HANDBOOK

COURSE STRUCTURE AND DETAILED SYLLABUS

B. Tech Programme

Batch: 2019-23

INSTITUTE OF ENGINEERING AND TECHNOLOGY

JK LAKSHMIPAT UNIVERSITY

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Program Education Objectives

The B.Tech. Programs at IET, JKLU are designed to prepare students for continued learning and successful careers. Our alumni are expected to:

PEO1: Apply their technical knowledge, complex problem solving and research skills in professional practice.

PEO2: Continue their intellectual development through critical thinking, self- study, apprenticeship, higher education, professional development courses, as well as participation in research groups and professional networks.

PEO3: Serve as ambassadors for engineering and sustainability by exhibiting high professional standards with a deep sense of civic responsibility.

PEO4: Effectively communicate about technical and related issues.

PEO5: Embrace roles of team members and leaders in their career.

Program Outcomes

The graduates of B.Tech Programs at IET, JKLU will have following competencies:

PO 1: Life-long learning*:* Demonstrate inquisitiveness, open mindedness, and the ability to engage in independent and life-long learning in the broadest context of technological, organizational, economic, and societal changes.

PO 2: Citizenship, Sustainability, and Professional ethics

PO 2a: Demonstrate knowledge of constitutional values of liberty, equity, justice, and fraternity with understanding of the impact of the engineering solutions in societal and environmental contexts as well as a sense of responsibility for sustainable development.

PO 2b: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, cultural, and environmental issues and the consequent responsibilities relevant to the professional engineering practice.

PO 2c: Demonstrate commitment for professional integrity and excellence and respect for ethics, responsibilities and norms as prescribed for the engineering practice.

PO 3: Engineering knowledge and Modern tool usage

PO 3a: Demonstrate clear conceptual understanding of fundamentals of engineering specialization and cognitive flexibility to appropriately 'transfer' what has been learned in a context, to different situations.

PO 3b: Apply engineering thinking, computational thinking, and the knowledge of mathematics, natural and social sciences, engineering fundamentals, information technology, engineering specialization, and engineering management to the solution of complex engineering problems.

PO 3c: Create, select, modify, and apply appropriate techniques, best practices, standards, resources, and modern engineering and IT tools including prediction and modelling to engineering and social activities with an understanding of the limitations.

PO 4: Complex problem solving, Design and Research

PO 4a: Identify, formulate, review research literature, and analyze complex engineering problems to arrive at substantiated conclusions using critical thinking along with principles of mathematics, computing, engineering as well as natural and social sciences.

PO 4b: Use systems thinking and reflection to identify and consider underlying structures, patterns, volatility, uncertainties, complexities, ambiguities, complications, and risks to design and develop engineering solutions for complex problems to meet the specified and anticipated needs with appropriate concern for constraints, performance, sustainability, and professional ethics.

PO 4c: Use research-based knowledge and research methods including design of experiments, simulation, analysis and interpretation of data, and synthesis of the information to evaluate and improve the engineering solutions and practice.

PO 5: Individual & team work and Engineering management

PO 5a: Ability to work effectively as an individual and as a team member or leader in diverse and distributed teams, and in multidisciplinary settings.

PO 5b: Ability to apply engineering management principles to one's own and team's work to manage engineering projects and operations and in multidisciplinary environment.

PO 6: Communication: Ability to communicate effectively on complex engineering and technology activities, situations, problems, and solutions using verbal, textual, and pictorial elements with the colleagues, engineering community, users, clients, policy makers, and society at large with intellectual honesty, clarity, empathy, and compassion.

PO 7: Innovation and entrepreneurship:

PO 7a: Demonstrate enthusiasm and understanding to identify opportunities and translate research in engineering and other disciplines to conceive and design innovative engineering solutions for business, industry, and societal problems.

PO 7b: Demonstrate enthusiasm and understanding to conceive and plan technology based new ventures either as independent start-up businesses or within existing corporate structures.

Program Specific Outcomes

B.Tech. (Electrical and Electronics Engineering)

The electrical and electronics engineering graduates of JKLU will be able to:

EEEPSO1: Conceive, design, implement, and manage electrical or electronic systems by using principles of circuit design, machines, communication systems, signal processing, digital systems, power systems, automation, control systems, computing, sustainability and state of the art components and tools.

EEEPSO2: Serve in fields of telecommunication, manufacturing, energy, EPC, IT and engineering services.

JK Lakshmipat University, Jaipur									
Institute of Engineering and Technology									
Department of Electrical and Electronics Engineering									
Course Structure for the B. Tech (Batch 2019 - 2023)									
Semester	**Courses**							**(L TP S) Credits**	**Hrs/ Week**
I	Computational Data Analysis	Design and Prototyping	Experimental Science-I	Fundamentals of Communication					
	ES1101	ES1102	AS1101	CC1101					
	(10s 2 0) 10	(6s 0 0) 6	(1 0 4) 3	2				21	25
II	Calculus and Applied Mechanics	Fundamentals of Automation Engineering	Object Oriented Programming	Energy and Environmental Studies	Critical Thinking and Storytelling	Scientific Perspectives			
	ES1103	ES1104	CS1101	ES1105	CC1102	AS1102			
	(6s 2 0) 6	(6s 2 0) 6	(1 0 4) 3	(1 0 0) 1	(2 0 0) 2	2		20	24
III	Data Structures	Computational Engineering Analysis-I	Engineering Measurements and Machines	Electronic Devices and Circuits	Perspectives on Contemporary Issues	Management Perspectives			
	CS1102	ES1106	ES1107	EE1101	CC1103	IL1101			
	(3 0 2) 4	(3 1 2) 5	(3 0 4) 5	(3 0 2) 4	2	2 (Management week)		22	25
IV	Power Systems-I EE1107/ Digital Systems Design EE1110	Computational Engineering Analysis-II	Advanced Electrical Machines EE1103/ Electromagnetics and Microwaves EE1104	Signals and Control Systems	Communication and Identity	Introduction to Design			
		ES1109		EE1105	CC1104	IL1102			
	(3 0 2) 4	(3 1 2) 5	(3 0 2) 4	(3 0 4) 5	(2 1 0) 2	2 (Design week)		22	25
	Practice School - I (PS 1101) – (4 to 6 Weeks Duration)							4	
V	Analog and Digital Communications	Analog Circuits	OE- I	DE-I	Understanding and Managing Conflict	Introduction to IoT	Automation Projects		
	EE1109	EE1102			CC1105	EE1111	PR1101		
	(3 0 2) 4	(6 0 0) 4	4	4	(2 0 0) 2	(1 0 2) 2	(0 0 1) 2	22	22
VI	Industrial Electronics EE1112/ Digital Communication Networks EE1208	Power System- II EE1114/ Digital Signal Processing EE1115	DE-II	DE-III/OE-II	Critical Thinking for Decisions at Workplace	Emerging Tech Week			
					CC1106				
	(3 0 2) 4	(3 0 2) 4	4	4	2	2		20	17/23
VII	DE-IV	DE-V	DE-VI	OE-II	Minor Project PR1103				
	4	4	4	4	4			20	20
VIII	Practice School - II /Entrepreneurial Project/Research Project/Semester at a partner University PS1102/PR1105/PR1104/							16	
Total Credits								167	

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B. Tech (EEE) (Batch: 2019-2023)		
Course Code	**Course Name**	**Page No**

Course Title and Code

Experimental Science-I: AS1101

Hours per Week **L-T-P: 1-0-4**

Credits **3**

Course Objectives:

This course is designed to familiarize the student with the fundamental concepts of different phenomenon related with optics, electrical & electronics, modern physics, properties of water and lubricants. This course will expose the students with experimental methods of physics, chemistry and integrates theoretical knowledge and concepts to practical experience.

Course Outcomes:

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

1. analyze ferromagnetic properties of any magnetic material and differentiate Soft and hard materials.
2. analyze thermoelectric effect of metal junctions due to temperature differences.
3. analyze nuclear radiation with respect to distance and thickness of absorbing media.
4. measure electrical properties e.g. specific resistance, time constant of various electrical components.
5. use Schroedinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials.
6. differentiate hard and soft water by determining it's hardness of different water samples.
7. analyze conductivity of samples by different techniques such as volumetric titrations and conductometric.
8. determine properties of the lubricant/oil samples by Pensky-Martens and Red Viscometer.

Prerequisites **Knowledge of Basic Science**

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	5
03	Class Participation	5
04	Quiz	10
05	Theory Exam	Nil
06	Theory Exam	Nil

07	Theory Exam	20
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	10
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation-1 (Continuous)	20
15	Lab Evaluation-2 (Exam)	30
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus:

Electromagnetism, B-H Curve, Thermo-emf, Nuclear radiation detection, Linear air track, charging discharging of capacitors, Conversion of galvanometer into ammeter/voltmeter, Specific and high resistance determination, Concept of quantum mechanics, Schrodinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials, Water analysis for hardness, PH, Alkalinity, oxygen & chloride content, conductometric titrations, Viscosity of lubricant oil, Science of solids.

Course Title –Fundamentals of Communication- 2 credits (2-0-1)
Course Code- CC1101
Semester- I

Course Description

This course provides an introduction to the importance of effective communication, the consequences of poor communication, and the different elements of verbal and non-verbal communication. Students learn about, and enhance, the components of communication: kinesics, paralanguage (voice) and language.

Course Outcomes

The students will be able to:

- Identify different cultural differences and their impact on communication.
- Compose grammatically correct sentences and paragraphs.
- Deliver effective oral presentations following appropriate kinesics and paralinguistic features.
- Identify impact of cultural differences on communication.
- Apply appropriate communication skills across settings, purposes, and audiences.

Topics to be Covered

1. Nature and importance of communication
2. Mehrabian's Communication Theory
3. Ethos, Pathos, Logos: The three pillars of persuasive communication
4. English as a Foreign Language
5. Consequences of poor communication
6. Writing Strategy
7. Basic of Effective Presentation
8. Influence of culture on communication
9. Formats of Public speaking (oral narration, conversational skills)
10. Common Errors in English

SUGGESTED READINGS:

(i) Raman, Meenakshi and Sangeeta Sharma, 2011. Technical Communication: Principles and Practice. Second Edition. New Delhi: Oxford University Press.

(ii) Mohan, Krishna and Meenakshi Raman. 2010. Advanced Communicative English. New Delhi: Tata McGraw Hill.

Evaluation Scheme:

Fundamentals of Communication

Prerequisites

Hours per Week: 2 hours **L-T-P: 2-0-1**

Credits **2**

Course Code **CC1101**

Sr. No	**Specifications**	**Weightage (in percentage)**
01	Attendance	Nil
02	**Assignments**	**30**
03	**Class Participation**	**10**
04	**Quiz**	**20**
05	Theory Exam I	Nil
06	**Theory Exam II**	**20**
07	**Theory Exam III**	**20**
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Es1101: Computational Data Analysis

Course Description: This course introduces computational analysis of data based on Linear Algebra Principles and Statistics. The computational analysis will include learning and utilizing Python as a programming language.

Course Outcomes

After course completion, the student will be able to

1. Write Simple Python programs using various datatypes, control structures, decision statements, libraries, functions (M1)
2. Develop Python programs using Objects, Classes and Files (M1, M2)
3. Develop Programs for analyzing and interpreting Complex situations in various domains including sustainable development by combining various Linear Algebra, Statistics and Other Problem Solving Techniques (M3)
4. Model Complex systems as Linear simultaneous equations and analyze the same using Matrix methods (M1)
5. Model Data as matrices and Find Eigen Values and Eigen Vectors and Apply the same for problem solving, e.g., ranking and performance analysis (M1)
6. Summarize and Visualize different datasets (M2)
7. Analyze and interpret different datasets using Discrete and Continuous Probability Distributions and Apply the same for problem solving, e.g., Goodness of Fit (M2)
8. Formulate and validate hypothesis with reference to different datasets (M2)
9. Apply correlation, regression, least square method and time series analysis for modeling, analysis, interpretation, and forecasting (M2)

Teaching Scheme and Credits

Hrs. per Week		Credits	Duration in Weeks
In Class	Out Class	10	15
10+2	20		

Evaluation Scheme

Sr. No	Specifications	Weightage (in percentage)
01	Attendance	Nil
02	Assignment	15
03	Class Participation	Nil
04	Quiz	15
05	Theory Exam (Mid Term I)	Nil
06	Theory Exam (Mid Term II)	20

07	Theory Exam	Nil
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	30
13	Project -3	Nil
14	Lab Evaluation 1	10
15	Lab Evaluation 2	10
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus

Introduction to Algorithms, Hardware Overview, Python as a Tool, Installing Python and Writing a Program, Variables & Expressions, Decision Statements, How to Debug?, Control Structures: Loops & Iterations, Linear Data Structure: String, List, Tuple, Data Dictionary and Set, Python Library (Pandas, Numpy, PyPlot), Functions, Classes & Objects, Working with Files

Matrix Operations, Eliminations, Matrix Inversion, Transformation, Solution of Linear , Simultaneous Equation, Eigen Values & Eigen Vectors , Linear Transformation, Linear Combination, Vector Spaces and Subspaces

Probability, Baye's Rule, Sampling, Data Processing and Pre-processing, Random Variable, Discrete & Continuous Distribution, Hypothesis Formulation, Test of Hypothesis, ANOVA, Correlation, Curve Fitting, Regression

Reference Books

1. Allen B. Downey. Think Python. Green Tea Press, Massachusetts, USA.
2. Kenneth Hoffman and Ray Kunze. Linear Algebra. PHI Learning Private Limited, 2nd Edition, 2012.
3. Gilbert Strang. Introduction to Linear Algebra. Wellesley-Cambridge Press, 4th edition, 2009.
4. Allen B. Downey. Think Stats. Green Tea Press, Massachusetts, USA.
5. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley & Sons, Inc., 3rd Edition (2004).
6. Rishard A. Johnson, Miller and Freund's probability and Statistics for Engineers, PHI

Course Title and Course Code	**Design and Prototyping (ES1102)**
Hours per Week	**L T P: 6 0 0**
Credits	**6**
O Students who can take	**B. Tech Semester-I (Batch: 2019-2023)**

Objective of the course:

The students will be trained to analyze an unknown situation through critical thinking and formulate it into a known problem so that solutions can be found. Once solution found, student will be able to use engineering tools to convert a conceptual product into a real product.

Course Outcomes:

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

1. Approach design challenges from the perspective of the user and offer innovative solutions effectively.
2. Communicate and work in team towards a common goal.
3. Think creatively towards a fun based, desirable solution.
4. Develop the projection views of the products with dimensions and scales.
5. Create the schematic diagram and isometric view of the parts using AutoCAD.
6. Fabricate prototype by combining the different parts.

Prerequisites		**Basics of Physics**
Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	30
3	Class Participation	NIL
4	Quiz	10
5	Theory Exam-I	NIL
6	Theory Exam-II	NIL
7	Theory Exam-III	NIL
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	50
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	NIL
16	Course Portfolio	NIL
Total (100)		**100**

Syllabus of Design & Prototyping 18hrs

1. Empathy

   Design thinking is a user-centered design process, and the empathy that comes from observing users enables design thinkers to uncover deep and meaningful needs (both overt & latent). Empathy, by definition, is the intellectual identification with or vicarious experiencing of the feelings, thoughts or attitudes of another. Three main techniques are used to gain empathy: interviewing, observation, immersion. The goal of the empathy mode is to discover gaps in between what people do and what people say they do. These gaps are the design opportunities.

   a. User Experience (On ground experience)
   b. Market Research
   c. Benchmarking, Competitor or Comparative Study
   d. Personal Experience (of the Designer)
   e. Analysis
   f. Revisiting the brief, make amendments (if brief is given by the client)

2. Define

   The Define mode is seen as a 'narrowing' part of the process. After collecting volumes of user information, it is time to distill down to one specific user group, their need and the insight behind that need so as to unify and inspire a team. The goal of this mode is to come up with at least one actionable problem statement (often referred to as Point of View (POV)) that focuses on the insights that you uncovered from real users**.**

   a. How to create a brief
   b. Setting parameters

3. Ideate

Ideation is the process of idea generation. Mentally it represents a process of "going broad" in terms of concepts and outcomes. Ideation provides the fuel for building prototypes and driving innovative solutions.

   a. Brain storming
   b. Mood Board and Theme Development
   c. Concept Sketches(doodling) and Design Proposals
   d. Final Sketches and Blueprints
   e. Logistics, Material and Production feasibility check

4. Prototyping or Mock-up models

Prototyping is the iterative development of artifacts – digital, physical, or experiential – intended to elicit qualitative or quantitative feedback. The act of prototyping implies "building", testing, and iterating and is, itself, both a flaring and a narrowing process. The flaring represents the proliferation of low-resolution prototypes developed as different aspects of the prototype are evaluated. The narrowing represents the refinement of the lower resolution models into increasingly complex and resolved models based on feedback, which leads to an even better understanding of the user's needs.

   a. Small and quick working models
   b. Scale 1:1 working prototypes

5. Product Testing , User Testing & Iterations and Changes

The test mode is another iterative mode in which we place our low-resolution artifacts in the appropriate context of the user's life. In regards to a team's solution, we should always prototype as if we know we're right, but test as if we know we're wrong— testing is the chance to refine our solutions and make them better.

a. Testing the product on field
b. Making relevant changes

Course Title and Code : Scientific Perspectives AS1102

Hours per Week **L-T-P: One week**

Credits **2**

Course Objective: This course aims to develop scientific temper in students and also improve their understanding of basic science fundamentals and their applications in industry and research.

Course Outcomes: After course completion, the student will be able to:

1. Distinguish between science, pseudo-science and other forms of knowledge.
2. Distinguish between science, engineering, technology and mathematics and also identify the opportunities for integrating these disciplines.
3. Use the scientific approach to identify and understand the societal problems
4. Explain, Design and carry out Scientific studies

Prerequisites

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	Nil
3	Class Participation	10
4	Quiz	20
5	Theory Exam-I	Nil
6	Theory Exam-II	30
7	Theory Exam-III	Nil
8	Report-I (poster)	25
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil

13	Project-III	Nil
14	Lab Evaluation-I (Continous.)	Nil
15	Lab Evaluation-II (exam)	15
16	Course Portfolio	Nil
	Total (100)	**100**

Evaluation Scheme for Retest

Sr. No	Specifications	Marks
1	Theory Exam-II	30

Syllabus

The philosophical aspects of scientific activity, Introduction to the Philosophy of Science, What is a "scientific theory"? ; The structure of a scientific theory, the methodology used to obtain scientific knowledge, Requirements to achieve scientific results, Methodology of experiment in engineering studies, the purpose and structure of the experiment, Planning, Analysis of the results, some selected seminal scientific studies.

Reference Books:

1) The Scientific Approach: Basic Principles of the Scientific Method by Carlo L. Lastrucci, Schenkman Publishing, 1963
2) Trends in Bibliometrics and Scientometrics Studies by Praveen Kumar Jain, Jean-Charles Lamirel, Parveen Babbar, Athena Academic, 2017
3) The Evaluation of Research by Scientometric Indicators by Peter Vinkler, Chandos Publishing
4) John Stuart Mill's Philosophy of Scientific Method by John Stuart Mill; Ernest Nagel Hafner Press, 1950
5) Logic, Inductive and Deductive: An Introduction to Scientific Method by Adam Leroy Jones Henry Holt, 1909
6) The Path of Science by C. E. Kenneth Mees; John R. Baker John Wiley & Sons, 1946
7) The Logic of Scientific Discovery by Karl R. Popper Basic Books, 1959
8) Failure: Why Science Is So Successful by Stuart Firestein Oxford University Press, 2016

Course Title and Code

Critical Thinking & Power of Storytelling CC1102

Hours per Week **L-T-P: 2-1-0**

Credits **2**

Students who can take **B. Tech Semester-II (Compulsory)**

Course Objective:

The modern world offers confounding opinions and choices that need to be navigated judiciously. This course explores frameworks and processes to critically examine narratives, reconstruct them, and craft well-reasoned stories that can be told using impactful communication.

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

1. Formulate intelligent questions to investigate.
2. Evaluate information and argument for correctness, consistency, relevance and validity.
3. Compose well-structured and well-reasoned arguments.
4. Articulate and evaluate the impact of narratives.
5. Distinguish between facts, assumptions and opinion.

