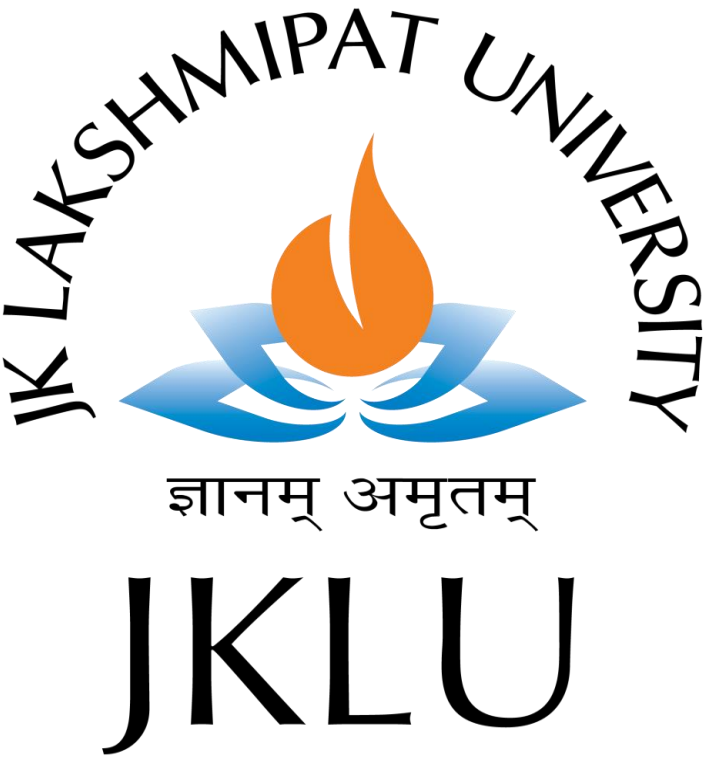


HANDBOOK

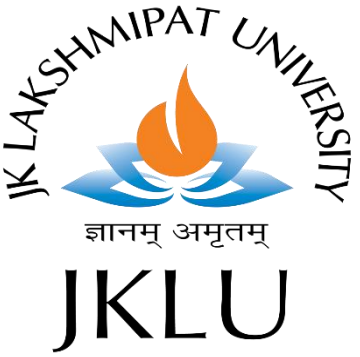
of

CURRICULUM STRUCTURE AND SYLLABUS

Bachelor of Technology in Electrical and Electronics Engineering (Programme Code: 3107)

Batch: 2019-23

Institute of Engineering and Technology



Vision

To be one of India's most innovative higher education institutions.

Mission

To realise its vision, the University will:

Practice teaching that inculcates critical thinking and problem solving,

Pursue research that leads to innovation and enhancement of real-life applications,

Offer experience that leads to all round development, and

Develop a culture that is strongly rooted in interdisciplinarity and learning by building, not just doing.

Values

Caring for people.

Integrity including intellectual honesty, openness, fairness, and trust.

Commitment to excellence.

IQAC Documentation

Document Name: Handbook of Curriculum Structure and Syllabus, Bachelor of Technology in Electrical and Electronics Engineering (Programme Code: 3107) - Batch 2019-2023

Document Compilation Date: Jan 24, 2022

Document Description: This document supplements the document titled Curriculum Structure: BTech, MTech and BCA Programs and is prepared by the Institute of Engineering and Technology (IET), JKLU to serve as an information baseline for further planning and delivery of courses w.r.t Bachelor of Technology in Electrical and Electronics Engineering (B. Tech EEE), Batch 2019-23.

It includes Program Education Objectives, Programme Outcomes, Programme Specific Outcomes, Desired minimum level of competence for POs and PSOs, Curriculum Structure, collation of Semester wise Course Description, and Course Articulation Matrix (CAM) of each course (including electives and additional courses, if any, opted by students) prepared by respective faculty members. The document also includes Programme Articulation Matrix (PAM).

This document is in compliance with BoS (upto 13th meeting) and approvals of the Academic Council (upto 20th meeting).

