Method, Case Study Method and Lecture Method will be adopted.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
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1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF182**
3. Course Title	**Indian English Literature**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Language and Literature**

8. Course Summary

- Indian English Literature is an honest enterprise to demonstrate the ever rare gems of Indian Writing in English. From being a singular and exceptional, rather gradual native flare – up of geniuses, Indian Writing has turned out to be a new form of Indian culture and voice in which India converses regularly. This course will introduce various authors and will help to understand the role of literature in reflecting the social context and the shaping of a young nation.

9. Course Objectives

- The course will enable the students to understand the level of Indian English Literature.
- It will also enable the students to understand different genres such as prose, poetry, and fiction in Indian Writers in English.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

Course Outcome:

- The students will develop an insight into Indian literature.
- The students will learn to appreciate different genres of literature of Indian Literature in English.
- The students will understand the role of literature in reflecting the social context and the shaping of a young nation.
- The students will demonstrate knowledge and comprehension of major texts and traditions of language and literature written in English as well as their social, cultural, theoretical, and historical contexts.

11. Curriculum Content

Unit 1

Prose

APJ Abdul Kalam: Unity of Minds

Swami Vivekananda: The Cosmos-Macrocosm

Mahatma Gandhi: Hind Swaraj, What is Civilization? (Chapter XIII) Education (Chapter XVIII)

Unit II

Poetry

Toru Dutt:	Our Casuarina Tree
Rabindranath Tagore:	Geetanjali – Where the mind is without fear
Sri Arbindo:	Stone Goddess
Sarojani Naidu:	Life
Nissim Ezekiel:	The Night of Scorpion
Kamla Das:	An Introduction

Unit III

Short Stories

R.N.Tagore:	Kabuliwala
Mulk Raj Anand:	Duty
R.K. Narayan:	An Astrologer's Day
NayantaraSehgal:	Martand

Unit IV

Novel

Ruskin Bond: Flights of Pigeons

Textbook(s).

1. Kumar, Shiv K. (ed),Contemporary Indian Short Stories in English, 2007 SahityaAkademi.
2. Anand, Mulk Raj; SarosCowasjee (ed.);Selected Short StoriesPenguin Books, 2006
3. Bond, Ruskin. Flights of Pigeons, Penguin Books, 2003

Reference Books

1. Tagore, Rabindra. *Nationalism*. Delhi: Rupa Publications, 1992.Print.
2. Chinhade, Sirish. *Five Indian English Poets*. New Delhi: Atlantic Publishers and Distributors, 1996.Print.
3. Naik, M.K. *A History of Indian English Literature*. New Delhi: SahityaAkademi, 2004.Print.

4. Agrawal, K.A. Ed. *Indian Writing In English: A Critical Study*. Atlantic Publishers &Dist, 2003.Print.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF183**
3. Course Title	**English Language Teaching (ELT)**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Language and Literature**

8. Course Summary

This course will offer a historical perspective to the teaching of English as a second language. It will trace the changes in language teaching methods throughout history depending on changes in the kind of proficiency learners need. It includes the different approaches used over the years and their application in teaching English as a second language in the classroom. It also traces the status of English language and the 'World English' and how it affects the teaching of English.

9. Course Objectives

To introduce students to the nature of English language learning and its theoretical implications. The main objective of the course is to enable students to evaluate a variety of language learning methods and approaches. It also aims to empower students to understand ELT in their contexts of language learning.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students will learn about communicative approaches to English language teaching.
2. Be able to understand the theories and methodologies of ELT
3. Be able to explore core components of communicative language teaching
4. Students will learn to apply ELT theories

11. Curriculum Content

Unit 1

Historical Perspective , ELT and its beginnings: development of reading approach, oral method and audio-lingual method

Unit 2

Communicative Language Teaching (CLT): the concept of 'communicative competence; ESL in India: a historical trajectory

Unit 3

Halliday's notion of 'transitivity' and 'meta-functions'

Corpus Linguistics ELT: corpus studies and how it can be used for language teaching

Unit 4

'World English' and ELT, Model of the 'Concentric Circles' and its impact on ELT

Textbook(s)

1. Maybin, Janet and Swann, Joan. (2009). The Routledge Companion to English Language Studies. London: Routledge, Print

Reference Books

1. Richards, J. & T.S. Rogers. (1986). Approaches and Methods in Language Teaching. Cambridge: Cambridge University Press, Print.
2. Ur, Penny. (1996). A Course in Language Teaching: Practice and Theory. Cambridge: Cambridge University Press, Print.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

1. Department offering the course	**Physics**
2. Course Code	**PYF101**
3. Course Title	**Wave & Optics and Introduction to Quantum Mechanics**
4. Credits (L:T:P:C)	**3:1:2:5**
5. Contact Hours (L:T:P)	**3:1:2**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Core Sciences**

8. Course Summary

9. Course Objectives

The objective of this course is to develop a fundamental basis of waves, optical phenomenon, concepts of quantum mechanics and semiconductor physics which the engineering students can apply to their respective area of specialization.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. To acquire skills allowing the student to identify and apply formulas of optics and wave physics using course literature.
2.To be able to identify and illustrate physical concepts and terminology used in optics and to be able to explain them in appropriate detail.
3. To be able to make approximate judgments about optical and other wave phenomena when necessary.
4. To acquire skills allowing the student to organize and plan simpler laboratory course experiments and to prepare an associated oral and written report.
5. To have basic knowledge of Quantum Mechanics and Semiconductors.Curriculum Content

Unit 1:

Mechanical and electrical simple harmonic oscillators (characteristics and energy), damped harmonic oscillator, forced mechanical and electrical oscillators, impedance.

Unit 2:

Transverse wave on a string, the wave equation on a string, harmonic waves, reflection and transmission of waves at a boundary, standing waves and their eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves (Newton formula and Laplace correction).

Unit 3:

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, fringes with white light, interference in parallel thin films, Newton's rings, Fraunhofer diffraction from a single slit & N- slits, Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Unit 4:

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, components of LASER and pumping methods (in brief), different types of lasers: gas

lasers (He-Ne), solid-state laser (ruby)

Unit 5:

Wave nature of particles, Phase velocity, wave-packet and group velocity, Uncertainty principle and its applications, time-dependent and time-independent Schrodinger equation, physical significance of wave function., Solution of stationary-state Schrodinger equation for one dimensional problem–particle in a box, potential barrier.

Textbook(s)

1. N. K Bajaj, Physics of Waves and Oscillations,Tata McGraw-Hill, 2008
2. AjoyGhatak, Optics, McGraw Hill Education, 2017.
3. D. J. Griffiths, Quantum mechanics, Pearson Education, 2015.

Reference Books

1.H. J. Pain, The physics of vibrations and waves, Wiley, 2008

2.E. Hecht, Optics, Pearson Education, 2008

SR.NO.	LIST OF EXPERIMENTS
1	(a) To determine wavelength of sodium light using Newton's Rings. (b) To determine the refractive index of a liquid using Newton's Rings.
2	To determine wavelength of sodium light using Fresnel's Biprism.
3	(a) To determine wavelength of prominent lines of mercury using plane diffraction grating. (b) To determine the dispersive power of a plane transmission diffraction grating.
4	To determine the specific rotation of cane sugar solution using bi-quartz polarimeter
5	To study the diffraction pattern of Single slit and hence determine the slit width.
6	(a) To verify cosine square law (Malus Law) for plane polarized light. (b) To study the nature of polarization using a quarter wave plate.
7	To study the variation of refractive index of the material of the prism with wavelength and to verify Cauchy's dispersion formula
8	(a) To study photoelectric effect and determine the value of Planck's constant. (b) To verify inverse square law using photocell.
9	To determine the frequency of AC mains using sonometer.
10	To determine the frequency of AC mains or of an electric vibrator by Melde's experiment
11	To measure the numerical aperture (NA) of an optical fiber.

11. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Assignments, Class Tests etc. will be done. Various teaching methods like Discussion Method, and Lecture Method will be adopted.

1. Department offering the course	**Physics**
2. Course Code	**PYF102**
3. Course Title	**Introduction to Mechanics**
4. Credits (L:T:P:C)	**3:1:2:5**
5. Contact Hours (L:T:P)	**3:1:2**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Core Sciences**

8. Course Objectives

Mechanics lies at the foundation of physics and along with an appreciation of the molecular structure of matter exposes the student to the phenomenology of physics.

9. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. To know Newton's laws of motion, potentials, conservation of energy, momentum and angular momentum, and be able to apply them to projectiles, circular motion, and gravity
2. Demonstrate an understanding of intermediate mechanics topics such as co-ordinate transformations, oscillatory motion, gravitation etc.
3. Demonstrate rigid body and rotational dynamics using the concept of angular velocity and momentum.
4. Understand the concept of non-inertial frames of reference, coriolis and centripetal accelerations and their applications.
5. Understand the concept of elastic constants and demonstrate bending of beams.

10. Curriculum Content

Unit 1:

Transformation of scalars and vectors under Rotation transformation; Newton's laws and its completeness in describing particle motion, Cylindrical and spherical coordinatesMechanics of a system of particles, conservation of laws of linear momentum, angular momentum and mechanical energy, centre of mass and equation of motion, Constraints and degrees of freedom.

Unit 2:

Potential energy function; F = - Grad V, Equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum and areal velocity; Elliptical, parabolic and hyperbolic orbits

Unit 3:

Non-inertial frames of reference; Rotating frames of reference, Coriolis force; Applications: Weather systems, projectile motion

Unit 4:

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped

oscillators; Forced oscillations and resonance, Kater's Pendulum and bar pendulum.

Unit 5:

Rotation of rigid body, Moment of Inertia, Torque, angular momentum, kinetic energy of rotation, Theorems of perpendicular and parallel axis, Moment of Inertia of rectangular rod, spherical and cylindrical bodies. Acceleration of a body moving on horizontal and inclined plane. Moment of inertia of Fly Wheel.

Unit 6:

Elastic constants- Introduction and relationship between elastic constants, Cantilever, Beam, Bending of beam, Twisting of a cylindrical body.

Textbook(s)

1. Mechanics – D.S. Mathur, S. Chand & Co., 2012.
2. Introduction to Mechanics –D.Kleppner&R.Kolenkow, Cambridge University Press, 2017

Reference Books

1. Analytical Mechanics, G.R. Fowles and G.L. Cassiday., Cengage Learning India Pvt. Ltd., 2006
2. Introduction to Special Relativity, R. Resnick, John Wiley and Sons, 2007
3. Principles of Mechanics — J.L. Synge & B.A. Griffiths, Andesite Press, 2015

SR.NO.	LIST OF EXPERIMENTS
1	To measure internal diameter, external diameter and depth of a vessel using vernier calipers
2	To measure density of a wire using screw gauge.
3	To determine the Moment of Inertia of a Flywheel
4	To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method)
5	To determine the Modulus of Rigidity of a Wire by Maxwell's needle
6	To determine the elastic Constants of a wire by Searle's method
7	To determine the value of g using Bar Pendulum
8	To measure the Young's Modulus using Bending of Beam
9	To determine the value of g using Kater's Pendulum
10	To determine the moment of inertia of a body using Torsion pendulum

11. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Assignments, Class Tests etc. will be done. Various teaching methods like Discussion Method, and Lecture Method will be adopted.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Physics**
2. Course Code	**PYF104**
3. Course Title	**Introduction to Electromagnetic Theory**
4. Credits (L:T:P:C)	**3:1:2:5**
5. Contact Hours (L:T:P)	**3:1:2**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Core Sciences**

8. Course Summary

9. Course Objectives

To teach students the effects of electric charges at rest and in motion. Both positive and negative charges produce force field which is called “electric field”. Moving charges produce current, which gives rise to another force field called “magnetic field”. The electromagnetic theory studies the behavior of the electric and magnetic fields.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. The use of Coulomb's law and Gauss' law for the electrostatic force
2. The relationship between electrostatic field and electrostatic potential
3. The use of the Lorentz force law for the magnetic force
4. The use of Ampere's law to calculate magnetic fields
5. The use of Faraday's law in induction problems
6. The basic laws that underlie the properties of electric circuit elements

Unit 1: Electrostatics in vacuum

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Gauss law and its applications, Laplace’s and Poisson’s equations; Practical examples like Faraday’s cage and coffee-ring effect; energy of a charge distribution and its expression in terms of electric field.

Unit 2: Electrostatics in a linear dielectric medium

Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; gauss law in dielectrics; Polarization vector, solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field. Energy in dielectrics system

Unit 3:Magnetostatics

Electric current and current density, magnetic force, continuity equation, Bio-Savart law and its applications(straight wire and solenoid), Divergence and curl of static magnetic field; Ampere circuital law

and its applications(wire, solenoid & toroid), current loop as magnetic dipole and dipole moment, Para, dia and ferro magnetic materials (properties only)

Unit 4: Faraday's law

Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field.

Unit 5: Displacement current, Magnetic field due to time-dependent electric field and Maxwell's equations

Concept of displace current, Modifying equation for the curl of magnetic field to satisfy continuity equation; and magnetic field arising from time-dependent electric field; Maxwell's equation in integral and differential form in vacuum and non-conducting medium; transverse nature of EM wave, Wave equation in free space, Wave propagation in conducting medium and non conducting medium & skin depth, Flow of energy and Poynting vector.

Textbook(s)

1. David Griffiths, Introduction to Electrodynamics, PHI Learning, 2012.

Reference Books

1. Halliday and Resnick, Physics, Wiley, 2013.
2. W. Saslow, Electricity, Magnetism and Light,Academic Press, 2002.

SR.NO.	LIST OF EXPERIMENTS (ANY TEN)
1	Identification of various electronic components.
2	Use of multimeter for testing diodes, LEDs, transistors and measurements of resistance, capacitance, inductance, dc voltage, dc current, ac voltage, ac current and frequency of ac mains.
3	Charging and discharging of capacitor through resistance and determination of time constant.
4	To determine the specific resistance of a given wire using Carey Foster's bridge.
5	To verify Stefan's law by electrical method.
6	To study the variation of magnetic field with distance along the axis of a current carrying coil and determination of radius of the coil.
7	To calibrate the given voltmeter using potentiometer.
8	To calibrate the given ammeter using potentiometer.

9	To determine the bandgap of a semiconductor p-n junction.
10	To determine the resistance of a sample using four probe method.
11	To determine the band gap of semiconductor using four probe method.
12	To determine a unknown resistance using Wheatstone bridge.

11. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Assignments, Class Tests etc. will be done. Various teaching methods like Discussion Method, and Lecture Method will be adopted.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Department of Chemistry**
2. Course Code	**CHF101**
3. Course Title	**Engineering Chemistry**
4. Credits (L:T:P:C)	**3:1:1:5**
5. Contact Hours (L:T:P)	**3:1:2**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Core Science Elective**

8. **Course Summary:** It covers fundamentals of Chemistry required for the engineering students.

9. Course Objectives: The objective of the course is to provide a summery on water treatment, Fuels, green chemistry and synthetic chemistry. The course is specifically designed for CSE& IT students to give them an overview of the working principles, mechanisms, reactions and applications of the building blocks of batteries, cells and surface coatings to protect the metal.

10. Course Outcomes:

At the end of the course student will get:

CO1: To understand about the treatment of water, sewage water and hardness related calculations.

CO2: An overview of of the working principles, mechanism of reactions and applications of cells, electrodes and batteries.

CO3: An overview of different types, mechanism of corrosion its prevention and surface coatings.

CO4: The concept of different types of fuel, lubricants. They will understand about their applications in various industries and also about latest development in the field of alternative fuels.

CO5: aware of how chemical processes can be designed, developed and run in a sustainable way. Students acquire the competence to think of chemistry as a sustainable activity.

11. Curriculum Content:

Unit 1: Water Treatment and Analysis **(08 Lectures)**

Standards for drinking water, Water Quality parameters, Determination of alkalinity of water, Hardness of water: Units and determination. Demineralization of water, softening of water: Lime-soda Process, Ion exchange process, Zeolite process and RO process. Internal conditioning methods: Carbonate conditioning, Phosphate conditioning, Colloidal conditioning, Calgon conditioning. Desalination of brackish water

Unit 2: Electrochemistry **(06 Lectures)**

Migration of ions, Transference number, Determination of Transference number by Hittorf`s method, Conduct metric titrations, Types of electrode: Calomel and glass electrode, Battery.

Unit 3: Corrosion **(06 Lectures)**

Corrosion and its economic aspects, Types of corrosion: Galvanic, Erosion, Crevice, Pitting, Waterline, Soil, Microbiological. Theories of corrosion: Acid, Direct Chemical attack, Electrochemical. Corrosion prevention by metallic, organic/inorganic coatings and corrosion inhibitors

Unit 4: Fuels, Lubrication **(08 Lectures)**

Classification of fuels, Calorific value, Cetane number, Octane number, fuel quality, Comparison of solid, liquid and gaseous fuel, properties of fuel, alternative fuels: Biofuels, Power alcohol, Introduction of Lubricants, Functions of Lubricants, Classification of lubricants, Mechanisms of Lubrication, Properties of Lubricants.

Unit 5: Green Chemistry **(08 Lectures)**

Emergence of green chemistry, twelve principle of green chemistry, Use of alternative Feedstock (biofuels), Use of innocuous reagents, use of alternative solvents, design of safer chemicals, designing alternative reaction methodology, minimizing energy consumption

Text Books Recommended:

1. Engineering Chemistry by Shikha Agarwal. Cambridge University Press Edition 2015.
2. Engineering Chemistry by S. Vairam & Suba Ramesh. Wiley India Pvt. Ltd. 2014.

Reference Books:

1. Environmental Chemistry by Stanley E. Manahan. CRC Press Taylor and Francis.
2. Organic Chemistry by Morrison and Boyd. Pearson.
3. Physical Chemistry by Atkins. Oxford University Press.
4. Concise Inorganic Chemistry by J.D. Lee. Oxford University Press.

LIST OF PRACTICALS

1. Determination of alkalinity in the given water sample.
2. Estimation of temporary and permanent hardness in water sample using EDTA as standard solution.
3. Calculation of percentage of available chlorine in bleaching powder.
4. Chloride content in the given water sample by Mohr's method.
5. Determination of iron content in the given ore by using external indictor
6. pH-metric titration.
7. Proximate Analysis of coal sample
8. Flash and Fire point determination of a Lubricant
9. To determine the DO in a given water sample
10. Viscosity of a lubricant by Redwood Viscometer

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Department of Chemistry**
2. Course Code	**CHF102**
3. Course Title	**Applied Engineering Chemistry**
4. Credits (L:T:P:C)	**3:1:1:5**
5. Contact Hours (L:T:P)	**3:1:2**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Core Science Elective**

8. **Course Summary:**It covers fundamentals of Chemistry required for the engineering students.

9. Course Objectives: The objective of the course is to provide a summery on water treatment, Fuels, green chemistry and synthetic chemistry. The course is specifically designed for non CSE students to give them an overview of the working principles, mechanisms, reactions and applications of the building blocks of batteries, cells and surface coatings to protect the metal.

10.Course Outcomes:

At the end of the course student will get:

CO1: To understand about the treatment of water, sewage water and hardness related calculations.

CO2: An overview of electrical properties of the metals and detailed knowledge of semiconductors.

CO3: The basic fundamental behind selection of engineering materials and their properties required depending on their applications.

CO4: The concept of different types batteries and their applications.

CO5: Aware of how chemical processes can be designed, developed and run in a sustainable way. Students acquire the competence to think of chemistry as a sustainable activity.

11. Curriculum Content:

Unit 1 Water Technology (08 Lectures)

Standards for drinking water, Water Quality parameters, Demineralization of water, softening of water: Lime-soda Process, Ion exchange process, Zeolite process and Reverse Osmosis process. Internal conditioning methods: Carbonate conditioning, Phosphate conditioning, Colloidal conditioning, Calgon conditioning, Desalination of brackish water, sterilization of water.

Unit 2 Conductivity of solids (06 Lectures)

Introduction, Electrical properties of solids, Band theory of solids, Types of energy bands, Application of band theory to solids, Elemental semiconductors, Non-elemental semiconductors, Non-stichiometric n-type semiconductors, Chalcogen semiconductors

Unit 3 Engineering Materials (10 Lectures)

Introduction of polymers; Classification of Polymers; Functionality; Mechanism of Polymerization; Plastics; Individual Polymers; LDPE, HDPE, PVC, Polystyrene, Bakelite, Teflon, PMMA, PET, Nylon-6, Rubbers (BUNA-S and BUNA-N); Specialty Polymers

(Conducting Polymers, Silicones and Polycarbonates), Gypsum, Plaster of Paris, Insulating Materials

Unit 4 Battery Technology (06 Lectures)

Battery, Photovoltaic cell, Metal-air battery, Lithium and nickel battery

Unit 5 Green Chemistry (08 Lectures)

Emergence of green chemistry, Twelve principle of green chemistry, Use of alternative Feedstock (biofuels), Use of innocuous reagents, use of alternative solvents, design of safer chemicals, designing of alternative reaction methodology, minimizing energy consumption.

Text Books Recommended:

1. Engineering Chemistry by Shikha Agarwal. Cambridge University Press Edition 2015.
2. Engineering Chemistry by S. Vairam&Suba Ramesh. Wiley India Pvt. Ltd. 2014.

Reference Books:

1. Environmental Chemistry by Stanley E. Manahan. CRC Press Taylor and Francis.
2. Organic Chemistry by Morrison and Boyd. Pearson.
3. Physical Chemistry by Atkins. Oxford University Press.
4. Concise Inorganic Chemistry by J.D. Lee. Oxford University Press.

LIST OF PRACTICALS

1. Determination of alkalinity in the given water sample.
2. Estimation of temporary and permanent hardness in water sample using EDTA as standard solution.
3. Calculation of percentage of available chlorine in bleaching powder.
4. Chloride content in the given water sample by Mohr's method.
5. Determination of iron content in the given ore by using external indictor
6. pH-metric titration.
7. Proximate Analysis of coal sample
8. Flash and Fire point determination of a Lubricant
9. To determine the DO in a given water sample
10. Viscosity of a lubricant by Redwood Viscometer

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

1. Department offering the course	**Mathematics**
2. Course Code	**MAF101**
3. Course Title	**ENGINEERING MATHMATICS-I**
4. Credits (L:T:P:C)	**3:1:0:4**
5. Contact Hours (L:T:P)	**3:1**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Core Sciences**

OBJECTIVE: To introduce the fundamentals in Differential, Integral and Vector Calculus relevant to engineering applications.

Unit I

Review of Limit, Continuity and differentiation, Successive Differentiation, Leibnitz theorem

(without proof), Problems based on Leibnitz's theorem, Maclaurin's series in one variable, Taylor's expansion in one variable, Asymptote & Curvature, Point of inflexion, Double Points, Cusp, Node andconjugate points, Curve tracing for Cartesian curves.

Unit II

Partial differentiation and problems, Euler's theorem and its proof, Problems based on Euler's

theorem, Few corollaries on Euler's theorem for higher order derivatives and problems based on them, Taylor's expansion of a function in two variables, Jacobians, its properties, and transformations of coordinates,Maxima and minima of a function in two variables, Method of Lagrange's multipliers and problems.

Unit III

Double and triple integrals, Change of order of integration, Change of variables, Application of

integration to lengths, Surface, areas and Volumes- Cartesian and Polar coordinates. Beta and Gammafunctions, Dirichlet's integral and its applications.

Unit IV

Scalar and Vector fields, Vector differentiation, Directional derivatives Gradient, Divergence

and curl and their physical significance. Evaluation of Line integral, Green's theorem in plane (withoutproof), Stokes theorem (without proof), Gauss Divergence theorem (without proof) and problems basedon them.

LEARNING OUTCOME: Students will be able to:

- Use techniques for determining area under a curve, extrema of functions and their use in drawing graphs.

- Compute partial derivatives of functions of two or more variables and use them for determining extrema, saddle points of the surfaces of given functions.
- Use vector calculus in determining motions of fluids, work done by a force etc..
- Theorems like Greens theorem, Diverges theorem, Stocks theorem and their applications in determining surface area and volume.

Text Books:

1. G. B. Thomas Jr. & R. L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson Education
2. R. K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, 2nd edition, Narosa Publishing House, New Delhi, India,2006

Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, U.K., 2006.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Mathematics**
2. Course Code	**MAF102**
3. Course Title	**ENGINEERING MATHMATICS-II**
4. Credits (L:T:P:C)	**3:1:0:4**
5. Contact Hours (L:T:P)	**3:1**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Core Sciences**

OBJECTIVE: To introduce the fundamentals in Matrices and Linear Algebra, Ordinary Differential Equations, Laplace Transform and Infinite Series relevant to engineering applications.

UNIT I

Elementary row operations, row reduced Echelon form, rank of a matrix, invertible matrices,

Consistency of linear system of equations and their solution, Linear independence and dependence of vectors, Vector Spaces and its basis, Linear Transformations, Eigenvalues and Eigenvectors, Cayley-HamiltonTheorem, Diagonalization of matrices.

UNIT II

Order, degree of ODE and some basic concepts such as linearity and nonlinearity, general so-

lution and particular solution, formation of ODEs, First order differential equation: variable separablemethod, homogeneous method, and its variants, Linear differential equation of second order with constantcoefficients: Complementary function and particular integral for some standard functions, Cauchy Eulerlinear differential equation, Solution of second order linear differential equation with variable coefficients,method of variation of parameters, solution of simultaneous linear differential equations.

UNIT III

Laplace transform of some standard functions, Properties of Laplace transform, Inverse Laplace

transforms, Properties of Inverse Laplace transforms, using partial fractions for inverse Laplace transforms,Convolution theorem (without proof), Application of Laplace transforms to solve various types of differential equation, e.g., differential equations with constant coefficient, variable coefficients, simultaneousdifferential equations.

UNIT IV

Introduction to sequence and series, series of positive terms, comparison test, D'Alembert's ratio test, Root Test, Alternatingseries, Leibnitz test.Fourier series of periodic functions, Euler's formulae, functions having arbitraryperiod, change of intervals, even and odd functions, half range sine and cosine series.

Outcome: Students will be able to:

- Differentiate between invertible and singular matrices, determine characteristic equations of a matrix and hence eigen values and eigen vector for a given matrix.
- Determine differential equations satisfied by various physical application and their solutions.
- Use properties of improper integrals to define Laplace Transforms and use them to solve initial value physical problems
- Mathematically deal with infinite series and test their convergence.

Text Books:

1. R. K. Jain & S. R. K. Iyenger, Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, New Delhi, India, 2006.
2. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, U.K., 2006.

Reference Books:

1. W. E. Boyce and R. Di Prima, Elementary Differential Equations, (8th Edition), John Wiley & Sons, U.K., (2005).
2. B. S. Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publication, New Delhi, India, 2012

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Mathematics**
2. Course Code	**MAF201**
3. Course Title	**ENGINEERING MATHMATICS-III**
4. Credits (L:T:P:C)	**3:1:0:4**
5. Contact Hours (L:T:P)	**3:1**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Core Sciences**

OBJECTIVE: Introduce the fundamentals in Complex variable.Solving Partial Differential Equations. Legendre polynomial of first kind with properties.Bessel function of first kind and its properties.

UNIT I

Series solution of ODE of 2^{nd}order with variable coefficient with special emphasis to Legendre and Bessel differential equation by Frobenious method, Legendre polynomial of first kind, Bessel function of first kind and their properties.