Evaluation Scheme

Sr. No	Specifications	
1	Attendance	Nil
2	Assignment	30
3	Class Participation	20
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	30 (10% weightage to MOOC course)
8	Report-I	20
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil

12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**
1	Theory Exam III	

Syllabus:

I. **Introduction to Critical Thinking**- Definitions of Critical Thinking, its applications and the methods to think critically. Paul & Elder model will be used.

II. **Importance of questioning**-The key to critical thinking is the ability to formulate intelligent questions. Students will be able to create, improve and prioritize their questions. They will be able to use different types of question by using Bloom's taxonomy to understand the root of any situation, problem or subject.

III. **Examine data Critically-**Students will be able to filter information, separate fact from opinion, identify cognitive biases and become aware of the ladder of inference. They will also be taught to conduct responsible research and basics of bibliography and citation.

IV. **Construct and reconstruct argument-** Students will be taught to construct arguments with sound reasoning. They will be able to support their claims and opinions with compelling data and facts, and present well-informed arguments. Evaluate argument using logical fallacies.

V. **Building a compelling Narrative-** Stories that we create and narrate influence how we see ourselves and our association with others. The students will be able to observe, think, create and narrate their stories in an effective manner.

Text and Reference Books:

1) Fisher, A. (2011). Critical thinking: An introduction. Cambridge University Press.
2) Fisher, A., & Scriven, M. (1997). Critical Thinking. Its definition and evaluation.
3) Dobelli, R. (2013). The art of thinking clearly: better thinking, better decisions. Hachette UK.
4) Budden, L. (2007). Critical Thinking Skills: Developing Effective Analysis and Argument. Contemporary Nurse, 25(1-2), 174-175.
5) Butterworth, J., & Thwaites, G. (2013). Thinking skills: Critical thinking and problem solving. Cambridge University Press.

Course Name: Object Oriented Programming
Course Code: CS1101 **L-T-P: 1-0-4**
Credits: 3

Course Description: This course teaches object oriented programming to those who have learnt basic programming concepts and are ready to learn in-depth programming. It focuses on object-oriented programming using JAVA. The main concepts are: Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding, Polymorphism, Inheritance, Interfaces, Exception Handling, and Database Connectivity. This course also covers basic concepts for software design and reuse.

Course Outcomes:

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

1. Develop Java Programs with the concepts of primitive data types, strings and arrays.
2. Develop Java Programs using Object Oriented Programming Principles such as Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding, Polymorphism, Inheritance, and Interfaces.
3. Design, develop and debug programs in Core Java using coding and documentation standards.
4. Incorporate exception handling in Java Programs.
5. Use JDBC API connectivity in between Java Programs and database.

***NOTE:* Integrated Development Environments (IDEs) to be used in this Course are Eclipse or NetBeans – Both are compatible for Object Oriented Programming using Java.**

Basics of Java & Decision Statements - Introduction to Java**:** Features of Java, Byte Code and JVM, JDK, JRE; Data types and Operators: Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Datatypes, ADT, Operator types and precedence, Statements and Flow Control: Conditional statements, looping, return, etc., Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function.

Control Structures, Methods & Constructors - Object Oriented Programming in Java: Object Life time & Garbage Collection.
Methods & Constructors - Constructor & initialization code block, Parameterized Constructor, Loops, Methods.
Array & String - Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Operation on String, Mutable & Immutable String, Collection Bases Loop for String, tokenizing a String, Creating Strings using StringBuffer.

OOP's Concept I - Class Fundamentals, Object & Object reference, Access Control, Modifiers, Methods in Java: Method Declarations, Method Signatures, Invoking Methods,
OOP's Concept II - Static vs. Instance Data Fields, Static vs. Instance Methods, Method Overloading, Encapsulation.
Inheritance, Composition, and Aggregation, Invoking Base Class Constructors, Overriding vs. Overloading, Polymorphism Overloading.
Interfaces - Inner Class & Anonymous Classes, Abstract Class, Interface**s.**
Exception Handling - Introduction to Exception handling.
JDBC Programming - The JDBC Connectivity Model, Database Programming: Connecting to the Database, Creating a SQL Query, Getting the Results, and Updating Database Data.

Prerequisites		**Object Oriented Programming**
Teaching Scheme (Hours per Week)		1-0-4
Credits		3
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	25
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	10
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
	Total (100)	**100**
Evaluation Scheme for Retest		
	Theory Exam-III	25
	Lab Evaluation-II	10
	Total	**35**

References

1. Liang, Y. Daniel. Introduction to Java programming: comprehensive version. Pearson Education, 2018.

2. Horstmann, Cay S., and Gary Cornell. Core Java 2: Volume I, Fundamentals. Pearson Education, 2016.
3. Schildt Herbert. The Complete Reference, Java 2, Fourth Edition. TMH, 2017.

Course Title and Code	Calculus and Applied Mechanics ES1103
Hours per Week	**L-T-P: 6-2-0**
Credits	**6**
Students who can take	**B. Tech Semester-II (Compulsory)**

Course Objective:

This course introduces the basic elements of calculus and mechanics through some engineering projects. The application of multivariable calculus in civil and mechanical engineering is also highlighted. This course will equip students with essential domain knowledge of calculus and applied mechanics in solving basic engineering problems.

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

1. apply analytical techniques to determine forces in structures
2. use commercial software(STAAD Pro.) to simulate a structure/frame and determine force in the members
3. model physical phenomena using calculus and solve using appropriate method
4. apply Newton's laws of motion and understand the concepts of dynamics concepts (force, momentum, work and energy)
5. interpret the geometrical significance of differential and integral calculus
6. solve problems of vector differentiation and integration
7. calculate the buoyant forces of objects with various shape and carryout the stability analysis
8. apply the concept of partial differentiation to solve optimization problems

Sr. No	Specifications	Old Scheme Marks
1	Attendance	--
2	Assignment	10
3	Class Participation	5
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	30
8	Report-I	--
9	Report-II	--
10	Report-III	--
11	Project-I	15
12	Project-II	15
13	Project-III	--
14	Lab Evaluation-I	--
15	Lab Evaluation-II	--
16	Course Portfolio	--
	Total (100)	**100**
	Provision of re test	
1	Theory Exam-III	**30**

Syllabus:

Vectors Algebra: basics of vector algebra, resultant vector, Application of vector equilibrium on structures.

Force systems basic concepts, equilibrium of system of forces, free body diagrams, equations of equilibrium of coplanar systems, structures (trusses), analysis of structures, method of joints, method of section, friction, virtual work, work energy principle, impulse-momentum (linear, angular).

Function of several variables, functions of one and several variables, partial differentiation, maxima-minima.

Vector Differentiation: Vector functions and derivatives, Arc length and unit tangent vector, Curvature and unit normal vector, Directional derivative and gradient vectors, Tangent plane, Divergence and curl of a vector field

Integral Calculus, area under curve, arc length, double integral, change of order and triple integrals, surface and volume integrals, solids of revolution, moment of inertia, floatation, buoyancy, centroid

Vector Integration: Line integral, flux, work done, circulation, path independence, potential function and conservative fields, Surface area and surface integral, Green's theorem in the plane, Stoke's theorem, Divergence theorem

Text Books:

1. M.D. Weir and J. Hass, Thomas, Calculus, Pearson, India, 2016.
2. R.C Hibbeler, Engineering Mechanics, Pearson India, 2010.

Reference Books:

1. Goldstein et. al., Calculus and Its Applications, Pearson, India, 2018.
2. SS Bhavikatti, Engineering Mechanics, New Age International Publishers, 2019.
3. Beer and Johnston, Vector mechanics for engineers, McGraw Hill Education, 2009.
4. S Timoshenko, Engineering Mechanics, McGraw Hill Education, 2017.
5. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, India, 2013.
6. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, New Delhi, India, 2015.

Course Name: Fundamentals of Automation Engineering (ES 1104)
This course aims at building key technical competencies needed by automation engineers.

Credit: 6; Design Studio – 6 Hrs/week; Tutorial Hours - 2 Hrs/week

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

1) Analyze electrical circuits using network theorems
2) Measure electrical parameters of passive as well as active electrical components
3) Design rectifier circuit using semiconductor devices.
4) Design filters for power conditioning.
5) Design and test a linear power supply for given specifications
6) Design and build Printed Circuit Boards.
7) Use electrical safety practices while working on electrical projects.

8) Formulate mathematical models for basic mechanical, electro-mechanical and fluid systems.
9) Design and simulate open-loop control system.

10) Evaluate and simplify Boolean functions and design the minimized logic using logic gates.
11) Design basic combinational and sequential circuits with minimum complexity
12) Implement combinational circuit using simulation tools.

Professional Skills
Collaboration, Leadership, Teamwork, Social Responsibility.

Teaching Scheme and Credits

Hrs. per Week		Credits	Duration in Weeks
In Class	Out Class	6	6
6 (L) + 2 (T)	4		

Expectations from the Students:
1. To be punctual at sessions and be interactive during discussions
2. To strictly follow safety rules while working on electrical circuits, handle the sophisticated equipment with care and neatly place the tools and equipment in safe place.
3. To dedicate 4-6 hours a week for this course (for self-study and assignments)
4. To demonstrate teamwork by contributing to the overall success of the project.
5. To seek prior concern from instructor(s) is required for absentees.
6. Academic integrity is expected from students.

Expectations from the Faculty Members:
1. To assess student progress by continuous evaluation and provide feedback to students on their performance, fortnightly.
2. To help students to update on latest automation technology used in industry and develop new project ideas.
3. To guide students to work safely and systematically for projects.

Course Feedback: Online Every Fortnight

Evaluation Scheme

Sr. No	**Specifications**	Regular student(s)
01	Attendance	Nil
02	Assignment (03)	10
03	Class Participation & Attendance	Nil
04	Quizzes	10
05	Theory Exam I	10
06	Theory Exam II	10
07	Theory Exam III	20
08	Report -I	Included with Project 1
09	Report-II	Included with Project 2
10	Report-III	Included with Project 3
11	Project -I	10
12	Project -II	10
13	Project -III	10
14	Lab Evaluation I (End Term)	10
15	Lab Evaluation II	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Evaluation scheme for retest.

1	Theory Exam III	20
2	Lab Evaluation (End Term)	10
	Total (30)	**30**

Project Evaluation Components –

Design of circuit	Skills demonstrated	Time Mgmt.	Sophistication/ neatness in work	Presentation	
				Presentation Skills	Viva
(20%)	(20%)	(10%)	(20%)	(20%)	(10%)

Syllabus: Element of DC network and circuits, Application of network Theorems, Concept of Phasors and power factor calculations. Single phase and three phase wiring and balancing of loads. Semiconductor devices and Rectifier circuit, Transformers and power supply. Safety in handling Electrical equipment.

Introduction to control system: open and closed loops. Block diagrams, Electro-Mechanical models. Simulation for dynamic model of a control system.

Digital circuits for automation: Boolean Algebra, Karnaugh map, Logic gates, Combinational and Sequential Circuits, Displays, Sensors and Microcontrollers for automation: Working principle of sensors. Architecture of ATMega328 (concepts on ALU, memory, ports). Applications on sensors interfacing with microcontroller.

Projects: The course involves three modules which ultimately lead to common goal of developing a dynamic model for cycles developed in course Design and Prototype.

Project 1: Power supply (Specifications:)
Domain Knowledge: AC and DC current, circuit theory, semiconductor pn junction, regulators, filters.

Project 2: Dynamic system modelling for cycle
Domain Knowledge: Control Systems, Dynamic models, Simulation.

Project 3: Digital tachometer for cycle
Domain Knowledge: Digital Logic, developing software for logical functions using microcontrollers.

Text Books:

1. WH Hayt, J E Kemmerly, SM Durbin, Engineering Circuit Analysis, Eight Edition, 2013, Mc. Graw Hill, ISBN 978-0-07-352957-8.
2. M. Morris Mano, Digital Logic and Computer Design, 1st Edition, 2016, Pearson India Publication, ISBN: 9789332542525.
3. S Palani, Control Systems Engineering, 2nd edition,2 August, Mc. Graw Hill Education, ISBN-10: 0070671931.

Reference Books:

1 C. L. Wadhwa, “Basic Electrical Engineering”, New Age Int. (P) Limited, Publishers, ISBN: 9788122421521.

2 Dhananjay Gadre and Nehul Malhotra, Tiny AVR Microcontroller Projects for the Evil Genius, Tata Mc Graw Hill Edition, ISBN: 9780071744546.

Evaluation Scheme

Sr. No	Specifications	Marks
01	Assignment	10
02	Quizzes	10
03	MID TERM Theory Exam	15
04	END TERM Theory Exam	20
05	Report -1	Included with Project 1
06	Report-2	Included with Project 2
07	Project -1	10
08	Project -2	10
09	Lab Evaluation (Continuous)	15
10	Lab Evaluation (Exam)	10
	Total (100)	**100**

Project Evaluation Components –

Design	Skills demonstrated	Time Mgmt.	Sophistication/ neatness in work	Presentation	
				Presentation Skills	Viva
(20%)	(20%)	(10%)	(20%)	(20%)	(10%)

Syllabus:

Digital circuits for automation: Boolean Algebra, Karnaugh map, Logic gates, Decoders and Multiplexers, Sequential Circuits, Displays, Sensors and Microcontrollers for automation: Working principle of sensors. Architecture of ATMega328 (concepts on ALU, memory, ports). Applications on sensors interfacing with microcontroller.

Project: The course leads to developing a digital measurement system for the device developed in course Design and Prototype.
Professional Skills: Team-work, Leadership, Professionalism, Time Management, Presentation skills, Communication Skills, Technical Report
Reference Books:

1. Digital Logic and Computer Design Fundamental by Morris Mano, Pearson Publication, 5th Edition.
2. Programming and Customizing the AVR Microcontroller by Dhananjay Gadre, 1st Edition, Mc Graw Hill Publication, ISBN-13: 978-0071346665

IT Resources
https://nptel.ac.in/courses/108/105/108105132/

Course Title and Code

Energy and Environment Studies ES1105

Hours per Week **L-T-P: 1-0-0**

Credits **1**

Students who can take **B. Tech Semester-II (Compulsory)**

Course Objective:

To enhance the understanding of conventional and non-conventional energy sources and its relationship with the ecology and environment.

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

1. Relate renewable energy with ecology & environment
2. Explain the climate change and threat to biodiversity
3. Describe the various pollution sources and their impacts on Environment

Evaluation Scheme

Sr. No	Specifications	
1	Attendance	Nil
2	Assignment	20
3	Class Participation	10
4	Quiz	10
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	20
8	Report-I	20
9	Report-II	20
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil

16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation policy for retest		
1	Theory Exam III	30

Syllabus (Theory):

Unit-1: Present Energy resources in India and its sustainability, Energy Demand Scenario in India- Advantage and Disadvantage of conventional Power Plants – Conventional vs Non-conventional power generation.

Unit-2: Basics of Solar Energy, Wind energy- Environmental benefits and impacts, Biomass resources- Bioenergy, Geothermal Energy.

Unit-3: Understanding environment, global crisis, Basic Concepts Forest and Grassland ecosystems, Desert Ecosystems, Aquatic Ecosystems Introduction to Biodiversity, Biodiversity Conservation.

Unit-4: Air pollution- Sources, effects, control, air quality standards, air pollution act, air pollution measurement. Greenhouse gases – effect, Global Warming, Acid Rain, and Ozone Depletion, Water pollution-Sources and impacts, Noise pollution, Soil pollution, Pollution aspects of various power plants.

Reference:

1) Rajagopalan, R., "Environmental Studies: From Crisis to Cure", Oxford **University Press, New Delhi, 2e, 2011**
2) Ranjit Daniels & J. Krishnaswamy "Environmental Studies", Wiley India
3) Davis & Cornwell "Environmental Engineering", McGraw Hill
4) Gilbert M. Masters and Wendell P. ELA – Introduction to Environmental Engineering And Science
5) W. Cunningham – Principles of Environmental Science, TMH
6) P. Venugoplan Rao – Principles of Environmental Science and Engineering, PHI.
7) Meenakshi – Environmental Science and Engineering, Prentice Hall India.
8) Martin – Ethics in Engineering, TMH

Video Lectures:

1) http://www.nptelvideos.in/2012/12/fundamentals-of-environmental-pollution.html
2) http://www.nptelvideos.in/2012/11/energy-resources-and-technology.html
3) https://nptel.ac.in/courses/122/102/122102006/
4) https://nptel.ac.in/courses/127106004/

Websites (related to the course)

1) http://www.cpcb.nic.in/
2) http://www.rpcb.rajasthan.gov.in
3) http://www.bis.org.in/
4) http://www.who.int/en/
5) http://www.moef.gov.in/

MANAGEMENT PERSPECTIVES (IL1101)

COURSE CREDITS: 2
SESSION DURATION: 60 MINUTES

COURSE DESCRIPTION:

The present course is an introductory and integrative action encapsulated course designed for the engineering students to introduce them to management discipline and the core functional areas contributing to it. This course adopts the integrated problem oriented approach via the use of cases and simulation. It implies that complex business problems, in the form of cases and simulations require students to understand different dimensions of the problem and come up with holistic solutions. The course will help students to be familiar with trending management issues and at the same time apply the knowledge gained.

COURSE OUTCOMES

After completion of this course, the students will able to:

- Comprehend the importance of management and its functional areas in businesses and also its interaction with technology.
- Highlight specific external and internal issues impacting businesses.
- Integrate and analyze multiple dimensions of management aspects to solve business problems.
- Evaluate the aspects that management might consider when evaluating technical and engineering projects such as planning and scheduling, personnel management, cost control etc. from a management perspective

TOPICS TO BE COVERED:

HR

1. Business organization- Current challenges
2. HR and its growing importance.
3. Overview of people management systems
4. Recent trends shaping HR.

Economics:

1. Introduction of important concepts of Micro and Macro Economics
2. Key Features of Indian Economy
3. Understanding of economic environment of business

Marketing:

1. Marketing Process
2. Elements of Marketing Mix
3. Segmentation, Targeting and Positioning

Finance and Accounts:

1. Understanding Accounting Terms
2. Overview of Financial Reports, viz., Balance Sheet, Income Statement, Cash Flow Statement
3. Interface of Balance Sheet and Income Statements
4. Types of Costs and assessing and ascertaining Costs

BOOKS FOR REFERENCE

- Aswathappa, K. (2008) - Human Resource Management Text and Cases,Tata McGraw Hill New Delhi.
- Rao VSP (2002)– Human Resource Management, Text and Cases,Excel Book, New Delhi
- Armstrong, G. and Kotler, P. (2017). Marketing: An Introduction. New Delhi: Pearson Education.
- Ramaswamy, V. S., & Namakumari, S. (2013). Marketing Management: Global Perspective, Indian Context. New Delhi: Macmillan (India) Limited.
- T. R. Jain (Latest Edition). Economics for Engineers. New Delhi: V K Publications.
- Ramachandran N & Kakani K.Ram.(2017). How to Read a Balance Sheet,2/e. New Dehi: Mc Graw Hill Publications.
- Mott Graham. (2008). Accounting for Non-Accountants: A Manual for Managers and Students. Kogan Publication.
- Goyal, V.K. & Goyal, Ruchi. (2016). Financial Accounting, 4/e, New Delhi: PHI Learning Pvt. Ltd.[ISBN.-978-81-203-4626-0]

ASSESSMENT MATRIX

The criteria for assess the learning outcomes of this course are as follows:

S.No.	**Specification**	**Marks**
1	Attendance	**10**
2	Assignment	Nil
3	Class Participation	**10**
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	**40**

8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	**40**
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total	**100**

Perspectives on Contemporary Issues

Course Code: CC1103

Credit: 2

L-T-P: 2-0-1

Course Description:

In an era of globalization, there is an increasing need for the youth to be able to empathize with others, value diverse perspectives and cultures and understand how events around the world are intertwined. Global issues revolve around social, economic and environmental factors which ultimately add to the interconnectedness of countries. In this course, students will employ key critical thinking concepts to analyze contemporary issues from multiple perspectives. They will explore the impact at micro and macro levels.

Course Outcomes:

The students will be able to:

- Identify different perspectives objectively.
- Explain interconnectedness of the issues and their impact at micro and macro levels.
- Recognize their own beliefs, biases, claims and assumptions.
- Evaluate sources, argue and defend effectively.