Document Creation Team:

Dr Devika Kataria

Dr Milind Thomas

Umesh Tripathi

Quality Checked by:

Dr Sonal Jain

Dr Umesh Gupta

JK LAKSHMIPAT UNIVERSITY ★ JAIPUR ★ IQAC

Approved by:

DIRECTOR-IQAC
JK LAKSHMIPAT UNIVERSITY
JAIPUR

Vice Chancellor
JK Lakshmipat University
Jaipur-302026

CONTENTS

Program Education Objectives

The B.Tech and M.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 the roles of team members and leaders in their careers.

Program Outcomes

"*Competence is a demonstrated ability to apply knowledge, skills and attributes for achieving desirable results."* The graduates of B.Tech. and M.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

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.

Desired minimum level of competence* for POs and PSOs

PO/PSO	Competence Level
PO 1	Competent
PO 2a	Novice
PO 2b	Novice/Advanced Beginner
PO 2c	Novice
PO 3a	Competent
PO 3b	Advanced Beginner
PO 3c	Advanced Beginner
PO 4a	Advanced Beginner
PO 4b	Advanced Beginner
PO 4c	Novice
PO 5a	Advanced Beginner
PO 5b	Advanced Beginner
PO 6	Advanced Beginner
PO 7a	Advanced Beginner
PO 7b	Novice
EEEPSO1	Competent
EEEPSO2	Competent

Following process has been adopted to create Course Articulation Matrix (CAM) and Program Articulation Matrix (PAM).

- Course Outcome of each Course is mapped to Program Outcome (PO) / Program Specific Outcome (PSO) using three Levels viz., Low Correlation (1), Moderate Correlation (2) and Substantial Correlation (3).
- Average of these Levels of each Course Outcome w.r.t each specific PO/PSO is calculated, and it indicates expectations laid in a course to attain different PO/PSO. In order to avoid over commitment of a course w.r.t its contribution to POs/PSOs, the following validation check is applied on the sum of PO/PSO wise averages in each course.

$$\sum (\text{Average}) <= \text{Min}(\text{Credits} * \text{Year}, 15)$$

In above equation, Credits are the credits assigned to the course, Year indicates the level of the students from 1st to 4th year. In case this sum exceeds the upper limit, CO-PO mappings are revised. This check ensures that early or low credit courses are not overburdened with very high expectations.

- For creation of Program Articulation Matrix, sum of these averages of different courses w.r.t each PO/PSO is calculated and interpreted as per following Table.

Competence Level *	**B.Tech**
Novice	<8
Advanced Beginner	8 - 16
Competent	>=16

Novice* (N): Knows objective facts, features, and rules for determining actions w.r.t. this PO/PSO without being context-sensitive. The student has studied the basic concepts.

Advanced beginner* (AB): Recognizes common situations w.r.t. this PO/PSO that help in recalling which rules should be exercised, starts to recognize and handle situations not covered by given facts, features and rules. The student has problem-solving and repeated practice experience for common situations w.r.t. this PO/PSO.

Competent* (C): Performs most standard actions w.r.t. PO/PSO without conscious application of rules after considering the whole situation. Handles new situations through the appropriate application of rules, can design systems, and may lead. Has demonstrated this PO/PSO through repeated engagements in advanced problem-solving, projects, extensive practice in common and exception situations, and participated in professional networks.

JK Lakshmipat University, Jaipur
Institute of Engineering and Technology
Curriculum Structure
Bachelor of Technology in Electrical and Electronics Engineering (Batch 2019 - 2023)

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

- Minimum required credit – 160
- A student can choose to drop DE/OE and still complete the minimum credit requirement of 160 for completion of B.Tech.
- Credits can vary for specific (*) courses.