UNIT II

Introduction and formation of Partial Differential Equations, Classification of Partial Differential

Equations, Solution of first order linear partial differential equations of the form Pp + Qq = R, LinearPDE with constant coefficients of IInd order. Method of separation of variables, Solution of wave equationin one dimension, Solution of heat in one dimension and Laplace equation using method of separation ofvariables.

UNIT III

Concept of Limit, continuity, and differentiability, Analytic functions, C-R equations and har-

monic functions, Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic function. Representation of a function by power series, Taylor's andLaurent's series, R Singularities, zeroes and poles, Residue theorem, evaluation of real integrals of type

$\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$ and $\int_{-\infty}^{\infty} f(x)\, dx$.

UNIT III

Fourier integral; Fourier transform; Fourier sine and cosine transform; linearity, scaling, fre-

quency shifting and time shifting properties; convolution theorem. Z-transform; properties of Z-transforms; Convolution of two sequences; inverse Z-transform. Applications of Fourier Transform and Z-Transform.

Outcome: The student will be able to use

- Familiarity with methods to solve partial differential equations.
- Differentiation and Integration of complex functions to physical problems.

- Complex integration for solving real integrals.
- Fourier and Z-transform rules to physical problems.

Text Books:

1. J.W. Brown & R. V. Churchill: Complex Variables & Applications, 9th edition, McGraw-Hill, 2013.
2. R. K. Jain & S. R. K. Iyenger, Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, New Delhi, India, 2014.

Reference Books:

1. B. S. Grewal, Higher Engineering Mathematics, 42th Edition, Khanna publication, New Delhi, India, 2012.
2. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, U.K., 2006.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Mathematics**
2. Course Code	**MAF202**
3. Course Title	**Probability and Statistics**
4. Credits (L:T:P:C)	**3:1:0:4**
5. Contact Hours (L:T:P)	**3:1**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Core Sciences**

OBJECTIVE: The objectives of the course are to familiarize the students with statistical techniques, to equip them with standard concepts and, to learn tools of probability theory to solve engineering problems.

Unit I: Descriptive Statistics and Probability

Review of mean, median and mode, variance. Moments and properties, Skewness and Kurtosis. Probability: concepts, definition, examples, conditional probability and Bayes' theorem.

Unit II: Random Variables and Probability Distributions

Discrete & continuous random variables and their properties, mass function, density function, distribution functions. Expectation, moment generating function, Binomial, Poisson, Exponential & Normal distributions and their applications.

Unit III: Correlation and Regression

Bivariate distributions and their properties, Joint and marginal density functions, Conditional densities. Covariance, Correlation, Regression, Regression lines. Curve fitting by the method of least square- fitting of straight lines.

Unit IV: Hypothesis Testing

Population and samples, Sampling distribution of statistic, standard error. Null and Alternative Hypothesis, critical region, critical values and level of significance. One tail and two-tail tests, confidence interval, Errors in testing of hypothesis; Type I and Type II errors, power of the test.

Unit V: Inferential test procedures

Test of significance, large sample test for single proportion, difference of proportion, single mean, difference of means and difference of standard deviation. Small sample test: Student's t-test and it's applications, F-test and it's applications. Chi-square test for goodness of fit and independence of attributes.

LEARNING OUTCOME: Students will be able to:

- Compute probability, various discrete and continuous probability distributions of random variables and their properties.
- Use the tools of statistics including measures of central tendency, correlation and regression.
- Use statistical methods for studying data samples.
- Use large sample and small sample tests.

Text Books:

1. S. Palaniammal, Probability and Random Processes, PHI learning private ltd., 2015.
2. S.C. Gupta, Fundamentals of Statistics, 7th Ed., Himalaya Publishing House, 2018.

Reference Books:

1. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2016.
2. Richards A Jonson, Irvin Miller and Johnson Freund, Probability and Statistics for Engineering, 9th Edition, PHI, 2011.
3. S. Ross, A First Course in Probability, 8th Ed., Pearson Education India, 2010.

M.R. Spiegel, J.J. Schiller and R.A. Srinivasan, Probability and Statistics, Schaum's Outlines, 2013.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF101**
3.	**Course Title**	**BASIC ELECTRICAL ENGINEERING**
4.	**Credits (L:T:P:C)**	**3:0:2:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Engineering Science**

8. Course Summary

To provide comprehensive idea about AC and D C circuit analysis, working principles and applications of basic machines in electrical engineering.

9. Course Objectives

- To impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency
- To provide working knowledge for analysis of basic DC & AC circuits used in electrical & electronic devices.
- To explain working principle, construction, applications of DC and AC machines & measuring instruments.
- Highlight the importance of transformers in transmission and distribution of electric power.

10. Course Outcomes

- To understand the basic concepts of magnetic circuits, electro magnetism.
- To understand and analyses AC & DC circuits.
- To understand the working principle, and applications of DC & AC machines.

11. Curriculum Content

Unit 1: D.C. Network Theory

Review of basic circuit theory concepts, Mesh and Nodal analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star – delta transformation, Magnetic Circuits.

Unit 2: A.C. Circuits & Measuring Instruments

Single Phase A.C.: Phasor representation of voltage and current, A.C. circuit behavior of resistance, inductance, capacitance & their combination in series and parallel, Power triangle, Power factor, Concept of series & parallel resonance.

Three Phase A.C.: Star – delta connections, Relation between line and phase quantities, three phase power and its measurement, What is 3 phase 4 wire and 3 phase 3 wire system.

Measuring Instruments: Construction and principle of voltage and current measuring instruments.

Unit 3: Power System & Transformers

Single line diagram of simple power system.

Single phase Transformer: Principle of operation, Types of construction, Phasor diagram, Equivalent circuit, Efficiency and voltage regulation, O.C. and S.C. tests.

Unit 4: D.C. & Synchronous Machines

D.C. Machines: Construction and working principle of d.c. generator and d.c. motor, Types of d.c. machines, E.M.F. equation, Torque equation, characteristics, Losses and efficiency, Need of starter in d.c. motors.

Synchronous Machines: Construction and Principle of operation of Alternator and Synchronous Motor.

Unit- 5: Induction Motors

Three Phase Induction Motors: Principle of operation of 3-Ø induction motor, Types of 3-Ø induction

motor, Need of starters in 3-Ø induction motors, Slip – torque characteristics
Single Phase Induction Motor: Principle of operation of single phase induction motor by double revolving field theory, Methods of starting of single phase induction motor.

Textbook(s)

1. V. Del Toro. "Principles of electrical Engineering", Prentice hall International.
2. J. Nagrath, "Basic Electrical Engineering", Tata Mc Graw Hill.

Reference Books

1. W.H. Hayt & J.E. Kemmerly, "Engineering circuit Analysis", Mc Graw Hill.
2. H. Cotton, "Advanced Electrical Technology" Wheeler Publishing.

List of Experiments

1. Verification of Network Theorems.
2. Study of diode characteristics. Study of phenomenon of resonance in RLC series circuit.
3. Measurement of power in a three phase circuit by two wattmeter method.
4. Measurement of efficiency of a single phase transformer by load test.
5. Determination of parameters and losses in a single phase transformer by OC and SC test.
6. Study of characteristic of DC Motor.
7. Study of characteristic of AC Motor.
8. DC generator characteristics.
9. Speed control of dc shunt motor.
10. Study running and reversing of a three phase induction motor.
11. Study of a single phase energy meter.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF101**
3.	**Course Title**	**FUNDAMENTAL OF ELECTRONICS ENGINEERING**
4.	**Credits (L:T:P:C)**	**3:0:2:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Engineering Science**

8. Course Summary

This course is designed to serve as a first course in an undergraduate Electrical and Electronics & Communication Engineering (EECE) curriculum. The course introduces the fundamentals of electronics engineering. Topics covered include: Semiconductor theory; devices based on semiconductor materials like diodes, transistors; BJT and FET; Op-amp as linear integrated circuit with various applications. Design and lab exercises are also significant components of the course.

9. Course Objectives

- After successfully studying this course, students will be able to understand the basic electronics engineering principles and abstractions on which the design of electronic systems is based. These include diodes and transistors models and operational amplifiers.
- Student will be able to use these engineering abstractions to analyse and design simple electronic circuits.
- Student will be able to formulate and solve the problems of electronic circuits and analyse their behaviour.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

- Employ simple electronics circuit models for resistors, sources, inductors, capacitors, diodes and transistors in circuits.
- Analyse circuits made up of linear and nonlinear elements. Specifically, analyse circuits containing resistors diodes and transistors such as rectifiers, clampers and clippers.
- Check linear and nonlinear constraints in circuits. For example, determine if the circuit representing a diode provides adequate output.
- Determine the output produced by a circuit for a given set of inputs using diode,op-amp and transistors
- Perform a small-signal analysis of an amplifier using small signal models for the circuit elements.
- Determine the need of biasing and its impact on the designing in electronics circuits.
- Analyse the difference between bipolar and unipolar semiconductor devices and distinguish the designing difference and their parameters.
- Understand the use of Opamp and its characteristics in linear integrated electronic circuits with various operations and applications.
- Use complex impedances to determine the frequency response of circuits and how to make the powerful electronics circuits.
- Study the regulators and their operations in various applications.

11. Curriculum Content

Unit 1: Semiconductor Diodes:

Semiconductor materials- intrinsic and extrinsic types, Ideal Diode, Terminal characteristics of diodes, p-n junction under open circuit condition, p-n junction under forward bias and reverse bias conditions, p-n junction in breakdown region, Diode small signal model, Zener diode and applications, Rectifier Circuits, Clipping and Clamping circuits

Unit 2: Bipolar Junction Transistors (BJTs):
Physical structure and operation modes, Active region operation of transistor, D.C. analysis of transistor circuits, Transistor as an amplifier, Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias, Basic BJT amplifier configuration: common emitter, common base and common collector amplifiers, Transistor as a switch: cut-off and saturation modes, High frequency model of BJT amplifier: Hybrid Models.

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Unit 3: Field Effect Transistor (FET):
Enhancement-type MOSFET: structure and physical operation, current-voltage characteristics, Depletion-type MOSFET, D.C. operation of MOSFET circuits, MOSFET as an amplifier, Biasing in MOSFET amplifiers, Basic MOSFET amplifier configuration: common source, common gate and common drain types, Junction Field-Effect Transistor (JFET).

Unit 4: Operation Amplifier (Op-amps):
Ideal Op-amp, Differential amplifier: differential and common mode operation, common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non -inverting amplifier, weighted, summer, integrator, differentiator, other applications of op-amps: instrumentation Amplifier, Controlled Sources using Op-amp.

Unit- 5: Power Circuits and Systems:
Class A large signal amplifiers, second-harmonic distortion, Transformer coupled audio power amplifier, Class B amplifier, Class AB operation, Regulated power supplies, Series voltage regulator.

Textbook(s)

1. Millman J., Halkias C.C., Jit S., "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd 2007.
2. Boylstead R.L., Nashelsky L., "Electronic Devices and Circuit Theory", Pearson, 10th 2009 Edition.

Reference Books

1. S.Shalivahanan, Electronics Devices & Circuits, Vikas Publication, 2nd Edition.2018
2. Ramakant A. Gayakwad, Op-Amp and Linear Integrated Circuits, Pearson Publications, 6th Edition.

List of Experiments

1.To identify and Study of the various component and Devices of electronics with their specification (CRO, Function Generator, Multimeter, Power Supply, resistor, capacitor, inductor, ICs, LED, potentiometer etc.)
2.To study the V-I characteristics of PN diode
3. To study the V-I characteristics Zener diode.
4. To find the efficiency of rectifiers and ripple factor of capacitive and non-capacitive half wave and full wave rectifier.
5. To Study and verify clipper and clamper with biased circuits.
6. To find the characteristics of CB and CE amplifiers.
7. Determine the characteristics of FET.
8. Verifications of all logics gates.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF143**
3.	**Course Title**	**ELECTRICAL AND ELECTRONICS ENGINEERING PRACTICE**
4.	**Credits (L:T:P:C)**	**3:0:2:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Engineering Sciences**

8. Course Summary

The course introduces the fundamentals of electronics and electrical engineering. In this syllabus the fundamentals of Circuits, semiconductors, Electronics devices and electrical machines would be studied by the students. The fundamental concepts of digital logic have been also included.

9. Course Objectives

- To acknowledge students about charge, current, voltage and various circuit laws involved in analysis.
- To provide students with the basic knowledge of operation and working different types of electrical machines and their application
- To get acquaints student with fundamental knowledge of semiconductor devices their characteristics and modelling in different applications.
- To provide students with the basic knowledge of digital logic.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Fundamental knowledge about charge, current, voltage and various basic electric circuit laws.
2. DC circuit analysis and methods.
3. Basics of AC circuits elements and various methods involved.
4. Functioning of DC machines and its characteristics.
5. Fundamental theory of semiconductor devices, fermi level and concept of doping.
6. Basics of different types of transistor configuration, modelling and their application.
7. Basics of logics circuits.

11. Curriculum Content

UNIT 1 – DC NETWORK THEOREM

Review of basic circuit theory concepts, Mesh and Nodal analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star – Delta transformation

UNIT 2 – AC CIRCUIT'S AND FUNDAMENTALS OF SEMICONDUCTORS

Single Phase AC: Phasor representation of voltage and current, AC circuit behaviour of Resistive, Inductive and Capacitive Load and their combination in series, Power triangle, Power factor

Three Phase AC: Delta and Star connections, Relation between Line and Phase values. Two Wattmeter test.

Fundamentals of semiconductors: Energy bands in semiconductors, Intrinsic and extrinsic semiconductors, Fermi level.

UNIT 3: DIODE AND TRANSISTOR FUNDAMENTAL:

Diode circuits: Construction, Junction diode characteristics, Half and full wave rectifiers - Expression for efficiency, Zener Diode Characteristics and its application as voltage regulator.

Transistor circuits: Construction and characteristics of a transistor in CB, CE and CC modes - Relative merits. Load Line and operating point concept (both AC and DC). Biasing of Transistors and stability analysis. Construction and characteristics of JFET and MOSFET.

UNIT IV: DIGITAL LOGIC:
Binary and Decimal Number systems, Boolean algebra, Basic Logic gates, Universal Logic gates and K-map upto 4 variables only.

UNIT V – ELECTRICAL MACHINES
Transformers: Principle of Operation and emf equation
DC Machines: Construction, working principle & characteristics
Induction & synchronous Machines: Principle of operation of 3 φ and 1 φ Induction Motor and synchronous machine.

Textbook(s)

1. Vincent Del Toro, "Principles of Electrical Engineering", Prentice Hall Publication.
2. Electronics Devices and Circuits, Millman and Halkias, Tata McGraw Hill, 4th ed.

Reference Books

1. I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill Publication.
2. Electronic Communication Systems, John Kennedy , Tata McGraw Hill, 4th ed.

List of Experiments

1. Verification of Network Theorems.
2. Measurement of efficiency of a single phase transformer by load test.
3. Determination of parameters and losses in a single phase transformer by OC and SC test.
4. Perform the polarity test on Transformer.
5. Study of characteristic of AC Motor.
6. Study of DC shunt and series generator characteristics.
7. Study the Speed control of dc shunt motor.
8. Study running and reversing of a three phase induction motor.
9. To identify and Study of the various component and Devices of electronics with their specification (CRO, Function Generator, Multimeter, Power Supply, resistor, capacitor, inductor, ICs, LED, potentiometer etc.)
10. To study the V-I characteristics of PN diode and Zener diode.
11. To find the efficiency of rectifiers and ripple factor of capacitive and non-capacitive half wave and full wave rectifier.
12. To Study and verify clipper and clamper with biased circuits.
13. To find the characteristics of CB and CE amplifiers.
14. Determine the characteristics of FET.
15. Verifications of all logics gates.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF141**
3.	**Course Title**	**ELECTRICAL ENGINEERING MATERIALS**
4.	**Credits (L:T:P:C)**	**3:1:0:4**
5.	**Contact Hours (L:T:P)**	**3:1:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Engineering Sciences**

8. Course Summary

This course provides knowledge regarding the structure of different types of materials, to understand the factors affecting thermal and electrical conductivity of materials. To have understanding about different types of materials used in engineering and their applications.

9. Course Objectives

- In this course student will learn the Crystal structure of materials
- The student will learn about electron theory of materials
- The student will learn about thermal conductivity and study the material properties according to use in electrical equipment

10. Course Outcomes

- To have knowledge about the types of engineering materials.
- Various phenomena associated with different types of materials.
- Applications of these materials in different fields.

11. Curriculum Content

Unit 1 Crystal Structure of Materials: Bonds in solids, crystal structure, co-ordination number, atomic radius representation of plane distance b/w two planed packing factor, Miller Indices, Bragg's law and x-ray diffraction, structural Imperfections, crystal growth

Unit 2 Electrical Engineering Material: Electron theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat developed in current carrying conductors, Half effect, Drift and Diffusion currents, continuity equation, thermoelectric effect, superconductivity and super conducting materials, optical properties of solids.

Unit 3 Magnetic Material: Origin of permanent magnetic dipoles in matters, Classification Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism and Ferrimagnetism, magnetostriction, Properties of magnetic materials, soft and hard magnetic materials, permanent magnetic materials.

Unit 4 Dielectric Materials: Polarization and Dielectric constant, Dielectric constant of mono-atomic, Poly atomic gases and solids, frequency dependence of electronic and ionic polarizabilities, dipolar relaxation, dielectric loss, piezoelectricity, ferroelectric materials

Unit 5 Semiconductor Material And Devices: Properties of semiconductors, Conductivity of insulators, Metals and semiconductor in terms of energy bands, Intrinsic and Extrinsic semiconductors, Concentration of charge carriers, Hall effect, Drift and Diffusion current, semiconductor junction diode, Integrated circuits, semiconducting materials.

Textbook(s)

A.J. Dekker, "Electrical Engineering Materials", Prentice Hall of India

R. K. Rajput, "Electrical Engineering Materials", Laxmi Publications

Reference Books

Solymar, “Electrical Properties of Materials” Oxford University Press.
Ian P.Hones, “Material Science for Electrical & Electronic Engineering,” Oxford University Press.
J.B.Gupta, “Electrical and Electronics Engineering Materials” Katson publishers

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF142**
3.	**Course Title**	**Fundamental of Semiconductor Electronics**
4.	**Credits (L:T:P:C)**	**3:1:0:4**
5.	**Contact Hours (L:T:P)**	**3:1:0**
6.	**Prerequisites (if any)**	
7.	**Course Basket**	**Engineering Science**

8. Course Summary

Semiconductor Physics deals with concepts which are responsible for the majority of modern technology. These properties determine the material mechanical strength. Semiconductor Physics gives guidance to the principles of the circuits needed for modern electronic devices. It gives both the Transistor & the Semiconductor Chip.

9. Course Objectives

- To provide an insight into the basic semiconductor concepts
- To provide a sound understanding of current semiconductor devices and technology to appreciate its applications to electronics circuits and systems

10. Course Outcomes

On successful completion of the course, students will be having a good knowledge in semiconductor theory and electronic devices.

11. Curriculum Content

Unit 1: Elemental and compound semiconductors: Fermi-Dirac, distribution, Equilibrium and steady state conditions, Equilibrium concentration of electrons and holes, Temperature dependence of carrier concentration,

Unit 2: Carrier transport in semiconductors: drift, conductivity and mobility, variation of mobility with temperature and doping, High Field Effects, Hall effect, Excess carriers in semiconductors: Generation and recombination, mechanisms of excess carriers, quasi Fermi levels, diffusion, Einstein relations, Continuity equations, Diffusion length, Gradient of quasi Fermi level

Unit 3: PN junctions: Contact potential, Electrical Field, Potential and Charge density at the junction, Energy band diagram, Minority carrier distribution, Ideal diode equation, Electron and hole component of current in forward biased p-n junction, piecewise linear model of a diode effect of temperature on V-I characteristics

Unit 4:Diode capacitances: switching transients, Electrical Breakdown in PN junctions, Zener and avalanche break down (abrupt PN junctions only), Tunnel Diode basics only, Metal Semiconductor contacts, Ohmic and Rectifying Contacts, current voltage characteristics

Unit- 5:BJT and MOSFET: current components, Minority carrier, distributions, basic parameters, Evaluation of terminal currents (based on physical dimensions),Transistor action, Base width modulation, Metal Insulator semiconductor devices: The ideal MOS capacitor, band diagrams at equilibrium, accumulation, depletion and inversion, surface potential, CV characteristics, effects of real surfaces, work function difference, interface charge, threshold voltage MOSFET: Output characteristics, transfer characteristics, sub threshold characteristics, MOSFET scaling (basic concepts)

List of Experiments:

1. Identification and testing of passive and active components
2. Measurement of I – V characteristic if p – n junction diode
3. Determination of diode parameters

4. Measurement of input and output characteristic parameters of BJT for common emitter configuration
5. Measurement of input and output characteristic parameters of BJT for common base configuration
6. Measurement of input and output characteristic parameters of BJT for common collector configuration
7. Determination of small signal model parameters of BJT
8. Measurement of I-V characteristics of JFET.
9. Measurement of I-V characteristics of MOSFET.
10. Study of switching behavior of BJT.
11. Study of switching behavior of MOSFET.

Textbook(s)

1. Ben G. Streetman and Sanjay Kumar Banerjee, Solid State Electronic Devices, Pearson, 6/e, 2010
2. Achuthan, K N Bhat, Fundamentals of Semiconductor Devices, 1e, McGraw Hill,2015

Reference Books

1. Tyagi M.S., Introduction to Semiconductor Materials and Devices, Wiley India, 5/e, 2008
2. Sze S.M., Physics of Semiconductor Devices, John Wiley, 3/e, 2005
3. Neamen, Semiconductor Physics and Devices, McGraw Hill, 4/e, 2012
4. Pierret, Semiconductor Devices Fundamentals, Pearson, 2006
5. Rita John, Solid State Devices, McGraw-Hill, 2014
6. Bhattacharya .Sharma, Solid State Electronic Devices, Oxford University Press, 2012
7. Dasgupta and Dasgupta , Semiconductor Devices : Modelling and Technology (PHI)

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF201**
3.	**Course Title**	**CIRCUIT ANALYSIS AND SYNTHESIS**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**Basic Electrical Engineering, Maths I, Maths II**
7.	**Course Basket**	**Discipline Core**

1. CourseSummary

This course provides basic understanding of the different types of signals used with their mathematical representation, the application of tools like graph theory for analyzing electrical circuits , study about h parameters, ABCD parameters and other parameters for two port networks

2. CourseObjectives

- To provide basic understanding of the different types of continuous time signals and systems and their mathematicalrepresentation.
- To provide knowledge of graph theory applicable for analysis of electricalcircuits.
- The students will understand of different two port networkparameters.

3. CourseOutcomes

- An ability to design and analyze electricalcircuits.
- An ability to control AC and DC circuits by using Basic Electricaldevices.
- An ability to visualize and work on laboratory and multi-disciplinarytasks.

4. CurriculumContent

UNIT I-INTRODUCTION TO CONTINUOUS TIME SIGNALS AND SYSTEMS:

Basic continuous time signals, unit step, unit ramp,unit impulse and periodic signals with their mathematical representation and characteristics. Waveform synthesis. Introduction to various types of systems, Causal and Non-causal, Stable and Unstable, Linear and Non-linear, Time invariant and Time varyingsystems.
Analogous System: Mechanical elements for translational and rotational systems, force-voltage and force- current analogy,torque-voltage and torque-current analogy.

UNIT II-GRAPH THEORY:
Graph of a Network, definitions, tree, co tree, link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix, Duality, Loop and Node methods of analysis. Analysis of first and second order linear systems by classicalmethod**.**

UNIT III-NETWORK THEOREMS (APPLICATIONS TO AC NETWORKS) AND NETWORK FUNCTIONS: Super-
position theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem. Network Functions: Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transferfunctions**.**

UNIT IV-TWO PORT NETWORKS:
Characterization of LTI two port networks; Z, Y, ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Inter- connections of two port networks, Ladder and Lattice networks: T & Π representation.

UNIT V-NETWORK SYNTHESIS:
Positive real function; definition and properties; properties of LC, RC and RL driving point functions, synthesisofLC,RCandRLdrivingpointimmittancefunctionsusingFosterandCauerfirst andsecondforms.

Textbook(s)
1. William Hayt, Jack Kemmerly, Steven Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 8thEdition
2. Choudhary D. Roy, "Network & Systems", Wiley EasternLtd.

Reference Books
1. Kuo, "Network Analysis & Synthesis", WileyIndia.
2. Jagan, "Network Analysis", B SPublication.
3. ME Van-Valkenberg; "Network Analysis", Prentice Hall ofIndia

List of Experiments:
1. Verification of principle of superposition with dc and acsources.
2. Verification of Thevenin's theorem with dc and acsources.
3. Verification of Norton's theorem with dc and acsources.
4. Verification of Maximum power transfer theorems in accircuits.
5. Verification of cascade connection of 2, two -portnetworks.
6. To find Z and Y parameters of two-portnetwork.
7. Time domain analysis of parallel RLC circuit using MULTI-SIMsoftware.
8. To find current through and voltage across different elements of a given network using MULTI-SIM software.
9. Determination of transient response of current in RL circuit with step voltage input using MULTI-SIM software.
10. Determination of transient response of current in RC circuit with step voltage input using MULTI-SIM software.

List of two value added Experiments
1. Verification of superposition theorem using MULTI-SIMsoftware.
2. Verification of reciprocity theorem using MULTI-SIMsoftware.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF202**
3.	**Course Title**	**ELECTROMECHANICAL ENERGY CONVERSION - I**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**Basic Electrical Engineering**
7.	**Course Basket**	**Discipline Core**

8. CourseSummary

The course provides the basic understanding of electrical to mechanical energy conversion. The working of transformer , d.c. generators and d.c. motors, types of d.c. motors The course provided knowledge regarding the types of 3 phase transformers and phenomenon of harmonics in them

9. CourseObjectives

- To empower students to understand the basics of electro mechanical energy conversion &transformer
- To empower students to understand the basics of d.c.machines
- To empower students to understand the basics of 3 phasetransformers

10. CourseOutcomes

- To familiarize students about dc machines, transformer, current, voltage and various circuit laws involved inanalysis.
- To provide students with the basic knowledge of operation and working of DC machines & transformer and theirapplication

11. CurriculumContent

Unit 1 Principles of Electro-mechanical Energy Conversion

Introduction, Flow of Energy in Electromechanical Devices, Energy in magnetic systems (defining energy & Co- energy), Singly Excited Systems; determination of mechanical force, mechanical energy, torque equation, Doubly excited Systems; Energy stored in magnetic field, electromagnetic torque, Generated emf in machines; torque in machines with cylindrical air gap.

Unit 2 D.C. Machines
Construction of DC Machines, Armature winding, Emf and torque equation Armature Reaction, Commutation, Interpoles and Compensating Windings, Performance Characteristics of D.C. generators.

Unit 3 D.C. Machines (Contd.)
Performance Characteristics of D.C. motors, Starting of D.C. motors; 3- point and 4-point starters, Speed control of D.C. motors: Field Control, armature control and Voltage Control (Ward Leonard method); Efficiency and Testing of D.C. machines (Hopkinson's and Swinburne's Test).