Teaching Pedagogy:

This course will be an amalgamation of brief lectures and activity based learning i.e. films, group discussions, debates, and case studies. The objective behind utilizing activity based learning is for the learners to have a more hands on experience. This will encourage and ensure active participation and longer retention. The idea is for learners to feel engaged and also express their views in a conducive environment. The takeaway from this course will not only be awareness about certain issues but equipping learners with skills of decision making and reasoning in alignment with certain global contexts.

Course Content:

- **Introduction to contemporary perspective**
- **Research, analysis & evaluation of a topic from local, national and global perspectives on:**
- **Climate Change and Sustainability**
  Understanding the magnitude of the issue, its impact and future challenges.

  How we can meet our current needs without diminishing the quality of the environment or reducing the capacity of future generations to meet their own needs.

- **Globalization**
  With increasing development throughout the world, the focus of this theme will be on the impact of globalization in India**.**

- **Nationalist Movement**
  There is a sense that excesses of globalization have created an identity crisis across the world, facilitating the rise of nationalist movements. Rising nationalism is seen everywhere, from the election of Donald Trump to Brexit, the success of far-right parties in Italian,

German and Austrian elections in 2017 and 2018, nationalism appears to be on rise globally. We will look at its reasons and implication**.**

- **Technology**
  Impact of unprecedented technological growth, challenges and opportunities.
- **Social justice and human rights**
  An understanding of the impact of inequality and discrimination, the importance of standing up for our own rights and our responsibility to respect the rights of others

Evaluation Scheme:

Sr. No	**Specifications**	**Weightage (%)**
01	Assignment	20
02	Class Participation	20
03	Theory Exam II	15
04	Theory Exam III	25
05	Report	20
	Total (100)	**100**

References for Reading:

1. Harari, Y. N. (2019). *21 Lessons for the 21st century*. Toronto: CELA.
2. Guha, R. (2019). *India After Gandhi: the history of the world's largest democracy*. NEW YORK: ECCO.
3. Rosling, H., Rosling, O., & Ro¨nnlund Anna Rosling. (2019). *Factfulness: ten reasons were wrong about the world* - and why things are better than you think. London: Sceptre.

Kolbert, E. (2015). *The Sixth Extinction: An unnatural History*. Bloomsbury

Course Title and Code Data Structures**:** CS1102	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech Semester III(2019-2023) (CSE+ECE)

Course Objective: This course aims to develop understanding for Design, Analysis, and implementation of data structures and algorithms to solve computational problems using an object-oriented programming language. Topics includes introduction to algorithms and complexity analysis (time & space), Recursion, Linear Data Structures (Arrays, Queue, Stack, Linked list), Non-linear data structures (Trees, Graphs), Searching, Sorting, Indexing and Hashing.

Course Outcomes:

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

1. Write programs for performing basic operations like insertion, deletion, searching, sorting, merging, traversal etc. on various data structures like array, queue, stack, linked list, tree, graph.
2. Use and design appropriate data structures for solving a variety of computational problem.
3. Develop test cases for their programs and debug the code.
4. Analyze the algorithms in terms of asymptotic time and space complexity.
5. Implement and compare various searching and sorting algorithms
6. Convert a recursive algorithm to non-recursive algorithm.

Prerequisites		**Programming Language**
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	**20 (Coursera certificate 10 Marks)**
3	Class Participation	**10**
4	Quiz	**20 TCS ION LX**
5	Theory Exam-I	Nil
6	Theory Exam-II	**10**
7	Theory Exam-III	**20**
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	**10 (Hacker Rank)**
15	Lab Evaluation-II	**10 (Hacker Rank)**
16	Course Portfolio	Nil
	Total (100)	**100**

Syllabus (Theory)

Unit I: Introduction to linear Data Structures: Types of Data Structures - Linear & Non-Linear Data Structures. Linear Structures: Arrays: Types, Operations and applications (searching sequential and binary, Sorting: bubble, Insertion, Selection, Quick and Merge sorting algorithms for different characteristics of input

data. Complexity analysis, Comparison of sorting algorithms in term of complexity-time and space.

Unit II: Stacks and Queues: Operations and Applications, conversion of expression from one form to other form using stack (with & without parenthesis), Evaluation of expression in infix, postfix & prefix forms using stack, Queues: Operations and Applications, Circular Queues: Operations and Applications, De-queue and Priority queue, Recursion.

Unit III: Linear linked lists: Singly, doubly and circularly connected linear linked lists insertion, deletion at/ from beginning and any point in ordered or unordered lists, Application of linked list for polynomial operations, Comparison of arrays and linked lists as data structures. Implementation of stack, and queue, Algorithms for/of insertion, deletion of stack, and queue implemented using linked list data structure.

Unit IV: Trees: Trees definition, characteristics concept of child, sibling, parent child relationship etc., binary tree: different types of binary trees based on distribution of nodes, threaded binary tree and its application, insertion, deletion and traversal of binary trees, constructing binary tree from traversal results, BST tree: Concept of BST, insertion into and deletion from BST, Height balanced tree: AVL and its operations, Application of trees for representation of sets, Splay Tree and its operation.

Unit V: Graphs: Definition, Relation between tree & graph, directed and undirected graph, representation of graphs using adjacency matrix and list, Depth first and breadth first traversal of graphs, finding connected components and minimum spanning tree-Kruskal and Prims, Dijkstra Algorithm.

Indexing and Hashing: Hashing: The symbol table, Hashing Functions, Collision Resolution Techniques.

Syllabus (Lab):

DS Lab:

1. Write a program to search an element in the array using Linear Search.
2. Write a program to merge two sorted arrays into one sorted array.
3. Write a program to search an element in the array using Iterative and recursive Binary Search.
4. Write a program to implement a program for stack that performs following operations using array.
5. PUSH (b) POP (c) PEEP (d) CHANGE (e) DISPLAY
6. Write a program to implement a program to convert infix notation to postfix notation using stack.
7. Write a program to implement QUEUE using arrays that performs following operations (a) INSERT (b) DELETE (c) DISPLAY
8. Write a program to implement Circular Queue using arrays that performs following operations. (a) INSERT (b) DELETE (c) DISPLAY
9. Write a menu driven program to implement following operations on the singly linked list.
    i. Insert a node at the front of the linked list.
    ii. Insert a node at the end of the linked list.
    iii. Insert a node such that linked list is in ascending order. (according to info. Field)

iv. Delete a first node of the linked list.
v. Delete a node before specified position.
vi. Delete a node after specified position.

10. Write a program to implement stack using linked list.
11. Write a program to implement queue using linked list.
12. Write a program to implement following operations on the doubly linked list.
    i. Insert a node at the front of the linked list.
    ii. Insert a node at the end of the linked list.
    iii. Delete a last node of the linked list.
    iv. Delete a node before specified position.
13. Write a program to implement following operations on the circular linked list.
    i. Insert a node at the end of the linked list.
    ii. Insert a node before specified position.
    iii. Delete a first node of the linked list.
    iv. Delete a node after specified position.
14. Write a program which create binary search tree.
15. Implement recursive and non-recursive tree traversing methods in-order, pre-order and post-order traversal.
16. Write a program to implement Binary Search Tree.
17. Write a program to implement BFS in a given Graph.
18. Write a program to implement DFS in a given Graph.
19. Write a program to implement stack using linked Dijkstra's Algorithm for given graph.
20. Write a program to implement Kruskal's Algorithm for the given graph.
21. Write a program to implement Prim's Algorithm for the given graph.
22. Write a program to implement Bubble Sort, Selection sort, Insertion Sort in an array.
23. Write a program to implement Merge Sort in an array.
24. Write a program to implement Quick Sort in an array.
25. Write a program to implement Binary Search in an array.

Text Books:

T1. Sahni, Sartaj. Data structures, algorithms, and applications in Java. Universities Press, 2005.

T2. Goodrich, Michael T., Roberto Tamassia, and Michael H. Goldwasser. Data structures and algorithms in Java. John Wiley & Sons, 2014.

T3. Data Structures and Algorithms in Java -- Robert Lafore second edition Sams Publication, 2003

Reference Books:

R1. Introduction to Algorithms, by Cormen, Leiserson, Rivest, and Stein.

R2. Alfred V. Aho, Jeffrey D. Ullman, John E. Hop croft, Data Structures and Algorithms. Pearson Education, 2012

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1101	Electronic Devices & Circuits	3	0	2	0	4

Course Objectives: This course is designed to disseminate knowledge of semiconductor devices and circuits and their implementation for switches, regulators, LED, Solar cells, amplifiers, etc. This course also focusses on developing two port networks using various parameters and analyzes their characteristics.

Course Outcomes:

On successful completion of this course, the students will be able to

1. Analyse characteristics of electronic components, devices and circuits
2. Apply electronic devices and circuits to various engineering applications
3. Design and analyse different amplifier configurations
4. Analyse input-output characteristics of a given complex network
5. Design efficient power amplifiers with least harmonic distortion

Assessment Scheme:

S. No.	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	15
3	Class Participation	05
4	Quiz	15
5	Theory Exam-I	10
6	Theory Exam-II	Nil
7	Theory Exam-III	30
8	Report I (Case Study)	05
9	Report II	Nil
10	Report III	Nil
11	Project I	Nil
121	Project II	Nil
13	Project III	Nil
14	Lab Evaluation I (Continuous)	10
15	Lab Evaluation II (Exam)	10
16	Course Portfolio	Nil
	Total (100)	**100**

Evaluation Scheme for Re-Test

1	**Theory Exam – III**	30

2	**Lab Evaluation – II**	10
	Total (40)	**40**

Syllabus (Theory):

Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors, Generation and recombination of carriers; Poisson and continuity equation

P-N junction characteristics, I-V characteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode, LED, solar cells

Bipolar Junction Transistor and FET, I-V characteristics, Biasing of BJT for optimum power consumption, BJT as switch and amplifier, Frequency response of amplifiers, Multistage amplifiers, MOS capacitor, C-V **C**haracteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor, Different configurations of MOS amplifier

Power amplifier: Various classes of operation (Class A, B, AB, C), their power efficiency and linearity issues, Design applications of power amplifier to obtain best efficiency and least harmonic distortion

Two port parameters: Admittance, impedance, hybrid and transmission parameter of two port networks, Conversion of one parameter to another parameter, Series, parallel and cascade connection of two port networks, Condition of reciprocity & symmetry, Iterative and Image Impedance

Syllabus (LABORATORY):

1. V-I characteristics of Reverse Biased PN junction diode
2. V-I characteristics of Forward Biased PN junction diode
3. V-I characteristics of Zener diode
4. Zener diode as a voltage regulator
5. V-I characteristics of LED
6. Input & Output characteristics of BJT Common Emitter configuration
7. Input & Output characteristics of BJT Common Base configuration
8. Frequency Response of Common Emitter amplifier
9. Drain and Transfer characteristics of FET Common Source configuration
10. Frequency Response of Common Source FET amplifier

Textbooks

1. Electronic Devices and Circuits, Salivahanan Kumar, Tata McGraw Hill, 2nd Ed. 2011
2. Network Analysis, Van Valkenburg, Pearson, 2rd Ed. 2015

Reference Books

1. Electronic Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, Pearson, 10th Ed. 2009
2. Electronic Devices and Circuits, Jimmie J Cathey, McGraw Hill, 3rd Ed. 2009
3. *Electronics for You magazine*

MOOCs

1. https://www.coursera.org/learn/electronics
2. https://www.coursera.org/specializations/semiconductor-devices
3. *Two port network parameters:* https://nptel.ac.in/courses/108/102/108102042/
4. https://gndec.ac.in/~librarian/web%20courses/IITDelhi/Semiconductor%20Devices/elright.html

Other Web Resources

1. https://nptel.ac.in/courses/108/108/108108112/
2. http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html

Course Title and Code

Computational Engineering Analysis – I: ES1106

Teaching Scheme **L-T-P: 3-1-2**

Credits **5**

Course Objective

The course will cover the basic components of Ordinary Differential Equations (ODE), Complex analysis and Laplace transforms and modelling & simulation of various problems in engineering discipline. Few numerical methods will be introduced to find the numerical solutions of various problems. Various domain specific Engineering problems will be discussed and appropriate simulation tools will be used for solving them.

Course Outcomes:

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

1. Solve ordinary differential equations through various techniques.
2. Determine the structural behavior of the body by determining the stresses, strains produced by the application of load.
3. Analyze the concept of buckling and be able to solve the problems related to column and struts.
4. Model the problems of column and struts mathematically in terms of ordinary differential equations and solve them using the appropriate method.
5. Simulate the solutions of the above mentioned models of columns and struts.
6. Analyze a function of complex variables in terms of analyticity, poles and zeroes.
7. Find Laplace and inverse Laplace transforms of given function and use Laplace transform to solve ordinary differential equations.
8. Design and Evaluate the LC, RC & RL Networks using Foster'sand Cauer Forms
9. Analyze stability criteria for electrical network using pole zero plot and routh-hurwitz polynomials
10. Model and simulate electrical networks using Proteus simulator/ Virtual lab.

Prerequisites **Nil**

Sr. No	Specifications	Marks
01	Attendance	NA
02	Assignment	NA
03	Class Participation	10
04	Quiz	20
05	Theory Exam I	20
06	Theory Exam II	NA
07	Theory Exam III	30

08	Report-1	NA
09	Report-2	NA
10	Report-3	NA
11	Project -1	NA
12	Project -2	NA
13	Project -3	NA
14	Lab Evaluation-1	10
15	Lab Evaluation-2	10
16	Course portfolio	NA
	Total (100)	100

Evaluation Scheme for Re-Test

1	Theory Exam-III	30
	Total	30

Syllabus

ODE : Ordinary differential equations of first order and first degree, higher order ODEs with constant coefficients, Differential equation of second order with variable coefficients, Numerical solution of ODEs.

Applications of ODE in structural analysis : column and struts - Definitions, Classifications, Assumptions made in the Euler's Column Theory, Expressions for crippling load of different cases like both the ends are hinged or pinned, one end is fixed and other is free, both ends are fixed, one end is fixed other is hinged, Effective length of column, Slenderness ratio, Crippling stress in terms of Effective length and radius of gyration, limitations of Euler's Formula, Rankine's Formula, Eccentric loading, Johnson's Formula for Columns, both straight line and parabolic formula for columns.

Functions of Complex variables : Complex numbers, complex conjugates, functions of complex variables, real and imaginary parts of a complex function, analytic functions, C-R equations, Poles and zeros of a complex function, Taylor's theorem and Taylor's expansion.

Laplace transform: Basic Laplace transform and inverse Laplace Transforms, solution of ODEs using Laplace transform, solution of system of ODEs using Laplace transform.

Network Functions : Concept of complex frequency, transform independence, network functions of one and two port network, concepts of poles and zeros, properties of driving point and transfer functions, time response stability from pole zero plot, Routh-Hurwitz polynomials.

Network Synthesis: Positive real functions, Basic syntheses procedure, method of syntheses, driving point syntheses of one port network (R-L and R-C and R-L-C).

Transient Analysis: Modeling of Resistors, Inductors, capacitors, operating temperature, transient sources and transient output variables. Complete response of RL, RC, and RLC circuits to step, sinusoidal, exponential, ramp, impulses and the combinations of excitations. Initial value and final value theorem.

Textbook:

1. Advanced Engineering Mathematics, Erwin Kreysig, Wiley, India.
2. Hibbeler, R.C., "Mechanics of Materials", 6th SI edition, Prentice Hall

References :

1. Thomas' Calculus, M.D. Weir and J. Hass, Pearson.
2. Engineering Mathematics, Srimanta Pal and Subodh C. Bhunia, Oxford University Press, New Delhi, India.
3. Higher Engineering Mathematics, B.V. Ramana, Mc Graw Hill Education.
4. T.K.Nagsarkar,M.S. Sukhija,"Basic Electrical Engineering", Oxford University press, 2nd edition, 2011.
5. Roy Choudhary, "Network Theory", TMH, 3rd Edition, 2004.
6. Edminister Joseph A., "Electrical Circuits, Schaum's Outline Series", Tata McGraw Hill, 3rd edition, 2012.
7. Hayt W.H., Kemmerly J. E., Durbin S. M., "Engineering Circuit Analysis", Tata Mcgraw Hill, 6th edition, 2006.
8. Beer, F.P., Johnston, E.R., DeWolf, J.T., "Mechanics of Materials", 4th edition, McGraw Hill. Craig, R.R., "Mechanics of Materials", 2nd edition, John Wiley and Sons.

Course Title and Course Code	**Engineering Measurements and Machines (ES1107)**
Hours per Week	**L T P: 3 0 4**
Credits	**5**
Students who can take	**B. Tech Semester-III**

Course Objectives:

The aim of this course is to impart the knowledge of mechanical and electrical machine used in industries. Students will learn the fundamental of engineering principles governing the engineering process and its use in real-world. Students will get the knowledge of sensors, actuators and its selection process for any industrial application.

Course Outcomes:

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

1. Evaluate suitable electrical and non-electrical instruments for measuring physical quantities.
2. Analyze the construction, characteristics and applications of various types of rotating machines.
3. Analyze the working of any mechanical and electrical machine using mathematical model.
4. Integrate the sensors for monitoring and automation of electrical and mechanical systems.
5. Design electro-mechanical machines as per Indian standards.

Prerequisites	**Basics of Physics**

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	5
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	20
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	10
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio (MOOC Course)	10
Total (100)		**100**

Evaluation scheme for Retest		**Marks**
1	Theory Exam	20
2	Lab Evaluation (Exam)	10
Total		**30**

Syllabus (Theory):

Unit-I: Measurement, Instrumentation and Calibration

Introduction, types of applications of measurement instrumentation, performance characteristics, error in measurements, calibration and standards, static and dynamic characteristics of instrument, Measuring Instruments, Digital meters, Function Generators, AC Bridges, Electronic Instruments for Measuring Basic Parameters.

Unit-II: Transducers

Classification of transducers, Selection of transducers, measurement of physical quantities, Elements of data acquisition system, Smart sensors.

Unit-III: Transformers

Construction, principle of operation, equivalent circuit, losses, testing, efficiency and voltage regulation, auto transformer, three phase connections, parallel operation of transformers, tap changing.

Unit-IV: Rotating Machines

DC Machines

Construction, EMF and torque equation, circuit model, armature reaction, methods of excitation, characteristics of generators, characteristics of motors, starting and speed control, testing and efficiency.

Induction Motors: Construction, working principle, classification and applications, equivalent circuit, Torque - slip characteristics, starting and Speed control of induction motors.

Unit-V: Mechanical Machines

Turbines: Introduction to steam turbines, Impulse and Reaction turbines, turbine power and related calculations.

Pumps: Introduction of pumps, centrifugal pumps, working of centrifugal pumps, Cavitation and its effect on pump, working of reciprocating pumps, Application of pumps in industries.

Power Transmission Systems: Mechanical drives and their performance analysis.

List of Experiments:

Measurement

1. To Determine Output characteristics of LVDT and Measure of Displacement Using LVDT.
2. Measurement of Inductance using Maxwell's bridge.
3. Measurement of earth resistance by earth tester and measurement of Insulation resistance by Megger.

Electrical Machines

1. To perform Ratio, Polarity and Load test on a single-phase transformer.
2. To perform open circuit and Short circuit test on a single-phase transformer and hence determine its equivalent circuit parameters.
3. To find the relation between open circuit voltage and field current of:

(i) Separately excited DC generator, (ii) Self excited DC shunt generator

4. Speed control of DC shunt motor: (i) By varying field current with armature voltage constant. (ii) By varying armature voltage with field current kept constant.
5. To perform No load and blocked rotor test on a three-phase Induction Motor, and hence determine its equivalent circuit parameters.

Mechanical Machines

1. To study the performance of turbines used in steam power plant
2. To study the performance of belt drive system used for power transmission.

Text Books:

1. H S Kalsi, Electronic Instrumentation, McGraw Hill Education (India) Private Limited.
2. Nagrath I. J and Kothari D. P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd.
3. B. L. Theraja, and A. K. Theraja, Text of Electrical Technology, Vol -2; S. Chand Publication.
4. J B Gupta, Theory and Performance of Electrical Machines, S.K. Kataria and Sons.
5. Ashfaq Hussain, Electrical machines, Dhanpat Rai and Co.
6. P S Bimbhra, Generalised theory of rotating machines, Khanna Publishers.
7. R K Bansal, A Textbook of Fluid mechanics and Hydraulic machines, Laxmi Publication (P) ltd.
8. S S Ratan, Theory of Machines, Tata McGraw-Hill.