List of Electives	
Sem V	
DE-I	**OE-I**
Real Time Operating Systems- EE1214	Urban and Regional Planning- CE1215
Power system Protection- EE1215	Introduction to User-Experience-IL1204
	Idea to Business Model- ED1102
	Design and Manufacturing
	Numerical Methods- AS1204
Sem VI	
Emerging Tech week	
Robotic Process Automation Lab-CS1125	
Geographical Information Systems Lab-CE1114	
DE-II, III	**OE-II**
Industrial IoT- EE1216	Electric Vehicle Technology-EE1220
Electrical Safety	Green Energy- IL1202
Full Stack Web Development with REACT-CS1212	Mechatronics-ME1207
Cyber Security-EE1219	Disaster Management- CE1206
Flexi Core	Modern Physics
Industrial Electronics-EE1112	Introduction to Nano Technology
Digital Communication Networks-EE1205	Introduction to Quantum Computing
	Engineering Optimisation
	Integral Transforms
	Algorithm Design and Analysis-CS1126
	Virtualisation and Cloud Computing-CS1127
Sem VII	
DE-IV, V, VI (Tentative)	**OE-III (Tentative)**
Industrial Drive and E-Vehicle- EE1206	Geographical Information System- CE1214
Industrial Robotics- IL2203	Operations Research- AS1201
Information Theory and Coding- EE1218	Fintech in Retail Banking and Insurance- FA1151
Advanced Communication Systems- EE1211	Industrial Safety
Machine Vision- EE1217	Advanced Statistics- AS1202
Advances in Power Delivery- EE1213	

NOTE:

1. For every credit, in each course, every student is expected to put in a total work of 35-36 hours including the class time. The specified teaching scheme is applicable if the course is taught as full semester course. However, sometimes, a few courses may actually be completed in a shorter duration by increasing the weekly contact hours.
2. Students have the option for earning additional Minor certification from CSE (through electives/minor project, 16 Credits) or a Concentration in Renewable Energy Systems, Control and Automation, Electrical Vehicles, Digital Systems, or Communications and Signal Processing (through electives, 12 credits).
3. Learning outcomes focus on higher order thinking and practical skills. Rote learning is completely de-emphasized and assessment scheme includes several components like assignments, labs, projects, reports etc. The exams are designed to assess problem solving ability through questions focusing on analysis, synthesis, and evaluation.
4. Emerging Tech Week in the VI semester is a slot in which the actual course is decided flexibly. The course has to be in an emerging technology area. Students have the option to replace the course on Emerging Tech Week by a Department elective or Open elective.
5. Relevant engineering standards and sustainability issues are incorporated in all engineering courses.
6. Student can optionally take upto four Independent Study courses with 2 credits each to complete their credit requirement.
7. Students can optionally undergo additional summer internship of 2 credits each after first year and third year to complete their credit requirement.
8. A student may sometimes be allowed to take a few additional courses for earning extra credits, fulfilling credit deficiency or completion of academically equivalent core course requirements in special cases, e.g., lateral entry/transfer cases, semester exchange at partner universities, medical cases, student detention, backlog, etc.

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 Outcome:

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

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. apply Schroedinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials.
AS1101.6. determine the hardness of various water samples. And differentiate the hard and soft water.
AS1101.7. analyze conductivity of different water samples by volumetric titrations and conductometric methods.
AS1101.8. determine different properties of the lubricant/oil samples by Pensky-Martens and Red Viscometer instruments.

Prerequisites		**Knowledge of Basic Science**
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	Nil
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
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-1 (continuous)	20
15	Lab Evaluation-2 (Exam)	30
16	Course portfolio	Nil
17	Presentation	Nil
18	Viva	Nil
	Total (100)	100

Retest:

Sr. No	**Specifications**	**Marks**
1	Lab Evaluation-2 (Exam)	30

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.

Text Books:

1. Dattu R Joshi, "Engineering Physics", Tata McGraw Hill Education Pvt. Ltd. New Delhi, I edn. 2010.
2. Neeraj Mehta, "Applied Physics for Engineers", PHI, I edn. 2011.
3. Jain & Jain, "Engineering chemistry", Dhanpat Rai Publication, Delhi, 16 edn. 2014.
4. Sivasankar, "Engineering Chemistry", Tata McGraw-Hill Education, 2008
5. Lab Manuals

Reference Books:

1. Arther Beiser, "Concept of Modern Physics" Tata McGrawHill, New Delhi, 5thedn. 1997.
2. Eyvind H Wichman, "Quantum Physics" Tata McGraw Hill, Volume 4.
3. B.K. Pandey, S. Chaturvedi, "Engineering Physics", Cengage Learning, 2012.
4. D.K. Bhattacharya, Poonam Tondon, "Engineering Physics", Oxford University Press, 2015.
5. O.G. Palana, "Engineering Chemistry", Tata McGraw Hill, 2009.
6. Dr. E.R. Nagarajan & Dr S Ramalingam "Engineering Chemistry", Wiley; Second edition (2013)