Unit 4 Single Phase Transformer
Phasor diagram, efficiency and voltage regulation, all day efficiency, Testing of Transformers: O.C. and S.C. tests, Sumpner's test, polarity test. Auto Transformer: Single phase and three phase auto transformers, volt-amp relationship, efficiency, merits & demerits and applications.

Unit 5 Three Phase Transformers

Construction, three phase transformer phasor groups and their connections, open delta connection, three phase to 2 phase (Scott connection), 6 phase or 12 phase connections, and their applications, parallel operation and load sharing of single phase and three phase transformers, excitation phenomenon and harmonics in transformers.

Textbook(s)

P.S.Bhimbra, "Electrical Machinery", Khanna publication.
I.J. Nagrath & D.P.Kothari, "Electrical Machines". Tata McGraw Hill

Reference Books

Charles Gross, Electric Machines, T & F, Delhi

List of Experiments

1. To obtain magnetization characteristics of a d.c. shuntgenerator.
2. To obtain external characteristics of a d.c. shunt generator and compoundgenerator.
3. To obtain efficiency of a dc shunt machine using Swinburne'stest.
4. To perform Hopkinson's test and determine losses and efficiency of DCmachine.
5. To obtain speed-torque characteristics of a dc shuntmotor.
6. To obtain speed control of dc shunt motor using (a) armature resistance control (b) fieldcontrol.
7. To obtain speed control of dc separately excited motor using ConventionalWard-Leonard.
8. To study polarity and ratio test of single phase and 3-phasetransformers.
9. To obtain equivalent circuit, efficiency and voltage regulation of a single phase transformer using O.C. and S.C.tests.

Value Added Experiments

- To obtain efficiency and voltage regulation of a single phase transformer by Sumpner'stest.
- To obtain 3-phase to 2-phase conversion by Scottconnection.
- To determine excitation phenomenon (B.H. loop) of single phase transformer usingC.R.O.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF205**
3.	**Course Title**	**ELECTROMAGNETIC FIELD THEORY**
4.	**Credits (L:T:P:C)**	**3:1:0:4**
5.	**Contact Hours (L:T:P)**	**3:1:0**
6.	**Prerequisites (if any)**	**Maths I, Maths III**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

This course will introduce students about problem solving techniques using different coordinate systems. It can familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems. It can also expose the students to the ideas of electromagnetic waves and structure of transmission line.

9. Course Objectives

To understand

1. The concept of electromagnetic field
2. The electromagnetic wave and their propagation
3. Transmission lines and wave guides.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. To acknowledge students about electric field and magnetic field.
2. To get acquaints students with the basic idea of electromagnetic wave, characteristics of electromagnetic waves.

11. Curriculum Content

Unit 1:Coordinate Systems and Transformation

Cartesian Coordinates, Circular Cylindrical Coordinates, Spherical Coordinates Vector Calculus: Differential Length, Area and Volume, Line Surface and Volume Integrals, Del Operator, Gradient of a Scalar, Divergence of a Vector and Divergence Theorem, Curl of a Vector and Stoke's Theorem, Laplacian of a Scalar.

Unit 2: Electromagnetic Wave Propagation

Faraday's Law, Electromotive Forces, Displacement Current, Derivation of Maxwell's Equations For Static and Time- Varying Fields. Differential and integral forms, concept of displacement current, Boundary conditions.

Unit 3-Electromagnetic Wave Propagation Applications

Electromagnetic Wave Propagation: Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Wave in Free Space, Plane Waves in Good Conductors, Power and The Poynting Vector, Reflection of a Plane Wave at Normal incidence.

Unit 4-Transmission Lines

Transmission Lines: Transmission Line Parameters, Transmission Line Equations, Input Impedance, Standing Wave Ratio and Power, Smith Chart, Some Applications of Transmission Lines, Low loss RF and UHF transmission lines, Distortion less condition. Transmission line charts-impedance matching.

Unit 5-Waveguides

Wave Guides: Introduction to Planar (Rectangular) Waveguides, Derivation of TE and TM Modes, TEM Mode, Impedance and characteristics impedances. Transmission line analogy for wave guides, Attenuation and factor of wave guides, Resonators.

Textbook(s)

1. Elements of Electromagnetics, M N O Sadiku.

Reference Books

1. Engineering Electromagnetic, William Hayt, McGraw-Hill Electronic Communication Systems, John Kennedy, Tata McGraw Hill, 4th edition.
2. Electromagnetic Fields, K. D. Parsad

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF209**
3.	**Course Title**	**ANALOG & DIGITAL ELECTRONICS**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**Fundamentals of Electronics Engg.**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

The course covers fundamentals of semiconductors like energy bands Fermi level, types of diodes and their characteristics. The construction and characteristics of various types of transistors like BJT, FET. The course provides basics of oscillators circuits, and fundamentals of digital circuits.

9. Course Objectives

- To Teach the basic concept of various Analog and Digital electronic devices, circuits and their application
- To develop ability among students for problem formulation, system design and solving skills
- To have basic knowledge of amplifiers and oscillators

10. Course Outcomes

- Students will be able to build analog and digital electronics circuits
- Students should be able to design and analyze amplifiers
- Students should be able to develop model and analyze oscillators

11. Curriculum Content

Unit 1 FUNDAMENTALS OF SEMICONDUCTORS AND DIODES: Review of energy bands in solids, Intrinsic and Extrinsic semiconductors, Fermi Level, Transport phenomenon in semiconductors: diffusion current, drift current, mobility, conductivity. The Hall Effect. Generation and recombination of carriers. Special Diodes- their characteristics and applications.

Unit 2 BJTs AND FETs : Construction and characteristics of transistor, Transistor biasing and stability factor analysis. Transistor application as an amplifier and as a switch. Types, construction and characteristics of JFET, Biasing of JFET. Construction and characteristics of Depletion and Enhancement types of MOSFET.

Unit 3 FEEDBACK AMPLIFIERS AND OSCILLATORS CIRCUITS: Introduction to positive and negative feedback: Negative feedback -current, voltage, Series and Shunt type. It's effect on input impedance, output impedance, voltage gain, current gain and bandwidth. Oscillators circuits: Frequency of oscillation and condition for sustained oscillations. Types of oscillator circuits-RC-phase shift, Wein-Bridge, Hartley, Clapp, Colpitt and Crystal Oscillators.

Unit 4 FUNDAMENTALS OF DIGITAL SYSTEMS: Combinational Logic Circuits: Review of logic gates and Boolean Algebra, Adder, Subtractor. Introduction to Multiplexers and Demultiplexers & Encoders and Decoders**.** Sequential Logic Circuits: Introduction to

latches, Flip-flops, Registers and Counters.

Unit 5 OPERATIONAL AMPLIFIERS:
Introduction to Operational Amplifiers, Characteristics of an ideal op-amp, Inverting and Non-inverting amplifier, Application of op-amp as summer, differential amplifier, Integrator and Differentiator.

Textbook(s)

1. Boylstead and Neshelsky, ," Electronic Devices and Circuits", PHI
2. Jacob Millman & Christos C. Halkias," Integrated Electronics" Tata McGraw Hill, 1991.
3. Malvino & Leach, "Digital Principles and applications" Tata Mc. Graw Hill
4. R.A. Gayakwad "Op amps and Linear Integrated Circuits" Prentice Hall of India.

Reference Books

1. Taub & Schilling "Digital Electronics"- Tata Mc Graw Hill
2. Anil K. Maini, "Digital Electronics: Principles and Integrated circuits" Wiley India Ltd, 2008.
3. Millman, J. and Grabel A, "Microelectronics" Mc Graw Hill
4. S Salivahanan, N Suresh Kumar, "Electronic Devices and Circuits", 3rd edition, McGraw Hill Publication

List of Experiments

1. To identify and Study of the various component and Devices of electronics with their specification (CRO, Function Generator, Multimeter, Power Supply, resistor, capacitor, inductor, ICs, LED, potentiometer etc.)
2. To study the V-I characteristics of PN diode and Zener Diode
3. To find the efficiency of rectifiers and ripple factor of capacitive and non-capacitive half wave and full wave rectifier.
4. To find the characteristics of CE Transistors.
5. To Study and verify oscillator circuits.
6. Implementation of All Logic Gates using Universal gates (NAND & NOR both).
7. To study operation of Adder / Subtractor
8. To study application of Operational Amplifier as summer integrator and voltage comparator

Value added experiments:

1. To study operation IC 555 based astable and monostable multibrators.
2. To study operation of (a) multiplexer using IC 74150 (b) demultiplexer using IC 74138.

2.	**Course Code**	**EEF203**
3.	**Course Title**	**MEASUREMENTS & INSTRUMENTATION**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**Basic Electrical Engineering**
7.	**Course Basket**	**Discipline Core**

8. CourseSummary

The course provides knowledge regarding the different types of instruments used for measuring various electrical quantities like current, voltage, frequency, power factor etc. The course provides understanding of the construction and the working mechanism of these instruments. It also provides knowledge about the different types of bridges used for measuring parameters like inductance, capacitance andresistance.

9. CourseObjectives

- To acquire knowledge regarding the use, measure and analyse theinstruments.
- To be able to calculate all the parameters related tomeasurements.
- To develop an understanding about different instruments that are used for measurementpurpose.
- To have knowledge about digital methods used for measurement of differentquantities.

10. CourseOutcomes

- Develop an understanding of construction and working of different measuringinstruments
- Develop an understanding of construction and working of different AC and DC bridges and itsapplications
- Develop an ability to use measuring instruments and AC and DC bridges formeasurement

11. CurriculumContent

Unit 1 Philosophy Of Measurement: Methods of Measurement, Measurement System, Classification of instrument system, Characteristics of instruments & measurement system, Errors in measurement & its analysis, Standards. Analog Measurement of Electrical Quantities: Electrodynamic, Thermocouple, Electrostatic & Rectifier type Ammeters & Voltmeters, Electrodynamic Wattmeter, Three Phase Wattmeter, Power in three phase system, errors & remedies in wattmeter and energymeter

Unit 2 Instrument transformers: Instrument Transformer and their applications in the extension of instrument range, Introduction to measurement of speed, frequency and powerfactor.

Unit 3 Measurement of Parameters: Different methods of measuring low, medium and high resistances, measurement of inductance & capacitance with the help of AC Bridges, Q Meter
.
Unit 4 AC Potentiometer: Polar type & Co-ordinate type AC potentiometers, application of AC Potentiometers in electricalmeasurement
Magnetic Measurement: Ballistic Galvanometer, flux meter, determination of hysteresis loop, Measurement of ironlosses.

Unit 5 Digital Measurement of Electrical Quantities: Concept of digital measurement, block Diagram, Study of digital voltmeter, frequency meter Power Analyzer and Harmonics Analyzer; ElectronicMultimeter.

Textbook(s)

1. E.W. Golding & F.C. Widdis, "Electrical Measurement &Measuring Instrument", A.W. Wheeler & Co.Pvt. Ltd..
2. A.K. Sawhney ,"Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons , India.

Reference Books

1. E.W. Golding & F.C. Widdis, "Electrical Measurement &Measuring Instrument", A.W. Wheeler & Co.PvtLtd..
2. A.K. Sawhney ,"Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons , India.
3. W.D.Cooper, "Electronic Instrument & Measurement Technique", Prentice HallInternational.

List of Experiments

1. Calibration of ac voltmeter and acammeter
2. Measurement of phase difference and frequency of a sinusoidal ac voltage usingC.R.O.
3. Measurement of low resistance by Kelvin's doublebridge
4. Measurement of voltage, current and resistance using dcpotentiometer
5. Measurement of inductance by Maxwell'sbridge
6. Measurement of inductance by Hay'sbridge
7. Measurement of inductance by Anderson'sbridge
8. Measurement of capacitance by Owen'sbridge
9. Measurement of capacitance by De SautyBridge
10. Measurement of capacitance by ScheringBridge

Value added Experiments:

1. Measurement of power and power factor of a single phase inductive load and to study effect of capacitance connected across the load on the powerfactor
2. Measurement of form factor of a rectified sine wave and determine source of error if r.m.s.value is measured by amulti-meter
3. Study of Frequency and differential timecounter

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF204**
3.	**Course Title**	**ELECTROMECHANICAL ENERGY CONVERSION- II**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**Basic Electrical Engineering, EMEC-I**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

The course provides advanced understanding of AC machines like synchronous generators, synchronous motors, induction motors and single phase motors of various types.

9. Course Objectives

- To empower students with the advanced understanding of ACmachines.
- To empower students to have sufficient knowledge about synchronousmachines.
- To empower students to have sufficient knowledge about inductionmachines

10. Course Outcomes

- Student becomes familiar with the elementary AC machines other thantransformers
- To empower students with the advanced knowledge about principle of operation and applications of synchronousmachines.
- To empower students with the advanced knowledge about principle of operation and applications of inductionmachines.

11. Curriculum Content

Unit 1 Synchronous Machine I:

Constructional features, Armature winding, EMF Equation, Winding coefficients, equivalent circuit and phasor diagram, Armature reaction, Working principle of synchronous generator, O. C. & S. C. tests, Voltage Regulation using Synchronous Impedance Method, MMF Method, Potier's Triangle Method, Parallel Operation of synchronous generators, operation on infinite bus, synchronizing power and torqueco-efficient

Unit 2 Synchronous Machine II:
Two Reaction Theory, Power flow equations of cylindrical and salient pole machines, Operating characteristics Synchronous Motor: Working principle of synchronous motor, Starting methods, Effect of varying field current at different loads, V-Curves, Hunting & damping, synchronous condenser.

Unit 3 Three phase Induction Machine – I:
Constructional features, Rotating magnetic field, Principle of operation , Phasor diagram, equivalent circuit, torque and power equations, Torque- slip characteristics, no load & blocked rotor tests, efficiency, Induction generator

Unit 4 Three phase Induction Machine- II:
Starting, Deep bar and double cage rotors, Cogging & Crawling, Speed Control (with and without emf injection in rotorcircuit.)

Unit 5 Single phase Induction Motor:
Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, Starting methods, repulsion motor. AC Commutator Motors: Universal motor, steppermotors

Textbook(s)
1. P.S.Bhimbra, "Electrical Machinery", Khannapublication.
2. I.J. Nagrath & D.P.Kothari, "Electrical Machines". Tata McGrawHill

Reference Books
Charles Gross, Electric Machines, T & F, Delhi

List of Experiments
1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor anddetermine equivalent circuit.

2. To perform load test on a three phase induction motor anddraw:

(i) Torque -speed characteristics (ii) Power factor-line currentcharacteristics

3. To perform no load & blocked rotor tests on 1- Ø induction motor and determine equivalentcircuit.

4. To study speed control of three phase induction motor by keeping V/f ratioconstant

5. To perform O.C. & S.C. tests on a 3-Ø alternator and determine voltage regulation at full load and atunity,

0.8 lagging and leading power factors by (i) EMF method (ii) MMF method.
6. To determine V-curves and inverted V-curves of a three phase synchronousmotor.

8. To determine Xd and Xq of a three phase salient pole synchronous machine using the slip test and draw the power-anglecurve.

9. To study synchronization of an alternator with the infinite bus by using: (i) dark lamp method (ii) two bright and one dark lampmethod

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF205**
3.	**Course Title**	**ELEMENTS OF POWER SYSTEM**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core**

8. CourseSummary

The course covers fundamentals of Single line diagram, Supply system, skin effect, Kelvin's law, Proximity effect, short, medium and long transmission lines, Ferranti effect, Surge impedance loading, Corona, insulators and their application, Potential distribution over a string of insulators. The course provides the knowledge of Mechanical Design of Transmission Lines, Grading of cables, Insulation resistance, Capacitance of single phase and three phase cables, Dielectric losses, Heating of cables.

9. CourseObjectives

- To give an overview of power system and its various components and theirimportance.
- Calculation of line parameters, evaluation of lineperformance
- Mechanical aspects of overhead transmission line, underground cables, their constructionalfeatures

10. CourseOutcomes

- The students should be able to know about the overhead and underground types of transmission systems,
- The students should be able to know about different mathematical models to represent different types of transmission lines and evaluate theirperformance.
- They should also be able to design an overhead transmission line including mechanicalaspects.
- They will also know about different types of cables used in case of electrical powersystems.

11. CurriculumContent

Unit 1 POWER SYSTEM COMPONENTS: Single line diagram of Power System, Supply system, Different types of supply system and their comparison, Transmission line configurations, Types of conductors, Skin effect, Kelvin's law, Proximityeffect.

Unit 2 OVER HEAD TRANSMISSION LINES: Calculation of inductance and capacitance of single phase, three phase, single circuit, and double circuit transmission lines. Representation of short, medium and long transmission lines, Ferranti effect, Surge impedance loading

Unit 3 CORONA AND LINE Insulators: Corona formation, calculation of potential gradient, corona loss, factors affecting corona, Methods of reducing corona and interference. Electrostatic and electromagnetic interference with communication lines. Types of insulators and their application, Potential distribution over a string of insulators, Methods of equalizing the potential, Stringefficiency

Unit 4 Mechanical Design of Transmission Lines: Catenary curve, Calculation of sag & tension, Effects of wind and ice loading, Sag template, Vibration dampers, Types of towers and theirdesign

Unit 5 Insulated Cables: Types of cables and their construction , Dielectric stress, Grading of cables, Insulation resistance, Capacitance of single phase and three phase cables, Dielectric losses, Heating of cables.

Textbook(s)

1. W.D. Stevenson, "Element of Power System Analysis", McGraw Hill,USA
2. C.L. Wadhwa, "Electrical Power Systems", New Age International Ltd., ThirdEdition
3. Ashfaq Husain, "Power System", CBS Publishers & Distributors,India
4. B.R. Gupta, "Power System Analysis & Design", S.Chand & Co, ThirdEdition
5. M.V. Deshpande, " Electrical Power System Design", Tata McGrawHill

Reference Books

1. Soni, Gupta & Bhatnagar, "A Course in Electrical Power", Dhanpat Rai & Sons,India
2. S.L. Uppal, " Electric Power", KhannaPublishers
3. S.N. Singh, "Electric Power Generation, Transmission & Distribution", PHI, NewDelhi

ListofExperiments MATLABbased

1. To compute line parameters for a single phase transmissionline
2. To compute line parameters for a three phase short transmissionline
3. To compute line parameters for a three phase medium transmissionline
4. To compute line parameters for a three phase long transmissionline
5. Verification of Ferranti Effect for Different Length TransmissionLines
6. To calculate sag in case of transmissionlines
7. To calculate voltage regulation of transmission line usingMATLAB
8. To carry out modelling of 3 phase ACcable

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF301**
3.	**Course Title**	**POWER SYSTEM ANALYSIS**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**Elements of Power System, EMEC-I**
7.	**Course Basket**	**Discipline Core**

8. CourseSummary

The course covers fundamentals of Representation of power system components like synchronous machine, transformer, transmission line, Formation of bus admittance matrix by singular transformation, Formation of load flow problem, Gauss – Siedel and Newton – Raphson method of load flow analysis, Approximation of Newton – Raphson load flow analysis, Fast decoupled method, Fault analysis of symmetrical short circuit, Unsymmetrical short circuits, steady state and transient Stability of power systems, Swing equation, Equal area criteria, Solution of swing equation, Distribution System & Substations.

9. CourseObjectives

- To introduce the concepts of Load flow analysis, bus impedance/admittancematrix,
- To introduce load flow problem formulation and solutiontechniques,
- To introduce fault analysis, steady state and transient stability analysis, load frequency and voltage control and different type of distributionsystems.

10. CourseOutcomes

- To solve load flow problems using per unit valuessystems.
- To develop power system networkmodels.
- To formulate and solve load flow problems using various techniques as per the requirements of complexity, computational time andaccuracy.
- To calculate power losses in power system and develop economical power system operationscheme.

11. CurriculumContent

Unit 1 Introduction: Representation of power system components like synchronous machine, transformer, transmission line. One line diagram, Impedance and Reactance diagram, per unit system of calculation, Brief description of power system components like synchronous machine, transformer, busbar, transmission line and isolators.

Unit 2 Load Flow Analysis: Bus classifications, Formation of bus admittance matrix by singular transformation, Formation of load flow problem, Gauss – Siedel and Newton – Raphson method of load flow analysis, Approximation of Newton – Raphson load flow analysis, Fast decoupled method.

Unit 3 Fault analysis: Types of fault – shunt and series, Calculation of fault current and voltages for symmetrical short circuit, Symmetrical components, Sequence impedance, Unsymmetrical short circuits, Open conductor fault, Current limiting reactors

Unit 4 Stability Analysis: Introduction to steady state and transient Stability of power systems,

Swing equation, Equal area criteria, Solution of swing equation, Methods of improving stability

Unit 5 Distribution System & Substations: Different types of distribution systems, Distribution from one and both ends, Ring mains, Unbalanced loading, 3 phase 4 wire and 3 phase 5 wire distribution system, Layout of distribution substation, Rural electrification andgrounding.

Textbook(s)

1. W.D. Stevenson, "Element of Power System Analysis", McGraw Hill,USA

2. C.L. Wadhwa, "Electrical Power Systems", New Age International Ltd., ThirdEdition

3. Ashfaq Husain, "Power System", CBS Publishers & Distributors,India

4. B.R. Gupta, "Power System Analysis & Design", S. Chand & Co, ThirdEdition

5. M.V. Deshpande, " Electrical Power System Design", Tata McGrawHill

Reference Books

1. Soni, Gupta & Bhatnagar, "A Course in Electrical Power", Dhanpat Rai & Sons,India

2. S.L. Uppal, " Electric Power", KhannaPublishers

3. S.N. Singh, "Electric Power Generation, Transmission & Distribution", PHI, NewDelhi

ListofExperiments MATLABBased

1. Computation of Parameters and Modeling of TransmissionLines

2. Formation of Bus Admittance and ImpedanceMatrices

3. Solution of load flow and related problems using Gauss- SeidelMethod.

4. Solution of load flow and related problems using Newton RaphsonMethod

5. Fault Analysis

6. Transient and Small Signal Stability Analysis: Single-Machine Infinite BusSystem

7. Transient Stability Analysis of Multi machine PowerSystems

8. Electromagnetic Transients in PowerSystems

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF303**
3.	**Course Title**	**CONTROL SYSTEM**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**Circuit Analysis & Synthesis, EMEC-I, Maths 1, Maths 2, Maths 3**
7.	**Course Basket**	**Discipline Core**

8. CourseSummary

The course covers fundamentals of Control System, Transfer functions, Block diagram algebra, Signal flow graph, Open loop & closed control, time response of first and second order systems, Constructional and working concept of ac servomotor, Routh-Hurwitz criteria, Root Locus Technique, Frequency response, polar and inverse polar plots, Bode plots, Nyquist stability criterion, lag and lead-lag networks, design of closed loop systems.

9. CourseObjectives

- To introduce the state variable representation of continuous and discrete data control systems, stability analysis and time response analysis using statemodel,
- The concepts of controllability and observability, basic concepts of digital control systems, their stabilityanalysis,
- Use of state feedback for pole placement design, basic concepts and stability analysis of non linear systems

10. CourseOutcomes

- Possess in-depth knowledge of concepts from classical control theory, understand the concept of transfer function.
- Find out the time response of a given system and design of different basic controller (P, PI,PID)
- Understand the basic knowledge of servo &servomotor.
- Gain knowledge of finding out system stability in time and frequencydomain.
- To draw different plots of control system and compensation design using theseplots.

11. CurriculumContent

Unit 1 The Control System: Open loop & closed control; servomechanism, Physical examples.

Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback

Unit2 Time Response analysis: Standard test signals, time response of first and second order systems, time response specifications, steady state errors and errorconstants.
Controllers: Introduction to P, PI, & PID controller. performance indices

Unit 3 Control System Components: Constructional and working concept of ac servomotor, synchros and stepper motor.

Concept of Stability: Routh-Hurwitz criteria, Root Locus Technique

Unit 4 Frequency response Analysis: Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots: gain margin and phase margin**.**

Stability in Frequency Domain: Nyquist stability criterion, relative stability.

Unit 5 Introduction to Design: The design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain.

Textbook(s)

1. I.J. Nagrath & Gopal, "Control System Engineering", 4th Edition, New ageInternational.

2. K. Ogata, "Modern Control Engineering", Prentice Hall ofIndia.

Reference Books

1. Norman S. Nise, Control System Engineering 4th edition, Wiley PublishingCo.

2. M.Gopal, "Control System; Principle and design", Tata McGrawHill.

3. M.Gopal," Modern Control system", Tata McGrawHill.

4. D.Roy Choudhary, "Modern Control Engineering", Prentice Hall ofIndia.

List of Experiments

1. To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practicalresults.
2. To study P, PI and PID temperature controller for an oven and compare theirperformance.
3. To study and calibrate temperature using resistance temperature detector(RTD)
4. To design Lag, Lead and Lag-Lead compensators using Bodeplot.
5. To study DC position controlsystem
6. To study synchro-transmitter and receiver and obtain output V/S inputcharacteristics
7. To determine speed-torque characteristics of an acservomotor.
8. To study performance of servo voltage stabilizer at various loads using loadbank.
9. To study behaviour of separately excited dc motor in open loop and closed loop conditions at various loads.

Software based experiments (Use MATLAB, LABVIEW software etc.)

1. To determine time domain response of a second order system for step input and obtain performance parameters.
2. To convert transfer function of a system into state space form andvice-versa.
3. To plot root locus diagram of an open loop transfer function & determine range of gain 'k' for stability. 4.To plot a Bode diagram of an open loop transferfunction.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF304**
3.	**Course Title**	**POWER ELECTRONICS**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**Analog & Digital Electronics**
7.	**Course Basket**	**Discipline Core**

8. CourseSummary

The course covers fundamentals of Power semiconductor devices such as Triacs, GTOs, MOSFETs and IGBTs, their characteristics, turn-on of SCR, gate characteristics, AC-DC Converters, DC - DC Converters, AC- AC and DC-AC Converters, three phase cyclo-converters, Single phase series resonant inverter; Single phase bridge inverters, Single phase and three phase current sourceinverters.

9. CourseObjectives

- To introduce the basic concepts of powerelectronics,
- To introduce types of converters, their characteristics, turn-on of SCR, gatecharacteristics,
- To know about AC-DC Converters, DC - DC Converters, AC-AC and DC-ACConverters.

10. CourseOutcomes

- Articulate the basics of power electronicdevices
- Express the design and control of rectifiers,inverters.
- Design of power electronic converters in power controlapplications
- Ability to express characteristics of SCR, BJT, MOSFET andIGBT.
- Ability to express communicationmethods.
- Ability design AC voltage controller andCyclo-Converter

11. CurriculumContent

Unit 1 Power semiconductor Devices: Power semiconductor devices their symbols and static characteristics; Characteristics and specifications of switches, types of power electronic circuits. Thyristor – Operation V- I characteristics, two transistor model; Triacs, GTOs, MOSFETs and IGBTs - static characteristics and principles ofoperation

Unit 2 Power Semiconductor Devices (Contd): Protection of devices; Series and parallel operation of thyristors; Commutation techniques of thyristor

DC-DC Converters: Principles of step-down and step-up chopper and their operation with R-L load; Classification of choppers

Unit 3 Phase Controlled Converters: Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode; Single phase fully controlled and half controlled bridge converters; Three phase half wave converters, three phase fully controlled and half controlled bridge converters; Effect of source impedance; Single phase and three phase dualconverters.