Reference Books:

1. Fitzgerald and C. Kingsley Jr., Electric Machinery, McGraw-Hill Book Co.
2. Chapman, Electric Machinery Fundamentals, The McGraw-Hill Companies, Inc.

Online sources:

Electrical Measurement and Electronic Instruments
https://nptel.ac.in/courses/108/105/108105153/

Sensors and Sensor Circuit Design
https://www.coursera.org/programs/j-k-lakshmipat-university-on-coursera-kzogk/browse?index=prod_enterprise_products&productId=487N_QqXEeeqsQo32tjRBA&productType=course&query=Sensor&showMiniModal=true

Electrical Machines
https://nptel.ac.in/courses/108/102/108102146/

Motors and Motor Control Circuits
https://www.coursera.org/programs/j-k-lakshmipat-university-on-coursera-kzogk/browse?index=prod_enterprise_products&page=3&productId=-i5RF2jdEeecwwoEvbWpsg&productType=course&query=Electrical+Machines&showMiniModal=true

Turbines and Pumps
https://nptel.ac.in/courses/112/103/112103249/

Power Transmission Systems
https://www.youtube.com/watch?v=3UaFeNm_ZF8

Course Title and Code: Communication and Identity: CC1104

Course Description:

This course enables students to explore their personal and professional identities, to create their distinctive presence. It intends to help them gain an understanding of the basic purpose, benefits, and responsibilities of self-presence, and to begin the process of defining their values, strengths, and goals, which helps them enhancing their employability skills through exposing themselves through various activities.

Course Outcomes

- Analyse their personal identities, both private and social
- Identify their different values, strengths and areas of professional interest
- Articulate their personal statement and use it to craft an influential pitch
- Express themselves through various communication formats on different platforms

Prerequisites		**N/A**
Hours per Week		**L-T-P: 2-1-0**
Credits		**2**
Sr. No	**Specifications**	**Weightage**
01	Attendance	**NIL**
02	Assignment	**30**
03	Class Participation	**30**
04	Viva	**20**
05	Theory Exam	Nil
06	Theory Exam	Nil
07	Theory Exam	**20**
08	Report-1	Nil
09	Report-2	Nil

10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Module	Topics/ Session no.	Topics to be Covered
Identifying Self	Factor that shape our identity	The 3 Types of Diversity That Shape Our Identities. Three things: demographic diversity (our gender, race, sexual orientation, and so on), experiential diversity (our affinities, hobbies, and abilities), and cognitive diversity (how we approach problems and think about things).
	Internal confidence or "principle-centred living"	Living a principle-centred life is the key to excelling in all other areas of our living. A principle is based on the fundamental idea that there is learned behavior that governs human effectiveness.
	Personal Statement	Use of story map to create a personal statement.
Persuasive Communication	Steps to build a Personal Brand	Personal branding: meaning, importance and how to create and use it; the three Cs' of personal branding and
	Online presence	Creating an online presence for professional and personal branding through social media.(LinkedIn, Facebook etc.)
	Elevator Pitch, Cover Letter	Elevator Pitch: Meaning and use of an elevator pitch in interview and workplace; techniques to craft and improve their pitch Purpose of a cover letter, types of the cover letter, the structure of a cover letter and tips on the cover letter, to craft their cover letter to be used for placements
	Presence in Group Discussion and Personal Interviews	Practice different types of group discussions, dos and don'ts of group discussions and use of techniques to perform well in GDs

Assessments	

1. Self- identity

1. *When Your Job Is Your Identity, Professional Failure Hurts More*
   Timothy O'Brien
   Pub Date: Jun 18, 2019
   Source: Harvard Business School Publishing - HBD
   Product #: H050HO-PDF-ENG
   Discipline: General Management
   Length: 1106 words

2. *The 3 Types of Diversity That Shape Our Identities*
   Celia de Anca; Salvador Aragón
   Pub Date: May 24, 2018
   Source: Harvard Business School Publishing – HBD
   Product #: H04BSY-PDF-ENG
   Discipline: Human Resource Management
   Length: 1004 words

3. *Coaching Makena Lane*
   Ethan S. Bernstein; Om Lala
   Pub Date: Oct 1, 2017
   Source: HBS
   Product #: 418031-PDF-ENG
   Discipline: Organizational Behavior
   Length: 24 p

4. *The Talent Curse*
   Jennifer Petriglieri; Gianpiero Petriglieri

Pub Date: May 1, 2017

Source: Harvard Business School Publishing - HBD

Product #: R1703E-PDF-ENG

Discipline: General Management

Length: 8 p

2. Personal Statement

1 *From Purpose to Impact*

Nick Craig; Scott A. Snook

Pub Date: May 1, 2014

Source: Harvard Business School Publishing - HBD

Product #: R1405H-PDF-ENG

Discipline: General Management

Length: 9 p

3. Internal confidence or "principle centered living"

1 *Cultivating Everyday Courage*

James R. Detert

Pub Date: Nov 1, 2018

Harvard Business School Publishing - HBD

Product #: R1806K-PDF-ENG

Discipline: General Management

Length: 9 p

4. Steps to build Personal Brand

1 *A Strategic Marketing Plan to Successfully Deliver Your Professional Brand*
Kimberly A Whitler
Pub Date: Oct 20, 2015
Source: University of Virginia Darden School Foundation
Product #: UV7572-PDF-ENG
Discipline: Marketing
Length: 7 p

2 *Sadiq Gillani's Airline Career Takes Off: Strategy in Action*
Jeffrey Pfeffer
Pub Date: Nov 30, 2018
Source: Stanford University
Product #: OB95-PDF-ENG
Discipline: Organizational Behavior
Length: 17 p

3 *How Women Can Develop - and Promote - Their Personal Brand*
Dorie Clark
Pub Date: Mar 2, 2018
Source: Harvard Business School Publishing - HBD
Product #: H046PA-PDF-ENG
Discipline: Human Resource Management
Length: 1419 words

5. Online presence

1 *What's Your Personal Social Media Strategy?*
Soumitra Dutta
Pub Date: Nov 1, 2010

Source: Harvard Business School Publishing - HBD

Product #: R1011L-PDF-ENG

Discipline: Organizational Behavior

Length: 6 p

6. Resume, Elevator Pitch, Cover Letter

1 *The Art of the Elevator Pitch*

Carmine Gallo

Pub Date: Oct 3, 2018

Source: Harvard Business School Publishing - HBD

Product #: H04KFL-PDF-ENG

Discipline: General Management

Length: 992 words

2 *Writing Your Résumé When Your Job Title Doesn't Reflect Your Responsibilities*

Jane Heifetz

Pub Date: May 16, 2017

Source: Harvard Business School Publishing - HBD

Product #: H03NAN-PDF-ENG

Discipline: Human Resource Management

Length: 1243 words

3 *Improve Your Résumé by Turning Bullet Points into Stories*

Jane Heifetz

Pub Date: May 4, 2016

Source: Harvard Business School Publishing - HBD

Product #: H02UR4-PDF-ENG

Discipline: Human Resource Management

Length: 1481 words

7. Presence in Personal Interviews

1. *15 Rules for Negotiating a Job Offer*
   Deepak Malhotra
   Pub Date: Apr 1, 2014
   Source: Harvard Business School Publishing - HBD
   Product #: R1404K-PDF-ENG
   Discipline: General Management
   Length: 5 p

2. *How to Show You're Passionate in a Job Interview*
   Sabina Nawaz
   Pub Date: Apr 24, 2019
   Source: Harvard Busines School Publishing - HBD
   Product #: H04WSV-PDF-ENG
   Discipline: Human Resource Management
   Length: 724 words
   How to Highlight Your Talents in a Job Interview Without Showing Off
   Tomas Chamorro-Premuzic PhD.
   Pub Date: Dec 28, 2017
   Source: Harvard Business School Publishing - HBD
   Product #: H0436N-PDF-ENG
   Discipline: Human Resource Management
   Length: 1139 words

Course Title and Course Code	**Advanced Electrical Machines (EE1103)**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-IV EEE**

Course Objective: This course focuses on operating principles and characteristics of transformers and rotating electrical machines. Students will develop thorough understanding of transformers, DC motors, induction machines and synchronous machines, with a particular focus on how these are utilized in industrial applications.

Course Outcomes:

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

1. Develop intuitive concepts regarding fundamental electromagnetic laws governing working of electrical machines including transformers, generators and motors
2. Develop deep insight relating to construction, detailed working and modern day applications of mentioned electrical machines
3. Develop and analyze mathematical models for AC and DC machines under varying load conditions
4. Identify, analyze and evaluate power conversion and control techniques to interface with an electrical machine.
5. Analyze and evaluate the safety and compliance requirements of an electrical machine.

Sr. No	**Specifications**	
1	Attendance	NIL
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	NIL
6	Theory Exam-II	10
7	Theory Exam-III	30
8	Report-I (case study)	10
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL

14	Lab Evaluation-I (Continuous)	10
15	Lab Evaluation-II (Exam)	15
16	Course Portfolio	NIL
	Total (100)	**100**

Course Code	Course Title	Teaching Scheme				
		S				Credits
EE1102	ANALOG CIRCUITS	6	0	0	0	4

Course Objectives: The course aims to develop understanding about working of analog circuits and learn to develop their applications.

Course Outcomes:

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

1. Explain electrical characteristics of op-amps and their open loop configurations.
2. Design inverting, noninverting, and differential amplifiers.
3. Find out frequency response, stability, transient response, bandwidth, maximum output voltage, and other important parameters of an op-amp with and without feedback.
4. Analyze and design summing and differential amplifiers, voltage to current converters, low voltage dc voltmeters, low voltage ac voltmeters, zener diode testers, light-emitting diode testers, and integrator and differentiator circuits.
5. Design and analyze filters and oscillators viz., low-pass filters, high-pass filters, band-pass filters, band-reject filters, Phase shift oscillators, Wien bridge oscillators, quadrature oscillators, square wave generators, triangular wave generators, and sawtooth wave generators.
6. Fabricate and design some op-amp based devices such as power supplies, audio function generators, LED temperature indicators, dc motor speed controllers, appliance timers, sirens/alarms etc.
7. Test the performance of different circuits as per IEEE, IEC, ISO and other standards.
8. Refine the design of devices with a sensitivity to sustainability.

Assessment Scheme:

Sr. No.	Evaluation Component	
1	Attendance	Nil
2	Assignment	10
3	Class Participation	Nil
4	Quiz	10
5	Theory Exam-I	20
6	Theory Exam-II	Nil
7	Theory Exam-III	20
8	Report I	Nil
9	Report II	Nil
10	Report III	Nil
11	Project I	15
121	Project II	15
13	Project III	Nil
14	Lab Evaluation I	10

15	Lab Evaluation II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Evaluation scheme for retest.

1	Theory Exam III	20
2	Lab Evaluation (End Term)	10
	Total (30)	**30**

Syllabus:

UNIT I: Feedback topologies

Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

UNIT II: Oscillators

Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators

UNIT III: Differential amplifier

Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation. OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications.

UNIT IV: Active filters

Low pass, high pass, band pass and band stop, design guidelines; Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder; Analog to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc.

UNIT V: Design and Standards

Projects using Linear Integrated circuits for minimum power consumption as well as low cost. Familiarize with 1801-2013 - IEEE Standard for Design and Verification of Low-Power Integrated Circuits.

Projects:

Project 1: Function generator (sine, triangular, square wave form of various frequencies using oscillators and filters).

Project 2: Instrumentation amplifier design to interface pH sensor, thermistor, flexible tactile sensor for use in IoT projects**.**

Text Books:

1. *Op-amps and linear integrated circuit technology,* Gayakwad, Ramakant A. Englewood Cliffs, NJ: Prentice-Hall, 1983**,** ISBN. 0136373550..
2. *Microelectronic circuits*, Adel S. Sedra and Kenneth C. Smith, 5th Edition, Oxford International Student Edition, 2004, *ISBN*-10: 0195142527.

Reference Books:

3. *Design with operational amplifiers and analog integrated circuits*. Franco, Sergio, Vol. 1988, New York: McGraw-Hill, 2002.

Online resource : Introduction to Electronics https://www.coursera.org/learn/electronics

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1104	Electromagnetics and Microwaves	3	0	2	0	4

Course Objectives: This course aims to develop understanding of fundamental concepts of field effects in transmission of electromagnetic waves and its propagation in guided medium. The course further develops understanding of microwave network theory, passive devices & microwave generators. Important microwave properties and applications of the various devices & networks like klystrons, magnetrons, couplers, circulators, and isolators are emphasized.

Course Outcomes:

On successful completion of this course, the students will be able to

1. Analyze static electromagnetic field in cables, coils, etc., used in electric power transmission circuits.
2. Analyze fluctuating electromagnetic fields in different medium, e.g., linear and isotropic medium using Maxwell's equations.
3. Analyze characteristics of EM waves under time varying potentials and polarization of EM waves due to different mode of transmission.
4. Analyze wave propagation through different transmission lines and plane electromagnetic waves in homogeneous media.
5. Analyze the amount of electromagnetic noise generated by a device and test Electromagnetic compatibility (EMC) and electromagnetic interference (EMI).
6. Design and Analyze SWR, cutoff frequency, guide wavelength, etc and Characterize microwave junctions like tees
7. Design and Characterize microwave corners, bends & twists and directional couplers, isolators, circulators, and attenuators
8. Analyze the applications of microwave generators like klystrons & magnetrons

Assessment Scheme:

Sr. No.	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	10
3	Class Participation	5

4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	Nil
7	Theory Exam-III	30
8	Report I (Case Study)	5
9	Report II	Nil
10	Report III	Nil
11	Project I	Nil
121	Project II	Nil
13	Project III	Nil
14	Lab Evaluation I	10
15	Lab Evaluation II	10
16	Course Portfolio	10
	Total (100)	100
Evaluation Scheme for Re-Test:		
1	Theory Exam - III	20
2	Lab Evaluation - II	20
	Total (40)	40

Syllabus (Theory):

UNIT I: Introduction
Revision of vector calculus– Scalars and Vectors – Different co-ordinate systems-vector calculus –- Divergence theorem – Stoke's theorem

UNIT II: Time Varying Fields and Maxwell's Equations
Faraday's laws, induced emf – Transformer and motional EMF–Forces and Energy in quasi-stationary Electromagnetic Fields - Maxwell's equations (differential and integral forms) – Displacement current – Relation between field theory and circuit theory

UNIT III: Electromagnetic Waves
Generation – Electro Magnetic Wave equations – Wave parameters; Waves in free space, lossy and lossless dielectrics, conductors-skin depth, Poynting vector – Plane wave reflection and refraction

UNIT IV: Transmission Structures and Resonators
Transmission Line equation, Characteristic impedance, losses in transmission line, reflection coefficient, standing wave ratio, Smith Chart, Impedance matching, Rectangular Waveguides – TE/TM mode analysis, Characteristic Equation and Cut-off Frequencies, Circular Waveguides- Nature of Fields, Characteristic Equation, Dominant and Degenerate Modes

UNIT V: Microwave Network Theory and Passive Devices

Scattering matrix - Microwave junctions -Tee junctions -Magic Tee - Rat race - Corners - bends and twists - Directional couplers -two hole directional couplers- Ferrites - important microwave properties and applications– Termination - Gyrator- Isolator-Circulator – Attenuator

UNIT VI: Microwave Generators

Transit-time effect, Limitations of conventional tubes, Two-cavity and multi-cavity Klystrons, Reflex Klystron, TWT, Magnetrons

Syllabus (LABORATORY):

1. Set up Microwave components and instruments
2. Characterize Reflex Klystron
3. Microwave Test Bench Measurement of guide wavelength, cut off frequency, SWR (X band)
4. Measurement of an unknown Load Impedance
5. Characterize Gunn diode oscillator
6. Characterize and Analyse Magic Tee junction
7. Characterize and Analyse Isolators, Circulators and Couplers
8. Characterization and measurement using the Horn Antenna
9. Designing transmission lines and microstrip patches using CST software
10. Designing microstrip patch antenna using CST and MATLAB

Textbooks:

1. Principles of Electromagnetics, N. O. Sadiku ; Oxford Univ. Press, 6/e, 2016.
2. Microwave Engineering by David M. Pozar, WILEY India, 4/e, 2012.

Reference Books:

1. Introduction to Electrodynamics: David J Griffiths, Pearson Education, 2015.

2. Microwave Devices and Circuits by S.Y. Liao, Pearson, 2008.

Web Resources:

1. *Electromagnetic Waves in Guided and Wireless Media*
   https://onlinecourses.nptel.ac.in/noc21_ee43/preview

2. https://nptel.ac.in/courses/115/101/115101005/
3. https://nptel.ac.in/courses/108/103/108103141/

Course Code and Title	**EE1105: SIGNALS AND CONTROL SYSTEM**
Scheme	**L T P: 3 0 4**
Credits	**5**
Students who can take	B. Tech: Semester IV, EEE

Course Objective:

To develop an understanding of signals, systems, and control concepts with focus on mathematical model formulation, stability analysis, simulation, and industrial applications.

Course Outcomes:

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

1. identify and differentiate signals, systems, and their properties,
2. evaluate Fourier, Laplace, and z-transform for continuous and discrete time systems,
3. apply properties like symmetry, time scaling, time shifting, frequency shifting, time differentiation, time integration, time convolution, frequency convolution, inverse transform on continuous and discrete signals,
4. design open loop or closed loop control system of mechanical, electrical, thermal, chemical, or analogous systems,
5. convert linear system to discrete system through sampling,
6. solve the control system using block diagram reduction method and Mason's gain formula,
7. perform the error analysis on the system,
8. evaluate the stability of the system and effect of parameter variation on the stability using pole-zero location method, Routh-Hurwitz criterion, and root locus technique,
9. analyse the control system in frequency domain and time domain,
10. frequency analysis plots viz. Bode plot, Polar plot, and Nyquist Plot,
11. improve a system as per design and equipment standards keeping energy efficiency in consideration.

Prerequisite: Mathematics concepts related to Fourier transform, Laplace transform, and Z-transform.

Evaluation Scheme:

Sr. No	Specifications	Marks
1	Attendance	NIL
2	Assignment	NIL
3	Class Participation	NIL
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	20
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	25
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I (Continuous)	20
15	Lab Evaluation-II (Examination)	10

16	Course Portfolio	NIL
	Total (100)	**100**

COURSE SYLLABUS (Theory):

UNIT I: SIGNALS AND SYSTEMS
Basic concepts, mathematical form, classification of signals, signal transformations, continuous and discrete signals, energy and power, basic system properties, classification of systems.

UNIT II: FOURIER, LAPLACE, AND Z-TRANSFORM FOR CONTINUOUS AND DISCRETE TIME SYSTEMS
Evaluation, properties and theorems: symmetry, time scaling, time shifting, frequency shifting, time differentiation, time integration, time convolution, frequency convolution, inverse transform. Converting from continuous time to discrete. Mathematical representation of sampling. Sample and hold. Aliasing.

UNIT III: INTRODUCTION TO CONTROL SYSTEMS
Definition of the elements in a control loop. Open and closed loop systems. Linear time invariant systems: Transfer function, state variable representation. Block diagram reduction techniques, signal flow graphs. Mason theorem. Standards: ISA 5.1 – Instrument symbols and identification. ISA 20 – Instrumentation specification forms.

UNIT IV: TIME AND FREQUENCY DOMAIN ANALYSIS
Test signals, transient and steady state response, specifications, steady state error. BIBO-stability, Routh-Hurwitz criterion. Basic properties of root locus. Introduction to frequency response and specifications. Stability analysis using Bode and Nyquist plots.

UNIT V: INTRODUCTION TO CONTROLLER AND FILTER DESIGN
PID, Low/High pass filters, Lead/Lag, state feedback.

UNIT VI: PROJECT
Application of signals and control systems theory to sustainability problems: health, energy, water, smart cities, etc.

Syllabus (Practical)

1. Introduction to Python, Numpy and Scipy for signal processing
2. Signal convolution, frequency analysis and filtering using Python libraries
3. Introduction to MATLAB Computing Control Software.
4. Defining Systems in TF, ZPK form, and (a) Plot step response of a given TF and system in state-space. Take different values of damping ratio and w_n natural undamped frequency (b) Plot ramp response.
5. To design 1st order R-C circuits and observes its response with the following inputs and traces the curve.
   - Step
   - Ramp
   - Impulse
6. To design 2nd order electrical network and study its transient response for step input and following cases.
   (a) Under damped system
   (b) Over damped System.
   (c) Critically damped system
7. To Study the frequency response of following compensating Networks, plot the graph and final out corner frequencies.
   (a) Leg compensation Network
   (b) Lead compensation Network

(c) Leg-lead compensation Network.