Course Articulation Matrix: (Mapping of COs with POs)

Course specific CO's contribution to PO/PSO	Rate the level of course specific CO's corelated with POs/PSOs (1: Low Corelation; 2: Moderate; 3: Substantial corelation) Leave Blank if Not Corelated																	
	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2	
AS1101.1					1		1											
AS1101.2							1											
AS1101.3			1		1	1				1								
AS1101.4					1						1							
AS1101.5	1		1		1													
AS1101.6	1					1						1	1					
AS1101.7			1				1				1							
AS1101.8						1				1		1	1					

Course Title –Fundamentals of Communication Course Code- CC1101
Credits 2 (2-0-1)
Course Objective
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:
CC1101.1. Identify different cultural differences and their impact on communication.
CC1101.2. Compose grammatically correct sentences and paragraphs.
CC1101.3. Deliver effective oral presentations following appropriate kinesics and paralinguistic features.
CC1101.4. Identify impact of cultural differences on communication.
CC1101.5. Apply appropriate communication skills across settings, purposes, and audiences.

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**

Evaluation Scheme:
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.

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				

ES1101: Computational Data Analysis

L T P: (10s 2 0) **Credits: 10**

Course Objective: 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

ES1101.1 Write Simple Python programs using various datatypes, control structures, decision statements, libraries, functions (M1)

ES1101.2 Develop Python programs using Objects, Classes and Files (M1, M2)

ES1101.3 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)

ES1101.4 Model Complex systems as Linear simultaneous equations and analyze the same using Matrix methods (M1)

ES1101.5 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)

ES1101.6 Summarize and Visualize different datasets (M2)

ES1101.7 Analyze and interpret different datasets using Discrete and Continuous Probability Distributions and Apply the same for problem solving, e.g., Goodness of Fit (M2)

ES1101.8 Formulate and validate hypothesis with reference to different datasets (M2)

ES1101.9 Apply correlation, regression, least square method and time series analysis for modeling, analysis, interpretation and forecasting (M2)

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, PH

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

Course Objective:

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:

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.

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 Thinking & Prototyping

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 regard 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

Syllabus of Engineering Drawing,

Introduction to Engineering Drawing, Orthographic Projections

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain and Diagonal Scales. Angle of projection.

Projection of line.

Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes. Determination of true lengths and true inclinations by rotating line method and traces.

Projections of plane

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Projections of regular solid.

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

Sections of Regular Solids

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development

of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

Development of surface

Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

Isometric Projections

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Syllabus of AutoCAD Lab

1. Introduction to Autocad software basic Sketch tool.
2. Advance sketch tool.
3. Editing tool.
4. Dimensioning.
5. Hatching, Layers, and block.
6. 3D Design in AutoCAD.

Syllabus of Workshop Practice

Carpentry, Welding, foundry, sheet metal work, fitting, 3D printing.

Text books.

1. K.C John, "Textbook of Machine Drawing", Phi Learning Pvt. Ltd. New Delhi, 2010
2. N.D Bhatt, "Elementary Engineering Drawing", Charotar Publishing House.
3. Vishnu P. Singh, "AUTOCAD 2019", ASIAN (2018).
4. Choudhury H S K, "Elements of Workshop Technology Vol-1", MPP pvt. Ltd.
5. SK Hajra Choudhury, Nirjhar Roy, Elements of Workshop Technology, Vol-II: Machine Tools, 15th Edition, Media Promotors & Publishers Pvt Ltd.

Reference books:

1. P.S Gill, "Engineering Drawing", S.K. Kataria & Sons.
2. Rajendra Singh, "Introduction to Basic Manufacturing Process & Workshop Technology", New Age International.
3. W.A.J. Chapman, "Workshop Technology Part 1, May 6th 2016" by Routledge.