Unit 4 AC Voltage Controllers: Principle of On-Off and phase controls; Single phase ac voltage

controller with resistive and inductive loads; Three phase ac voltage controllers (various configurations and comparison) Cyclo Converters: Basic principle of operation, single phase to single phase, three phase to single phase and three phase to three phase cyclo converters, output voltageequation

Unit 5 Inverters: Single phase series resonant inverter; Single phase bridge inverters

Three phase bridge inverters: 1200 and 1800 mode of operation; Voltage control of inverters; Harmonics reduction techniques; Single phase and three phase current source inverters.

Textbook(s)

1. M.H. Rashid, "Power Electronics: Circuits, Devices & Applications", Prentice Hall of India Ltd. 3rdEdition,
2. P.S.Bimbhra, "Power Electronics" KhannaPublication.
3. Umanand "Power Electronics" WileyIndia.

Reference Books

1. P.C. Sen, "Power Electronics", Mc GrawHill
2. Dragan Maksimović and Robert Warren Erickson, "Fundamentals of Power Electronics",Springer

List of Experiments

1. To study V-I characteristics of SCR and measure latching and holdingcurrents.
2. To study UJT trigger circuit for half wave and full wavecontrol.
3. To study single-phase half wave controlled rectified with (i) resistive load (ii) inductive load with and without freewheelingdiode.
4. To study single phase (i) fully controlled (ii) half controlled bridge rectifiers with resistive & inductive loads.
5. To study three-phase fully/half controlled bridge rectifier with resistive and inductiveloads.
6. To study single-phase ac voltage regulator with resistive and inductiveloads.
7. To study single phasecyclo-converter
8. To study triggering of (i) IGBT (ii) MOSFET (iii) powertransistor
9. To study operation of IGBT/MOSFET choppercircuit
10. To study MOSFET/IGBT based single-phase series-resonantinverter.

Software based experiments (PSPICE/MATLAB)

1. To obtain simulation of SCR and GTOthyristor.
2. To obtain simulation of Power Transistor andIGBT.
3. To obtain simulation of single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductiveload.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF305**
3.	**Course Title**	**SWITCHGEAR AND PROTECTION**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**EMEC-I, Elements of Power System**
7.	**Course Basket**	**Discipline Core**

8. CourseSummary

The course provides the knowledge of PROTECTIVE Relays, different protection schemes, Relays, Circuit breakers, Arc Interruption Theory and Power System Transients, Power System Transients, Lightning arrestors, BIL and insulation coordination.

9. CourseObjectives

- To introduce the basic concepts of different protectionschemes,
- To introduce the basic concepts of Relays, Circuitbreakers
- To introduce the basics of Arc Interruption Theory and Power SystemTransients.

10. CourseOutcomes

- Learn the fundamental concept of different types of protectiverelays.
- Apply fundamental concepts of various protectionschemes.
- Use different types of circuit breakers according to their principle of operation, characteristics, ratings and theirduties.
- Become familiar with arc properties, their formation andextinction.
- Become familiar with Power System Transients, Lightning arrestors, BIL and insulationcoordination.

11. CurriculumContent

Unit 1 PROTECTIVE Relays: Basic principles, types, Construction and characteristics of electromagnetic relays, Elements of static relays, Comparators, Basic principle of digital relays, Overcurrent , Earth fault and differentialrelays.

Unit 2 Protection Schemes: Protection of generators, transformers, transmission line, busbar and motors

Unit 3 Arc Interruption Theories: Formation and extinction of arc, properties of the arc, Restriking and recovery voltage, Methods and control devices for arc extinction, Current chopping, Resistance switching

Unit 4 Circuit breakers: Oil circuit breaker, Air blast circuit breaker, SF6 circuit breaker, Vacuum circuit breaker, Circuit breaker duties and ratings, Testing and maintenance of circuit breakers, HRC and other types of fuse, Isolators

Unit 5 Power System Transients: Overvoltage in the transmission lines, Fault clearance, Lightning

and switching surges, Transmission, refraction and attenuation of surges. Ground wire, Sphere gaps, Lightning arrestors, BIL and insulation coordination, Grounding of power system.

Textbook(s)

1. Switchgear and protection Sunil S. Rao, KhannaPublishers

2. Power System Engg. Soni Gupta & Bhatnagar, Dhanpat Rai &Sons

3. A course in Electrical Power, C.L. Wadhawa, New AgeInternational

4. Power system protection and switchgear, B. Ram, Wiley EasternLtd.

Reference Books

1. Power system protection & switchgear, Badriram & D.V. Vishwakarma,TMH

2. Switchgear & Protection, M.V. Deshpande,TMH

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF401**
3.	**Course Title**	**ELECTRIC DRIVES**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**EMEC-I, EMEC-II, Power Electronics**
7.	**Course Basket**	**Discipline Core**

8. CourseSummary

The course provides the knowledge of Electric Drives, Dynamics of motor-load combination; Steady state stability of Electric Drive; Load equalization, Selection of Motor Power rating, electric braking, braking of dc, three phase induction and synchronous motors, Power Electronic Control of DC Drives, Power Electronic Control of AC Drives, static frequency control scheme (VSI, CSI, and cyclo – converter based) static rotor resistance and slip power recovery controlschemes.

9. CourseObjectives

- To introduce the basic concepts of dc electric drives and ac electricdrives
- To understand dc and ac electric drives closed-loopoperation
- To understand dc and ac electric drives operation including microprocessor basedarrangements.

10. CourseOutcomes

- Apply the knowledge of drives and use themeffectively.
- Suggest the particular type of AC drive system for anapplication.
- Suggest the particular type of DC drives system for anapplication.

11. CurriculumContent

Unit 1 Fundamentals of Electric Drive: Electric Drives and its parts, advantages of electric drives, classification of electric drives; Speed-torque conventions and multi-quadrant operations; Types of load, Load torque: components, nature andclassification
Dynamics of Electric Drive: Dynamics of motor-load combination; Steady state stability of Electric Drive; Loadequalization

Unit 2 Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty.

Unit 3 Electric Braking: Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors

Dynamics During Starting and Braking: Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting; Energy relations during braking, dynamics during braking Special Drives: Switched Reluctance motor.

Unit 4 Power Electronic Control of DC Drives: Single phase and three phase controlled converter

fed separately excited dc motor drives (continuous conduction only); dual converter fed separately excited dc motor drive; rectifier control of dc series motor; Chopper control of dc separately excited and dc series motor.

Unit 5 Power Electronic Control of AC Drives:
Three Phase induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo – converter based) static rotor resistance and slip power recovery control schemes.

Textbook(s)
1. G.K. Dubey, "Fundamentals of Electric Drives", Narosa publishingHouse.
2. V. Subrahmanyam, "Electric Drives: Concepts and Applications", Tata McGrawHill.

Reference Books
1. M.Chilkin, "Electric Drives", Mir Publishers,Moscow.
2. Mohammed A. El-Sharkawi, "Fundamentals of Electric Drives", Thomson Asia Pvt. Ltd. ,Singapore.
3. N.K. De and Prashant K. Sen, "Electric Drives", Prentice Hall of IndiaLtd.
4. S.K. Pillai, "A First Course on Electric Drives", New AgeInternational.

List of Experiments
1. To study speed control of separately excited dc motor by varying armature voltage using single-phase fully controlled bridgeconvertor.
2. To study speed control of separately excited dc motor by varying armature voltage using single-phase half controlled bridgeconvertor.
3. To study speed control of separately excited dc motor using single-phase dual converter (Static Ward- LeonardControl)
4. To study speed control of separately excited dc motor using MOSFET/IGBTchopper.
5. To study closed loop control of separately excited dcmotor.
6. To study speed control of single-phase induction motor using single-phase ac voltagecontroller.
7. To study speed control of three-phase induction motor using three-phase ac voltagecontroller.
8. To study speed control of three-phase induction motor using three-phase current sourceinverter.
9. To study speed control of three-phase induction motor using three-phase voltage sourceinverter.

Simulation Based Experiments (using MATLAB or any other software)
1. To study starting transient response of separately excited dcmotor.
2. To study speed control of separately excited dc motor using single phase fully/half controlled bridge converter in discontinuous and continuous currentmodes.
3. To study speed control of separately excited dc motor using chopper control in motoring and braking modes.

SYLLABUS OF ELECTIVE

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF251**
3.	**Course Title**	**SIGNALS AND SYSTEMS**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course is the study of analog and digital signals, a topic that forms an integral part of engineering systems in many diverse areas, including signal processing, seismic data processing, communications, speech processing, image processing, defense electronics, consumer electronics, and consumerproducts.

9. CourseObjectives

To develop basic knowledge of signals and systems and its properties in Continuous time and Discrete time domain along with sampling procedure.The course will develop understanding of the concepts and applications of Continuous Time and Discrete Time Fourier Series/Transforms and analyse signals and systems in time as well as frequency domain. To understand the concepts of Sampling and aliasing

10. CourseOutcomes

On successful completion of the course, students will be able to achieve the following:

1. Classify various signals and systems (continuous and discrete) based on theirproperties.
2. Determine response of LTI systems using graphical ormathematicalconvolution.
3. Perform sampling of Continuous time signals using Nyquistcriterion.

11. CurriculumContent

Unit 1: Time-Domain Analysis of Signals & LT I Systems:

Signals: Definition of Continuous Time (CT) and Discrete Time (DT) signals, Properties of CT & DT Signals, Operations on signals Systems: Types of Systems, Definition of CT & DT systems, system properties, Impulse response and the convolution integral and convolution summation, Properties of convolution, Analysis of LTIsystems.

Unit 2: Frequency Domain Analysis of CT Signals and LTI Systems:
Fourier series (FS): Exponential FS and its properties, Continuous Time Fourier Transform (CTFT): Definition & Properties, Frequency Response of LTI systems.
Laplace Transform (LT): RoC, Properties and Applications. Relationship between Laplace transform and CTFT

Unit 3: Frequency Domain Analysis of DTSignals:
Sampling Theorem for Low Pass Signals, Nyquist Criterion, Aliasing, Discrete-Time Fourier Series, Discrete- Time Fourier Transform - Definition &Properties.
Unit 4: Frequency Domain Analysis of DT Systems:
Difference equation representation of I/O relationship, System properties in terms of the impulse

response using DTFT, System response for complex-exponential inputs.

Unit- 5: Z-Transform:
Z-transform: Definition, existence and motivation, Evaluation of ZT, ROC and its Properties, Inverse ZT, Relationship between DTFT and z-transform, ZT Properties.

Textbook(s)
1. Signals and Systems, Oppenheim and Willsky with Nawab, 2nd Edition, PrenticeHall.

Reference Books

1. Linear Systems and Signals, B. P. Lathi, Oxford Press, 2ndEdition.

2. Signals and Systems, Tarun Kumar Rawat, 1st Edition, Oxford University Press,2011

3. Signals and Systems, H P Hsu, Second Edition, Schaum's Outlines, Mc Graw HillEducation

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF252**
3.	**Course Title**	**ELECTRICAL POWER GENERATION**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**EMEC-I, Basic Electrical Engineering**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course provides basic knowledge about the different methods used for power generation like thermal power plants, hydroelectric power plants, gas turbine plants. The working of various components like economizer, boiler, turbine, types of turbine, To have understanding about power generation using non conventional energy resources like solar energy and wind energy.

9. CourseObjectives

- The objective of the course is that after studying this subject the student should become familiar with the different modes of electrical power generation, their advantages andlimitations.
- He should also become aware of the various components and their working which are involved in the process of electrical powergeneration.
- He should have fair idea about energy generation and cost structure for revenue generation byenergy

10. CourseOutcomes

- The student will become familiar with the different modes of electrical power generation, their advantages andlimitations.
- He will become aware of the various components and their working which are involved in the process of electrical powergeneration.
- He will have fair idea about energy generation and cost structure for revenue generation byenergy

11. CurriculumContent

Unit 1 Introduction: Present energy scenario in India,

Power Plant Economics and Tariffs: Load curve, load duration curve, different factors related to plants and consumers, Cost of electrical energy, depreciation, generation cost, effect of Load factor on unit cost. Fixed and operating cost of different plants, role of load diversity in power system economy. Objectives and forms of Tariff including three part tariff; Causes and effects of low power factor, advantages of power factor improvement, different methods for power factor improvements

Unit 2 Thermal Power Plant: Site selection, general layout and operation of plant, Rankine cycle, Function of pulverization, boiler, economizer, super heater, air pre-heater, ESP, turbine and pump. Classification of steam turbines, impulse and reaction turbines velocitydiagrams
Gas Turbine Plant: Operational principle (Brayton cycle) of gas turbine plant & its efficiency, fuels, open and closed-cycle plants, regeneration, inter-cooling and reheating, role and applications,

Diesel Plants: Diesel plant layout, components & their functions, its performance, role and applications

Unit 3 Nuclear Power Plant: Location, site selection, general layout and operation of plant. Brief description of different types of reactors, Moderator material, fissile materials, control of nuclear reactors, disposal of nuclear waste material,shielding.
Hydro Electric Plants: Classifications, location and site selection, detailed description of various components, general layout and operation of Plants, brief description of impulse, reaction, Kaplan and Francis turbines, advantages & disadvantages

Unit 4 Major Electrical Equipment in Power Plants: Differences between generators used in steam and hydro power plants, requirement of excitation systems, types of excitationsystems

Cogeneration: Introduction, types of cycles and technologies, advantages and scope in India
Captive Generation: Introduction, advantages and constraints

Unit 5 Solar power plant: Working of solar power plant, Solar energy collectors, Photovoltaic cell, merits and limitations of solar powerplant
Wind Energy: site selection for wind power plant, differences between horizontal and vertical axis turbines, power developed using wind turbine and its efficiency
Introduction to Geothermal energy, Ocean Energy and Tidal energy, Introduction to fuel cells.

Textbook(s)

B.R. Gupta, "Generation of Electrical Energy", S. Chand Publications

Reference Books

S. N. Singh, "Electric Power Generation: Transmission And Distribution", PHI Learning Pvt. Ltd

1.	Department offering the course	EECE
2.	Course Code	ECF348
3.	Course Title	Biomedical Instrumentation
4.	Credits (L:T:P:C)	2:0:1:3
5.	Contact Hours (L:T:P)	2:0:2
6.	Prerequisites (if any)	None
7.	Course Basket	Discipline Elective

8. Course Summary

This course introduces the students to the various technical details of the different biomedical Instrumentation systems aiming to make them aware of the principles and concepts involved.

9. Course Objectives

- Requirement of bio-medical and itsapplication
- Concept of bio-potential electrodes and measurements related tothem.
- Concepts of bio-transducers and measurements related tothem.
- Concept of bio-medical instruments and theiruses.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

The course provides an understanding of:

- Bio-medical instruments andmeasurements.
- Principle of working of bio-medicaltransducers.
- Skills to use modern bio-medical tools and equipment for measurements related to humanbody.

11. Curriculum Content

Unit 1: ANATOMY AND PHYSIOLOGY:
Basic Cell Functions, Origin of Bio-potentials, Electrical Activity of Cells, components of man Instrument system, types of bio-medical stems, design factors and limitations of biomedical instruments, terms and transducers to various physiologicalevents.

Unit 2: **BIO-POTENTIAL ELECTRODE:**
Types of bio-potential electrodes., Electrode-Electrolyte interface, half cell potential, Polarization-polarisable and non- polarisable electrodes, Ag/AgCl electrodes, Electrode circuit model; Electrode and Skin interface and motion artifact. Body surface recording electrodes for ECG, EMG, EEG. Electrodes standards.

Unit 3: BIO-TRANSDUCER:
Transduction Principles: Resistive Transducers Strain Gauge- types, construction, selection materials, Gauge factor, Bridge circuit, Temperature compensation. Strain Gauge type Blood pressure transducers. Thermo resistive transducer, Inductive Transducers, Capacitive Transducer Piezoelectric Transducer Bio potential Measurement.

Unit 4: BIOMEDICAL INSTRUMENTATION CARDIAC MEASUREMENT:
Cardiovascular System, Heart Structure, Cardiac Cycle, ECG Theory, ECG Electrodes, Electrocardiograph, Indicator dilution methods; Measurement of continuous Cardiac output derived from aortic pressure waveforms, cardiac Arrhythmias; Phonocardiogram, Measurement of heart rate, Blood pressure, Temperature, Respiration rate, Blood Flow meters.

Unit- 5: BIOTELEMETRY AND ELECTRICAL SAFETY:
Bio-telemetry design, single channel bio telemetry transmitter and receiver system based on AM, FM and,

pulse modulation. Significance of Electrical Danger, physiological effect of current, ground shock Hazards.

Textbook(s)

1. Joseph J. Carr & John. M. Brown, 'Introduction to Biomedical Equipment technology'

Reference Books

1. J.G. Webster, 'Medical instrumentation application and design', Houghton Miffin Co., BostonUSA.
2. Mohan Murali H, 'Monograph on Biomedical engineering', O.U. Press1985.
3. Geddes L. A. & L. E. Baker, 'Principles of Applied Biomedical Instrumentation', Wiley,1989.
4. LeslieCromwell,FredJ.WeibellandErichA.Pfeiffer,'BiomedicalInstrumentationsandMeasurements'(2nd edition), PHI, 1991.
5. R.S. Khandpur, 'Handbook of Biomedical Instrumentation', McGrawHill.

LIST OF EXPERIMENTS

1. Pulsemeasurement
2. Heartbeatmeasurement
3. Automatic BPmeasurement
4. Heart sound study using electronicsstethoscope
5. ECGmeasurement

Following experiments to be done on the breadboard

6. Design of low noise and low frequency amplifier for biomedicalapplication
7. Design of Instrumentationamplifier
8. Construction of chopperamplifier

Two Value Added Experiments to be added by Instructor.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF457**
3.	**Course Title**	**ANN & FUZZY LOGIC**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of Neural network architecture: Single layer and multilayer feed forward networks, single layer artificial neural networks, multilayer perceptron model, concept of fuzzy, Fuzzy sets and crisp sets, Fuzzy sets theory and operations, Membership functions, inference in fuzzy logic, fuzzy if then rules, fuzzifications & defuzzifications, fuzzy controller, Application of neural network.

9. CourseObjectives

- To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and theirlimitations
- Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and itsapplications.
- Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy settheory.
- Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzylogic
- Reveal different applications of these models to solve engineering and otherproblem

10. CourseOutcomes

- Understand the fundamentals of neural networks and identify different neural network architectures, algorithms, applications and theirlimitations
- Understand appropriate learning rules for each of thearchitectures
- Understand the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy settheory.

11. CurriculumContent

Unit 1 Neural Networks-1(Introduction & Architecture): Neuron, biological neuron, Artificial Neuron and its model, activation functions, Neural network architecture: Single layer and multilayer feed forward networks, recurrent networks, and various learningtechniques**.**

Unit 2 Back propagation networks Architecture: perceptron model, single layer artificial neural networks, multilayer perceptron model; back propagation algorithm, effects of learning coefficient; factors affecting back propagation training, applications.

Unit 3 Fuzzy logic-I (Introduction): Basic concept of fuzzy, Fuzzy sets and crisp sets, Fuzzy sets theory and operations, Properties of fuzzy sets. Fuzzy and crisp relation.

Unit 4 Fuzzy Membership Functions, Rules: Membership functions, inference in fuzzy logic, fuzzy if then rules, fuzzifications & defuzzifications, fuzzy controller.

Unit 5 Application of Neural and fuzzy logic: Application of neural network, Neural Network approach in load flow study. Fuzzy logic application inindustries.

Textbook(s)

1. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms",PHI

Reference Books

1. Simon Haykins, "Neural Networks" Prentice Hall ofIndia
2. Moore, "Digital control devices", ISA press,1986.
3. Kumar Satish, "Neural Networks", Tata Mc GrawHill
4. Timothy J Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill1997

List of Experiments:

The instructor will give real time based problems each for neural networks and fuzzy logic controllers

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF343**
3.	**Course Title**	**DIGITAL CONTROL SYSTEM**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**Control System**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of digital control system, discrete time signals, z-transform and inverse z-transform, modelling of sample-hold circuit, Design of Digital Control Algorithms, State Space Analysis and Design, Stability on the z-plane and Jury stability criterion, bilinear transformation, Routh stability criterion on rth plane. Lyapunov's Stability, Discrete Euler Lagrange equation, max. min. principle, optimality & Dynamicprogramming.

9. CourseObjectives

- To introduce the state variable representation of continuous and discrete data control systems, stability analysis and time response analysis using statemodel,
- The concepts of controllability and observability, basic concepts of digital control systems, their stability analysis,
- Use of state feedback for pole placement design, basic concepts and stability analysis of non-linearsystems

10. CourseOutcomes

- Possess in-depth knowledge of concepts from classical control theory, understand the concept of transfer function.
- Find out the time response of a given system and design of different basic controller (P, PI,PID)
- Understand the basic knowledge of servo &servomotor.
- Gain knowledge of finding out system stability in time and frequencydomain.
- To draw different plots of control system and compensation design using theseplots.

11. CurriculumContent

Unit 1 Signal Processing in Digital Control Basic digital control system, advantages of digital control and implementation problems, basic discrete time signals, z-transform and inverse z-transform, modelling of sample-hold circuit., pulse transfer function, solution of difference equation by z-Transform method.

Unit 2 Design of Digital Control Algorithms Steady state accuracy, transient response and frequency response specifications, digital compensator design using frequency response plots and root locus plots.

Unit 3 State Space Analysis and Design: State space representation of digital control system, conversion of state variable models to transfer functions and vice versa, solution of state difference

equations, controllability and observability, design of digital control system with state feedback.

Unit 4 Stability of Discrete System: Stability on the z-plane and Jury stability criterion, bilinear transformation, Routh stability criterion on rth plane. Lyapunov's Stability in the sense of Lyapunov, stability theorems for continuous and discrete systems, stability analysis using Lyapunov's method**.**
Unit 5 Optimal digital control: Discrete Euler Lagrange equation, max. min. principle, optimality & Dynamic programming, Different types of problem and their solutions.

Textbook(s)

1. B.C.Kuo, "Digital Control System", Saunders CollegePublishing.
2. M.Gopal, "Digital Control and State Variable Methods", Tata McGrawHill.

Reference Books

1. J.R.Leigh, "Applied Digital Control", Prentice Hall,International
2. C.H. Houpis and G.B.Lamont, "Digital Control Systems: Theory, hardware, Software", Mc GrawHill.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF350**
3.	**Course Title**	**DYNAMIC SYSTEM ANALYSIS**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**Signals and Systems**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of Control Concepts and Mathematical Modelling System, Relationship between State Model and Transfer Function, System Representation and Control Components Block Diagram Algebra, Time response of First Order and Second Order Systems, Frequency Response Analysis Correlation between Time and Frequency Response, Control System Design Cascade and Feedback Compensation.

9. CourseObjectives

- To study the mathematical model ofsystems
- To study time responseanalysis
- To study the frequencyanalysis

10. CourseOutcomes

- Apply the knowledge about the Automatic Control System to use them moreeffectively.
- Describe the State Space Analysis and use it for the stability analysis of the dynamicsystems.
- Differentiate between types of controllers and design them for specificapplications.
- Design Lag, Lead, Lag-Lead Compensator using Bode Plot and Root Locus techniques and suggest the relative stabilities of different dynamicsystems.

11. CurriculumContent

Unit 1 Control Concepts and Mathematical Modelling System Concepts, Effect of Feedback, System Modelling, Transfer Function, Modelling of Different Types of Physical Systems, Analogy between the Elements of Different Types of Systems. State Variable Representation. Relationship between State Model and Transfer Function.

Unit 2 System Representation and Control Components Block Diagram Algebra. Signal Flow Graph and Mason's Gain Formula. State Diagram and Simulation. Introduction to Simulink. Working Principle and Control Applications of Synchros, Tach generator, Servomotor and StepperMotor.

Unit 3 Time Response Analysis: Time response of First Order and Second Order Systems. Steady State Error and Error Coefficients. State Transition Matrix and Solution of State Equations. Concepts of Stability–Routh- Hurwitz Criterion of Stability. Root Locus Technique**.**

Unit 4 Frequency Response Analysis Correlation between Time and Frequency Response. Frequency Response of Second Order System. Bode Plots, Polar Plots, Nichols Chart and Nyquist Stability criterion – Gain Margin and PhaseMargin.

Unit 5 Control System Design Cascade and Feedback Compensation – Design of Lag, Lead, Lag-Lead Compensator Using Bode Plot and Root Locus. Introduction to P, PI and PID Controllers and their Tuning.

Textbook(s)

1. Norman S. Nise, “Control Systems Engineering”, Wiley Eastern,2007.

2. K. Ogata, “Modern Control Engineering”, Prentice Hall of India2003.

Reference Books

B.C. Kuo, “Automatic Control Systems”, Prentice Hall of India,

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF345**
3.	**Course Title**	**POWER STATION PRACTICE**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of loads, demand factor, group diversity factor and peak diversity factor, load curve, load duration curve, load factor, capacity factor and utilization factor, base load and peak load stations, operating and spinning reserves, load forecasting, tariff form , Coordinated operation of different types of power plants, hydrothermal scheduling: short term and long term, exciters and automatic voltage regulators (AVR), bus bar arrangements, Substation Layout of EHV substation, brief description of variousequipment's.

9. CourseObjectives

- The course has been designed to fulfill the requirement of powerindustry.
- The course aims to provide basic fundamentals of economics involved with powergeneration
- The course aims to provide basic fundamentals of techniques used for optimization of generationcost.

10. CourseOutcomes

- Understanding the economics of powergeneration.
- Apply design of various new technologies to optimize the economicalrelations.
- Formulate and solve coordination problem of power systemplants.

11. CurriculumContent

Unit 1 Economics of Generation : Types of loads, demand factor, group diversity factor and peak diversity factor, load curve, load duration curve, load factor, capacity factor and utilization factor, base load and peak load stations, operating and spinning reserves, load forecasting, capital cost of power plants, depreciation, annual fixed and operatingcharges.

Unit 2 Tariff and Power Factor Improvement General tariff form and different types of tariffs, Tariff option for DSM. Causes and effect of low power factor, necessity of improvement and use of power factor improvementdevices.

Unit 3 Coordinated Operation of Power Plants Advantages of Coordinated operation of different types of power plants, hydrothermal scheduling: short term and long term. Coordination of various types of powerplant.

Unit 4 Electrical Equipments in Power Plants Governors for hydro and thermal generators, excitation systems; exciters and automatic voltage regulators (AVR), bus bar arrangements.

Unit 5 EHV Substation Layout of EHV substation, brief description of various equipments used in

EHV substations, testing and maintenance of EHV substations equipments. Gas insulated substations (GIS).

Textbook(s)

1. B.R. Gupta, Generation of Electrical Energy, (Euresia PublishingHouse).
2. M.V. Deshpande, Elements of Electrical Power Station Design, (Wheeler PublishingHouse).

Reference Books

1. S. Rao, Electrical Substation-Engineering and Practice,(Khanna).
2. S.N. Singh, Electric Power Generation, Transmission and Distribution(PHI).