8. To study the Potentiometer error detector.
9. To draw the speed-torque characteristics of a.c. servomotor.
10. To Study the bode plot for a 2nd order system and find GM and PM.
11. To study and design of P, PI and PID controllers.
12. To study and draw the characteristics of stepper motor.

Text Book(s)

1. K. D. Rao, Signals and Systems. Cham: Springer International Publishing, 2018.
2. I J Nagrath and M Gopal, "Control Systems Engineering" 3rd edition, New Age Publication.
3. B C Kuo, "Modern Control Engineering" New Age Publication.
4. Katsuhiko Ogata, "Modern Control Engineering" PHI Learning Pvt. Ltd., New Delhi.

Reference Book(s)

1. H P Hsu, "Signals and Systems", Schaum's outlines, The McGraw Hill Companies.
2. B P Lathi and Roger Green, "Linear Systems and Signals", 3rd edition, The Oxford Series in Electrical and Computer Engineering.
3. Robert H Bishop, "Modern Control Systems" Boyd and Fraser publications.
4. Norman S Nise, "Control System Engineering" John Wiley & Sons.
5. Gene F Frankline, J David Powell, Abbas Emami Naeini, "Feedback Control of Dynamic Systems" Pearson Education Inc., 2006.

E-resource(s)

1. NPTEL: http://nptel.ac.in/courses/108102044/
   http://nptel.ac.in/courses/108101037/
   http://nptel.ac.in/courses/108102043/
2. NCTEL: http://www.nitttrchd.ac.in/sitenew1/nctel/electrical.php
3. SWAYAM: https://swayam.gov.in/nd1_noc20_ee15/preview
   https://swayam.gov.in/nd1_noc20_ee22/preview

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
ES1109	Computational Engineering Analysis – II	3	1	2	0	5

Course Objectives: The course will develop ability to use Partial Differential Equations (PDE), Fourier transforms and Z-transform for a variety of Engineering applications from fluid dynamics, heat conduction and circuit design. It also aims to develop skills for using common simulation Platforms i.e. Virtual lab /Python/ MATLAB. Few numerical methods will also be introduced to find the numerical solutions of various problems.

Course Outcomes:

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

1. Classify various types of partial differential equations and solve them through various analytical and numerical methods.
2. Formulate and analyze differential equations especially Navier stokes and energy equations and use numerical methods for solving the same.
3. Use Numerical method for solving partial differential equations using finite difference method.
4. Find Fourier and inverse Fourier transforms of given function and use Fourier transform to solve partial differential equations.
5. Find Z-transform and inverse Z-transforms of given functions and use them to analyze control systems.
6. Design and analyse various types of filters and attenuators to minimize power losses and improve signal quality.
7. Solve problems involving vertex and edge connectivity, planarity and crossing numbers.

Teaching Scheme (Hours per Week)		L T P 3 1 2
Credits		5
Sr. No	**Specifications**	**Marks**
1	Attendance	-
2	Assignment	10
3	Class Participation	10
4	Quiz	15
5	Theory Exam-I	15
6	Theory Exam-II	-
7	Theory Exam-III	30
8	Report-I	-
9	Report-II	-

10	Report-III	-
11	Project-I	-
12	Project-II	-
13	Project-III	-
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	-
	Total (100)	**100**

Evaluation policy for retest

Theory Exam-III	30
Total	30

Course Syllabi (Theory):

PDE : Partial Differential Equations of First Order, Variable separable technique for solving PDE. Heat equation, wave equation, Laplace equation

Boundary value problems: Solution of boundary value problems using separation of variables technique.Numerical solution of PDE.

Application of PDE: Momentum and Energy Transport:

The governing equations of fluid dynamics- models of the flow, continuity equation, momentum equation, Energy equation, boundary conditions. Poisouli's flow, Couette flow, steady and unsteady conduction.

Fourier Transforms : Fourier transform and inverse Fourier transform, properties of Fourier transform, Applications in solving Partial differential equations.

Filter Circuits: Types of passive filters, design low-pass, High-pass, Band-pass, Band-reject filters as constant k type, design low-pass, High-pass, Band-pass, Band-reject filters as RC type, Advantages of active filters over passive filters.

Graph Theory : Introduction, Linear graph of a network, Tie-set and cut-set schedule, incidence matrix, cut-set, and tie-set. Graph theory application to a practical radial system.

Z-transform : Introduction, standard z- transform, properties of z – transform, initial and final value theorems, inverse z-transform, applications in control systems.

Textbook:

3. Advanced Engineering Mathematics, Erwin Kreysig, Wiley, India.
4. White F. M., "Fluid Mechanics" Tata McGraw-Hill, New Delhi.
5. Incropera F P "Principles of Heat and Mass Transfer", John Wiley & Sons.
6. Hayt W.H., Kemmerly J. E., Durbin S. M., "Engineering Circuit Analysis", Tata Mcgraw Hill, 6th edition, 2006.

Reference Books –

1. Thomas' Calculus, M.D. Weir and J. Hass, Pearson.
2. Engineering Mathematics, Srimanta Pal and Subodh C. Bhunia, Oxford University Press, New Delhi, India.
3. Higher Engineering Mathematics, B.V. Ramana, Mc Graw Hill Education.
4. Fox and McDonald, "Introduction to fluid dynamics", John Wiley & Sons.
5. Cengel Y. "Heat and Mass Transfer" Tata McGraw-Hill, New Delhi.
6. J. D. Anderson Jr. "Computational Fluid Dynamics" McGraw-Hill International Edition.
7. Roy Choudhary, "Network Theory", TMH, 3rd Edition, 2004.

8. Edminister Joseph A., “Electrical Circuits, Schaum’s Outline Series”, Tata McGraw Hill, 3rd edition, 2012.

Course Title and Code: **Introduction to Design** Course Code: IL1102 Year: 2021	
Hours per Week	30
Credits	2
Students who can take	2nd Year B. Tech
Course Objective: The students are going to explore the world of hand-crafted toys and animation during this week. Thus, taking an idea forward from an intangible thought to a material-based product or communicating it visually. The toys we explore will be designed in relevance to the audience group that the students choose.	
Learning Outcome: On successful completion of this course, the students should be able to: 1. Identify the user and build it’s persona. 2. Sketch their ideas on paper to visualize and assess viability. 3. Create a plan for process and management to materialize the desired idea. 4. Test the material for possibilities and capabilities. 5. Develop skills of joinery, material manipulation and various hand tools. 6. Develop technical and narrative skills useful for both film and animation. 7. Develop troubleshooting and problem solving skills .	

Evaluation Criteria:

Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	**Assignment**	**20**
3	**Class Participation**	**10**
4	Quiz	Nil
5	Theory Exam I	Nil
6	Theory Exam II	Nil
7	Theory Exam III	Nil
8	Report-1	Nil

9	Report-2	Nil
10	Report-3	Nil
11	**Project -1**	**35**
12	**Project -2**	**35**
13	Project -3	Nil
14	Lab Evaluation1	Nil
15	Lab Evaluation2	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Course Contents:

Introduction to Design Process for making Toys.

1. Material properties – Cardboard, Epoxy Putty, Wire, Thread
2. Material joinery
3. Use of tools – Plier, Paper Cutter, Basic Stationery
4. Developing creative thinking.
5. Basic drawing and visualisation skills including 2D to 3D - Form exploration.
6. Principles of animation.
7. Technical aspects of animation and film making (Frame rate, persistence of vision).
8. Building a Narrative – Start, Middle and End of a story.
9. Mediums of animation.

Suggested Reading Materials:

1. Simple wooden toymaking by Mathias, available at MP Ranjan LRC [Call number: 745.592]
2. Model Making by Megan Werner Learning Resource Centre [Call number: 720.2 WER at MP Ranjan LRC].
3. Joy of making Indian Toys [Call number 688.72 at MP Ranjan LRC]
4. Made by hand at MP Ranjan LRC Call number 745.0974
5. Universal Perception of Design at MP Ranjan LRC Call number 745.403
6. https://www.etsy.com/market/toys_handmade
7. https://en.wikipedia.org/wiki/Toy
8. https://en.wikipedia.org/wiki/Category:Traditional_toys (Hover over the categories to see the thumbnail)
9. https://fashion.mithilaconnect.com/6-popular-traditional-toys-in-india/
10. https://www.dutchcrafters.com/Amish-Toys-Games-Hobbies/cat/98
11. https://www.walmart.com/cp/toys/4171 (Toys that we are not interested in)
12. https://www.target.com/c/toys/-/N-5xtb0 (Toys that we are not interested in)
13. https://in.pinterest.com/pin/12807180177802375/
14. https://www.youtube.com/watch?v=_ppedXZHhE0 (Stop Motion Basics)
15. https://www.youtube.com/watch?v=p5SygzMSLhM (Stop Motion in Movies)
16. https://www.youtube.com/watch?v=GcryIdriSe4 (12 principles of animation)

Course code	Course Title	Teaching Scheme	
		Sessions	Credits
EE1116	Digital Systems Design	3	4

Course Objectives: The course gives an insight to working of Digital Logic families and helps to model sequential digital systems using Finite State Machines. The course imparts hands-on skill on implementation and testing of digital systems using Field Programmable Gate Arrays and familiarises with the Xilinx tools for simulation and testing.

Course Outcomes:

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

1. Appreciate the tradeoff between various performance parameters, and to select suitable logic family for an application.
2. Create a gate-level implementation of a combinational logic function described by a truth table using and/or/inv gates, multiplexers or ROMs. Implement these logic functions using VHDL program on FPGA and analyze their timing behavior.
3. Create a state transition diagram from a description of a sequential logic function and then convert the diagram into an implementation of a finite-state machine with the appropriate combinational and sequential components.
4. Evaluate combinational and sequential logic designs using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power.
5. Properly incorporate synchronous and asynchronous memories into a circuit design.
6. Write test-benches and perform verification of the relatively complex digital system.

Syllabus

Review of Combinational and Sequential Circuits

Integrated circuit logic families: TTL, ECL, CMOS LOGIC families. Sensitize to use of low power consumption logic family.

Design of logic machines. Finite state machines, gate array designs, ALU and 4bit CPU unit designs, micro-programmed systems. Design of energy efficient architectures.

Hardware design of advanced digital circuits using VHDL programming: Behavioral, Data flow, Structural Models., Library, Packages., Functions, Procedures., FSM, FPGA Programming. Functional simulation and verification, synthesis, structural simulation and verification, place and route, and target mapping, using the latest commercial FPGA design tools.

Introduction with VHDL standard IEEE 1164. and application of standard libraries during programming.

Assessment Scheme:

Sr. No.	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	20 (*10 Marks through MOOC*)
3	Class Participation	Nil
4	Quiz	20 (*10 Marks through MOOC*)
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	30
8	Report I	Included with Project
9	Report II	Nil
10	Report III	Nil
11	Project I	20 (*Total through MOOC*)
121	Project II	Nil
13	Project III	10
14	Lab Evaluation I	Nil
15	Lab Evaluation II	Nil
16	Course Portfolio	Nil
	Total (100)	100
Evaluation Scheme for Re-Test		
1	**Theory Exam - III**	30
	Total (30)	30

Textbooks:

1. Digital Systems-Principles and Applications., Ronald J. Tocci, Widmer and Moss, Pearson Education, 10th Edition, 2012, ISBN 978-81-317-2724-9.
2. A VHDL Primer – Jayaram Bhasker, Prentice Hall; 3rd edition, 1999, *ISBN*-10: 0130965758.

Web Resources:https://www.coursera.org/learn/fpga-hardware-description-languages

Course Title and Code – Understanding and Managing Conflict| CC1105|Semester- V

Course Description

In today's increasingly complex and fragmented world, it is important to be able to resolve conflicts and build healthy relationships. Interpersonal and Group Dynamics is a course designed to prepare students to identify conflicts, manage emotions, analyze the situation and characters, and practice different frameworks to deal with conflicts.

Course Outcomes

The students will be able to:

- Define a group and explain the stages of group development
- Describe conflict and explain types and causes of conflict
- Use inquiry and advocacy to engage with groups
- Give and receive feedback effectively
- Identify sources of conflict and manage them using difference conflict handling styles

Prerequisites	**N/A**
Hours per Week	**L-T-P: 2-0-0**
Credits	**2**

Sr. No	**Specifications**	**Marks**
1.	Attendance	Nil
2.	Assignment	30
3.	Class Participation	20
4.	Quiz	20
5.	Theory Exam-I	Nil
6.	Theory Exam-II	Nil
7.	Theory Exam-III	30
8.	Report-I	Nil
9.	Report-II	Nil
10.	Report-III	Nil

11.	Project-I	Nil
12.	Project-II	Nil
13.	Project-III	Nil
14.	Lab Evaluation-I	Nil
15.	Lab Evaluation-II	Nil
16.	Course Portfolio	Nil
	Total (100)	100

Course Content

1. Introduction to the stages of group development
2. Introduction to Personality, Perception and Learning as source of differences in individual and groups
3. Nature, Types and sources of Conflict
4. Conflict Resolution Strategies
5. Emotional Intelligence
6. Empathy and Feedback
7. Inquiry & Advocacy – Concept of silence (Masking, Avoiding, Withdrawing) and violence (Controlling, Labeling, Attacking)

References for Reading:

1. Fisher, R., & Ury, W. (2011). Getting to yes: Negotiating agreement without giving in. Toronto, ON: Penguin Random House.
2. Harper, G. (2004). The joy of conflict resolution: Transforming victims, villains and heroes in the workplace and at home. Gabriola Island, BC: New Society Publishers.
3. Miles, E. W. (2013). Developing strategies for asking questions in negotiation. Negotiation Journal, 29(4): 383–412. doi: 10.1111/nejo.12034.

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1107	Power Systems-I	3	0	2	0	4

Course Objectives:

The course aims to develop understanding to indentify the segments of the electrical power system, and have comprehensive knowledge about common components like insulator, conductor, power cables and transformers etc. It will also equip students with the different electrical & mechanical aspects of the power network along with its environmental and safety constraints. They will also learn to evaluate the performance of low and medium voltage networks.

Course Outcomes:

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

- Choose the appropriate type of power generating station in consideration to cost, environment, and societal issues.
- Review different tariff model and select the most appropriate model for a given scenario to optimize the revenue.
- Evaluate the suitability of installing overhead and underground power transmission strategies considering electrical, mechanical, environmental, performance, safety and economic constraints
- Develop and use mathematical models for performance analysis of transmission and distribution networks.
- Design earthing system and take other measures to avoid electrical hazards.

Assessment Scheme:

Prerequisites		Electrical Machines, Power Systems
Teaching Scheme (Hours per Week)		L T P (3 1 0)
Credits		4
Sr. No.	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	10
3	Class Participation	Nil
4	Quiz	20

5	Theory Exam-1	Nil
6	Theory Exam-2	20
7	Theory Exam-3	30
8	Report-1	Nil
9	Report-2	Nil
10	Report-3	Nil
11	Project-1	Nil
12	Project-2	Nil
13	Project-3	Nil
14	Lab Evaluation-1(Continuous)	10
15	Lab Evaluation-2	Nil
16	Course portfolio (Coursera MOOC Course on Electric Power Systems)	10
	Total (100)	**100**

Evaluation Scheme for Retest

1	Theory Exam-3	30
	Lab Evaluation-1(Continuous)	10

Course Syllabi (Theory):

Unit-I: Power system structure, Power system components ,Overview of different conventional power plants as hydro-electric, thermal power plants, nuclear power plants, Renewable Energy & Smart Grid Technologies, System Design & Switching

UNIT II: Load curves, load duration curves, Connected load, maximum load, Peak load, base load and peak load power plants, load factor, Plant capacity factor, Plant use factor, Demand factor, diversity factor, Tariffs determination.

UNIT III: Types of insulators; pin, disc and strain type. Voltage distribution and equalization; Arcing horns, Types of line supports, Air clearance. Sag calculations, effect of wind and ice loading. Ground clearance, Vibration of conductors and dampers, Corona and radio interference.

UNIT IV: Types of conductors, line parameters, inductance and capacitance for single and double circuit lines, bundle conductors. Concept of GMD and GMR, Effect of earth on line capacitance

UNIT V: Representation of short, medium and long transmission. Lines, nominal-T, nominal- π and equivalent π, SIL, ABCD parameters, Voltage regulation and efficiency, Overview of underground cables.

Course Syllabi (Practical):

1. To measure the dielectric Strength of transformer oil.
2. To Study the effect of different shape of electrodes on dielectric (air) breakdown.
3. To Study the Ferranti Effect of a transmission line/cable.
4. Design a solar plant using HelioScope software

Text Book(s)/ Reference Book(s)/E-Content Link

1. Power System Engineering by I. J. Nagrath & D.P. Kothari, TMH publication
2. Electrical Power System by C.L. Wadhwa, New age international publisher.
3. M.V.R. Koteswara Rao, "Energy Resources: Conventional & Non-Conventional" BSP Publications, 2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. Coursera material on electric-power-systems, available on https: // www. coursera. org /learn/electric-power-systems/resources/1ARO1
6. Central Electrical Authority Reports, available on http://cea.nic.in/ monthlyexesummary.html

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1109	Analog and Digital Communications	3	0	2	0	4

Course Objectives: This Course aims to develop understanding about the principle and techniques required for analog and digital communication. This will also prepare students to appraise and pursue future trends in digital communications research and technologies.

Course Outcomes:

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

8. Apply the knowledge of signals and system to analyze the communication system.
9. Implement and analyze various analog modulation and demodulation techniques as per ITU standards.
10. Use the sampling theorem to determine optimum sampling frequency for a signal.
11. Implement and analyze various digital modulation and demodulation techniques.
12. Evaluate the performance of analog and digital communication systems in the presence of white noise.
13. Improve receiver's performance by applying various algorithms.

Assessment Scheme:

Prerequisites		Signal & System
Teaching Scheme (Hours per Week)		L T P 3 0 2
Credits		4
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	NA
2	Assignment	10
3	Class Participation	NA
4	Quiz	10
5	Theory Exam-I	15
6	Theory Exam-II	NA
7	Theory Exam-III	20
8	Report-I	5
9	Report-II	NA

10	Report-III	NA
11	Project-I	10
12	Project-II	NA
13	Project-III	NA
14	Lab Evaluation-I (Continuous)	15
15	Lab Evaluation-II	15
16	Course Portfolio (partly in lieu of Quiz and Assignments)	10
	Total	100

Evaluation Scheme for Retest

1	Theory Exam-III	20
2	Lab Evaluation-II	15
	Total	35

Course Syllabi (Theory):

1. Introduction to International Standards Organization (ISO), International Telecommunications Union-Telecommunications Sector(ITU-T), Institute of Electrical and Electronics Engineering (IEEE), American National Standards Institute(ANSI) for Analog and Digital Communication
2. Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals
3. Spectral characteristics of angle modulated signals. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.
4. Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.
5. Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter Symbol Interference and Nyquist criterion. Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.
6. Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver).

Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

7. Use of Digital Communication standards & technique to develop the high data rate communication projects.

Course Syllabi (Practical):

Software

1. Introduction to MATLAB and basic signal generations and Plotting Tools in MATLAB
2. User Defined Functions, Nested If-Else, Relational Operators, Logical Operations in MATLAB
3. Matlab code for Amplitude modulation and demodulation
4. Matlab code for DSB-SC modulation and demodulation
5. Matlab code for SSB- SC modulation and demodulation
6. Matlab code for Frequency modulation and demodulation
7. Matlab code for PN sequence generation and verifying properties
8. Matlab code for BASK (OOK) Modulation and Demodulation
9. Matlab code for BFSK waveform generation and demodulation
10. Matlab code for BPSK waveform generation and demodulation
11. Matlab code to generate QPSK waveform for the given binary sequence
12. Matlab code for BER of BASK(OOK) modulation scheme under AWGN
13. Matlab code for plotting BER of BFSK under AWGN channel
14. Matlab code for BER of BPSK modulation scheme under AWGN
15. Matlab code to plot BER of QPSK under AWGN channel

References:

1. Communication Systems-B.P. Lathi, BS Publication, 2006.
2. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
3. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
4. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill,2001.
5. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering'',John Wiley, 1965.
6. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication'', Kluwer Academic Publishers, 2004.
7. Proakis J.G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.