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 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:

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

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 (Contus.)	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:

- The Scientific Approach: Basic Principles of the Scientific Method by Carlo L. Lastrucci, Schenkman Publishing, 1963
- Trends in Bibliometrics and Scientometrics Studies by Praveen Kumar Jain, Jean-Charles Lamirel, Parveen Babbar, Athena Academic, 2017
- The Evaluation of Research by Scientometric Indicators by Peter Vinkler, Chandos Publishing
- John Stuart Mill's Philosophy of Scientific Method by John Stuart Mill; Ernest Nagel Hafner Press, 1950
- Logic, Inductive and Deductive: An Introduction to Scientific Method by Adam Leroy Jones Henry Holt, 1909

- The Path of Science by C. E. Kenneth Mees; John R. Baker John Wiley & Sons, 1946
- The Logic of Scientific Discovery by Karl R. Popper Basic Books, 1959
- Failure: Why Science Is So Successful by Stuart Firestein Oxford University Press, 2016

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 Title and Code Critical Thinking and Storytelling CC1102

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

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:

CC1102.1. Formulate intelligent questions to investigate.

CC1102.2. Evaluate information and argument for correctness, consistency, relevance and validity.

CC1102.3. Compose well-structured and well-reasoned arguments.

CC1102.4. Articulate and evaluate the impact of narratives.

CC1102.5. Distinguish between facts, assumptions and opinion.

Evaluation Scheme

Sr. No	Specifications	Marks
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**
Evaluation Scheme for retest		
1	Theory Exam III	30

Syllabus:

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

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.

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.

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

Course Objective: 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:
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.

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**

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

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 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 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 this course, the student should be able to:

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

Evaluation Scheme:

Sr. No	Specifications	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 retest		
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 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 Name: Fundamentals of Automation Engineering (ES1104)
Credit: 6; Design Studio – 6 Hrs/week; Tutorial Hours - 2 Hrs/week

Course Objective: This course aims at building key technical competencies needed by automation engineers.

Course Outcomes

On successful completion of this course, the students should 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 mechanical, electro-mechanical and fluid systems.
ES1104.9. Design and simulate 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.

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**

Unit 1 Introduction to Electrical Engineering – U1

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 build Printed Circuit Boards.
6) Use electrical safety practices while working on electrical projects.

Unit 2 Introduction to Automation Engineering and Control Systems – U2

1) Design and implement open-loop control system
2) Formulate mathematical models for basic mechanical, electro-mechanical and fluid systems
3) Conduct analysis of dynamic control system.
4) identify the need for feedback in control systems

Unit 3 Introduction to Digital Circuits and Embedded Systems – U3

1) Evaluate and simplify Boolean functions and design the minimized logic using logic gates.
2) Design basic combinational and sequential circuits with minimum complexity
3) Implement various logic functions using software programming with micro controller, to make optimal utilization of resources.
4) Identify the key features of embedded systems in terms of hardware and software
5) Interface sensors and design low power embedded systems projects using microcontroller

Professional Skills

Collaboration, Leadership, Team-work, 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

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:
- WH Hayt, J E Kemmerly, SM Durbin, Engineering Circuit Analysis, Eight Edition, 2013, Mc. Graw Hill, ISBN 978-0-07-352957-8.
- M. Morris Mano, Digital Logic and Computer Design, 1st Edition, 2016, Pearson India Publication, ISBN: 9789332542525.
- 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.

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 Title and Code: Energy and Environmental 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:
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

Evaluation Scheme

Sr. No	Specifications	Marks
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 Scheme 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/

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												

MANAGEMENT PERSPECTIVES (IL1101)
COURSE CREDITS: 2

COURSE OBJECTIVE:
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:
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

ASSESSMENT MATRIX
The criteria for assess the course 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**

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]

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					

Perspectives on Contemporary Issues

Course Code: CC1103
Credit: 2
L-T-P: 2-0-1
Course Objective:

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.

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**

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 hand 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

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., & Rönnlund Anna Rosling. (2019). *Factfulness: ten reasons were wrong about the world* - and why things are better than you think. London: Sceptre.
4. Kolbert, E. (2015). *The Sixth Extinction: An unnatural History.* Bloomsbury

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 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:

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.