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF346**
3.	**Course Title**	**SPECIAL ELECTRICAL MACHINE**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**EMEC-I, EMEC-II**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course provides knowledge regarding the construction and working of special electrical machines like deep bar induction motors, switched reluctance motors stepper motors, permanent magnet motors and commutator motors. It provides information about working of linear induction motors and their applications.

9. CourseObjectives

- To study regarding construction working and purpose of special 3 phase a.c.machines
- To study working and characteristics ofservomotors
- To study working, construction and applications of special ac and dcmotor

10. CourseOutcomes

- Able to distinguish between normal types of motors and special types ofmotors
- Understand the working of servomotors, stepper motors reluctancemotors
- Understand and able to select the suitable motor for the type ofload

11. CurriculumContent

Unit 1 Poly-phase AC Machines: Construction and performance of double cage and deep bar three phase induction motors; e.m.f. injection in rotor circuit of slip ring induction motor, concept of constant torque and constant power controls, static slip power recovery control schemes (constant torque and constant power), Introduction to multiphasemachines.

Unit2 Single phase Induction Motors: Construction, starting characteristics and applications of split phase, capacitor start, capacitor run, capacitor start, capacitor-run and shaded polemotors.
Two Phase AC Servomotors: Construction, torque-speed characteristics, performance and applications

Unit 3 Stepper Motors: Principle of operation, variable reluctance, permanent magnet and hybrid stepper motors, characteristics, drive circuits and applications.
Switched Reluctance Motors: Construction; principle of operation; torque production, modes of operation, drive circuits

Unit 4 Permanent Magnet Machines: Types of permanent magnets and their magnetization characteristics, demagnetizing effect, permanent magnet dc motors, sinusoidal PM ac motors, brushless dc motors and their important features and applications, PCB motors. Single phase synchronous motor; construction, operating principle and characteristics of reluctance and hysteresis motors; introduction to permanent magnetgenerators.

Unit 5 Single Phase Commutator Motors: Construction, principle of operation, characteristics of universal and repulsion motors; Linear Induction Motors. Construction, principle of operation, Linear force, and applications

Textbook(s)

1. P.S. Bimbhra "Generalized Theory of Electrical Machines" KhannaPublishers.

2. P.C. Sen "Principles of Electrical Machines and Power Electronics" John willey & Sons,2001

Reference Books

1. G.K.Dubey "Fundamentals of Electric Drives" Narosa Publishing House,2001

2. Cyril G. Veinott "Fractional and Sub-fractional horse power electric motors" McGraw Hill International, 1987

3. M.G. Say "Alternating current Machines" , Pitman &Sons

1.	**Department offering the course**	**Electrical Engineering**
2.	**Course Code**	**EEF347**
3.	**Course Title**	**TRANSDUCERS AND INSTRUMENTATION**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of Identification, classification construction, working principle and application of various transducers used for Displacement measurement, Temperature measurement, Level measurement, and Miscellaneous measurement, Thermal Sensors, Pressure Sensors, Opto-Electronic Sensors, Measurements of Liquid Level, Measurement of Humidity, Measurement of pH value, Sound measurement of using Microphone, ultrasonic sensors, Measurement of Nuclear Radiations: Geiger Muller Tube, Scintillation detectors, MEMS Sensors.

9. CourseObjectives

- To make students understand the Identification, classification construction, working principle and application of various transducers used for Displacement measurement, Temperature measurement, Level measurement, and Miscellaneousmeasurement
- To make the students learn the selection procedure, applications and comparative study of various Transducers
- To understand the role of the various elements of a measurement system and to specify and evaluate a measurement system for a givenapplication
- To make the students evaluate the technological and physical limitations of a specific sensor and propose a suitable sensor for a given measurementsituation

10. CourseOutcomes

- Able to understand Working principles of sensors andtransducers.
- Able to take Measurement of physical quantities like displacement, temperature, pressure,etc.
- Able to understand the Applications of various transducers used inindustry.
- Able to analyze smart sensors for their relevantapplications

11. CurriculumContent

Unit 1 Transducers: Definition, principle of sensing & transduction, classification, Static and Dynamic characteristics. Mechanical and Electro-mechanical sensors: Resistive Transducers – potentio-metric type (linear and logarithmic), Strain gauge- resistive and semiconductor type, rosettes. Inductive sensors - Reluctance type, Mutual inductance, LVDT: Construction, material, I/O curve, applications, RVDT, Hall Effect Sensor. Capacitive transducers - variable distance-parallel plate type, variable area- parallel plate, cylindrical type, and variable dielectric constant type. Piezoelectric element: piezoelectric effect, materials.

Unit 2 Thermal Sensors: Classification, Bimetallic Thermometer, Resistance thermometer (RTD), , Thermistors, Thermocouples – Principle of working, Thermoelectric Laws, Radiation Pyrometers, Optical Pyrometers, Pyrometers, Liquid Crystal Thermometer, Digital Thermometer.

Unit 3 Pressure Sensors: Types, Manometers, Bourdon Tube – C Type, spiral type, Helical Type, Bellows, Diaphragms, Pressure Measurement using: LVDT, Potentiometer, Photoelectric Transducer.

Unit 4 Opto-Electronic Sensors: Photo-emissive transducer, Photo-Conductive Transducer, Photo-Voltaic Transducer, Applications of Photo Diode and Photo Transistors as transducers, Optical encoders, Stroboscope, Fibre Optic Sensors.

Unit 5 Miscellaneous Measurements: Measurements of Liquid Level, Measurement of Humidity,

Measurement of pH value, Sound measurement of using Microphone, ultrasonic sensors, Measurement of Nuclear Radiations: Geiger Muller Tube, Scintillation detectors, MEMS Sensors, Introduction to Smart Sensors.

Textbook(s)

1. D. Patranabis, "Sensors and Transducers," 2nd edition, Prentice Hall of India PrivateLimited
2. Ian R. Sinclair, " Sensors & Transducers", 3rd Edition, NewnesPublications.
3. E.O. Doebelin and Dhanesh N Manik, "Measurement Systems," 6th Edition, McGraw Hill Education,India

Reference Books

1. B.C. Nakra & K. Chaudhry, "Instrumentation, Measurement and Analysis", Tata Mc Graw Hill 2ndEdition.

2. A.K. Sawhney and Puneet Sawhney,"Mechanical Measurements & Instrumentation & Control," Dhanpat Rai & Co.,India

D.V.S. Murthy, "Transducers and Instrumentation," Prentice Hall of India Private Limited (2003).

List of Experiments

1. Measurement of unknown resistance with the help of a dcpotentiometer.
2. To determine the characteristics ofLVDT
3. To determine the characteristics ofRVDT.
4. Measurement of strain using straingauge.
5. Measurement of load using strain gauge based loadcell.
6. Temperature measurement usingthermocouple.
7. Temperature measurement usingRTD.
8. Pressure measurement using BourdonTube.
9. Measurement of speed using Stroboscope/opticalencoder.
10. Displacement measurement using IRSensor.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF357**
3.	**Course Title**	**MICROPROCESSOR**
4.	**Credits (L:T:P:C)**	**2:0:2:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**Analog & Digital Electronics**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of hardware and software components of a microprocessor-based system work together to implement system-level features and integrating digital devices into microprocessor-based systems, Register organization, 8085 Microprocessor Architecture, 8085 Instruction Set, Memory interfacing, I/O interfacing – memory mapped and peripheral mapped I/O Programmable Interfacing Devices Like 8255A PPI, 8253/8254 Timer, 8259A PIT, 8237 DMA Controller, Architecture of 8086, block diagram, register set, flags, Queuing, concept of segmentation, Pin description, operating modes, and addressing modes.

9. CourseObjectives

- The student will learn how the hardware and software components of a microprocessor-based system work together to implement system-level features and integrating digital devices into microprocessor-based systems.
- The student will learn the operating principles of, and gain hands-on experience with, common microprocessor peripherals such as timers, USART, and PPI; role of CPU, registers, and modes of operation of 8085 and 8086microprocessor.
- Learning Microprocessor instruction sets and learning assembly-programming styles, structured assembly language programming.

10. CourseOutcomes

- Identify the basic element and functions ofmicroprocessor.
- Describe the architecture of microprocessor and its peripheraldevices.
- Demonstrate fundamental understanding on the operation between the microprocessor and its interfacing devices.

11. CurriculumContent

Unit 1 Evolution of Microprocessors, history of computers, Introduction to Microprocessor, Microprocessor systems with bus organization, Microprocessor Architecture & Operations, Tristate devices, buffers, encoder, decoder, latches, Memory devices: Semiconductor memory organization, Category of memory, I/ODevice.

Unit 2 Register organization, 8085 Microprocessor Architecture, Address, Data and Control Buses, Pin Functions, Demultiplexing of Buses, Generation of Control Signals, Timing diagrams: Instruction Cycle, Machine Cycles, T- States, Concept of Address line and Memory interfacing, Address Decoding and Memory Interfacing.

Unit 3 Classification of Instructions, Addressing Modes, 8085 Instruction Set, Instruction And Data Formats, Writing assembly language programs, Programming techniques: looping, counting and indexing, Stack & Subroutines, Developing Counters And Time Delay Routines, Code

Conversion,BCD Arithmetic And 16-Bit Data Operations. The 8085 Interrupts, 8085 vectorinterrupts.

Unit 4 Memory interfacing, I/O interfacing – memory mapped and peripheral mapped I/O Programmable Interfacing Devices Like 8255A PPI, 8253/8254 Timer, 8259A PIT, 8237 DMA Controller, and Serial I/O Concepts 8251A USART. Interfacing of above chips with 8085, Programming them In Different Modes.

Unit 5 Architecture of 8086, block diagram, register set, flags, Queuing, concept of segmentation, Pin description, operating modes, and addressing modes.

Textbook(s)

1. Microprocessor Architecture, Programming, and Applications with the 8085 Ramesh S. Gaonkar - PenramInternational
2. Microcomputers and Microprocessors: The 8080, 8085 and Z-80 Programming, Interfacing and Troubleshooting John E.Uffenbeck.

Reference Books

1. Microprocessor and Microcontroller fundamentals. The 8085 and 8051 Hardware and Software William Kleitz

List of Experiments

1. To perform 8-bit arithmetic operations between two numbers stored at consecutive memory locations: addition, subtraction, multiplication,division.

2. To perform 16-bit arithmetic operations between two numbers stored at consecutive memory locations: addition, subtraction, multiplication,division.

3. To find the largest and smallest element in an array. Also find the sum of elements in anarray.

4. Generation of Fibonacci series in 8085 in hexadecimalsequence.

5. Write and execute the program for finding even and oddnumbers.

6. To sort the given number in the ascending and descending order using 8085microprocessor.

7. Code conversion: decimal number to hexadecimal, hexadecimal number todecimal.

8. To add two 8 bit BCD numbers stored at consecutive memorylocations.

9. To subtract two 8 bit BCD numbers stored at consecutive memorylocations.

10. To interface programmable peripheral interface 8255 with 8085 and study its characteristics in mode 0, mode 1 and BSRmode.

Value added Experiments:

1. To interface 8253 Interface board to 8085 mp and verify the operation of 8253 in six different modes.
2. To interface a stepper motor with 8051 microcontroller and operateit.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF441**
3.	**Course Title**	**COMPUTER METHODS IN POWER SYSTEM ANALYSIS**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**Power System Analysis**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of Power flow analysis – Gauss Siedel method, Newton Raphson method – DLF and FDLF method, Short Circuit Analysis, Methods of Load Forecasting, Power systems State estimation and various techniques like LSET & WLSET, The line power flow state estimation, real time and computer control of power system, SCADA & Energy Management Centers, Smart Grid.

9. CourseObjectives

- To have knowledge about methods used for modeling of network and methods used for itsanalysis
- To study about methods used for short circuit analysis of a powersystem
- To study techniques used for forecasting of load both long term and shortterm

10. CourseOutcomes

- A student is able to model a power system network and analyze it using different analysismethods
- A student is able to do short circuit analysis of a powersystem
- A student is able to do short circuit analysis and able to do load forecast both long termand short term

11. CurriculumContent

Unit 1 Network Modelling: - Impedance and Admittance representation. Power flow analysis – Gauss Siedel method, Newton Raphson method – DLF and FDLF method, DC Load flow, sparsity oriented programming, Optimal Power FlowAnalysis

Unit 2 Short Circuit Analysis: - SCA of multi node system using bus impedance matrix, Z-bus building algorithm, asymmetrical fault analysis using Z-bus, development of voltage and current equations under asymmetrical fault using symmetrical components.

Unit 3 Load Forecasting Techniques:- Methods of Load Forecasting

Unit 4 Contingency Analysis:- Power systems State estimation and various techniques like LSET & WLSET, The line power flow stateestimation.

Unit 5 Computer Control of Power System:- Need of real time and computer control of power system, Operating states of power system, SCADA & Energy Management Centers, Smart Grid.

Textbook(s)

1. Glonn N. Stagg and Aimed H. El-abiad, "Computer Method in Power System Analysis", McGraw Hill, International edition1988.

2. George L. Kusic, "Computer Aided Power System Analysis", Prentice Hall,1986.

Reference Books

1. J. Arrillage, C.P. Amold and S. J. Harker, "Computer Modeling of Electrical Power Systems", John Wiley and Sons1983.

2. Jos Arrillaga and Bruce Smith, "AC-DC Power System Analysis", IEE London UK,1998.

3. L.P. Singh, "Advanced Power System Analysis and Dynamics", New Age International Ltd, New Delhi,1992.

4. Hadi Sadat, "Power System Analysis", Tata McGraw Hill, New Delhi,1999.

5. Mariesa Crow, "Computational methods for Electrical Power Systems", CRCpress.

List of Experiments

1. To plot the daily load curve for the given data usingMATLAB

2. Introduction to basics of Electrical Transients Analyser Program(ETAP)

3. Evaluate the value of voltages for a 4 bus system using node equations inMATLAB

4. Modeling and Load flow analysis of 5 bussystem

5. Bus elimination of a 4 bus system usingMATLAB

6. Application of Gauss-Siedel and Newton-Raphson method for load flow studies on a three bus system usingMATLAB

7. Analysis of fault for a multibus system using bus impedancematrix

8. Load flow analysis using Gauss-Siedel and Newton-Raphson method for 5 bussystem

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF442**
3.	**Course Title**	**DIGITAL SIMULATION OF POWER SYSTEM**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**PSA, EPS, PSOC**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of formation of network matrices – Y BUS, Y BR and Z LOOP, Z BUS building algorithms Short circuit studies using 3-phase Z BUS matrix, Simulation example, Automatic generation control (AGC), Reactive power compensation, static VAR systems, FACTS devices, Optimal power flow solution, Database for control: SCADA, Stateestimation.

9. CourseObjectives

- The objectives of the course are to make the student understand the operation and control of a modern powersystem,
- To introduce various problems encountered in proper operation of the system and theirmitigation.
- Students will learn how to analyze a large interconnected power system through digitalsimulation.

10. CourseOutcomes

- To be able to model the power system for variousstudies.
- To analyze the system for different short circuitconditions.
- To be able to optimize the generation scheduling in a hydro-thermal mix including the effect of system losses and maintaining the desired operatingconditions.
- To analyze large data, in an interconnected power system, obtained through SCADA and utilize them for state estimation, contingency analysis and securityassessment

11. CurriculumContent

Unit 1 Network Matrices: Graph-theoretic approach for the formation of network matrices – Y BUS , Y BR and Z LOOP ; Z BUS building algorithms, Simulationexample.

Unit 2 Short Circuit Studies: Representation of 3-phase networks. Short circuit studies using 3-phase Z BUS matrix. Fault impedance and admittance matrices for various types of faults. Simulation example.

Unit 3 Power System Control: Automatic generation control (AGC). Voltage control methods. Reactive power compensation, static VAR systems, FACTSdevices.

Unit 4 Optimal System Operation: Unit commitment. Optimal power flow solution, Hydro–Thermal load scheduling; short range and long range. Determination of Loss-Formula. Simulation example.

Unit 5 Computer Control and Automation: Database for control: SCADA, State estimation. Contingency analysis and power system security assessment. Modern energy control centres

Textbook(s)

1. Hadi Sadat : Power System Analysis; (McGrawHill)

Reference Books

1. Nagrath and Kothari: Power System Analysis; 4th edition(TMH)
2. Grainger and Stevenson: Power System Analysis; (McGrawHill)
3. El-Abiad and Stagg: Computer Methods in Power System Analysis; (McGrawHill)
4. Wood and Wollenberg: Power Generation Operation and Control; Wiley,NY

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF443**
3.	**Course Title**	**EHV A.C. & D.C. TRANSMISSION**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**Basic Physics, EPS**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of EHV AC & DC transmission systems, corona current, audible noise- generation, radio interference (RI), Extra High Voltage Testing, dc links, converter station, converter controls characteristics, firing angle control, current and excitation angle control, protection against over currents and over voltage, HVDC Circuit breakers, Smoothing reactors, generation of harmonics, ac and dc filters, multi –terminal dcsystems.

9. CourseObjectives

- Understand the need of EHV AC transmission and various issues related withit
- Reactive power management, Stability of AC and DCsystems
- In depth converter analysis, faults, protections, harmonic considerations, groundingsystem

10. CourseOutcomes

- Student will be able to demonstrate the knowledge of Power handling capacity of different Transmission systems
- Effect of Electrostatic and electromagnetic fields and corona due to EHVAClines.
- Voltage control and current control systems for power flow controls in HVDCsystem.
- The knowledge of AC filters as well as DC filters and Reactive powercompensation
- Overall knowledge about the HVDC system such as MTDC, protection and substation layout of HVDC powerplant

11. CurriculumContent

Unit 1 Introduction: Need of EHV transmission, standard transmission voltage, comparison of EHV AC & DC transmission systems and their applications & limitations, surface voltage gradients in conductor, distribution of voltage gradients on sub-conductors, mechanical considerations of transmission lines, modern trends in EHV AC & DC transmission, Types oftower

Unit 2 EHV AC Transmission: Corona loss formulas, corona current, audible noise- generation and characteristics corona pulses their generation and properties, radio interference (RI) effects, over voltage due to switching, ferroresonance, reduction of switching surges on EHVsystem.

Unit 3 Extra High Voltage Testing: Characteristics and generation of impulse voltage, generation of high AC and DC voltages, measurement of high voltage by sphere gaps and potential dividers. Consideration for Design of EHV Lines, Design factors under steady state limits, EHV line insulation design based upon transient over voltages. Effects of pollution on performance of EHVlines.

Unit 4 EHV DC Transmission-I: Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters, principle of dc link control, converter controls characteristics, firing angle control, current and excitation angle control, power control, starting and stopping of dc link.

Unit 5 EHV DC Transmission- II: Converter faults, protection against over currents and over voltage, HVDC Circuit breakers, Smoothing reactors, generation of harmonics, ac and dc filters, multi –terminal dc systems (MTDC): Types, control, protection and application.

Textbook(s)

1. R.D. Begamudre, "Extra High Voltage AC Transmission Engineering "WileyEastern
2. K.R Padiyar,"HVDC power transmission System, Technology and System Reactions "new ageinternational.

Reference Books

1. M.H Rashid,"Power Electronics: Circuit, Devices and Applications", Prentice hall ofIndia.
2. S .Rao, "EHV AC & HVDC Transmission Engineering and practice", KhannaPublishers
3. J Arrillaga,"High Voltage Direct current Transmission", IFFE Power Engineering Series 6, Peter Peregrionus Ltd. London.
4. M.S Naidu & V.K Kamaraju "High Voltage Engineering", Tata Mc GrawHill.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF444**
3.	**Course Title**	**ELECTRICAL ENERGY CONSERVATION AND AUDITING**
4.	**Credits (L:T:P:C)**	**3:0:0**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of the current energy scenario and importance of energy conservation, Energy Conservation Act-2001 and its features, various forms Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Energy management (audit) approach-understanding energy costs, bench marking, energy performance, Facility as an energy system, methods for preparing process flow, material and energy balance diagrams, Energy Efficiency in Electrical Systems Electrical system, Energy Efficiency in IndustrialSystems.

9. CourseObjectives

- To be able to understand the current energy scenario and importance of energyconservation.
- To be able to understand the concepts of energymanagement.
- To be able to understand the methods of improving energy efficiency in different electricalsystems.

10. CourseOutcomes

- Understand the current energy scenario and importance of energyconservation.
- Understand the concepts of energymanagement.
- Understand the methods of improving energy efficiency in different electricalsystems.

11. CurriculumContent

Unit 1 Energy Scenario : Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, Energy Conservation Act-2001 and itsfeatures.

Unit 2 Basics of Energy and its various forms Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units andconversion.

Unit 3 Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and

energy balance diagrams.

Unit 4 Energy Efficiency in Electrical Systems Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficientmotors.

Unit 5 Energy Efficiency in Industrial Systems: 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, Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation

opportunities., Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers. Energy Efficient Technologies in Electrical Systems

Textbook(s)

1. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.

Reference Books

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (availableonline)

2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (availableonline)

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF342**
3.	**Course Title**	**ENERGY MANAGEMENT SYSTEM**
4.	**Credits (L:T:P:C)**	**3:0:0**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of SCADA and its Purpose and necessity, methods of data acquisition systems, commonly acquired data, transducers, RTUs, data concentrators, various communication channels, Supervisory and Control Functions, Regulatory functions, MAN-Machine Communication, mimic diagrams, report and printing facilities, SCADA system structure, real time operation system requirements, modularization of software programming languages, production control and load management economic dispatch, distributed centres and power poolmanagement.

9. CourseObjectives

- Understand the fundamentals of energy managementfunctions
- Understand the economic analysis and system energy management for electrical system andequipment.
- Enhance the knowledge in SCADA, Multicontrol centres, systemconfiguration

10. CourseOutcomes

- To understand the fundamentals of energy managementfunctions
- To understand the economic analysis and system energy management for electrical system and equipment.
- To have understanding of the concept of supervisory control and dataacquisition.
- To familiarize the application of SCADA in powersystems

11. CurriculumContent

Unit 1 SCADA: Purpose and necessity, general structure, data acquisition, transmission & monitoring. General power system hierarchical Structure. Overview of the methods of data acquisition systems, commonly acquired data, transducers, RTUs, data concentrators, various communication channels- cables, telephone lines, power line carrier, microwaves, fibre optical channels andsatellites.

Unit 2 Supervisory and Control Functions: Data acquisitions, status indications, majored values, energy values, monitoring alarm and event application processing. Control Function: ON/ OFF control of lines, transformers, capacitors and applications in process in industry - valve, opening, closing etc.
Regulatory functions: Set points and feedback loops, time tagged data, disturbance data collection and analysis. Calculation and report preparation**.**

Unit 3 MAN-Machine Communication: Operator consoles and VDUs, displays, operator dialogues, alarm and event loggers, mimic diagrams, report and printingfacilities.

Unit 4 Data basis- SCADA, EMS and network data basis. SCADA system structure- local system, communication system and central system. Configuration- NON-redundant- single processor, redundant dual processor. Multicontrol centers, systemconfiguration.
Performance considerations: real time operation system requirements, modularization of software programming languages.

Unit 5 Energy Management Center: Functions performed at a centralized management center, production control and load management economic dispatch, distributed centers and power pool management.

Textbook(s)

1. Torsten Cergrell, " Power System Control Technology", Prentice HallInternational.

2. George L Kusic "Computer Aided Power System Analysis",, Prentice Hall ofIndia,

Reference Books

1. A. J. Wood and B. Woolenberg, "Power Generation Operation and Control", John Wiley &Sons.

2. Sunil S Rao, "Switchgear Protection & Control System" Khanna Publishers 11 thEdition.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF343**
3.	**Course Title**	**MATLAB FOR ENGINEERS**
4.	**Credits (L:T:P:C)**	**1:0:2:3**
5.	**Contact Hours (L:T:P)**	**1:0:4**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of MATLAB environment Matrices Creating and Manipulating matrices, Matrix maths and Matrix functions, Simulink, M-file scripts Creating, saving and running an M-file, Applications Root finding, Data analysis, Statistical functions, Polynomials, Curve fitting, Interpolation, Ordinary differential equations, Integration and differentiation.

9. CourseObjectives

- To aim at providing programming skills from basic level onwards using MATLABsoftware
- To aim at using MATLAB software for data acquisition, dataanalysis,
- To aim at using MATLAB software for graphical visualization, numerical analysis, algorithm development, signal processing and many otherapplications

10. CourseOutcomes

- To be able to illustrate the direct connection between the theory and real-world applications encountered in the typical engineering and technologyprograms

11. CurriculumContent

Unit 1 Basics MATLAB environment, Variables, Basic data types, Relational and Logic operators, Conditional statements, Input and Output, Loops and branching.

Unit 2 Matrices Creating and Manipulating matrices, Matrix maths and Matrix functions, Colon operator, Linspace, Cross product, Dot product, Logical functions, Logical indexing, 3-dimensional arrays, Cell arrays, Structures, Plotting: 2-D and 3-D plots: Basic plots, subplots, Histograms, Bar graphs, Pie charts.

Unit 3 Simulink Introduction, Block diagram, Functions, Creating and working with models, Defining and managing signals, Running a simulation, analysing the results.

Unit 4 M-file scripts Creating, saving and running an M-file, Creating and running of a function, Function definition line, H1 and help text lines, Function body, Sub-functions, Nested functions, File I/O handling, M- file debugging.

Unit 5 Applications Root finding, Data analysis, Statistical functions, Polynomials, Curve fitting, Interpolation, Ordinary differential equations, Integration and differentiation, Signal processing applications, Circuit analysis applications, Control systemapplications.

Textbook(s)

1. D. Hanselman and B. Littlefield, Mastering Matlab 7, Pearson Education.

Reference Books

1. A. Gilat, Matlab: An Introduction with Applications, John Wiley and Sons,2004.

2. Y. Kirani Singh and B.B. Chaudhari, Matlab Programming, Prentice Hall of India,2007

3. Steven T Karris, Introduction to Simulink with Engineering Applications, 2nd edition, Orchard Publication, 2008.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF445**
3.	**Course Title**	**HIGH VOLTAGE ENGINEERING**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**EMFT,EPS, EMEC-I & EMEC-II**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of breakdown mechanisms of electric breakdown in liquids, gases, and solids, Generation of High direct Current Voltage, generation of impulse voltages generation of impulse currents, overvoltage's and their causes, importance of insulation coordination, measurement of partial discharges and loss tangent, high voltage testing and condition monitoring of power equipment's.

9. CourseObjectives

- To introduce the basic concepts of high voltage engineering including mechanism of electrical breakdown in gases, liquids andsolids,
- To understand high voltage ac/dc and impulse generation andmeasurement,
- To have knowledge about overvoltage's and their causes, importance of insulationcoordination
- To understand measurement of partial discharges and loss tangent, high voltage testing and condition monitoring of powerequipment's

10. CourseOutcomes

- To analyze the breakdown mechanisms of electric breakdown in liquids, gases, andsolids.
- To have understanding of fundamental concepts of high voltage AC, DC, and impulsegeneration.
- To be able to apply techniques for high voltage measurements and non-destructive test techniques in high voltageengineering.
- To become familiar with testing and condition monitoring of powerequipments.