Video Lecture:

1. Analog Communication By Prof. Goutam Das, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc20_ee69/announcements?force=true#registration_confirmation

2. Digital Communication Systems by Dr. K. Vinoth Babu, VIT
   https://www.youtube.com/playlist?list=PL2ICMuWYlLBjqr9RmrQSx8zi1Q-XJOkbV
3. Principles of Communication Systems – Part I By Prof. Aditya K. Jagannatham, IIT Kanpur.
   https://www.youtube.com/watch?v=XoVLa6Dqd5I
4. Principles of Communication Systems – Part II By Prof. Aditya K. Jagannatham , IIT Kanpur.
   https://www.youtube.com/watch?v=OyWdYkx0PmI&list=PL7EYujdHIJbZ9ZRMTBmYz7i61FppXLTop&index=1

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1111	Introduction to Internet of Things (IoT)	1	0	2	0	2

Course Objectives:

The course aims to develop understanding of Internet of Things concepts and working on IoT development boards to interface sensors and actuators. The course will enable the students to upload data from sensors on a web server and to use this data for analytical purposes or to actuate some transducers.

Course Outcomes:

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

1. Interface the Analog and Digital sensors to Node-MCU
2. Develop Embedded C programs to read sensor data and upload to public cloud platform.
3. Use Python-based IDE (integrated development environments) for the Raspberry Pi
4. Interface Raspberry Pi with I/O devices.
5. Visualize sensor data uploaded on public cloud.
6. Apply standard protocol(s) for implementation of IoT Systems.
7. Analyze and Improve existing systems with innovative IoT based approaches.

Assessment Scheme:

Prerequisites		Basic Programming
Teaching Scheme (Hours per Week)		L T P 1 0 2
Credits		2
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	NA
2	Assignment	NA
3	Class Participation	NA
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	NA
7	Theory Exam-III	20
8	Report-I (Case Study on Raspberry Pi, IoT)	20
9	Report-II	NA

10	Report-III	NA
11	Project-I	NA
12	Project-II	NA
13	Project-III	NA
14	Lab Evaluation-I (Continuous)	30
15	Lab Evaluation-II	NA
16	Course Portfolio (MOOC certificate)	10
	Total (100)	100

Evaluation Scheme for Retest

1	Theory Exam-III	20
2	Lab Evaluation-II	0
	Total (40)	20

Course Syllabi (Theory):

UNIT 1: Introduction to IoT Fundamentals: Definition, Characteristics, Applications, Connectivity Layers, Addressing, Networking.

UNIT 2**:** Sensors and Actuators: Sensors and Transducers, Sensor Classes, Sensor Types, Actuator Basics, Actuator Types,

UNIT 3**:** Basics of IoT Networking & Protocol: IoT Components, Inter-dependencies, SoA, Wireless Networks, Protocol Classification, MQTT, Secure MQTT, CoAP, XMPP, AMQP (Advanced Message Queuing Protocol)

UNIT 4**:** Connectivity Technologies: IEEE 802.15.4, ZigBee, 6LoWPAN, RFID, HART, NFC, Bluetooth, Zwave.

UNIT 5**:** Introduction to NodeMCU and Server: Basic Concepts of Arduino Platform, Examples of Arduino Programming, Interfacing different sensors with NodeMCU. Introductio to Blynk App, Uploading and downloading data from server using Blynk App. Intoduction to ThingSpeak Server, Uploading and downloading data from ThingSpeak server.

UNIT-6 Raspberry Pi: Basic functionality of the Raspberry Pi B+ board, Setup and Configuring Raspberry Pi, programming on the Raspberry Pi using Python, Python functions to access the Raspberry Pins, how Raspberry Pi interact with online services through the use of public APIs and SDKs, case studies.

References:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. Rajkamal, Internet of Things, Architecture and Design Principles, Mc. Graw Hill Education (India) Pvt Ltd.
4. IoT fundamentals: networking technologies, protocols, and use cases for the internet of things : Hanes, David | Salgueiro, Gonzalo | Grossetete, Patrick | Barton, Robert Henry, Jerome, Pearson, 2018, ISBN: 9789386873743.
5. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT by David Etter,

Video lectures:

1. Introduction to internet of things By Prof. Sudip Misra, IIT Kharagpur https://swayam.gov.in/nd1_noc20_cs66/preview
2. https://www.coursera.org/specializations/iot#courses
3. https://www.coursera.org/specializations/embedding-sensors-motors

MOOC course

The Arduino Platform and C Programming

https://www.coursera.org/learn/arduino-platform?specialization=iot#syllabus

Course code	Course Title	Teaching Scheme	
		NA	Credits
PR1101	Automation Projects		2

Course Objectives: The course aims to train students for designing and implementing solutions for Automation using Internet of Things.

Course Outcomes:

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

1. Design and implement a complete project in IoT using Node-MCU and sensors using Embedded C programs

   Or

   Design and implement a complete project in IoT using Raspberry pi and sensors using Python programs
2. Apply one/more standard protocol(s) during project implementation
3. Demonstrate sensitivity to sustainability issues for power consumption / Bandwidth utilization/economic solutions during implementation of projects.

Assessment Scheme:

Sr. No.	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	Nil
3	Class Participation	Nil
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	Nil
8	Report I (Synopsis)	30
9	Report II (Midterm Progress Presentation and Viva)	30
10	Report III	Nil
11	Project I (with Report)	Nil
121	Project II	Nil
13	Project III (With working model)	40
14	Lab Evaluation I	Nil
15	Lab Evaluation II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Evaluation scheme for retest.		
	Project III (with Report)	**40**
	Total (100)	**40**

Critical Thinking for Decisions at Workplace

Course Code: CC1106
Credit: 2

L-T-P: 2-0-0

Course Objective:

In today's world, the idea of right and wrong is being challenged by businesses, use of technology, economic conditions, and norms of societies. The relevance of a well-reasoned decision is crucial. This course intends to make students take better decisions keeping in mind purpose, context, and ethics.

Course Outcomes:

The students will be able to:

- Apply techniques of Critical Thinking to analyse organisational problems through positive inquiry
- Describe and analyse appropriate problem-solving and ethical decision-making processes
- Choose the most effective and logical decision among multiple alternatives
- Evaluate solutions and anticipate likely risks based on purpose, context and ethics

Topics to be Covered:

- Decision Making: Definition and Type
- Barriers to Sound Reasoning
- Steps of Decision Making
- Ethics and Decisions
- Importance of purpose and context
- Problem analysis best practices
- Decision Implementation Techniques
- Comparing alternative solutions

References for Readings:

1. Lehrer, J. (2010). *How we decide*. Houghton Mifflin Harcourt.
2. Heath, C., & Heath, D. (2013). *Decisive: How to make better choices in life and work*. Random House.
3. Hammond, J. S., Keeney, R. L., & Raiffa, H. (2015). *Smart choices: A practical guide to making better decisions*. Harvard Business Review Press.
4. Cases and scenario will be shared in the class.

Evaluation Scheme:

The criteria that will be applied to assess the learning outcomes of this course:

Specifications	**Weightage (%)**
Assignment	20
Class Participation	10
Presentation	20
Mid-Term Examination	20
End-Term Examination	30
	100

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1112	Industrial Electronics	3	0	2	0	4

Course Objectives:

1. Equip students with comprehensive knowledge of powerelectronics devicesandpassivecomponents, theirpracticalapplicationsinpower electronics
2. Provide the essential numerical background for analyse, designandsynthesisofdifferentpower conversioncircuitsandtheirapplications.
3. Equip students with basic experimental and modeling skills for handling problems associated with power electronic circuits and systems

Course Outcomes:

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

1. Analyze the characteristics of power devices under different load condition
2. Choose appropriate power devices for different requirement of power conversion, and speed control of drives. Also analyse and evaluate their performance
3. Design an electric vehicle charging station with solar PV system.
4. Design battery pack using lithium ion batteries.
5. Use IEC standards for design and analysis of power electronics system.

Assessment Scheme:

Prerequisites: Power Engineering, Electrical Machines, Electronics Devices and Circuits

S. No	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	10
3	Class Participation	Nil
4	Quiz	20
5	Theory Exam-I	Nil
6	Theory Exam-II	20
7	Theory Exam-III	30
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil

12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	Nil
	Total	100
Evaluation Scheme for Retest		
1	Theory Exam-III	30
2	Lab Evaluation-II (Examination)	10
	Total	40

Course Syllabi (Theory):

Unit – I: Power Devices: Need for power conversion; Power electronic converters: classifications and scope; Power semiconductor switches: diodes, SCR, GTO and transistors (BJT, MOSFET and IGBT): Ratings, static and dynamic characteristics, drive and switching aid circuits and cooling.

Unit – II: Phase controlled converters: Principle of operation of single phase and threephase half wave, halfcontrolled, full controlled converters with R, RL and RLE loads, effects of freewheeling diodes, performance parameters evaluation of converters.

Unit – III: DC-DC converters: Principle of operation, control strategies, step up choppers, types ofchoppers circuits based on quadrant of operation, performance parameters, multiphase choppers and switching mode regulators.

Unit – IV: Inverters: Classification, method of commutation & connections, single phase and three phase bridge inverter with R and RL loads, performance parameters evaluation of inverters, design solar power fed electrical vehicle charging station

Unit – IV:Cyclo-converter: Principle of cyclo-converter operation, single phase to single phase Cyclo-converter circuit, Three-phase to single-phase and three-phase to three phase configurations.

Course Syllabi (Practical):

1. Determine V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents.
2. Find V-I characteristics of TRIAC and DIAC.

3. Find transfer and output characteristics of MOSFET and IGBT.
4. Study and test firing circuits for SCR-R, RC and UJT firing circuits.
5. Study and test 3-phase diode bridge rectifier with R and RL loads.
6. Study and obtain waveforms of single-phase half wave controlled rectifier. Study the variation of output voltage with respect to firing angle.
7. Study and test 3-phase diode bridge rectifier with R and RL loads.
8. Study and obtain waveforms of single-phase half controlled bridge rectifier with R and R-L loads. Study and show the effect of freewheeling diode.
9. Design a solar power fed electrical charging station using data sheet of PV module, solar inverter and electrical vehicle.
10. Study and design a battery pack using Lithium Ion batteries.

Text Book(s)

7. Bimbhra P.S. "Power Electronics", Khanna Publisher.
8. Singh M.D. &Khanchandani K.B., "Power Electronics", Tata McGraw Hill.
9. Sen P.C., "Power Electronics", Tata McGraw Hill.

Reference Book(s)

1. M. Ramamurthy, "An Introduction to Thyristors and their Applications", East West Press Pvt Ltd.
2. Mohammad H. Rashid, "Power Electronics Circuits, Devices and Applications", Prentice Hall of India Pvt. Ltd.

Course Title and Course Code	**Power System-II (EE 1114)**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-VI EEE**

Course Objective: The course focuses on representation of power system using per unit system and study fault analysis, formation impedance and admittance matrices for power system network, finding different electrical parameters for various buses in power system, assessment of steady state and transient stability of power system.

Course Outcomes:

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

1. Develop the computational models for Power system analysis including per unit system and stability.
2. Analyze the performance of power system under symmetrical and unsymmetrical fault conditions.
3. Evaluate the model of power system components during normal and fault conditions.
4. Evaluate the power system dynamics and its stability during normal and abnormal conditions according to IEEE standards.
5. Assess the different methods of control and compensation to choose the best option so that social and environmental problems are minimized and recognize the need to continuously follow the advancements in technology and incorporate them in the present system to improve efficiency and increase the flexibility and quality of operation.

Sr. No	Specifications	Marks (Existing)
1	Attendance	NIL
2	Assignment	10
3	Class Participation	05
4	Quiz	10
5	Theory Exam-I	NIL
6	Theory Exam-II	10
7	Theory Exam-III	30
8	Report-I (case study)	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	15
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I (Continuous)	10
15	Lab Evaluation-II (Exam)	10
16	Course Portfolio	NIL
Total (100)		**100**

Evaluation Scheme for Retest:

S. No.	Specifications	Marks
1	Theory Exam-III (End Term)	30
2	Lab Evaluation-II (Exam)	10
3	**Total**	**40**

Syllabus (Theory)

UNIT-I: Per Unit System: Per unit quantities, Impedance/Reactance diagram of a balanced for a balanced 3-phase system, per unit impedance of 3-phase transformer, **Admittance Model**: Equivalent admittance network and calculation of Y bus, Modification of an existing Y bus.

UNIT-II: Symmetrical Fault Analysis: Transient analysis of a transmission line, Short circuit analysis of a synchronous machine, Equivalent circuits of synchronous machine under sub transient, transient and steady state conditions, Fault analysis of an unloaded and loaded synchronous generator, balanced three phase fault analysis, Selection of circuit breaker.

UNIT-III: Sequence Components: Fortesque theorem, symmetrical components, Sequence networks of transmission lines, Synchronous machine and Transformers, sequence networks of power system, Phase shift in star-delta transformers. **Unsymmetrical Fault Analysis:** Classification of unsymmetrical faults, analysis of Unsymmetrical faults i.e. L-G, L-L, L-L-G faults, connection of sequence networks under the fault conditions, IEC 60909 , ANSI/IEEE Short Circuit Studies standards**.**

UNIT-IV: Power System Stability: Steady state stability, transient stability, Power angle curve, equal area criterion, swing equation, Methods of improving stability, High speed fault clearing, regulated shunt compensation, dynamic braking, and Independent pole operation of circuit breaker, automatic voltage regulator.

UNIT-V: Load Flow Study: Load flow problem, development of load flow equations, bus classification. Gauss Seidel, Newton-Raphson, decoupled and fast decoupled methods for load flow analysis. Comparison of load flow methods, IEEE30022018-1721251 load flow standard.

Syllabus (Practical)

1. Introduction to Matlab and its commands.
2. Matlab program to solve swing equation using point by point method.
3. Matlab program to find optimum loading of generators neglecting transmission loses.
4. Matlab program to simulate Ferranti effect.
5. Matlab program for formulation of admittance matrix.
6. Matlab program to solve load flow equations by Gauss Seidel method.
7. Matlab program to solve load flow equation by Newton Raphson method.
8. Matlab program for formulation of impedance matrix.
9. Modelling of DC Machines.
10. Modelling of Synchronous Machine.
11. Modelling of Induction Machine.

Textbooks

1. Kothari. D. P., Nagrath. I. J., "Power System Engineering", TMH New Delhi, 2019.
2. Gupta, B.R., "Power System Analysis and Design", S. Chand & Company Ltd. New Delhi, 2015.
3. Hadi Saadat, "Power System Analysis", TMH New Delhi, 2011.

Reference books

1. Weedy B.M., Cory B.J., Jenkins N., Ekanayake J.B., Strbac G., "Electric Power Systems", John Wiley & Sons Limited, 2012.
2. Wadhwa C. L., "Electrical Power Systems", New Age International Private Limited, New Delhi, 2017.
3. Glover J.D. , Sarma M., Overbye T. J., Power System Analysis & Design, Cengage Learning India Private Limited, 2012.
4. Grainger John, William Stevenson Jr., Power System Analysis, Hill Education, 2017.

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1115	Digital Signal Processing	3	0	2	0	4

Course Objectives: The course develops the fundamental concepts of signals & systems, the sampling concept, representation of signals in frequency & time domain and their analyses. Various operations on discrete time signals are done using z-transform, Fourier transform, DFT, and IIR and FIR digital filter designs are also emphasized.

Course Outcomes:

On successful completion of this course, the students will be able to

1.Analyze the various classifications & operations on signals

2. Analyze the frequency & time domain representations of signals

3. Implement fast Fourier transforms on signals

4. Implement discrete time systems

5. Analyze and solve problems using z transform

6. Implement digital filter design techniques

7. Implement IEEE standards for efficient signal processing

Assessment Scheme:

Sr. No.	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	Nil
7	Theory Exam-III	30
8	Report I (Case Study)	5
9	Report II	Nil
10	Report III	Nil
11	Project I	Nil
121	Project II	Nil
13	Project III	Nil
14	Lab Evaluation I	10
15	Lab Evaluation II	10

16	Course Portfolio	10
	Total (100)	100
Evaluation Scheme for Re-Test		
1	**Theory Exam - III**	20
2	**Lab Evaluation - II**	20
	Total (40)	40

Syllabus (Theory):

Signals, systems and signal processing, classification of signals, Signal operations, elements of digital signal processing system, concept of frequency in continuous and discrete time signals, Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples

Discrete-Time Signals and Systems (Frequency Domain analysis):

The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Frequency domain representation of Discrete-Time Signals & Systems, Representation of sequences by discrete time Fourier Transform (DTFT), Properties of discrete time Fourier Transform, and correlation of signals, Fourier Transform Theorems; The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution; Relationship between Fourier and Z-transforms

Efficient Computation of the DFT: Fast Fourier Transform Algorithm

Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT,Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Frequency (DIF); Applications of FFT Algorithms: Efficient Computation of the DFT of two Real Sequences, Efficient Computation of the DFT a 2N-Point Real Sequence

Implementation of Discrete-Time Systems:

Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures; Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures

Filter Design Techniques:

Filter Function Approximations and Transformations: Review of approximations of ideal analog filter response, Butterworth filter, Chebyshev Type I & II; Design of Discrete-Time IIR filters from Continuous-Time filters Approximation by derivatives, Impulse invariance and Bilinear Transformation methods; Design of FIR filters by windowing techniques

Syllabus (LABORATORY):

11. (a) Generation and analysis of mathematical operations/functions and analysis of continuous and discrete signal waveforms (periodic and non-periodic)

    (b) Generation of Exponential and Ramp signals in Continuous & Discrete domain

12. Verify the Sampling Theorem
13. Adding and subtracting two given signals (Continuous and Discrete)
14. Analyze and compare Linear and Circular Convolution
15. Generate and analyze random sequences with arbitrary distributions, means and variances for Rayleigh distribution, Normal distributions: N (0,1) and Gaussian distributions: N (m_x, σ_x^2)
16. Computation of DFT and IDFT using direct and FFT methods
17. Generate sum of sinusoidal signals
18. Compute frequency response of analog filters (Low Pass/High Pass)
19. Design and simulate FIR Rectangular/Hamming/Kaiser windows digital filter (Low Pass/High Pass)
20. Design and simulate IIR Butterworth/Chebyshev digital filter (Low Pass/High Pass)

Textbooks:

1. Digital Signal Processing Principles, Algorithms and Applications, J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson, 2014.
2. Digital Signal Processing, Tarun Kumar Rawat, Oxford University Press, 2014.

Reference Books:

1. Digital Signal Processing: a Computer-Based Approach, Sanjit K. Mitra, TMH, 2007.
2. Digital Signal Processing, S. Salivahan, A. Vallavraj and C. Gnanapriya, TMH, 2017.
3. Digital Signal Processing, Manson H. Hayes, Schaum's Outlines, TMH, 2011.
4. Digital Signal Processing: A Modern Introduction, Ashok K Ambardar, Cengage Learning, 2007
5. Digital Signal Processing: Fundamentals and Applications, Li Tan, Jean Jiang, Academic Press, Elsevier, 2018.
6. Digital Signal Processing: A MATLAB-Based Approach, Vinay K. Ingle and John G. Proakis, Cengage Learning, 2017.
7. Fundamentals of Digital Signal Processing using MATLAB, Robert J. Schilling and Sandra L. Harris, Cengage Learning, 2011.

Web Resources:

1. *Digital Signal Processing and its Applications*
   https://onlinecourses.nptel.ac.in/noc21_ee20/preview
2. https://nptel.ac.in/courses/108/105/108105055/

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1208	Digital Communication Networks	3	0	2	0	4

Course Objectives: The course introduces the evolution of various digital communication networks. The course emphasizes on the architecture & protocols describing the wireless LANs, mobile cellular networks & optical networks. Components, applications, research issues & network management functions are discussed.