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 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		1	1						1					2
CS1102.2			1		1	1										2	2
CS1102.3	2			1	1	1				1			1				2
CS1102.4		1			1		1					2				2	2
CS1102.5	1				1		1									2	2
CS1102.6	1			1	1						1		1			2	2

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1101	Electronic Devices and 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

EE1101.1. Analyse characteristics of electronic components, devices and circuits
EE1101.2. Apply electronic devices and circuits to various engineering applications
EE1101.3. Design and analyse different amplifier configurations
EE1101.4. Analyse input-output characteristics of a given complex network
EE1101.5. 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 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 Title and Code: Computational Engineering Analysis – I: **ES1106**

Teaching Scheme **L-T-P: 1-0-1**

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:

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.

Evaluation Scheme

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:

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

References:

- Thomas' Calculus, M.D. Weir and J. Hass, Pearson.
- Engineering Mathematics, Srimanta Pal and Subodh C. Bhunia, Oxford University Press, New Delhi, India.
- Higher Engineering Mathematics, B.V. Ramana, Mc Graw Hill Education.
- T.K. Nagsarkar, M. S. Sukhija," Basic Electrical Engineering", Oxford University press, 2nd edition, 2011.
- Roy Choudhary, "Network Theory", TMH, 3rd Edition, 2004.
- Edminister Joseph A., "Electrical Circuits, Schaum's Outline Series", Tata McGraw Hill, 3rd edition, 2012.
- Hayt W.H., Kemmerly J. E., Durbin S. M., "Engineering Circuit Analysis", Tata McGraw Hill, 6th edition, 2006.
- 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 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 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:

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.

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 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 Title and Code: Communication and Identity: CC1104

Course Objective:

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

CC1104.1 Analyze their personal identities, both private and social
CC1104.2 Identify their different values, strengths and areas of professional interest
CC1104.3 Articulate their personal statement and use it to craft an influential pitch
CC1104.4 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 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				

Course Title and Code: Electromagnetics and Microwaves EE1104		
Hours per Week	**L-T-P: 3-0-2**	
Credits	**4**	
Students who can take	B. Tech Sem IV	
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 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 corners, bends & twists and directional couplers, isolators, circulators, and attenuators EE1104.8. Analyze the applications of microwave generators like klystrons & magnetrons		
Prerequisites: (optional)		
Evaluation Scheme		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	5
04	Quiz	10
05	Theory Exam-I	10
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report	5
09	Report-II	Nil
10	Report-III	Nil
11	Project	10
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	10
17	Presentation	Nil
18	Viva	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Theory Exam-III	20

2	Lab Evaluation-II	20
	Total	**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 (Practical):

1. Set up Microwave components and instruments (X band Test Bench)
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

Reference/Textbooks:

Textbooks:
1. Principles of Electromagnetics, N. O. Sadiku, Oxford University 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.https://www.coursera.org/learn/microwave-antenna, TU Eindhoven, Netherlands
2.Electromagnetic Waves in Guided and Wireless Media
https://onlinecourses.nptel.ac.in/noc21_ee43
3.https://nptel.ac.in/courses/115/101/115101005
4.https://nptel.ac.in/courses/108/103/108103141

Course Articulation Matrix: (Mapping of COs with POs):

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

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Code and Title	**EE1105: SIGNALS AND CONTROL SYSTEMS**
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:

EE1105.1. Identify and differentiate signals, systems, and their properties.
EE1105.2. Evaluate Fourier, Laplace, and z-transform for continuous and discrete time systems.
EE1105.3. 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.
EE1105.4. Design open loop or closed loop control system of mechanical, electrical, thermal, chemical, or analogous systems.
EE1105.5. Convert linear system to discrete system through sampling.
EE1105.6. Solve the control system using block diagram reduction method and Mason's gain formula.
EE1105.7. Perform the error analysis on the system.
EE1105.8. 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.
EE1105.9. Analyse the control system in frequency domain and time domain.
EE1105.10. Frequency analysis plots viz. Bode plot, Polar plot, and Nyquist Plot.
EE1105.11. Improve a system as per design and equipment standards keeping energy efficiency in consideration.