11. CurriculumContent

Unit 1 Break Down In Gases Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, breakdown in non-uniform field, breakdown invacuum.
Break Down In Liquid Dielectrics Classification of liquid dielectric, characteristics of liquid dielectric, breakdown in pure liquid and commercial liquid.

Break Down In Solid Dielectric Intrinsic breakdown, electromechanical breakdown, breakdown of solid, dielectric in practice, breakdown in composite dielectrics**.**

Unit 2 Generation of High Voltage and Currents: Generation of High direct Current Voltage, Generation of high voltage alternating voltages, generation of impulse voltages generation of impulse currents, tripping and control of impulsegenerators.

Unit 3 Measurement of High Voltage and Currents: Measurement of High direct Current Voltages, Measurement of High alternating & Impulse voltages, Measurement of High direct, alternating & Impulse Currents, Cathode ray Oscillographs for impulse voltage and current measurements.

Unit 4 Over Voltage Phenomenon & insulation Coordination: Lighting Phenomenon as natural cause for over voltage, over voltage due to switching surges and abnormal conditions, Principal of insulation coordination.

Unit 5 Non -Destructive Testing Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements.

High voltage testing: Testing of insulator & bushing, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interferencemeasurements.

Textbook(s)

1. M.S. Naidu & V. Kamraju," High voltage Engineering, Tata Mc-Graw hill.

Reference Books

1. E Kuffel and W.S.Zacngal , High voltage Engineering:, PergamumPress

2. M.P Churasia, High Voltage Engineering KhannaPublishers.

3. R.S. Jha,"High voltage Engineering", Dhanpat Rai &Sons.

4. C.L. Wadhwa,"High Voltage Engineering", Wiley EasternLtd.

5. Subir Ray." An Introduction to High Voltage Engineering" Prentice Hall ofIndia.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF351**
3.	**Course Title**	**NON-CONVENTIONAL ENERGY RESOURCES**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of various renewable energy source, Theory of solar cells. Solar cell materials, solar cell power plant, limitations, ocean geothermal Biomass energy sources, mechanism of solar, wind and ocean energy sources, the methods to handle the biomass in a productive way.

9. CourseObjectives

- To introduce fundamentals of various renewable energysource
- The technologies used to harness usable energy from solar, wind, fuelcells
- The technologies used to harness usable energy from ocean geothermal Biomass energysources.

10. CourseOutcomes

- Identify renewable energysources.
- Understand the mechanism of solar, wind and ocean energysources.
- The understanding of various technologies involved in power generation from renewable energysources.
- Understand the methods to handle the biomass in a productiveway.

11. CurriculumContent

Unit 1 Introduction Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits, present energy scenario.

Unit 2 Solar Cells - Theory of solar cells. Solar cell materials, solar cell power plant, limitations. Solar Thermal Energy Solar radiation flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling,limitations.

Unit 3 Geothermal Energy - Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.
Magneto-hydrodynamics (MHD) Principle of working of MHD Power plant, performance and limitations.

Unit 4 Fuel Cells - Principle of working of various types of fuel cells and their working, performance and limitations. Thermo-electrical and thermionic conversions, Principle of working, performance and limitations.
Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and

limitations of energy conversionsystems**.**

Unit 5 Bio-mass - Availability of bio-mass and its conversion theory.

Ocean Thermal Energy Conversion (OTEC) - Availability, theory and working principle, performance and limitations.

Wave and Tidal Wave - Principle of working, performance and limitations. Waste Recycling Plants

Textbook(s)

1. D.S. Chauhan, "Non-Conventional Energy Resources", New AgeInternational

2. B.H. Khan, "Non-Conventional Energy Resources", Tata McGrawHill

Reference Books

1. Andra Gabdel, "A Handbook for Engineers andEconomists".

2. A. Mani, "Handbook of Solar radiation Data forIndia".

3. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by AcademicPress.

4. F.R. the MITTRE, "Wind Machines" by Energy Resources and EnvironmentalSeries.

5. Frank Kreith, "Solar Energy HandBook".

6. N. Chermisinogg and Thomes, C. Regin, "Principles and Application of SolarEnergy".

7. N.G. Calvert, "Wind PowerPrinciples".

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF344**
3.	**Course Title**	**WIND AND SOLAR ENERGY SYSTEM**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**Basic Physics, EMEC-I**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, modern wind turbine technologies, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability, Solar photovoltaic, Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and windsystems.

9. CourseObjectives

- Understand the energy scenario and the consequent growth of the power generation from renewable energysources.
- Understand the basic physics of wind and solar powergeneration.
- Understand the power electronic interfaces for wind and solargeneration.
- Understand the issues related to the grid-integration of solar and wind energysystems.

10. CourseOutcomes

- To be able to apply the concepts of renewable energy sources for electricitygeneration
- To be able to apply the concepts of grid integration with renewablesources
- To evaluate the options and estimate the energy generation through renewablesources

11. CurriculumContent

Unit 1 Physics of Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

Unit 2 Wind generator topologies: Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent- Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

Unit 3 The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energyavailability.
Solar photovoltaic: Technologies - Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Unit 4 Network Integration Issues: Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behaviour during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and windsystems.

Unit 5 Solar thermal power generation: Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

Textbook(s)

1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd.,2005.
2. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons,2004.
3. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill,1984.
4. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd.,2006.

Reference Books

1. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications,2004.
2. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons,1991.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF455**
3.	**Course Title**	**OPTIMIZATION TECHNIQUES**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of Linear Programming Model-Graphical Solution–Solving LPP Using Simplex Algorithm – Revised Simplex Method, Advancements In Linear Programming Techniques, Non- Linear Programming Techniques, Dynamic Programming Method.

9. CourseObjectives

- To Introduce The Basic Concepts Of LinearProgramming
- To Educate On The Advancements In Linear ProgrammingTechniques
- To Introduce Non-Linear ProgrammingTechniques
- To Introduce The Interior Point Methods Of SolvingProblems
- To Introduce The Dynamic ProgrammingMethod

10. CourseOutcomes

- To be able to solve linear optimization problems applicable to engineering basedproblems
- To be able to grasp the nuances of advanced techniques used in linear problemprogramming
- To be able to classify linear and nonlinear system from optimizationpoint
- To apply the optimization techniques to practical problems faced in day to dayscenario

11. CurriculumContent

Unit 1 LINEAR PROGRAMMING Introduction – Formulation Of Linear Programming Model-Graphical Solution–Solving LPP Using Simplex Algorithm – Revised Simplex Method.

Unit 2 ADVANCES IN LPP Duality Theory- Dual Simplex Method – Sensitivity Analysis–- Transportation Problems– Assignment Problems-Traveling Sales Man Problem -Data Envelopment Analysis.

Unit 3 NON LINEAR PROGRAMMING Classification Of Non Linear Programming – Lagrange Multiplier Method – Karush – Kuhn Tucker Conditions–Reduced Gradient Algorithms–Quadratic Programming Method – Penalty And BarrierMethod.

Unit 4 INTERIOR POINT METHODS Karmarkar's Algorithm–Projection Scaling Method–Dual Affine Algorithm–Primal Affine Algorithm Barrier Algorithm.

Unit 5 DYNAMIC PROGRAMMING

Formulation Of Multi Stage Decision Problem–Characteristics–Concept Of Sub-Optimization And The Principle Of Optimality – Formulation Of Dynamic Programming – Backward And Forward Recursion – Computational Procedure – Conversion of final Value Problem In To Initial ValueProblems

Textbook(s)

1. Hillier and Lieberman "Introduction to Operations Research", TMH,2000.
2. R. Panneerselvam, "Operations Research", PHI,2006
3. Hamdy A. Taha, "Operations Research –An Introduction", Prentice Hall India,2003.

Reference Books

1. Philips, Ravindran And Solberg, "Operations Research", John Wiley,2002.
2. Ronald L.Rardin, "Optimization In Operation Research" Pearson Education Pvt. Ltd. New Delhi,2005.

List of Experiments

1. Study of Introduction toMATLAB
2. Study of basic matrixoperations
3. To solve linearequation
4. Solution of Linear equations for Underdetermined and Over determinedcases.
5. Determination of Eigen values and Eigen vectors of a Squarematrix.
6. Solution of DifferenceEquations.
7. Solution of Difference Equations using EulerMethod.
8. Solution of differential equation using 4th order Runge- Kuttamethod.
9. Determination of roots of apolynomial.
10. Determination of polynomial using method of Least Square CurveFitting.
11. Determination of polynomial fit, analyzing residuals, exponential fit and error bounds from the given data.
12. Determination of time response of an R-L-Ccircuit.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF446**
3.	**Course Title**	**POWER SYSTEM DEREGULATION**
4.	**Credits (L:T:P:C)**	**3:0:0**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of Electricity demand operation and reliability, energy policy and cost, competitive market for generation, Electricity Market and Management, multilateral transaction model, power exchange and ISO- functions and responsibilities, open transmission system operation and congestion management in open access transmission systems in normal operation, Predicting electricity costs, electricity cost derivation.

9. CourseObjectives

- The objectives of the course are to make the student understand the concept ofreliability,
- To make the student understand about energy policy, demand sidemanagement,
- To make the student understand about power exchange, trading arrangements and different pricing structur

10. CourseOutcomes

- Use various models for electrical supply such as central pool model, independent modeletc.
- Use benefits of deregulation for efficient energymanagement.
- Converse with the concept of power exchanges for tradingarrangement.
- Converse with different pricing methods for variousconditions.

11. CurriculumContent

Unit 1 General: Electricity demand operation and reliability, energy policy and cost, competitive market for generation, role of the existing power industry, renewable generation technologies, distributed generation, traditional central utility model, independent system operator (ISO), retail electric providers.

Unit 2 Electricity Market and Management: Wholesale electricity markets, characteristics, bidding market clearing and pricing, ISO models, market power evaluation, demand side management, distribution planning.

Unit 3 Power Pool: Role of the transmission provider, multilateral transaction model, power exchange and ISO- functions and responsibilities, classification of ISO types, trading arrangements, power pool, pool and bilateral contracts, multilateral traders.

Unit 4 Electricity Pricing-I: Transmission pricing in open access system, rolled in pricing methods, marginal pricing methods, zonal pricing, embedded cost recovery, open transmission system operation and congestion management in open access transmission systems in normaloperation.

Unit 5 Electricity Pricing-II: Predicting electricity costs, electricity cost derivation, electricity pricing of inter provincial power market, transmission policy.

Textbook(s)

1. L.L. Loi : Power System Restructuring and Deregulation-Trading, Performance and Information Technology, John Wiley &Sons.

Reference Books

1. C.S. Frd, C.C Michael, D.T Richard and E.B. Roger: Spot Pricing of Electricity, Kluwer AcademicPublishers

2. I. Marija, G. Francisco and F. Lester: Power System Restructuring: Engineering and Economics, Kluwer AcademicPublishers

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF352**
3.	**Course Title**	**RELIABILITY ENGINEERING**
4.	**Credits (L:T:P:C)**	**3:0:0**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The aim of the course is to provide students with knowledge in concepts, methodology, and tools of reliability engineering. On completion of the course, the students should be able to construct models for the estimation and improvement of reliability parameters of manufactured products and components**.**

9. CourseObjectives

- To provide students with knowledge in concepts of reliabilityengineering
- To provide students with knowledge of methodology used to assess reliabilityengineering
- To provide tools of assessing reliabilityengineering.

10. CourseOutcomes

- The student should have knowledge in concepts of reliabilityengineering
- The student should have knowledge of methodology used to assess reliabilityengineering
- The student should have knowledge of tools used for assessing reliabilityengineering.

11. CurriculumContent

Unit 1 Introduction: Definition of reliability, types of failures, definition and factors influencing system effectiveness, various parameters of system effectiveness.

Unit 2 Reliability Mathematics : Definition of probability, laws of probability , conditional probability, Bay's theorem; various distributions; data collection, recovery of data, data analysis procedures, empirical reliabilitycalculations

Unit 3 Reliability: Types of system- series, parallel, series parallel, stand by and complex; development of logic diagram, methods of reliability evaluation; cut set and tie-set methods, matrix methods event trees and fault trees methods, reliability evaluation using probability distributions, Markov method, frequency and durationmethod.

Unit 4 Reliability Improvements: Methods of reliability improvement, component redundancy, system redundancy, types of redundancies-series, parallel, series - parallel, stand by and hybrid, effect of maintenance.

Unit 5 Reliability Testing: Life testing, requirements, methods, test planning, data reporting system, data reduction and analysis,

reliability test standards.

Textbook(s)

1. R.Billintan & R.N. Allan,"Reliability Evaluation of Engineering and Systems", Plenum Press.

Reference Books

1. K.C. Kapoor & L.R. Lamberson,"Reliability in Engineering and Design", John Wiley andSons.

2. S.K. Sinha & B.K. Kale, "Life Testing and Reliability Estimation", Wiley EasternLtd.

3. M.L. Shooman, "Probabilistic Reliability, An Engineering Approach", McGrawHill.

4. G.H. Sandler, "System Reliability Engineering", PrenticeHall.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF447**
3.	**Course Title**	**POWER SYSTEM OPERATION & CONTROL**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**EPS, EMEC-I, Control System**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of optimization techniques used in the power system and Load Frequency Control (LFC), Hydrothermal scheduling, reactive power control, governing system in Turbine models, different FACT controllers.

9. CourseObjectives

- To provide students the knowledge of optimization techniques used in the power system and Load Frequency Control(LFC).
- To provide a solid foundation in mathematical and engineering fundamentals required to control the governing system in Turbinemodels.
- To provide the knowledge of Hydrothermal scheduling, reactive powercontrol.

10. CourseOutcomes

- To make students understand Economic operation of power system and importance of LFCcontrol.
- To allow students discuss about thermal and hydro power plants operation in meeting the load demand optimally.
- To improve student's ability in solving problems (numerical problems atpresent)
- Ability to discuss single area load frequency control and two area load frequencycontrol.
- Ability to model and design turbine and Automaticcontroller

11. CurriculumContent

Unit 1 Introduction: Structure of power system, power system control center, level decomposition in power system, power system security, various operational stages of power system, power system voltage stability, introduction toSCADA

Unit 2 ECONOMIC operation: Concept and problems of unit commitment, input output characteristics of thermal and hydroplants, system constraints, Optimal operation of thermal units without and with transmission losses, penalty factor, incremental transmission loss, transmission loss formula (without derivation), hydrothermal scheduling long and short terms, concept of optimal power flow

Unit 3 Load frequency control: Concept of load frequency control, load frequency control of signal area system: turbine speed governing system and modelling, block diagram representation of single area system, steady state analysis, dynamic response control area concept, P-I control, load frequency Control and economic dispatch control. Load frequency control of two area system tie line power modelling, block diagram representation of two area system,

Unit 4 AUTOMATIC voltage control: Schematic diagram and block diagram representation, Different type of excitation system & their controllers. Concept of voltage control, methods of voltage control, control by tap changing transformer. Shunt compensation, series compensation, phase anglecompensation

Unit 5 Fact Devices: Concept and objectives of facts controllers, Introduction to different FACT controllers like TCR, FC-TCR, TSC, SVC, STATCOM, TSSC, TCSC, SSSC, TC-PAR,UPFC

Textbook(s)

1. D.P. Kothari & I.J. Nagrath, "Modern Power System Analysis" Tata Mc Graw Hill, 3rdedition.
2. P.S.R. Murty, "Operation and Control in Power Systems" B.S.publications

Reference Books

1. N.G. Hingorani & l. Gyugyi, "Understanding Facts "Concepts and Technology of Flexible ACTransmission

   Systems", IEEE Press Publications
2. A.J. Wood & B.F. Wollenburg, "Power Generation, Operation and Control ", John Wiley &Sons
3. O.J. Elgerd,"Electric Energy System Theory", Tata Mc GrawHill.
4. P. Kundur, "Power System Stability and Control", Mc GrawHill.
5. M.H. Rashid, "Power Electronics: Circuits, Devices and Applications "Prentice Hall of India", 3rdedition.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EE355**
3.	**Course Title**	**UTILIZATION OF ELECTRICAL ENERGY & TRACTION**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**BEE, EMEC-I**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

- The course provides the knowledge of various types of electrical heating and electrical welding applications, fundamentals of refrigeration, air conditioning and illumination engineering, types of electric traction systems and the fundamentals related to electric traction, electric drives and their control mechanisms specially when used in electrictraction.

9. CourseObjectives

- To introduce the fundamentals of various types of electrical heating and electrical weldingapplications.
- To introduce the fundamentals of refrigeration, air conditioning and illuminationengineering
- To have knowledge about the types of electric traction systems and the fundamentals related to electric traction
- To have knowledge about the types of electric drives and their control mechanisms specially when used in electrictraction

10. CourseOutcomes

- Have the knowledge of various types of methods used for heating andwelding
- A student should be able to select a suitable heating method depending on types of material to beheated
- Have proper knowledge of different welding methods andelectroplating.
- Electroplating and itsapplications
- A student should be able to design the lighting system for variousapplications.
- Have understanding of Different types of traction systems particularly electric traction system, types of services and theircharacteristic

11. CurriculumContent

Unit 1 Electric Heating: Advantage & methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating

Unit 2 Electric Welding: Electric arc welding, electric resistance welding, Electric Welding control,

Electrolyte Process: Principal of Electro deposition, laws of Electrolysis, application Electrolysis**.**

Unit 3 Illumination: Various definition, laws of Illumination, requirement of good lighting, Design of indoor lighting & outdoor lighting system.
Refrigeration and Air Conditioning: Refrigeration system, domestic Refrigerator, water cooler, Types of Air conditioning, Window air conditioner

Unit 4 Electric Traction – I : Types of electric traction, system of track electrification, Traction mechanics- types of services, speed time curve and its simplification, average and schedule speeds, Tractive effort specific energy consumption, mechanics of train movement, coefficient of adhesion and itsinfluence

Unit 5 Electric Traction – II: Salient features of traction drives, Series-parallel control of dc traction drives (bridge traction) and energy saving, Power Electronic control of dc & ac traction drives, Diesel electric traction.

Textbook(s)

1. H. Pratab. "Art & Science of Electric Energy's" Dhanpat Rai &Sons.

2. G.K. Dubey," Fundamentals of electric drives" Narosa PublishingHouse.

Reference Books

1. H. Pratab."Modern electric traction" Dhanpat Rai &Sons.

2. C.L. Wadhwa,"Generation, Distribution and Utilization of Electrical Energy "New Age International Publishers.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF456**
3.	**Course Title**	**MODERN CONTROL SYSTEM**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**Control System**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of discrete data systems, concepts of controllability and observability, stability methods, State Space analysis, Non-linear System & Linearization.

9. CourseObjectives

- To study about discrete datasystems
- To study state space analysis involving concepts of controllability andobservability
- To study different types of stabilitymethods

10. CourseOutcomes

- To have understanding of discrete datasystems
- To have understanding and be able to carry out state space analysis involving concepts of controllability andobservability
- To be able to analyse different types of stabilitymethod

11. CurriculumContent

Unit 1 Discrete Data Systems: Introduction to discrete time systems, sample and hold circuits, pulse transfer function, representation by differential equations and its solution using z-transform and inverse-z transforms, analysis of LTI systems, unit circleconcepts.

Unit 2 State Space analysis: State equations for dynamic systems, State equations using phase, physical and canonical variables, realization of transfer matrices, Solution of state equation, concepts of controllability, observability, Controllability and Observabilitytests.

Unit 3 Non-linear System & Linearization: Introduction to non-linear system and their state variable representation. Linearization, describing function of various non-linearities. Stability analysis using describingfunction.

Unit 4 Stability: Liapunov's method, generation of Liapunov's function, Popov's criteria, design of state observers and controllers, adaptive control systems, model reference.

Unit 5 Optimal Control: Introduction , formation of optimal control problems, calculus of variation, minimization of functions, constrained optimization, dynamic programming, performance index , optimality principles, Hamilton – Jacobian equation, linear quadratic problem, Ricatti II equation and its solution, solution of two point boundary value problem

Textbook(s)

1. K. Ogata, "Modern Control Engineering", Prentice Hall ofIndia.

2. M. Gopal, "Modern Control System", WileyEastern.

3. Stefani, Shahain, Savant, Hostetter, “Design of feedback control system”, oxford universitypress

Reference Books

1. B.D.O. Anderson and IB. Moore, " Optimal Control System: Linear Quadratic Methods", Prenctice Hall International.

2. U. Itkis, "Control System of Variable Structure", John Wiley andSons.

3. H. Kwakemaok and R. Sivan, "Linear Optimal Control System", WileyInterscience**.**

List of Experiments

1. To convert a given system of 2nd order from transfer function model to state spacemodel
2. To convert a 3rd order system from transfer function model to state spacemodel
3. To check the controllability of a givensystem
4. To check the observabiility of a givensystem
5. To assess the stability of a 2nd order system using Liapunovsmethod
6. To assess the stability of a 2nd order system using Popovsmethod
7. To solve problems based on constrainedoptimization
8. To solve problems based on two point boundaryproblems

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF348**
3.	**Course Title**	**INDUSTRIAL ELECTRICAL SYSTEMS**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**EPS**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of electrical wiring systems for various applications, components of industrial electrical systems, Illumination Systems, HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, LT Breakers, MCB and other LT panel components, DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Selection of UPS and BatteryBanks.

9. CourseObjectives

- To be able to understand the electrical wiring systems for variousapplications
- To be able to understand various components of industrial electricalsystems.
- To be able to analyze and select the proper size of various electrical systemcomponents.

10. CourseOutcomes

- Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings,SLD.
- Understand various components of industrial electricalsystems.
- Analyze and select the proper size of various electrical systemcomponents.
- To be able to design an illumination scheme for a given building, workshopetc.

11. CurriculumContent

Unit 1 Electrical System Components: LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

Unit 2 Residential and Commercial Electrical Systems: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing ofcomponents.

Unit 3 Illumination Systems Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, floodlighting.

Unit 4 Industrial Electrical Systems I : 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 panelcomponents.

Unit 5 Industrial Electrical Systems II: DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Selection of UPS and BatteryBanks.

Industrial Electrical System Automation: Study of basic PLC, advantages of process automation, PLC based

control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Textbook(s)

1. 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. Web site for ISStandards.
3. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education,2008.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF448**
3.	**Course Title**	**POWER QUALITY**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**EPS**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of power quality disturbances, and their causes, detrimental effects and solutions, sag and swell, short duration/long duration voltage variations, voltage imbalance, waveform distortion, voltage fluctuations, power frequency variation, Poor load power factor, loads containing harmonics, notching in load voltage, DC offset in loads, unbalanced loads, disturbance in supply voltage, harmonic distortion: IEEE, IEC, EN, NORSOK, 2-pulse, 6-pulse and 12-pulse converter configurations, Effect of Harmonics, Elimination/Suppression ofHarmonics.

9. CourseObjectives

- Learn to distinguish between the various categories of power qualityproblems.
- Understand the root of the power quality problems in industry and their impact on performance and economics.
- Learn to apply appropriate solution techniques for power quality mitigation based on the type ofproblem

10. CourseOutcomes

- Understand the definition of power quality disturbances, and their causes, detrimental effects and solutions;
- Understand the causes of power quality problems and relate them toequipment.
- To introduce the harmonic sources, passive filters, active filters andstandards.
- To know the power quality monitoring method, equipments and develop the ability to analyze the measureddata

11. CurriculumContent

Unit 1 Power Quality Terms and Definitions: Introduction, transients, sag and swell, short duration/long duration voltage variations, voltage imbalance, waveform distortion, voltage fluctuations, power frequency variation.
Power Quality Problems: Poor load power factor, loads containing harmonics, notching in load voltage, DC offset in loads, unbalanced loads, disturbance in supply voltage

Unit 2 Fundamentals of Harmonics: Representation of harmonics, waveform, harmonic power, measures of harmonic distortion; current and voltage limits of harmonic distortion: IEEE, IEC, EN,NORSOK
Causes of Harmonics: 2-pulse, 6-pulse and 12-pulse converter configurations, input current waveforms and their harmonic spectrum; Input supply harmonics of AC regulator, integral cycle control, cycloconverter, transformer, rotating machines, ARC furnace, TV and battery charger.

Unit 3 Effect of Harmonics: Parallel and series resonance, effect of harmonics on static power plant- transmission lines, transformers, capacitor banks, rotating machines, harmonic interference with ripple control systems, power system protection, consumer equipments and communication systems, power measurement.

Unit 4 Elimination/Suppression of Harmonics: High power factor converter, multi-pulse converters using transformer connections (Delta, polygon)

Passive Filters: Types of passive filters, single tuned and high pass filters, filer design criteria, double tuned filters, damped filters and their design.

Unit 5 Active Power filters: Compensation principle, classification of active filters by objective, systems configuration, power circuit and control strategy.

Shunt Active Filter: Single phase active filter, principle of operation, expression for compensating current, concept of constant capacitor voltage control; Three phase active filter: Operation, analysis and modeling; Instantaneous reactive power theory
Three phase series active filters: Principle of operation, analysis and modeling.

Other Techniques: Unified power quality conditioner, voltage source and current configurations, principle of operation for sag, swell and flicker control

Textbook(s)

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill, 2003. (For Chapters1,2,3, 4 and5)

Reference Books

1. G.T. Heydt, 'Electric Power Quality', 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994). (For Chapter 1, 2, 3 and5)

2. M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', (New York: IEEE Press, 1999). (For Chapters 1, 2, 3 and5)

3. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', (NewYork: Wiley,1999

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF449**
3.	**Course Title**	**POWER SEMICONDUCTOR CONTROLLERS**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**Power Electronics**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of power conditioners, uninterruptible power supplies; dc power supplies: comparison of linear and switched-mode power supplies, Analysis and simulation of Power Electronic Circuits, Recent advances in power devices, Three-phase ac regulators, multiple converters, application of different converters in solar and wind energy systems.

9. CourseObjectives

- To give the exposure to types of powersupplies
- To give the exposure to types of resonant converter used in real worldapplications
- To analyze and gain knowledge about practical exposure and applications of different power electronic controllers.

10. CourseOutcomes

- A student will have exposure to types of powersupplies
- A student will have exposure to types of resonant converter used in real worldapplications
- A student will be able to analyze and gain knowledge about practical exposure and applications of different power electroniccontrollers

11. CurriculumContent

Unit 1 Power Supplies: Introduction, ac power supplies: power quality, power supply protection, power conditioners, uninterruptible power supplies; dc power supplies: comparison of linear and switched-mode power supplies, dc to dc converters with electrical isolation: forward, push-pull and bridge converter, SMPS.

Unit 2 Resonant Converters: Switched-mode inductive current switching, significance of ZVS and ZCS, classification of resonant converters, series and parallel load resonant converters, class-E converters, ZCS/ZVS resonant switch converters and their switch configurations, resonant dc link converters and their circuitconfigurations.

Unit 3 Analysis and simulation of Power Electronic Circuits: Analysis of simple power electronic circuits with RL, RC and RLC type loads and dc / sinusoidal sources; performance of transformers for high frequency applications, computer simulation of power electronic devices andsystems.

Unit 4 Recent Power Semiconductor Devices: Recent advances in power devices and their relative merits, power modules, protection of devices and converters, heat management.

Unit 5 Applications of Different Controllers: Three-phase ac regulators, multiple converters, application of different converters in solar and wind energy systems as well as in dispersed generation, current trends in powerelectronics.