Course Outcomes:

On successful completion of this course, the students will be able to

1. Analyze the OSI model of networks.
2. Analyze the various architectures employed in digital communication networks.
3. Analyze the different protocols used in the digital networks.
4. Design issues & protocols of wireless LANs. Emphasis on IEEE 802.11 standards. WiMax mobility support & broadband applications.
5. Formulate, solve & understand research issues in wireless networks
6. Design ad-hoc networks, sensor networks & mesh networks
7. Analyze satellite, optical and mobile cellular network architectures & protocols and their applications
8. Implement quality of service & network management functions

Assessment Scheme:

Sr. No.	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	Nil
7	Theory Exam-III	30
8	Report I (Case Study)	5
9	Report II	Nil
10	Report III	Nil
11	Project I	Nil
121	Project II	Nil
13	Project III	Nil
14	Lab Evaluation I	10

15	Lab Evaluation II	10
16	Course Portfolio	10
	Total (100)	100
Evaluation Scheme for Re-Test:		
1	**Theory Exam - III**	20
2	**Lab Evaluation - II**	20
	Total (40)	40

Syllabus (Theory):

1. Evolution of Communication Networks, Layered Architecture and OSI Model, Unified View of Protocols and Services

2. Wireless LANs: Network components, design requirements, Architectures, IEEE-802.11x, WLAN protocols, 802.11p and applications. WMANs, IEEE-802.16: Architectures, Components, WiMax mobility support, Protocols, Broadband networks and applications

3. Cellular networks, Satellite Network, Applications. Wireless ad-hoc networks: Mobile ad-hoc networks, Sensor network, Mesh networks, VANETs, Research issues in Wireless networks

4. Optical networks Client layers of the optical layer, SONET/SDH, Multiplexing, layers, Frame Structure, ATM functions, Adaptation layers, Quality of service and flow, ESCON, HIPPI, Network management functions

Syllabus (LABORATORY):

1. NS2/3 Implementation of congestion control protocol (TCP over IP) after creating a duplex link using nodes in a network
2. Analyze performance of IEEE 802.4 token bus LAN protocol in MAC layer
3. Analyze performance of IEEE 802.5 token ring LAN protocol in MAC layer
4. Implement ARQ stop and wait protocol/sliding window protocol in Data Link layer
5. Implement the different frames of HDLC protocol
6. Execute the Distance Vector Routing and Link State Algorithms
7. Analyze the performance of IEEE 802.3 CSMA/CD LAN protocol operating at MAC layer
8. Execute the go back N protocol/ selective repeat transmission flow control protocol
9. Design and Analyze a wireless sensor network architecture (also with TCP)
10. Design and Analyze a mobile ad-hoc network architecture

Textbooks:

1. "Optical Network Design and Planning", Simmons, Jane M, Springer, 2/e, 2014
2. "Computer Networks", Andrew S. Tanenbaum, David J. Wetherall, Pearson, 2013
3. Tse, David, and Pramod Viswanath. Fundamentals of wireless communication. Cambridge university press, 2005

Reference Books:

1. Data and Computer Communications, William Stallings, 9/e, 2013
2. Data Communication and Networking, Behrouz Forouzan, 4/e, 2017

Web Resources:

1. *Computer Networks and Internet Protocol*
   https://onlinecourses.nptel.ac.in/noc21_cs18/preview
2. https://nptel.ac.in/courses/117/105/117105076/

Course Title and Code: Minor Project : PR1103

Prerequisites	**Nil**
Hours per Week	**L-T-P:**
Credits	**04**
Students who can take	**B.tech. Semester VII**

Course Objective:

In Minor Project, Students are expected to work towards the goals and milestones set in Minor Project. The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. At the end there would be a demonstration of the solution and possible future work on the same problem. The student will have to present the progress of the work through seminars and progress reports. (in continue contact with Faculty Supervisor Assigned)

Operation Procedure

- Student has to devote full semester for Minor Project.
- Student has to report to the Supervisor regularly.
- Seminars s evaluation has to be carried out in the presence of atleast two-member Committee comprising.
- Experts in the relevant area constituted by the Supervisor.
- Final Seminar Report to be submitted has to be in formal hard bound cover bearing of the Institute emblem.

Assessment Scheme:

Sr. No	Specifications	Marks
01	Attendance	NIL
02	Assignment	NIL
03	Class Participation	NIL
04	Quiz	NIL
05	Theory Exam(Mid Term)	NIL
06	Theory Exam	NIL

07	Theory Exam(Final)	NIL
08	Report-1 (Synopsis) (Panel)	15
09	Report-2	NIL
10	Report-3	NIL
11	Project -1 (Mid Term) (Panel)	20
12	Project -2 (Day to Day work) (Demo, Presentation, Viva, Report)	25
13	Project -3 (End Term) (Panel) (Demo, Presentation, Viva, Report)	40
14	Lab Evaluation – I	NIL
15	Lab Evaluation – II	NIL
16	Course portfolio	NIL
	Total (100)	**100**

Annexure

Program Education Objectives

The B.Tech. Programs at IET, JKLU are designed to prepare students for continued learning and successful careers. Our alumni are expected to:

PEO1: Apply their technical knowledge, complex problem solving and research skills in professional practice.

PEO2: Continue their intellectual development through critical thinking, self-study, apprenticeship, higher education, professional development courses, as well as participation in research groups and professional networks.

PEO3: Serve as ambassadors for engineering and sustainability by exhibiting high professional standards with a deep sense of civic responsibility.

PEO4: Effectively communicate about technical and related issues.

PEO5: Embrace roles of team members and leaders in their career.

Program Outcomes

The graduates of B.Tech Programs at IET, JKLU will have following competencies:

PO 1: Life-long learning*:* Demonstrate inquisitiveness, open mindedness, and the ability to engage in independent and life-long learning in the broadest context of technological, organizational, economic, and societal changes.

PO 2: Citizenship, Sustainability, and Professional ethics

PO 2a: Demonstrate knowledge of constitutional values of liberty, equity, justice, and fraternity with understanding of the impact of the engineering solutions in societal and environmental contexts as well as a sense of responsibility for sustainable development.

PO 2b: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, cultural, and environmental issues and the consequent responsibilities relevant to the professional engineering practice.

PO 2c: Demonstrate commitment for professional integrity and excellence and respect for ethics, responsibilities and norms as prescribed for the engineering practice.

PO 3: Engineering knowledge and Modern tool usage

PO 3a: Demonstrate clear conceptual understanding of fundamentals of engineering specialization and cognitive flexibility to appropriately 'transfer' what has been learned in a context, to different situations.

PO 3b: Apply engineering thinking, computational thinking, and the knowledge of mathematics, natural and social sciences, engineering fundamentals, information technology, engineering specialization, and engineering management to the solution of complex engineering problems.

PO 3c: Create, select, modify, and apply appropriate techniques, best practices, standards, resources, and modern engineering and IT tools including prediction and modelling to engineering and social activities with an understanding of the limitations.

PO 4: Complex problem solving, Design and Research

PO 4a: Identify, formulate, review research literature, and analyze complex engineering problems to arrive at substantiated conclusions using critical thinking along with principles of mathematics, computing, engineering as well as natural and social sciences.

PO 4b: Use systems thinking and reflection to identify and consider underlying structures, patterns, volatility, uncertainties, complexities, ambiguities, complications, and risks to design and develop engineering solutions for complex problems to meet the specified and anticipated needs with appropriate concern for constraints, performance, sustainability, and professional ethics.

PO 4c: Use research-based knowledge and research methods including design of experiments, simulation, analysis and interpretation of data, and synthesis of the information to evaluate and improve the engineering solutions and practice.

PO 5: Individual & team work and Engineering management

PO 5a: Ability to work effectively as an individual and as a team member or leader in diverse and distributed teams, and in multidisciplinary settings.

PO 5b: Ability to apply engineering management principles to one's own and team's work to manage engineering projects and operations and in multidisciplinary environment.

PO 6: Communication: Ability to communicate effectively on complex engineering and technology activities, situations, problems, and solutions using verbal, textual, and pictorial elements with the colleagues, engineering community, users, clients, policy makers, and society at large with intellectual honesty, clarity, empathy, and compassion.

PO 7: Innovation and entrepreneurship:

PO 7a: Demonstrate enthusiasm and understanding to identify opportunities and translate research in engineering and other disciplines to conceive and design innovative engineering solutions for business, industry, and societal problems.

PO 7b: Demonstrate enthusiasm and understanding to conceive and plan technology based new ventures either as independent start-up businesses or within existing corporate structures.

Program Specific Outcomes

B.Tech. (Electrical and Electronics Engineering)

The electrical and electronics engineering graduates of JKLU will be able to:

EEEPSO1: Conceive, design, implement, and manage electrical or electronic systems by using principles of circuit design, machines, communication systems, signal processing, digital systems, power systems, automation, control systems, computing, sustainability and state of the art components and tools.

EEEPSO2: Serve in fields of telecommunication, manufacturing, energy, EPC, IT and engineering services.

JK Lakshmipat University, Jaipur									
Institute of Engineering and Technology									
Department of Electrical & Electronics Engineering									
Course Structure for the B. Tech (Batch 2019-2023)									
Semester	**Courses**							**(L T P S) Credits**	**Hrs/ Week**
I	Computational Data Analysis	Design and Prototyping	Experimental Science-I	Fundamentals of Communication					
	ES1101	ES1102	AS1101	CC1101					
	(10s 2 0) 10	(6s 0 0) 6	(1 0 4) 3	2				21	25
II	Calculus and Applied Mechanics	Fundamentals of Automation Engineering	Object Oriented Programming	Energy and Environmental Studies	Critical Thinking and Power of Storytelling	Scientific Perspectives			
	ES1103	ES1104	CS1101	ES1105	CC1102	AS1102			
	(6s 2 0) 6	(6s 2 0) 6	(1 0 4) 3	(1 0 0) 1	(2 0 0) 2	2 (Science week)		20	24
III	Data Structures	Computational Engineering Analysis-I	Engineering Measurements and Machines	Electronic Devices & Circuits	Perspectives on Contemporary Issues	Management Perspectives			
	CS1102	ES1106	ES1107	EE1101	CC1103	IL1101			
	(3 0 2) 4	(3 1 2) 5	(3 0 4) 5	(3 0 2) 4	2	2 (Management week)		22	25
IV	Power Systems-I/ Digital Systems Design	Computational Engineering Analysis-II	Advanced Electrical Machines/ Electromagnetics and Microwaves	Signals and Control Systems	Communication and Identity	Introduction to Design			
	EE1107/EE1110	ES1109	EE1103/EE1104	EE1105	CC1104	IL1102			
	(3 0 2) 4	(3 1 2) 5	(3 0 2) 4	(3 0 4) 5	(2 1 0) 2	2 (Design week)		22	25
	Practice School - I (PS 1101) – (4 to 6 Weeks Duration)							4	
V*	Analog and Digital Communications	Analog Circuits	Open Elective-1	DE-1	Understanding and Managing Conflict	Introduction to IoT	Automation Projects		
	EE1109	EE1102			CC1105	EE1111	PR1101		
	(3 0 2) 4	(6 0 0) 4	4	4	(2 0 0) 2	(1 0 2) 2	(0 0 1) 2	22	22
VI*	Industrial Electronics/ Digital Communication Networks	Power Systems-II/ Digital Signal Processing	DE-2	DE-3/OE-2	Critical Thinking for Decisions at Workplace	Emerging Tech Week			
	EE1112/EE1208	EE1114/EE1115			CC1106				
	(3 0 2) 4	(3 0 2) 4	4	4	2	2		20	17/23
VII*	DE-4	DE-5	DE-6	OE-3	Minor Project PR1103				
	4	4	4	4	4			20	20
VIII*	Practice School - II /Entrepreneurial Project/Research Project/Semester at a partner University							16	

Annexure CO-PO Mapping

Course Code : ES1101

Course Name **:** Computational Data Analysis

Course Outcomes **:**

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

10. Write Simple Python programs using various datatypes, control structures, decision statements, libraries, functions (M1)
11. Develop Python programs using Objects, Classes and Files (M1, M2)
12. Develop Programs for analyzing and interpreting Complex situations in various domains including sustainable development by combining various Linear Algebra, Statistics and Other Problem-Solving Techniques (M3)
13. Model Complex systems as Linear simultaneous equations and analyze the same using Matrix methods (M1)
14. Model Data as matrices and Find Eigen Values and Eigen Vectors and Apply the same for problem solving, e.g., ranking and performance analysis (M1)
15. Summarize and Visualize different datasets (M2)
16. Analyze and interpret different datasets using Discrete and Continuous Probability Distributions and Apply the same for problem solving, e.g., Goodness of Fit (M2)
17. Formulate and validate hypothesis with reference to different datasets (M2)
18. Apply correlation, regression, least square method and time series analysis for modeling, analysis, interpretation and forecasting (M2)

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1101.1																	
ES1101.2											1						
ES1101.3					1	1					1			1			
ES1101.4			1		1	1				1	1						
ES1101.5			1		1	1				1	1			1			
ES1101.6					1	1		1			1		2				
ES1101.7		1	1		1	1		1			1		1	1			
ES1101.8		1	1		2	1		2			1		1	1			
ES1101.9		1	1		2	1		2		1	1		1	1			

Course Code : ES1102

Course Name **:** Design and Prototyping

Course Outcomes **:**

ES1102.1. Approach design challenges from the perspective of the user and offer innovative solutions effectively.

ES1102.2. Communicate and work in team towards a common goal.

ES1102.3. Think creatively towards a fun based, desirable solution.

ES1102.4. Develop the projection views of the products with dimensions and scales.

ES1102.5. Create the schematic diagram and isometric view of the parts using AutoCAD.

ES1102.6. Fabricate prototype by combining the different parts.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1102.1	2	1	1	1										2			
ES1102.2											1	1	1				
ES1102.3	2				2	1	1	1						2			
ES1102.4					1	1	1										
ES1102.5	1				2	1	1										
ES1102.6	2				2	1	1				1	1	1				

Course Code : AS1101

Course Name **:** Experimental Science

Course Outcomes **:**

AS1101.1. Analyze ferromagnetic properties of any magnetic material and differentiate Soft and hard materials.

AS1101.2. Analyze thermoelectric effect of metal junctions due to temperature differences.

AS1101.3. Analyze nuclear radiation with respect to distance and thickness of absorbing media.

AS1101.4. Measure electrical properties e.g. specific resistance, time constant of various electrical components.

AS1101.5. Use Schroedinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials.

AS1101.6. Differentiate hard and soft water by determining it's hardness of different water samples.

AS1101.7. Analyze conductivity of samples by different techniques such as volumetric titrations and conductometric.

AS1101.8. Determine properties of the lubricant/oil samples by Pensky-Martens and Red Viscometer.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
AS1101.1	1				1									1			
AS1101.2	1																
AS1101.3	1										1						
AS1101.4	1				1						1						
AS1101.5	1																
AS1101.6	1		1		1	1	1				1		1		1		
AS1101.7	1		1				1				1		1				
AS1101.8	1																

Course Code : CC1101

Course Name **:** Fundamentals of Communication

Course Outcomes **:**

ES1101.1. Identify different cultural differences and their impact on communication.
ES1101.2. Compose grammatically correct sentences and paragraphs.
ES1101.3. Deliver effective oral presentations following appropriate kinesics and paralinguistic features.
ES1101.4. Identify impact of cultural differences on communication.
ES1101.5. Apply appropriate communication skills across settings, purposes, and audiences.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1101.1									1		1		1				
CC1101.2																	
CC1101.3	1										1						
CC1101.4																	
CC1101.5	1										1		1				

Course Code : ES1103

Course Name **:** Calculus and Applied Mechanics

Course Outcomes **:**

ES1103.1: Apply analytical techniques to determine forces in structures.

ES1103.2: Use commercial software (STAAD Pro.) to simulate a structure/frame and determine force in the members.

ES1103.3: Model physical phenomena using calculus and solve using appropriate method

ES1103.4: Apply Newton's laws of motion and understand the concepts of dynamics concepts (force, momentum, work and energy)

ES1103.5: Interpret the geometrical significance of differential and integral calculus

ES1103.6: Solve problems of vector differentiation and integration

ES1103.7: Calculate the buoyant forces of objects with various shape and carryout the stability analysis

ES1103.8: Apply the concept of partial differentiation to solve optimization problems

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1103.1						2					1		2				
ES1103.2						2	2				1						
ES1103.3	1				1	2	2		1		2		1				
ES1103.4	2				1	2	2				1						
ES1103.5	1				1	2	2										
ES1103.6						1	1										
ES1103.7						1	1		1		1		2				
ES1103.8						2	1				1		1				

Course Code : ES1104

Course Name **:** Fundamentals of Automation Engineering

Course Outcomes **:**

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

ES1104.1. Analyze electrical circuits using network theorems,
ES1104.2. Measure electrical parameters of passive as well as active electrical components,
ES1104.3. Design rectifier circuit using semiconductor devices,
ES1104.4. Design filters for power conditioning,
ES1104.5. Design and test a linear power supply for given specifications
ES1104.6. Design and build Printed Circuit Boards,
ES1104.7. Use electrical safety practices while working on electrical projects,
ES1104.8. Formulate mathematical models for basic electro-mechanical systems,
ES1104.9. Design and simulate a basic analog open-loop control system,
ES1104.10. Evaluate and simplify Boolean functions and design the minimized logic using logic gates.
ES1104.11. Design basic combinational and sequential circuits with minimum complexity,
ES1104.12. Implement combinational circuit using simulation tools.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1104.1					2			1									
ES1104.2						2								1			
ES1104.3					1			1									
ES1104.4					2							1		1			
ES1104.5					1							1		1			
ES1104.6							1		1			1		1			
ES1104.7	2						2						1				
ES1104.8	2				2			2						2			
ES1104.9					1							1		1			
ES1104.10																	
ES1104.11	2				2							1					
ES1104.12						2			2			1	1	1			

Course Code : CS1101

Course Name **:** Object Oriented Programming

Course Outcomes **:**

CS1101.1. Develop Java Programs with the concepts of primitive data types, strings and arrays.

CS1101.2. Develop Java Programs using Object Oriented Programming Principles such as Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding, Polymorphism, Inheritance, and Interfaces.

CS1101.3. Design, develop and debug programs in Core Java using coding and documentation standards.

CS1101.4. Incorporate exception handling in Java Programs.

CS1101.5. Use JDBC API connectivity in between Java Programs and database.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CS1101.1					1	1	1							1			
CS1101.2																	
CS1101.3					1	1					1	1		1			
CS1101.4																	
CS1101.5											1	1					

Course Code : ES1105

Course Name **:** Energy and Environment Studies

Course Outcomes **:**

ES1105.1: Relate renewable energy with ecology & environment

ES1105.2: Explain the climate change and threat to biodiversity

ES1105.3: Describe the various pollution sources and their impacts on Environment

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1105.1	1					1											
ES1105.2		1									1						
ES1105.3	1				1												

Course Code : CC1102

Course Name **:** Critical Thinking & Power of Storytelling

Course Outcomes **:**

ES1101.1. Formulate intelligent questions to investigate

ES1101.2. Evaluate information and argument for correctness, consistency, relevance and validity.

ES1101.3. Compose well-structured and well-reasoned arguments.

ES1101.4. Articulate and evaluate the impact of narratives.

ES1101.5. Distinguish between facts, assumptions and opinion.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1102.1			1					1									
CC1102.2			1			1							1				
CC1102.3											1						
CC1102.4													1				
CC1102.5													1				

Course Code : AS1102

Course Name **:** Scientific Perspective

Course Outcomes **:**

AS1102.1. Distinguish between science, pseudo-science, and other forms of knowledge.

AS1102.2. Distinguish between science, engineering, technology, and mathematics and also identify the opportunities for integrating these disciplines.

AS1102.3. Use the scientific approach to identify and understand the societal problems.

AS1102.4. Explain, Design and carry out Scientific studies

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
AS1102.1	1												1				
AS1102.2					1	1											
AS1102.3		1			1												
AS1102.4	1												1				

Course Code : CS1102

Course Name **:** Data Structures

Course Outcomes **:**

CS1102.1. Write programs for performing basic operations like insertion, deletion, searching, sorting, merging, traversal etc. on various data structures like array, queue, stack, linked list, tree, graph.

CS1102.2. Use and design appropriate data structures for solving a variety of computational problem.

CS1102.3. Develop test cases for their programs and debug the code.

CS1102.4. Analyze the algorithms in terms of asymptotic time and space complexity.