Textbook(s)

M. H. Rashid (Editor), Power Electronics Handbook, Academic Press, California.

Reference Books

1. N. Mohan, T.M. Undeland and W.P. Robins, Power Electronics, John Wiley, Singapore, 3rded.

2. M. H. Rashid, Power Electronics, PHI Learning, 3rd ed, NewDelhi.

3. G.K. Dubey et al, ThyristorisedPower Controllers, New Age International, NewDelhi.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF353**
3.	**Course Title**	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of AI; Foundations of AI, History of AI; Problem solving; Problem-solving agents; Searching for solutions; Fuzzy theory, Search Strategies, Knowledge based agents; Logic; Propositional and Predicate logic; Reasoning patterns in propositional logic, Functional anatomy of neuron; Artificial neuron models; Neural network architectures; Activation functions; Rationale and basics of learning; Learning rules, Supervised and UnsupervisedNetworks.

9. CourseObjectives

- To become familiar with new technologies like AI being used in electricalengineering
- To become familiar with uses of AI in ElectricalEngineering

10. CourseOutcomes

- To have a basic idea about the concept of AI and itsworking
- To be able to apply AI for electricalengineering

11. CurriculumContent

Unit I Introduction to Artificial Intelligence (AI) and Fuzzy Logic: Introduction to AI; Foundations of AI; History of AI; Problem solving; Problem-solving agents; Searching for solutions; Fuzzy theory: Set- theoretic operations, Member function formulation and parameterization, Fuzzy Rules, Relations and Reasoning.

Unit II Search Strategies: Uninformed Search Strategies: Breadth-first search, Depth-first search, Depth-

limited search, Bidirectional search; Informed search strategies: Greedy best-first search, A* search, Memory-bounded heuristic search; Local Search algorithms: Hill climbing search, Simulated annealing search; Adversarial search: Minimax algorithm, alpha-beta pruning.

Unit III Knowledge and Reasoning: Knowledge based agents; Logic; Propositional and Predicate logic; Reasoning patterns in propositional logic; First-order logic: Syntax and semantics, Models for first- order logic, Inference rules; Rule based systems: Forward and backwardreasoning.

Unit IV Neural Network Fundamentals: Functional anatomy of neuron; Artificial neuron models;

Neural
network architectures; Activation functions; Rationale and basics of learning; Learning rules.

Unit V Supervised and Unsupervised Networks: Perceptrons; Perceptrons convergence theorem; Mutilayer

Perceptrons; Single layer networks; Limitations of single layer network; Multi layer Networks; Back propagation algorithm; Radial basis function Networks; Self-organizing networks.

Textbook(s)

1. Stuart Russell and Peter Norvig Artificial Intelligence: A Modern Approach, 2 nd edition, Prentice Hall of India, 2004.
2 D W Patterson Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India, 1998.

Reference Books

1. Simon Haykin Neural Networks: A Comprehensive Foundation, 2nd edition, Pearson Education, 2004
2. Satish Kumar Neural Networks: A Classroom Approach, Tata McGraw Hill,2004
3. Timothy J Ross Fuzzy Logic with Engineering Applications, McGraw Hill Inc,2001.
4. J.S.R.Jang, C.T.Sun and E.Mizutani Neuro-Fuzzy and Soft Computing, PHI,2004

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF450**
3.	**Course Title**	**DIGITAL INSTRUMENTATION TECHNIQUES**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**Measurements & Instrumentation, Transducers**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course provides knowledge about the digital techniques used for measuring and analysing various electrical and non-electrical signals. This course provides knowledge of Data Acquisition & Processing Techniques, Analysis & Record of Signals and Realization of Digital Instruments in Process Control

9. CourseObjectives

To introduce the concepts of digital techniques for measurement, signal conditioning, acquisition, analyzing, recording and displaying for electrical/non-electrical signals.

10. CourseOutcomes

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

1. Know the use of digital counting techniques and working of various digital instruments for measurement of electricalquantities.
2. Apply measurement, signal conditioning, acquisition, and know the digital hardware configurations for the aboveprocesses.
3. Analyze continuous and logic signals using various analyzers in time as well as frequency domain, and loggingsignal.
4. Apply various schemes for the measurement of non-electrical quantities using digital measurement methods and displayingtechniques.

11. CurriculumContent

Unit-I Digital Measurement of Electrical Quantities

Resolution, Sensitivity, Loading effect of digital instrument, Counters & Registers, Digital voltmeters, Digital Multimeter, Digital methods for the measurement of power and energy, Digital LCR meter, Low and high frequency measurement

Unit –II Data Acquisition & Processing Techniques

Introduction to digital signal processing, Implementation of ADC and types, Implementation of DAC and types

Distortions in ADC & DAC, signal conditioning, DAQ hardware configuration, DFT, FCT, DCT, realization in digital circuits

Unit –III Analysis & Record of Signals

Digital Oscilloscope, types, bandwidth, Spectrum analyzer, types of spectrum analyzers, Logic analyzer, types, triggering, Data logging: local & remoteacquisition

Unit –IV Realization of Digital Instruments in Process Control

Transducers for non-electrical quantities, Multiplexing of transducers, Digital Encoders & Decoders,

Measurement schemes for various non-electrical quantities, display devices, drivers and multiplexers

Textbook(s)

1. T. S. Rathore, "Digital measurement Techniques," CRC Press,2003.

2. Thomas L. Floyd, "Digital Fundamentals", 11th edition, Pearson,2014.

3. H. S. Kalsi, "Electronic instrumentation," Tata McGraw-Hill Education,2004.

Reference Books

1. Klaas B. Klaassen, "Electronic measurement and instrumentation, "Cambridge University Press,"2006

2. David A. Bell, "Electronic instrumentation and measurements," OUP Canada, 2nd edition,2006.

3. A. J. Bouwens, "Digital Instrumentation," McGraw-Hill,1984.

4. 7. Relevant journals/ Magazines / IEEE Transactionpapers.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF458**
3.	**Course Title**	**SOLAR PV SYSTEM**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course provides knowledge about the types of solar PV modules and arrays. The criteria and analysis of performance of solar modules as well their interconnections, It provides knowledge about the components which are the part of PV modules, about batteries and DC-DC converters. It also provides information about the types of solar PV power system their design andinstallation.

9. CourseObjectives

To study and analyze the components, design and installation of the solar PV systems.

10. CourseOutcomes

At the end of the course the students will be able to:
1. Classify different types of solar PV modules required and learn their performanceindex.

2. Analyze the different components of solar PVsystem.

3. Analyze different types of Solar PV PowerSystem.

4. Design a suitable solar PV powersystem.

11. CurriculumContent

Unit- 1: Solar PV Modules and Arrays

Introduction to PV System, Solar PV Module- Selecting criteria and performance analysis, Module interconnections, Solar PV Array- Design and assembly, Solar PV array characteristics and output conditioning

Unit- 2: Solar PV System and Components
Solar Inverter – Its characteristics and performance analysis, Batteries - Its characteristics and performance analysis, DC-DC converters and Maximum Power Point Tracking, Protection Devices and Switchgear assemblies, Balance of System Components

Unit- 3: Solar PV Power System
Types of SPV power systems, Grid connected power systems, Remote area power systems, Specific purpose Photovoltaic systems: Space – Marine –Telecommunication – water pumping – refrigeration etc.

Unit- 4: Power system design and installations
Power considerations and system design- Array integration, electrical integration, utility integration, Inspection and commissioning, Distributed power generation,Hybrid systems

Textbook(s)
1. Photovoltaic Systems, 2nd Edition, by James P. Dunlop, Publisher: American, Technical Publishers, Inc. 2010

Reference Books

1. Photovoltaics: Design and Installation Manual, by Solar Energy International, Publisher- New Society Publishers,(2004).

2. C. S. Solanki, Solar Photovoltaic Technology and Systems,PHI

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF451**
3.	**Course Title**	**INSTRUMENTATION FOR SOLAR ENERGY SYSTEM**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**Measurements & Instrumentation, Transducers**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course provides knowledge about the types and characteristics of instruments. It provides knowledge about the instruments used for the measurements of various parameters related to solar thermal system, about path finder, abut solar simulators. It also provides knowledge about interconnection and metering

9. CourseObjectives

To study the working principle of various instruments and control devices used in Solar PV systems.

10. CourseOutcomes

At the end of the course the students will be able to:
1. Classify different types of instruments required and learn their performanceindex.

2. Analyze the instruments required for solar thermalsystem.

3. Analyze the instruments required for solar PVsystem.

4. Design a suitable metering system for solar PVsystem.

11. CurriculumContent

Unit- 1: Characteristics of Instruments

Classification of instruments, Characteristics–Static and dynamics, Systematic and random errors - Statistical analysis –Uncertainty, Selection and reliability, Intelligent instruments -Physical variables -Error reduction.

Unit- 2: Instrument for Solar Thermal System
Measurement of temperature, pressure and flow, Data logging and acquisition, Sensors for heat flow measurements, Heat flux meters, Instruments for analysing Flat plate collectors

Unit- 3: Instruments for solar PV System
Instruments for Solar radiation, Solar pathfinder/ sun eye, Instruments for analysing PV performance Solar Simulators, Instruments for analysing battery performance

Unit- 4: Interconnection and metering
Interconnection and metering – Deciding factors,Gross Metering – Grid Tied LT and HT, Gross metering using 1 meter, 2 meters and for multiple buildings, Net metering – Grid Tied LT and HT, Net metering using 1 meter, 2 meters and for multiplebuildings

Textbook(s)
1. Raman .C.S, Sharma .G.R, Mani .V.S.V, “Instrumentation Devices and Systems”, TataMcGraw-Hill.

Reference Books

1. Doeblin, “Measurement System Application and Design”, McGraw-Hill,2010.
2. 3. Morris .A.S, “Principles of Measurements and Instrumentation”, Prentice Hall of India,2009

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF461**
3.	**Course Title**	**SOLAR THERMAL SYSTEMS**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course provides knowledge regarding solar radiation measurement methods, about analysing the performance of solar thermal collectors, use of solar energy for distillation, drying, cooking, heating and cooling in buildings and power generation

9. CourseObjectives

To impart knowledge of measurement and prediction of solar radiation; performance analysis of solar thermal systems for domestic and industrial applications.

10. CourseOutcomes

After successful completion of this course, the students will be able to:

1. Predict direct and diffuse radiation on different dates, times andlocations.
2. Apply solar radiation measurementmethods.
3. Analyse the performance of solar thermalcollectors.
4. Use solar energy for distillation, drying, cooking, heating and cooling in buildings and powergeneration

11. Curriculum Content Unit I: SolarRadiation

Solar Radiation: Extra-terrestrial and terrestrial solar radiation ,Solar Time, Solar radiation geometry ,Radiation on inclined surface, Solar radiation data, Measurement of solar radiation,Empirical Equations for estimation of solarradiation

Unit II: Flat Plate Collectors

Flat plate collectors; Basic energy balance equation, Transmissivity of the cover system, Transmissivity- absorptivity product, Overall loss coefficient and heat transfer correlations, Useful energy collection in liquid flat plate collector, collector efficiency factor, Collector heat removal factor, efficiency of flat plate collector, Effect of various parameters on performance of plat plate collectors, selective coatings, etc, Transient analysis of flat plate collectors , Testing procedure of flat platecollectors

Unit III: Solar Air Heater

Solar air heater; types and applications, Performance analysis of conventional air heater, Solar water heating system, Concentrating collectors; types and applications, Solar distillation, Thermal analysis of solar still, Solar dryers; types andapplications

Unit IV: Solar Cooking

Solar cooking; Testing procedure of solar cooker, Solar thermal power generation, Solar thermal energy storage; types, analysis of liquid storage tank, Active and passive heating & cooling of buildings

Textbook(s)

1. Solar Engineering of Thermal Processes by Duffie & Beckman;, Willey &Sons.

2. Principles of Solar Engineering by Goswami, Kreider & Kreith; Taylor &Francis.

Reference Books

1. Solar Energy: Principles Thermal collection and Storage by S.P. Sukhatme and J.K.Nayak, Tata McGrawHill.
2. Solar Heating and Cooling: Active and Passive Design by Kreider & Kreith, Hemisphere Publishing Corporation.
3. Solar Energy: Fundamentals, Design, Modelling and Applications by G. N. Tiwari, NarosaPublising

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF452**
3.	**Course Title**	**POWER SYSTEM STABILITY**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**EMEC-I, EMEC-II**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course knowledge about the types of stability, solutions of swing equation for both a single machine and a multi machine system for stability studies. It provides understanding of the both small single stability analysis, transient stability, sub synchronous and torsional oscillations, voltage collapse, static and dynamic analysis of voltage stability.

9. CourseObjectives

The goal of the course is to make the student understand the transient as well as small signal stability for single and multi-machine system and voltage stability of power systems.

10. CourseOutcomes

After successful completion of this course students will be able to:

1. Understand the concepts of different type of stability problems in powersystems.
2. Analyse single and multi-machine systems for transientstability.
3. Understand the enhancement of small signal stability using power system stabilizer and FACTScontrollers.
4. Analyse voltage stabilityproblems.

11. CurriculumContent

Unit I Review of Stability Concept:

Definition, Broad classification, Various modes of small signal oscillations, Rotor dynamics and Swing equation, Power angle equation, equal area criterion, Solution of Swing equation of a single and multimachine system: Modified Euler, R-K 4th Order Methods.

Unit II Small signal stability analysis

Small signal stability analysis of a single machine infinite bus system (i) Generator represented by the classical model (ii) Effect of synchronous machine field circuit dynamics including excitation and Power System

Stabilizer (PSS), Small signal stability analysis of multi-machine systems: Eigen value and time domain analysis. Improvement of Small signal stability using FACTSdevices.

Unit III Transient stability analysis, Sub-synchronous and Torsional Oscillations

Transient stability analysis of multi-machine systems- digital simulation. Direct method of stability analysis of a single and multi-machine systems using Lyapunav energy function. Methods of enhancing transient stability

Introduction, Subsynchronous resonance (SSR) Theory, Classification of SSR, Torsional Oscillations/Interaction with power system control, Computation of Torsional Natural frequencies of shaft system, Countermeasures toSSR.

Unit IV Voltage stability
Basic concept of voltage stability, Voltage Collapse, Transmission system characteristics of radial system, P-V and Q-V curves methods, Criteria for assessing voltage stability, Static analysis and Dynamic analysis.

Textbook(s)
1. P. Kundur Power System Stability and Control, Mc - GrawHill.

2. K. R. Padiyar , Power System Dynamics, Stability & Control, Interline Publishers,Bangalore.

Reference Books
1. P. Saur and M. A. Pai, Power System Dynamics & Stability, PrenticeHall

2. G.W. Stagg & A.H. Al-Abiad, Computer Methods in Power System, Mc - GrawHill.

3. Jan Machowski and others, Power System Dynamics Stability andControl

4. 6. C.W.Taylor. Power System VoltageStability

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF453**
3.	**Course Title**	**WIND AND SMALL HYDRO POWER (SHP) ENERGY SYSTEMS**
4.	**Credits (L:T:P:C)**	**3:0:9:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course provides knowledge about types of wind energy systems, horizontal axis and vertical axis wind turbines, mini micro hydroelectric power plants and their control strategies

9. Course Objectives

To introduce fundamentals of wind and small hydro energy system and their technologies used to harness usable energy from wind and hydro energy sources.

10. Course Outcomes

At the end of the course the students will be able to:
1. Identify wind energysystems.
2. Understand the mechanism of extraction of power from wind energyresources.
3. Understand the various components of hydro powerplants.
4. Understand the marketing issues and control strategies of stand-alone and hybrid energysystems.

11. Curriculum Content Unit-I Introduction

Introduction of wind energy systems, General theories of wind machines, Basic laws and concepts of aerodynamics, Micro-siting

Unit-II Wind Power Extraction
Description and performance of the horizontal-axis wind machines, Description and performance of the vertical-axis wind machines, Blade design, Generation of electricity by wind machines, case studies, Electrical and pitch controller design

Unit-III Hydro Power Plants
Overview of micro, mini and small hydro, Site selection and civil works, Penstocks and turbines, Speed and voltage regulation

Unit-IV
Control Strategies of Wind, Hydro and Hybrid Power Systems, Investment issues, load management and tariff collection, Distribution and marketing issues, case studies, Wind and hydro based stand-alone/hybrid power systems, Control of hybrid power systems, Wind diesel hybridsystems

Textbook(s)
1. B. H. Khan, "Conventional Energy Source" Second Edition, Tata McGraw Hill,2009

Reference Books
1. J.W. Twidell & A.D. Weir, Renewable Energy Resources, (ELBS / E. & F.N. Spon.,London).
2. Djamila Rekioua, Wind power electric systems, Modeling, Simulation and Control.Springer,
3. Qiuwei Wu, Yuanzhang Sun, "Modeling and control of wind power", John Wiley and Sons,pub.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	
3.	**Course Title**	**TELEMETRY AND DATA TRANSMISSION**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This subject provides knowledge about Data Formats, DM code converters, PSK, QPSK, FSK, Sensors, Signal conditioners, Multiplexing- high level and low level, ADC- range and resolution, Word Format, Frame format, Frame synchronizer codes, R. F. links, X24, RS 422, RS423, RS 232C interfaces, Multiplexing techniques in telecontrol, Industrial telecontrol

9. Course Objectives

- To study about various digital modulationtechniques
- To study about data handling and data receptionsystems
- To study about various control systems used and the types of commandsystem
- To study about telemetrysystems

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

- To have knowledge about data sampling and digital modulation techniquesused
- To have knowledge and understanding of requirements for data handling and dataanalysis
- To have knowledge about the techniques to be used for data transmission using varioustechnique

11. Curriculum Content

Unit 1 Sampling Fundamentals: Introduction to sampling theorem and sampling process, convolution, computing minimum sampling rate. Alising Errors.

Digital Modulation Techniques: Review of PCM, DPCM, Methods of binary data transmission, Data Formats, DM code converters, PSK, QPSK, FSK, probability of error, phase ambiguity resolution and differential encoding, error detection, error correction, error correction codes.

Unit 2 Data Handling System: Block schematic, Sensors, Signal conditioners, Multiplexing- high level and low level, ADC- range and resolution, Word Format, Frame format, Frame synchronizer codes, R. F. links, X24, RS 422, RS423, RS 232C interfaces, Multi terminal configuration, Multiplier & Concentrator, Data Modems, Data transmission over telephonelines.

Unit 3 Data Reception Systems: Bit synchronizers, frame synchronizers, subframe synchronizers, PLL, Displaysystems.

Unit 4 Remote Control: Communication based processing control systems, pipelines, Operational security systems components, Pipeline control, Power system control, Programmable controllers for factory automation.

Command: Tone command system, Tone digital command system, ON/OFF command and data commands.

Unit 5 Aerospace Telemetry: Signal formation and conversion, Multiplexing techniques in telecontrol, Industrial telecontrol installations, reliability in telecontrol installations**.**

List of Experiments

1. To plot the Characteristics of Straingauge

2. To plot the Characteristics of loadcell

3. To plot the Characteristics ofthermistor

4. To plot the Characteristics ofRTD

5. To plot the Characteristics ofThermocouple

6. To study the Loading effect ofPotentiometer

7. To plot the Characteristics ofSynchros

8. To plot the Characteristics ofLVDT

9.To plot the Characteristics of Piezo-electrictransducer

Textbook(s)

1. Patranabis," Telemetry Principles: Tata McGrawHill.

2. Schweber," Data Communication "McGrawHill.

Reference Books

1. Berder & Menjewlse," Telemetry Systems

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF354**
3.	**Course Title**	**NEW AND RENEWABLE ENERGY SOURCES**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course provides knowledge about different types of energy resources like solar, wind, biomass , MHD

9. CourseObjectives

- To introduce fundamentals of various renewable energysource
- To introduce fundamentals of technologies used to harness usable energy from solar,wind,
- To introduce fundamentals of technologies used to harness usable energy from ocean and Biomass energy sources

10. CourseOutcomes

- Able to identify renewable energysources.
- Able to understand the mechanism of solar, wind and ocean energysources.
- Able to demonstrate the understanding of various technologies involved in power generation from renewable energysources.

11. CurriculumContent

Unit 1 Introduction : Energy resources and their classification, oil crisis of late 20th century and its impacts on energy planning, consumption trend of primary energy sources, world energy future, energy audit and energy conservation, energystorage.

Unit 2 Solar Energy Conversion : Solar resources, passage through atmosphere, solar thermal energy conversion: solar energy collectors, solar thermal power plant, solar PV conversion: solar PV cell, V-I characteristics, MPPT, Solar PV power plant and applications.

Unit 3 Biomass Energy Conversion : Usable forms of Bio Mass, Biomass energy resources, biomass energy conversion technologies, ethanol blended petrol and diesel, biogas plants. Energyfarming.

Unit 4 Wind Energy Conversion : Wind Power: Energy estimation, Power extraction, lift and drag forces, horizontal axis wind turbine, vertical axis wind turbine, wind energy conversion and control schemes, environmentalaspects.

Unit 5 Other Alternate Energy Sources/Technologies: Geothermal Energy: geothermal fields, types, geothermal energy generation systems, ocean tidal energy systems, fuel cell: basic operation and classification, principle of MHD generation, output voltage and power, environmental aspects.

Textbook(s)

1. B.H. Khan, Non-conventional Energy Resources, 2nd edition, 2009.

Reference Books

1. G.D. Rai, Non-Conventional Sources of Energy, (KhannaPublishers).

2. J.W. Twidell & A.D. Weir, Renewable Energy Resources, (ELBS / E. & F.N. Spoon.,London).

3. Godfrey Boyle, Renewable Energy, Oxford, 2nd edition2010

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF357**
3.	**Course Title**	**BASIC INSTRUMENTATION AND PROCESS CONTROL**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course provides knowledge about types of transducers, their classifications, strain gauges, LVDT, RVDT, Thermistors, Opto electronic transducers, measurement of force, pressure, temperature. It provides knowledge about types of telemetrysystems.

9. CourseObjectives

- To make students understand the construction, working principle and application of various transducers used for flow measurement, strain measurement, pressure and vacuum measurement, force, torque and powermeasurement
- To develop an understanding about the different types of telemetry systems used and types of instruments required for display and recording of the data to betransmitted
- Understand about components, characteristics of various control processes used and their modes of operation

10. CourseOutcomes

- Identify the appropriate instruments for measurement of differentquantities.
- Ability to analyse, formulate and select suitable sensor for the given industrialapplications
- Ability to analyse various control processes used and their modes ofoperation.

11. CurriculumContent

Unit 1 Transducer – I : Definition, advantages of electrical transducers, classification, characteristics, factors affecting the choice of transducers, Potentiometers, Strain guages, Resistance thermometer, Thermistors, Thermocouples, LVDT,RVDT

Unit 2 Transducer – II: Capacitive, Piezoelectric Hall effect and opto electronic transducers. Measurement of Motion, Force pressure, temperature, flow and liquid level.

Unit 3 Telemetry: General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter. Data Acquisition System: Analog data acquisition system, Digital data acquisition system, Modern digital data acquisitionsystem.

Unit 4 Telemetry: General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter. Data Acquisition System: Analog data acquisition system, Digital data acquisition system, Modern digital data acquisitionsystem.

Unit 5 Display Devices and Recorders: Display devices, storage oscilloscope, spectrum analyser, strip chart & x-y recorders, magnetic tape & digital tape recorders.

Process Control: Principle, elements of process control system, process characteristics, proportional (P), integral (I), Derivative (D), PI, PD and PID control modes. Electronic, Pneumatic & digital controllers.

Textbook(s)

1. A.K.Sawhney, "Advanced Measurements & Instrumentation", Dhanpat Rai &Sons

2. B.C. Nakra & K.Chaudhry, "Instrumentation, Measurement and Analysis", Tata Mc Graw Hill 2ndEdition.

3. Curtis Johns, "Process Control Instrumentation Technology", PrenticeHall

Reference Books

1. E.O. Decblin, "Measurement System – Application & design", Mc GrawHill.

2. W.D. Cooper and A.P. Beltried, "Electronics Instrumentation and Measurement Techniques" Prentice Hall International

3. Rajendra Prasad,"Electronic Measurement and Instrumentation KhannaPublisher

4. M.M.S. Anand, "Electronic Instruments and Instrumentation Technology" PHILearning.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF460**
3.	**Course Title**	**ELECTRICAL MACHINE DESIGN**
4.	**Credits (L:T:P:C)**	**2:0:2:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**EMEC-I, EMEC-II, Electrical Engineering Materials**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

The course provides the knowledge of design the transformers and analysis design the induction motors, design the synchronous machines and dc machines.

9. CourseObjectives

- To study and design the transformers and analysethem
- To study and design the inductionmotors
- To study and design the synchronous machines and dcmachines

10. CourseOutcomes

- Students will be able to learn the applications of transformer and induction motor and application regarding representation using piece wise linearization and least square errormethod.
- Students will be able to formulate the mathematical modelling of transformer design, output equation, design dimension of core andyoke.
- Students will be able to learn the fundamentals of electrical circuits and thermal circuits of cooling method.
- Students will be able to learn the basics of induction motor stator design, electrical and magnetic loading, types and design ofwinding

11. CurriculumContent

Unit 1 INTRODUCTION Standards & standardization, Classification of insulating materials. Modes of heat dissipation & temperature rise-time curves. Methods of cooling ventilation (induced & forced, radial & axial), direct cooling & quantity of coolingmedium.

Unit 2 DESIGN OF TRANSFORMER Output equation design of core, yoke and windings, overall dimensions, Computation of no load current to voltage regulation, efficiency and cooling systemdesigns.

Unit 3 DESIGN OF SYNCHRONOUS MACHINES Output equations of synchronous machines, specific electric and magnetic loadings, separation of main dimensions, Rotor design, Design of field system. Estimation of performance from design data. Flow chart for design of three phase synchronousgenerators

Unit 4 DESIGN OF INDUCTION MACHINES Output equations , specific electric and magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, selection of frame size, Rotor design of three phase induction motors. Circle diagram, Estimation of performance from design data. Flow chart for design of three phase inductionmotors

Unit 5 DESIGN OF DC MACHINES & COMPUTER AIDED DESIGN Output equation, Main dimensions, Design of armature, commutator, flow chart for design of dcmachines.

Philosophy of computer aided design, advantages and limitations. Computer aided design approaches analysis- , synthesis and hybrid methods.

Textbook(s)

1. A.K. Sawhney, "Electrical Machine Design", Dhanpat Rai &Sons.

2. S. K. Sen, "Principles of Electrical Machine Design with Computer Programmes", Oxford & IBH Pub. Company

Reference Books

1. M.G. Say, "Alternating Current Machines", Pitman Publishing CompanyLtd.

2. A.E. Clayton, "The Performance and Design of DC Machines", Pitman Publishing CompanyLtd.

3. H. Cotton, "Advanced Electrical Technology" WheelerPublishing.

ListofExperiments Design usingMATLAB/Simulink/C

1. Design of a single phase transformer fordistribution

2. Design of a three phase distributiontransformer

3. Design of a three phase powertransformer

4. Design of a d.c.machine

5. Design of a synchronousgenerator

6. Design of a synchronousmotor.

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF454**
3.	**Course Title**	**AUTOMOTIVE ELECTRONICS**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. CourseSummary

This course will provide knowledge about batteries and their working principle, about the ignition system of automobiles , electronics being used currently inautomobiles.

9. CourseObjectives

- To understand the starting methods of avehicle.
- To know the functioning of ignition systems and use of electronics for controllingpurpose.
- To understand the use of sensors and actuators in the automotiveunit.

10. CourseOutcomes

After completion of this course the student will:

- To understand the Fundamentals of automotiveelectronics.
- To understand the needs of Sensors for various automotiveapplications.
- To have an overview of electrical and electronic systems used invehicles.
- To understand Electronic fuel injection and ignitionsystems
- To know the important of actuators and control system inAutomobiles.

11. CurriculumContent

UNIT I: Power Source and Starting Methods for Automotive Unit

Batteries: Principles and construction of lead-acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on battery condition, charging methods, constructional aspect of alkaline battery.
Starting System: Condition at starting. Behaviour of starter during starting, series motor and its characteristics, principle &construction of starter motor, working of different starter drive units, care and maintenance of starter motor, starter Switches.

Unit II: Ignition systems and Lighting System & Accessories:
Ignition Systems: Types, construction & working of battery coil and magneto ignition systems, relative merits, centrifugal and vacuum advance mechanisms, types and construction of spark plugs, electronic ignitionsystems.
Lighting System & Accessories: Insulated & earth return systems, positive & negative earth systems. Details of head light & side light, headlight dazzling & preventive methods, electrical fuel-pump, Speedometer, fuel, oil & temperature gauges, Horn, wipersystem.

Unit III: Automotive Electronics:
Current trends in modern automobiles Open and close loop systems-Components for electronic engine management, electronic management of chassis system, vehicle motion control

Unit IV: Sensors and Actuators:
Basic sensor arrangement, Types of sensors such as-Oxygen sensors, Crank angle position sensors- Fuel metering/vehicle speed sensor and detonation sensor- Altitude sensor, flow sensor, throttle position sensors. Solenoids, stepper motors, andrelays
Electronic Fuel Injection and Ignition Systems: Introduction, feedback carburettor systems. Throttle body injection and multi-port or point fuel injection, fuel injection systems, Injection system controls, Advantages of electronic ignition systems: Types of solid-state ignition systems and their principle of operation, Contact less electronic ignition system, and electronic spark timing control.

Unit V: Digital Engine Control System:
Digital Engine Control System: Open loop and closed loop control systems-Engine cranking and warm up control- Acceleration enrichment- Deceleration leaning and idle speed control, distributor less ignition- Integrated engine control systems, Exhaust mission control engineering, electronic dashboard instruments- On-board diagnosis system, security and warning system.

Textbook(s)
1. Judge. A.W, 'Modern Electrical Equipment of Automobiles', Chapman & Hall, London,1992.

2. William B. Ribbens, 'Understanding Automotive Electronics', 5th Edition, Butterworth, Heinemann Woburn,1998.

Reference Books
1. Vinal. G.W., 'Storage Batteries', John Wiley & Sons Inc., New York,1985.

2. Robert Bosch,'Automotive Hand Book', Bently Publishers,1997

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF281**
3. Course Title	**Introduction to Psychology**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

8. Course Summary

This course will highlight the most interesting scientific findings and insights of psychology, discussing the implications of those for our understanding of the human mind and human behaviour. We will explore some of the cognitive abilities including memory, learning, attention, perception and consciousness. We will examine the trajectory of growth of psychological perspectives. By the end of this course you will have gained a fascinating understanding and appreciation of who you are and how you work and relate with others. And I can guarantee you that you'll learn things that you'll be telling your friends and family about, things that will fundamentally change the way you think of yourself and others.

9. Course Objectives

The purpose of this course provides coverage for the broad range of learning outcomes that may be taught in introductory psychology courses. With the goal of supporting faculty in the selection of content for their courses, we have organized this course around the 5 pillars, or domains, of psychology as recently recommended by the American Psychological Association: biological pillar, cognitive pillar, developmental pillar, and social and personality pillar, mental and physical health pillar.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Identify the various approaches, fields, and subfields of psychology along with their major concepts and important figures
2. Describe the strengths and weaknesses of descriptive, experimental, and correlational research
3. Explain how nature, nurture, and epigenetics influence personality and behaviour
4. Explain the physical, cognitive, and emotional development that occurs from infancy through childhood
5. Recognize aspects of social psychology, including the fundamental attribution error, biases, social roles, and social norms, in your daily life.

11. Curriculum Content

Unit 1 Introduction

Definition, Scope, Perspectives: biological, psychoanalytic, behavioural, cognitive, humanistic, Methods: experiment, case study.

Unit 2 Cognitive Processes

Perception: Meaning, laws of perceptual organization, identifying perceptual errors; Techniques for improving our behaviors: Classical conditioning, Reinforcement theory & Modeling; Creative Thinking & Problem-Solving

Unit 3 Motivation and Emotion

Motivation: definition, self-motivation through goal setting, self-regulation, motivating employees, improving confidence; Emotion: definition, types, emotion and health, assessing emotional intelligence, body language.

Unit-4 Human abilities

Self & Personality: definition, approaches for assessment, exploration through JOHARI Window; Understanding intelligence; Stress: meaning & coping; Conflict: definition & resolution;

TEXT BOOKS

1. Baron, R.A. and Misra, G., Psychology (Indian Subcontinent Edition). Person Education Ltd. (2014)
2. Chadha, N.K. & Seth, S., The Psychological Realm: An Introduction. Pinnacle Learning, New Delhi. (2014)

REFERENCE BOOKS

1. Ciccarelli, S.K. & Meyer, G.E., Psychology (South Asian Edition). New Delhi: Tata Mc Graw Hill. (2008).\
2. Glassman, W.F., Approaches to Psychology (3rd Ed.) Buckingham: Open University Press. (2000).
3. Passer, M.W., Smith, R.E., Holt, N. and Bremmer, A., Psychology: The Science of Mind and Behaviour, McGraw-Hill Education, UK. (2008).

12. Teaching and Learning Strategy

All materials (PPTs, Assignments, Seminars, etc.) will be uploaded in Moodle.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF282**
3. Course Title	**Human Values**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

8. Course Summary

This course will introduce students to the nature of the individual and the relationship between the self and the community. It includes Principles of Interdependence between individuals and society and role of material values in promoting human well-being. It also includes psychological and spiritual values through topics like Humanistic Psychology, religion, concept of Dharma and Spirituality morality, Professional values and developing an open and balanced mind.

9. Course Objectives

To inculcate the skills of ethical decision making and then to apply these skills to the real and current challenges of the Engineering profession. The main objective of the course is to enable the students to understand the need and importance of value-education and education for Human Rights. It also aims to develop their inter personal and leadership skills and empower them to develop into evolved human beings.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students will become more sensitive to their surroundings including both people and nature, with commitment towards what they believe in (human values).
2. Be able to understand how universal values can be uncovered by different means, including scientific investigation, historical research, or public debate and deliberation (what some philosophers call a dialectic method).
3. They will become more aware of their self and their relationships and have better reflective and discerning ability.
4. Be able to understand and discuss the idea of moral relativism and the challenges it poses to universal values.

11. Curriculum Content

Unit 1 INTRODUCTION

Nature of Value-Crisis in the contemporary Indian society, Meaning, Nature & Types of Values; Sources of Value Formation, Foundational Human Values – Integrity, Freedom, Creativity, Morals, Love and Wisdom, Case Studies Case Studies on the above aspects

Unit 2 SOCIETAL VALUES & MATERIAL VALUES

Definition of Society, Units of Society, and Social Consciousness. Concepts & Principles of Interdependence, Conceptualizing 'Good Society' and 'Social Goods' and Corporate Social Responsibility, Role of Material Values in promoting Human Well-being. Role of Science and Technology; Problems of Material Development, Case Studies Case Studies on the above aspects

Unit 3 PSYCHOLOGICAL & SPIRITUAL VALUES

Humanistic Psychology; Concept of Intelligence, Emotional Intelligence & Mental health; Cognitive Dissonance & Ego Defense, Maslow's Hierarchy of Human Need; Characteristics of 'Self-Actualizing' persons; Understanding Common Religion & Concept of Dharma and Spirituality; Case Studies Case Studies on the above aspects

Unit 4 PSYCHOLOGICAL & SPIRITUAL VALUES

Bases for moral Judgments: Customary Morality, Religious Morality, Reflective Morality. Concept of Professional values: Competence , Confidence , Devotion to Duty, Efficiency , Accountability , Respect for learning / Learned , Willingness to Learn, Open and Balanced mind; Team spirit ; Willingness for Discussion, Aims, Effort , Avoidance of Procrastination and Slothfulness, Alertness, IEEE; Case Studies Case Studies on the above aspects

Textbook(s)

1. Human Values - Prof. A.N.Tripathi New Age International, 2009

Reference Books

1. Human Values and Professional Ethics - Jayshree, Suresh and B.S. Raghwan , S. Chand Publication, 2011-12

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF283**
3. Course Title	**Literature, Language & Society**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

8. Course Summary

This course will introduce students about the literature, language & society. It also includes the overview of aspects of literature and language with its impact on the society. The course explores the dimensions of literature, its nature and its functions with its approaches to the study of society. It explores the role of language and literature in the society. The course will through study of text, also analyse the practical aspect of it.

9. Course Objectives

The main objective of the course is to focus is on the interaction between literature & Society, and Literature and visual culture. This course is also about how Literature reacts to major changes in society. This course offers the students to experience different dimension of literature and language.

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10 Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students will read critically from a variety of genres, specifically poetry, drama, non-fiction, and fiction.
2. Students will read literature more carefully and meaningfully, practicing close-reading skills.
3. Students will understand the relation between historical and cultural contexts.
4. The students will develop a critical understanding of how literature can both uphold and resist existing structures of power.

11. Curriculum Content

Unit 1:
Nature and Functions of Literature, Literature and Society with special reference to Indian Literature and Indian Society, Literary Forms, Poetry, Drama, Fiction, Essay, Autobiography

Unit 2:
Approaches to the Study of Literature, Reader response to the study of Literature, Interpretation, Appreciation, Evaluation, Special problems in understanding Modern Literature.

Unit 3:
Social dimension of language. problems of multilingual communities, dominance and conflict, shift and attrition, language and the state, language and nation, Indian multilingualism, language variation, language

and identity, linguistic prejudice and inequality, standardization, linguistic determinism, critical discourse analysis, and methodological issues.

Unit 4:

Jerome K Jerome: Three Men on a Bummel (selection), Martin Amis: Last Days of Muhammad Atta, Li Ho: A Girl Comb her hair, R.K. Narayan: Malgudi Days (selection)

Textbook(s)

1. Jerome K Jerome: Three Men on a Bummel (selection), Arrow smith Publications.
2. R.K. Narayan: Malgudi Days (selection), I*ndian Thought Publications.*

Reference Books

1. Martin Montgomery, An Introduction to Language and Society (Studies in Culture and Communication) Routledge; 2 edition (December 22, 1995).
2. Robe Pope, *An Introduction to Language Literature and Culture*.Routledge, 2005.

1. **Teaching and Learning Strategy**
   All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF284**
3. Course Title	**Principles of Management**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

8. Course Summary

This course will introduce students about the basic Principles needed for management. It also includes case studies where a student can get idea about the actual working of the management field. Topics include Overview of Management, Management Information, and Planning Approach to Organizational Analysis, Motivation and Productivity.

9 Course Objectives

The objective of this course is to familiarize B.Tech. Students with the roles, responsibilities, and skills required of modern managers. This course will be present the concepts of management as it applies to current thinking in the workplace.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

- To present the topics in management, management theories, while at the same time focusing on practical applications in the real world especially for engineers.
- Evaluate the global context for taking managerial actions of planning, organizing and controlling.
- Assess global situation, including opportunities and threats that will impact management of an organization.
- Integrate management principles into management practices.

11. Curriculum Content

Unit 1 Overview of management

Definition-Management-Role of managers-Organization and the internal and environmental factors –Trends and Challenges of Management in India.
Directing – delegation –span of control– communication, Controlling

Unit 2 Management Information

Introduction to functional areas of management, Operations management, Human resources management, Marketing management, Financial management

Unit 3 Planning Approach to Organizational Analysis

Design of organization structure; job design and enrichment; job evaluation and merit rating

Unit 4 Motivation and Productivity

Theories of motivation, Leadership styles and Managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control; Few Cases on current management issues in India

TEXT BOOKS:

1. Schermerhorn, Management and Organisational Behaviour essentials, Wiley India
2. Koontz: Essentials of Management, PHI Learning.
3. Hirschey: Managerial Economics, Cengage Learning.
4. A V Rau: Management Science, BSP, Hyderabad
5. Mote, l Paul and Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.
6. Stephan R Robbins Fundamental of Management, Pearson

REFERENCE BOOKS

1. Koontz, H., and Weihrich, H., Essentials of Management: An International Perspective, 8th ed., McGraw Hill, 2009.
2. Hicks, Management: Concepts and Applications, Cengage Learning, 2007.
3. Mahadevan, B., Operations Management, Theory and Practice, Pearson Education Asia, 2009
4. Kotler, P., Keller, K.L, Koshy, A., and Jha, M., Marketing Management, 13th ed., 2009.
5. Khan, M.Y., and Jain, P.K., Financial Management, Tata-Mcgraw Hill, 2008.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF381**
3. Course Title	**Positive Psychology and Living**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

8. Course Summary

This course provides an introduction to the science related to happiness, well-being, flourishing and the positive aspects of human experience. This course discusses research findings in the field of positive psychology. It also features practical applications of this science that you can put to use immediately to help you live a full and meaningful life.

9. Course Objectives

The purpose of this course is to provide increase awareness for relevance of positive emotions at workplace. Students will gain psychological skills to maximize happiness and virtues like compassion, love and wisdom through experiential, workshop based and interactive activities along with assigned lectures and reading. Students will have an opportunity to explore the concepts (e.g., biological, psychological, social, emotional), the research behind the concepts, and evidence-based experiential activities that enhance well-being. Students will engage in a detailed analysis and evidence-based positivity change process utilizing validated questionnaires and positive psychology and well-being enhancing interventions.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students learn about modern psychological knowledge of happiness.
2. Students acquire skills to cultivate positive emotions.
3. Measure and build individual, workplace and educational flourishing; plan, implement and assess positive psychology.
4. Students will gain an understanding of what contributes to well-being and how to build the enabling conditions of a life worth living.

11. Curriculum Content

Unit 1: What is positive psychology?

Introducing Positive Psychology: Definition, goals, assumptions, key concepts and relationships with health psychology, developmental psychology, social psychology and psychology of religion, Meaning and measure of Happiness: Hedonic and Eudemonic perspective, Yogic notion of bliss

Unit 2: Positive Emotions, Cognitive states and Well-being

What are positive emotions? The broaden and build theory, relevance of positive emotional states for physical, social & psychological resources, Positive emotions and well-being: Happiness and positive

behavior, positive emotions and success, resilience, Self-efficacy, Optimism, Hope, Wisdom, Mindfulness and flourishing

Unit 3: How to enhance well-being?

Use of postures, breathing practices, Sounds, dietary consumption

Unit 4: Positive Psychology at work place

Maximizing achievement, conflict resolution, gratitude, positive leadership

Textbook(s)

Snyder (2011). Positive Psychology: The Scientific and Practical Explorations of Human Strengths. New Delhi: Sage.

Reference Books

1. Carr, A. (2004). Positive Psychology: The science of happiness and human strength.UK: Routledge.
2. Peterson, C. (2006). A Primer in Positive Psychology. New York: Oxford University Press.
3. Seligman, M.E.P. (2002). Authentic Happiness: Using the New Positive Psychology to Realize YourPotential for Lasting Fulfillment. New York: Free Press/Simon and Schuster.
4. Snyder, C.R., & Lopez,S.J.(2007). Positive psychology: The scientific and practical explorations of human strengths. Thousand Oaks, CA: Sage.
5. Snyder, C. R., & Lopez, S. (Eds.). (2002). Handbook of positive psychology. New York: Oxford University Press.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF382**
3. Course Title	**Engineering Economics**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

8. Course Summary

The course is devoted to teach basic concept of economics to the student of engineering. This includes basic concept of demand and supply of goods and services. Break-even point and evaluation is also included in this subject. Project evaluation and depreciation of physical assets are also key contribution in this subject. Finally, few concepts of banking system, inflation and business cycle are also the vital topics in this subject.

9. Course Objectives

- To provide the basic overview of economics in engineering perspectives.
- To increase the understanding of students to solve the engineering problems through economic theories.
- To increase the understanding of students to use economics theories in project investment of industries

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

- Students will be able to apply economic principles and calculations to solve engineering projects.
- To students will be efficient to get the idea of production activities and its applications in industries
- Students will be competent to estimate the present and future value of money on their various investment plans.
- Develop the ability to account for time value of money using engineering economy factors and formulas, as well as the implications and importance of considering taxes, depreciation, and inflation.

11. Curriculum Content

Unit 1 General Overview of Economics

Nature and Scope of Economics in engineering perspective; **Theory of Demand Analysis:** Meaning and Types, Law of demand, Exceptions to the Law of Demand, Elasticity of Demand; **Theory of Supply Analysis:** Law of Supply and Elasticity of Supply; Mathematical Explanation on cost, revenue and profit function

Unit 2 Production Function and Its Applications

Production Function: Short-run and long-run Production Function; **Mathematical Explanation:** Laws of Returns to Scale & Law of Diminishing Returns Scale; **Concept of Cost and Its Types:** Total cost, fixed cost, variable cost, average variable cost, average fixed cost, marginal cost, explicit and implicit cost; **Break-Even-Analysis:** Importance and graphical presentation, mathematical problems

Unit 3 Time Value of Money and Project Evaluation

Time Value of Money: Simple and Compound, Uniform Series Compound Interest Formula, Present Worth Analysis, Future Worth Analysis, Future Value through Annuity, Rate of Return Analysis, Cash flow diagrams; **Depreciation**: Introduction, Straight Line and Declining Balance Method of Depreciation; **Project Evaluation Techniques:** Present Worth Method, Future Worth Method, Annual Worth Method; Benefit Cost Analysis: Conventional and Modified B/C Ratio with PW method

Unit 4 Banking and Finance

Banking Sector: Functions of the Commercial Bank and Central Bank, Financial Institutions; **Financial Market:** Money Market and Capital Market; **Monetary and Fiscal Policy:** Objectives, Instruments, Tools in Indian Economy; **Inflation:**Causes, Effects and Methods to Control it, Measurement of Inflation-Consumer Price Index and Whole Price Index; Deflation and Stagflation; **Business Cycles:** Various phases, Control and Measurement, Impact on business cycles on economic activities

TEXT BOOKS TEXT BOOKS

1. Pravin Kumar (2015). Fundamental of Engineering Economics. Raj Kamal Press, New Delhi.
2. Riggs J.L., Dedworth, Bedworth D.B., and Randhawa, S.U. (1996). Engineering Economics. McGraw Hill International, New Delhi
3. PanneerSelvam R. (2001). Engineering Economics. Prentice Hall of India Ltd, New Delhi.

REFERENCE BOOK

1. L.M. Bhole (2007). Financial Institutions and Markets. Tata McGraw Hill, New Delhi.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF481**
3. Course Title	**Application of Psychology**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

8. Course Summary

This course will introduce students about knowledge in the various domains of psychology and its applications. It also includes theories of self, work motivation, job satisfaction, attitude and stress and its management.

9. Course Objectives

The purpose of this course is to develop a broad base of knowledge in the various domains of psychology and its applications. This course is also about to synthesis and demonstrates of useful skills in the field of psychology namely areas of organization, society, stress management etc.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

a. The students will be able to understand basic concepts of psychology in major domains.
b. The students will be able to apply the fundamentals of psychology in order to solve real life problems.
c. The students will Use scientific reasoning to interpret psychological phenomena.
d. To apply ethical standards to evaluate psychological science and practice

11. Curriculum Content

Unit 1: Role of Psychology in Understanding the Self

Three Stages – Self-awareness, Self-acceptance and Self-realization; Exploration through JOHARI Window; Development of Self-Mead & Cooley

Unit 2: Application of Psychology at Work Place

Work Motivation: Theories and applications: Maslow, Herzberg, Goal Setting, Emotion: Emotional Quotient & Job Satisfaction, Early approaches to leadership, contemporary approaches to leadership-Transformational & Transactional Leadership, styles of leadership

Unit 3: Application of Psychology in Personal & Professional Excellence

Achieving Success: Creativity & Innovation; Role of attitude; Role of competence; Role of Self-confidence; Time management; Role of Human Values.

Unit 4: Role of Psychology in Health & Fitness

Stress & Coping Strategies: Meaning, Types, Sources, Effects of stress on health, and coping strategies; Characteristics of a healthy personality

Textbook(s)

1. R. Bayne, and I. Horton, Applied Psychology, Sage publications, 2003.
2. A. Furnham, The Psychology of Behaviour at Work, Psychology Press, 1997.
3. D. Harris, Engineering Psychology and Cognitive Ergonomics, Aldershot: Ashgate, 1997

Reference Books

1. Baron, R.A. and Misra, G., Psychology (Indian Subcontinent Edition). Person Education Ltd. (2014).
2. Ciccarelli, S.K. & Meyer, G.E., Psychology (South Asian Edition). New Delhi: Tata Mc Graw Hill. (2008).
3. Passer, M.W., Smith, R.E., Holt, N. and Bremmer, A., Psychology: The Science of Mind and Behavior, McGraw-Hill Education, UK. (2008).
4. R. Gifford, (Ed.), Applied psychology: Variety and opportunity, Allyn and Bacon, 1991.
5. M.L. Blum, and J.C. Naylor, Industrial Psychology, CBS Publishers & Distributors, 1984.
6. D.M. Pestonjee, Stress and Coping: The Indian Experience, 2nd ed., Sage Publications, 1999.

13. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF482**
3. Course Title	**Intellectual Property Rights**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

8. Course Summary

The course offers a comprehensive intellectual property subject that is easy to understand for students. The intellectual property rights syllabus comprises topics ranging from patent registration to copyrights and trademarks, and examples are based on familiar situations that the students encounter in their day-to-day lives. Topics would include the major aspects of IPR, which include analysing an idea, patent search techniques, which also helps them to boost their career with additional industry-relevant skills.

9. Course Objectives

The purpose of this course is to provide the basic understanding of intellectual property rights, the rationale behind making provision for these rights and the recent concerns in the field. The main objective of the course is to increase the attention of students to protect their IP though legal provision and also teach the students how they can reduce the imitation rate. This course also helps to teach the students the understanding their involvement in technology transfer and commercialization.

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. The students will be able to understand the importance of IPRs in academic field.
2. The student gets idea how they can protect their IP through IPRs regime.
3. The student gets more incentive towards technology transfer and commercialization
4. Apply intellectual property law principles (including copyright, patents, designs and trademarks) to real problems and analyse the social impact of intellectual property law and policy

11. Curriculum Content

Unit 1: Introduction to IP

Public Funded Research and Its Implications in an Economy; Public Funded Research and Economic Development; Research & Development and Industrial Development

Unit 2: Historical Perspectives of IPRs

History and concept of Property; Introduction to intellectual property rights (IPRs); Patent, Industrial design; Copyrights, Trademarks, Geographical Indications; Trade Secrets; International aspect of IPRs; Development at International level regarding IPRs

Unit 3: Polices on IPRs in India

The debate: Copyright vs Copy left; Research ethics; role of IPRs in economic development in developed and developing economies; Overview of Various Policies on IPRs in India; Success Story of Bayh Dole Act of IPRs in USA

Unit 4: IPRs and Technology Commercialization

Technology Transfer and Commercialization; Key Determinants and Participants of Technology Transfer and Commercialization; Types of Technology Transfer and Commercialization; Technology Transfer and Commercialization in India and Other Developing Economies

Textbook(s)

1. Cornish, W.R. and L. David. 2010. 7th Edition. Intellectual Property: Patents, Copyrights, Trademarks and Allied Rights. Sweet and Maxwell.
2. Narayan, P. 2002. Intellectual Property, Law in India, 3rd Ed. New Delhi, Delhi Law House.
3. Ganguli, P. 2001. Intellectual Property Rights: Unleashing the Knowledge Economy. Tata McGraw Hills.
4. Watal, J. 2001. Intellectual Property Rights in the WTO and Developing Countries. New Delhi: Oxford University Press.

Reference Books

1. Singh A.K., Ashraf S.N. and Acharya S.R. 2017. Viability of Bayh Dole Act of USA in the context of India: Critical evidence from review of literature, in Sasi Misra.
2. Sunil Shukla and GanapathiBatthini (Eds). Proceedings of the 12th Biennial Conference on Entrepreneurship Organized by EDII Ahmedabad (pp. 235-252). Bookwell Publishing House: New Delhi

12. **Teaching and Learning Strategy**

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Course Structure & Syllabus of B.Tech.– Electrical Engineering
Applicable for Batch: 2020-24

1.	**Department offering the course**	**Humanities & Liberal Arts**
2.	**Course Code**	**LAF285**
3.	**Course Title**	**Indian Constitution**
4.	**Credits (L:T:P:C)**	**2:0:0:2**
5.	**Contact Hours (L:T:P)**	**2:0:0**
6.	**Prerequisites (if any)**	**NIL**
7.	**Course Basket**	**AEC**

8. Course Summary:

The Constitution of India is the supreme law of India. The document lays down the framework demarcating fundamental political code, structure, procedures, powers, and duties of government institutions and sets out fundamental rights, directive principles, and the duties of citizens. The course will provide knowledge of their constitutional rights to the students and also familiarize the students with the features of the Indian Constitution.

9. COURSE OBJECTIVE:

- To familiarize the students with the features of the Indian Constitution
- To provide a knowledge of their constitutional rights

10. Course Outcomes

On successful completion of the course, students will be able to achieve the following:

- Enable the students to protect their rights
- The students will be engaged in the political system of India

11. Curriculum Content

Unit 1: Introduction

Constitution- meaning of the term, basic features Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive, Principles of State Policy, debates on Fundamental Rights and Directive

Unit 2: Union Government and its Administration

Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha Institutional Functioning: Prime Minister, Parliament and Judiciary, Power Structure in India: Caste, class and patriarchy

Unit 3: State Government and its Administration

Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions.

Unit-4 Local Administration

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected, Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 5: Election Commission

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

TEXT BOOKS

1. Abbas, H., Kumar, R. & Alam, M. A. (2011) Indian Government and Politics. New Delhi: Pearson, 2011.
2. Chandhoke, N. & Priyadarshi, P. (eds.) (2009) Contemporary India: Economy, Society, Politics. New Delhi: Pearson.

REFERENCE BOOKS

1. Chakravarty, B. & Pandey, K. P. (2006) Indian Government and Politics. New Delhi: Sage.
2. Chandra, B., Mukherjee, A. & Mukherjee, M. (2010) India After Independence. New Delhi: Penguin.
3. Singh, M.P. & Saxena, R. (2008) Indian Politics: Contemporary Issues and Concerns. New Delhi: PHI Learning.
4. Vanaik, A. & Bhargava, R. (eds.) (2010) Understanding Contemporary India: Critical Perspectives. New Delhi: Orient Blackswan.

12 Teaching and Learning Strategy

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