CS1102.5. Implement and compare various searching and sorting algorithms

CS1102.6. Convert a recursive algorithm to non-recursive algorithm.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CS1102.1	1		1			2			1			1					1
CS1102.2			1					1		2				2		2	
CS1102.3	1			1		1				1			1		2		1
CS1102.4		1			1		1					2		1	1	2	
CS1102.5	1						1		2							2	1
CS1102.6	1			1				2			1		2				1

Course Code : ES1106

Course Name **:** Computational Engineering Analysis- I

Course Outcomes **:**

ES1106.1. Solve ordinary differential equations through various techniques.

ES1106.2. Determine the structural behavior of the body by determining the stresses, strains produced by the application of load.

ES1106.3. Analyze the concept of buckling and be able to solve the problems related to column and struts.

ES1106.4. Model the problems of column and struts mathematically in terms of ordinary differential equations and solve them using the appropriate method.

ES1106.5. Simulate the solutions of the above-mentioned models of columns and struts.

ES1106.6. Analyze a function of complex variables in terms of analyticity, poles and zeroes.

ES1106.7. Find Laplace and inverse Laplace transforms of given function and use Laplace transform to solve ordinary differential equations.

ES1106.8. Design and Evaluate the LC, RC & RL Networks using Foster'sand Cauer Forms

ES1106.9. Analyze stability criteria for electrical network using pole zero plot and routh-hurwitz polynomials.

ES1106.10. Model and simulate electrical networks using Proteus simulator/ Virtual lab.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1106.1					2	2	2	1	1		1	1					
ES1106.2					2			2									
ES1106.3					1			1							1		
ES1106.4		1			1	2	2	1	1	1	2	1					
ES1106.5							2	1		1							
ES1106.6					2												
ES1106.7					2	2	1	1	1		1	2					
ES1106.8					2	2		2			1	1		1			
ES1106.9					2	2		1			1	1					
ES1106.10	1						1		1								

Course Code : ES1107

Course Name **:** Engineering Measurements and Machines

Course Outcomes **:**

ES1107.1: Evaluate suitable electrical and non-electrical instruments for measuring physical quantities.
ES1107.2: Analyze the construction, characteristics and applications of various types of rotating machines.
ES1107.3: Analyze the working of any mechanical and electrical machine using mathematical model.
ES1107.4: Integrate the sensors for monitoring and automation of electrical and mechanical systems.
ES1107.5: Design electro-mechanical machines as per Indian standards.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1107.1	2				2	1	1				1	1	1	1			
ES1107.2		1			1	1	1	1									
ES1107.3					1	2	1	1	1		1						
ES1107.4	1	1	1		1	1	1	1	1		1		1				
ES1107.5	1		1	1	1	1	1	1	1		1	1					

Course Code : EE1101

Course Name : Electronic Devices & Circuits

Course Outcomes :

On successful completion of this course, the students will be able to

EE1101.1. Analyze characteristics of electronic components, devices, and circuits

EE1101.2. Apply electronic devices and circuits to various engineering applications

EE1101.3. Design and analyze different amplifier configurations

EE1101.4. Analyze input-output characteristics of a given complex network

EE1101.5. Design efficient power amplifiers with least harmonic distortion

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1101.1	1		1		1		1	1	1							2	2
EE1101.2	1		1		1	1		1	1	1				1		2	2
EE1101.3						1		1	1	1						1	1
EE1101.4					1				1	1						1	
EE1101.5					1	1			1					1		1	

Course Code : CC1103

Course Name **:** Perspectives on Contemporary Issues

Course Outcomes :

ES1101.6. Identify different perspectives objectively.

ES1101.7. Explain interconnectedness of the issues and their impact at micro and macro levels.

ES1101.8. Recognize their own beliefs, biases, claims and assumptions

ES1101.9. Evaluate sources, argue and defend effectively

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1103.1	1		1					1			1	1					
CC1103.2						1					1	1	1				
CC1103.3											1	1	1				
CC1103.4	1		1									1	1				

Course Code : IL1101

Course Name **:** Management Perspectives

Course Outcomes **:**

IL1101.1. Comprehend the importance of management and its functional areas in businesses and also its interaction with technology.

IL1101.2. Highlight specific external and internal issues impacting businesses.

IL1101.3. Integrate and analyze multiple dimensions of management aspects to solve business problems.

IL1101.4. Evaluate the aspects that management might consider when evaluating technical and engineering projects such as planning and scheduling, personnel management, cost control etc. from a management perspective

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
IL1101.1	0.5				0.2												
IL1101.2	0.5	1											0.5				
IL1101.3	1		0.2		0.2						1		0.5				
IL1101.4	1			0.2							1	2					

Course Code : EE1107

Course Name : Power Systems-I

Course Outcomes :

EE1107.1. Choose the appropriate type of power generating station in consideration to cost, environment, and societal issues.

EE1107.2. Review different tariff model and select the most appropriate model for a given scenario to optimize the revenue.

EE1107.3. Evaluate the suitability of installing overhead and underground power transmission strategies considering electrical, mechanical, environmental, performance, safety and economic constraints.

EE1107.4. Develop and use mathematical models for performance analysis of transmission and distribution networks.

EE1107.5. Design earthing system and take other measures to avoid electrical hazards.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1107.1	2	1	2		1	1	1					1	1	1	1	1	1
EE1107.2	1	1	1		1		1	1	1			1				1	1
EE1107.3	1	1		1	1	2		1		1	1		1			1	
EE1107.4					1	1	1									1	1
EE1107.5	1	1	1	1		1	1	2					1		1	2	1

Course Code : EE1110

Course Name : Digital System Design

Course Outcomes :

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

EE1110.1 Describe Hardware description languages (HDL),
EE1110.2 Design Digital Circuits,
EE1110.3 Write behavioral, structural and dataflow models of digital circuits
EE1110.4 Synthesize RTL models to standard cell libraries and FPGAs
EE1110.5 Implement FSM using HDL.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1110.1	2				1											2	1
EE1110.2					1											2	1
EE1110.3					1					1							1
EE1110.4	1					1		1		1				2		2	2
EE1110.5	2					1			2					2		2	2

Course Code: ES1109

Course Name: Computational Engineering Analysis – II

Course Outcomes: After course completion, the student will be able to

ES1109.1. Classify various types of partial differential equations and solve them through various analytical and numerical methods.
ES1109.2. Formulate and analyze differential equations especially Navier stokes and energy equations and use numerical methods for solving the same.
ES1109.3. Use Numerical method for solving partial differential equations using finite difference method.
ES1109.4. Find Fourier and inverse Fourier transforms of given function and use Fourier transform to solve partial differential equations.
ES1109.5. Find Z-transform and inverse Z-transforms of given functions and use them to analyze control systems.
ES1109.6. Design and analyse various types of filters and attenuators to minimize power losses and improve signal quality.
ES1109.7. Solve problems involving vertex and edge connectivity, planarity and crossing numbers.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
ES1109.1	1				1	1		1			1						
ES1109.2	2		2		2	2	1	2			1		1	2			
ES1109.3						1	2										
ES1109.4					2	2		1			1						
ES1109.5	1		1		2	2		1			1			1			
ES1109.6		1				1	2			2				1			
ES1109.7						1	2	2						1			

Course Code : EE1104

Course Name **:** Electromagnetics and Microwaves

Course Outcomes **:**

On successful completion of this course, the students will be able to

EE1104.1. Analyze static electromagnetic field in cables, coils, etc., used in electric power transmission circuits.

EE1104.2. Analyze fluctuating electromagnetic fields in different medium, e.g., linear and isotropic medium using Maxwell's equations.

EE1104.3. Analyze characteristics of EM waves under time varying potentials and polarization of EM waves due to different mode of transmission.

EE1104.4. Analyze wave propagation through different transmission lines and plane electromagnetic waves in homogeneous media.

EE1104.5. Analyze the amount of electromagnetic noise generated by a device and test Electromagnetic compatibility (EMC) and electromagnetic interference (EMI).

EE1104.6. Design and Analyze SWR, cutoff frequency, guide wavelength, etc and Characterize microwave junctions like tees

EE1104.7. Design and Characterize microwave corner, bends & twists and directional couplers, isolators, circulators, and attenuators

EE1104.8. Analyze the applications of microwave generators like klystrons & magnetrons

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1104.1			1		1			1	1							2	1
EE1104.2					1			1								2	1
EE1104.3																2	1
EE1104.4									1	1						2	1
EE1104.5	1		2	1	1	1	1	1	1			1	2	2		2	2
EE1104.6						1			1	1		1		1		2	1
EE1104.7					1				1	1						2	1
EE1104.8					1				1	1						1	1

Course Code : EE1105

Course Name : Signals and Control System

Course Outcomes :

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

ES1101.1. identify and differentiate signals, systems, and their properties,

ES1101.2. evaluate Fourier, Laplace, and z-transform for continuous and discrete time systems,

ES1101.3. apply properties like symmetry, time scaling, time shifting, frequency shifting, time differentiation, time integration, time convolution, frequency convolution, inverse transform on continuous and discrete signals,

ES1101.4. design open loop or closed loop control system of mechanical, electrical, thermal, chemical, or analogous systems,

ES1101.5. convert linear system to discrete system through sampling,

ES1101.6. solve the control system using block diagram reduction method and Mason's gain formula,

ES1101.7. perform the error analysis on the system,

ES1101.8. evaluate the stability of the system and effect of parameter variation on the stability using pole-zero location method, Routh-Hurwitz criterion, and root locus technique,

ES1101.9. analyse the control system in frequency domain and time domain,

ES1101.10. frequency analysis plots viz. Bode plot, Polar plot, and Nyquist Plot,

ES1101.11. improve a system as per design and equipment standards keeping energy efficiency in consideration.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1105.1	1			1	1		1									1	1
EE1105.2	1				1											1	
EE1105.3	1						1									1	
EE1105.4	1				1		1							1		1	1
EE1105.5					1								1			1	
EE1105.6	1						1										
EE1105.7	1				1											1	
EE1105.8	1				1		1									1	1
EE1105.9	1				1	1	1									1	1
EE1105.10	1				1	1	1									1	1
EE1105.11	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1

Code : CC1104

Course Name : Communication and Identity

Course Outcomes :

ES1101.1. Analyse their personal identities, both private and social

ES1101.2. Identify their different values, strengths and areas of professional interest

ES1101.3. Articulate their personal statement and use it to craft an influential pitch

ES1101.4. Express themselves through various communication formats on different platforms

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1104.1													1	1			
CC1104.2	1		2	1										2			
CC1104.3													1				
CC1104.4													2				
CC1104.1													1	1			

Course Code : IL1102

Course Name : Introduction to Design

Course Outcomes :

ES1101.1. Identify the user and build it's persona.

ES1101.2. Sketch their ideas on paper to visualize and assess viability.

ES1101.3. Create a plan for process and management to materialize the desired idea.

ES1101.4. Test the material for possibilities and capabilities.

ES1101.5. Develop skills of joinery, material manipulation and various hand tools.

ES1101.6. Develop technical and narrative skills useful for both film and animation.

ES1101.7. Develop troubleshooting and problem-solving skills.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
IL1102.1	1								1	1			1	1			
IL1102.2	2						1						2				
IL1102.3	1						1	1						2			
IL1102.4	1						1	1									
IL1102.5							1	1									
IL1102.6	2						1						1				
IL1102.7	1		1			1	1										

Course Code : EE1109

Course Name : Analog and Digital Communications

Course Outcomes :

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

EE1109.1: Apply the knowledge of signals and system to analyze the communication system.
EE1109.2: Implement and analyze various analog modulation and demodulation techniques as per ITU standards.
EE1109.3: Use the sampling theorem to determine optimum sampling frequency for a signal.
EE1109.4: Implement and analyze various digital modulation and demodulation techniques.
EE1109.5: Evaluate the performance of analog and digital communication systems in the presence of white noise.
EE1109.6: Improve receiver's performance by applying various algorithms.

Course specific CO's contribution to PO/PSO	Rate the level of course specific CO's corelated with POs/PSOs (1: Low Correlation; 2: Moderate; 3: Substantial correlation) Leave Blank if Not Correlated																
	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
EE1109.1	1			1	1		1	1			1	1	1			1	1
EE1109.2		1			1		1	1	1		1		1			2	2
EE1109.3	1					1	1	1	2				1			1	1
EE1109.4		1					1	2	1	1	1		1	1		2	3
EE1109.5			1		1	1		1	1	1	1	1		1		1	3
EE1109.6	1		1				1		1				2	1		1	2

Course Code : EE1102

Course Name : Analog Circuits

Course Outcomes :

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

EE1102.1 Explain electrical characteristics of op-amps and their open loop configurations,

EE1102.2 Design inverting, noninverting, and differential amplifiers,

EE1102.3 Find out frequency response, stability, transient response, bandwidth, maximum output voltage, and other important parameters of an op-amp with and without feedback

EE1102.4 Analyze and design summing and differential amplifiers, voltage to current converters, low voltage dc voltmeters, low voltage ac voltmeters, zener diode testers, light-emitting diode testers, and integrator and differentiator circuits

EE1102.5 Design and analyze filters and oscillators viz., low-pass filters, high-pass filters, band-pass filters, band-reject filters, Phase shift oscillators, Wien bridge oscillators, quadrature oscillators, square wave generators, triangular wave generators, and sawtooth wave generators.

EE1102.6 Fabricate and design some op-amp based devices such as power supplies, audio function generators, LED temperature indicators, dc motor speed controllers, appliance timers, sirens/alarms etc.

EE1102.7 Test the performance of different circuits as per IEEE, IEC, ISO and other standards.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1102.1	2				1			1									
EE1102.2					2			1									
EE1102.3																2	1
EE1102.4																**2**	**1**
EE1102.5	2							2						1		2	1
EE1102.6	2							2		1				1		2	1
EE1102.7	2							2		1							

Course Code : CC1105

Course Name **:** Understanding and Managing Conflict

Course Outcomes **:**

ES1101.1. Define a group and explain the stages of group development
ES1101.2. Describe conflict and explain types and causes of conflict
ES1101.3. Use inquiry and advocacy to engage with groups
ES1101.4. Give and receive feedback effectively
ES1101.5. Identify sources of conflict and manage them using difference conflict handling styles

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1105.1	1										2		1				
CC1105.2	1							1									
CC1105.3	1		1						1		2	1	1				
CC1105.4	1										1		1				
CC1105.5	1										1	1	1				

Course Code : EE1111

Course Name : Introduction to Internet of Things (IoT)

Course Outcomes :

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

EE1111.1: Interface the Analog and Digital sensors to Node-MCU.
EE1111.2: Develop Embedded C programs to read sensor data and upload to public cloud platform.
EE1111.3: Use Python-based IDE (integrated development environments) for the Raspberry Pi.
EE1111.4: Interface Raspberry Pi with I/O devices.
EE1111.5: Visualize sensor data uploaded on public cloud.
EE1111.6: Apply standard protocol(s) for implementation of IoT Systems.
EE1111.7: Analyze and Improve existing systems with innovative IoT based approaches.

Course specific CO's contribution to PO/PSO	**Rate the level of course specific CO's correlated with POs/PSOs (1: Low Correlation; 2: Moderate; 3: Substantial correlation) Leave Blank if Not Correlated**																
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO1	PSO2
EE1111.1								1		1	1						1
EE1111.2							1	1	1		1					1	2
EE1111.3								1		1						1	2
EE1111.4								1	1	1	1		1	1		1	1
EE1111.5							1	1		1	1			1		1	1
EE1111.6									1	1			1	1		1	1
EE1111.7									1	1	1					1	1

Course Code : PR1101

Course Name : Automation Projects

Course Outcomes :

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

PR1110.1 design and implement a complete project in IoT/Automation using microcontroller/SOC interfaced with sensors or any other automation hardware/tools,

PR1110.2 apply anyone/more standard data communication/IoT protocol(s),

PR1110.3 use cloud servers for data streaming/logging and analytic techniques,

PR1110.4 implement algorithms/signal processing using the data at edge/cloud,

PR1110.5 deploy techniques to conserve bandwidth/energy/other resources and achieve cost economy for project.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1110.1	2				2					2		2		3		2	1
EE1110.2						2											
EE1110.3							2										
EE1110.4	2								2								
EE1110.5					2		2									2	1

Course Code : EE1112

Course Name **:** Industrial Electronics

Course Outcomes **:**

ES1101.1. Analyze the characteristics of power devices under different load condition

ES1101.2. Choose appropriate power devices for different requirement of power conversion, and speed control of drives. Also analyze and evaluate their performance

ES1101.3. Design an electric vehicle charging station with solar PV system.

ES1101.4. Design battery pack using lithium ion batteries.

ES1101.5. Use IEC standards for design and analysis of power electronics system

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1112.1	1						1									1	1
ES1112.2	1															2	2
ES1112.3			1		1		1		2	1	2	1		2	2	2	3
ES1112.4			1		2		2		2	1	2	2		2	2	2	3
ES1112.5						1							2		1	2	2

Course Code : EE1208

Course Name **:** Digital Communication Networks

Course Outcomes **:**

On successful completion of this course, the students will be able to

EE1208.1. Analyze the OSI model of networks.

EE1208.2. Analyze the various architectures employed in digital communication networks.

EE1208.3. Analyze the different protocols used in the digital networks.

EE1208.4. Design issues & protocols of wireless LANs. Emphasis on IEEE 802.11 standards. WiMax mobility support & broadband applications.

EE1208.5. Formulate, solve & understand research issues in wireless networks

EE1208.6. Design ad-hoc networks, sensor networks & mesh networks

EE1208.7. Analyze satellite, optical and mobile cellular network architectures & protocols and their applications

EE1208.8. Implement quality of service & network management functions

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1208.1					1		1	1	1							2	2
EE1208.2			1		1	1	2		3	1						2	2
EE1208.3			1	2	1		1		1							2	2
EE1208.4			1	1			1		3	1						2	2
EE1208.5	1		1	1	1		1	2	1	1			1	2		2	2
EE1208.6					1			1	1	1						2	2
EE1208.7	1		1		1		1	1	2	1						1	1
EE1208.8			1	1	1		1	1	1	1				1		2	2

Course Code : EE1114

Course Name : Power System-II

Course Outcomes :

EE1114.1. Develop the computational models for Power system analysis including per unit system and stability.

EE1114.2. Analyze the performance of power system under symmetrical and unsymmetrical fault conditions.

EE1114.3. Evaluate the model of power system components during normal and fault conditions.

EE1114.4. Evaluate the power system dynamics and its stability during normal and abnormal conditions according to IEEE standards.

EE1114.5. Assess the different methods of control and compensation to choose the best option so that social and environmental problems are minimized and recognize the need to continuously follow the advancements in technology and incorporate them in the present system to improve efficiency and increase the flexibility and quality of operation.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1114.1	2	1			1	1	1	1					1			1	1
ES1114.2	1				1	1	1	1					1			1	1
ES1114.3					1	1	1	2	1	1			1			1	1
ES1114.4		1		1	3	1	1	1	1							1	1
ES1114.5		1	1		1	1	1	1	1	1	1	1	1	2	2	2	1

Course Code : EE1115

Course Name **:** Digital Signal Processing

Course Outcomes **:**

On successful completion of this course, the students will be able to

EE1115.1. Analyze the various classifications & operations on signals

EE1115.2. Analyze the frequency & time domain representations of signals

EE1115.3. Implement fast Fourier transforms on signals

EE1115.4. Implement discrete time systems

EE1115.5. Analyze and solve problems using z transform

EE1115.6. Implement digital filter design techniques

EE1115.7. Implement IEEE standards for efficient signal processing

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1115.1					2			2	1	1						2	1
EE1115.2								1	1	1						2	1
EE1115.3					1	1		1	1	1						2	1
EE1115.4					2	1	1	1	1	1						2	2
EE1115.5							1	1	1	1		1				2	1
EE1115.6						1	1	1	1	1		1		1		2	1
EE1115.7	1		2	2	1		1	1	1	1		1	2	2		2	2

Course Code : CC1106

Course Name **:** Critical Thinking for Decisions at Workplace

Course Outcomes **:**

ES1101.1. Apply techniques of Critical Thinking to analyse organisational problems through positive inquiry

ES1101.2. Describe and analyse appropriate problem-solving and ethical decision-making processes

ES1101.3. Choose the most effective and logical decision among multiple alternatives

ES1101.4. Evaluate solutions and anticipate likely risks based on purpose, context and ethics

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1106.1	1										2		2				
CC1106.2	2					1		2					1				
CC1106.3									1		1	2	1				
CC1106.4							1	2				2					