Prerequisites	Mathematics concepts related to Fourier transform, Laplace transform, and Z-transform.
Teaching Scheme (Hours per Week)	3 0 4
Credits	5

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
17	Presentation	Nil
18	Viva	Nil
	Total (100)	**100**
Retest Scheme:		
1	Theory Exam-III	20
2	Lab Evaluation-II (Examination)	10
	Total	**30**

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

	PO1	PO2 a	PO2 b	PO2 c	PO3 a	PO3 b	PO3 c	PO4 a	PO4 b	PO4 c	PO5 a	PO5 b	PO 6	PO7 a	PO7 b	PSO 1	PSO 2	PSO 3	PSO 4
EE1105.1					3					3						3	3		
EE1105.2					3					3						3	3		
EE1105.3					2					2						2	2		
EE1105.4					2					2						2	2		
EE1105.5					3					3						3	3		
EE1105.6					1					1						1	1		
EE1105.7					2					2						2	2		
EE1105.8					2					2						2	2		
EE1105.9					2					2						2	2		
EE1105.10					1					1						1	1		
EE1105.11					1					1						1	1		

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:

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.

Evaluation Scheme:		
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:

1. Advanced Engineering Mathematics, Erwin Kreysig, Wiley, India.
2. White F. M., "Fluid Mechanics" Tata McGraw-Hill, New Delhi.
3. Incropera F P "Principles of Heat and Mass Transfer", John Wiley & Sons.
4. 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 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 Title and Code: Introduction to Design IL1102	
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.

Course Outcome:

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

IL1102.1. Identify the user and build its persona.
IL1102.2. Sketch their ideas on paper to visualize and assess viability.
IL1102.3. Create a plan for process and management to materialize the desired idea.
IL1102.4. Test the material for possibilities and capabilities.
IL1102.5. Develop skills of joinery, material manipulation and various hand tools.
IL1102.6. Develop technical and narrative skills useful for both film and animation.
IL1102.7. Develop troubleshooting and problem-solving skills.

Evaluation Scheme

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:

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

Suggested Reading Materials:

1. https://en.wikipedia.org/wiki/Toy
2. https://en.wikipedia.org/wiki/Category:Traditional_toys (Hover over the categories to see the thumbnail)
3. https://fashion.mithilaconnect.com/6-popular-traditional-toys-in-india/
4. Simple wooden toymaking by Mathias, available at MP Ranjan LRC Call number: 745.592
5. https://www.etsy.com/market/toys_handmade
6. https://www.dutchcrafters.com/Amish-Toys-Games-Hobbies/cat/98
7. https://www.walmart.com/cp/toys/4171 (Toys that we are not interested in)
8. https://www.target.com/c/toys/-/N-5xtb0 (Toys that we are not interested in)
9. https://in.pinterest.com/pin/12807180177802375/
10. https://www.youtube.com/watch?v=_ppedXZHhE0 (Stop Motion Basics)
11. https://www.youtube.com/watch?v=p5SygzMSLhM (Stop Motion in Movies)
12. https://www.youtube.com/watch?v=GcryIdriSe4 (12 principles of animation)

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 Title and Code: EE1110 Digital Systems Design	
Hours per Week	**3-0-2**
Credits	**4**
Students who can take	B. Tech Sem IV

Course Objective: This course aims to introduce VHDL Objects, Data types, programming constructs and implementation of combinational and sequential logic. Finite Sate Machine modelling will be introduced, and a sophisticated digital system will be implemented on the ISE simulator.

Course Outcome:

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: Study the timing constraints of simulated design.

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
01	Attendance	NIL
02	Assignment	**30**
03	Class Participation	**Nil**
04	Quiz	**20**
05	Theory Exam-I	NIL
06	Theory Exam-II	NIL
07	Theory Exam-III	**30**
08	Report I	Included with Project
09	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	**20**
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II	NIL
16	Course Portfolio	NIL
17	Presentation	NIL
18	Viva	NIL
	Total (100)	100
Evaluation Scheme for Retest		
1	Theory Exam-III	**30**
2	Quiz	NIL
	Total	**30**

Syllabus (Theory)

UNIT I: Hardware design of advanced digital circuits using VHDL programming: Behavioral, Data flow, Structural Models., Library, Packages., Functions, Procedures, Processes

UNIT II: Understand the Verilog HDL language basics, Use Verilog HDL building blocks (design units) including modules, ports, processes, and assignments, Model code styles including behavioral code style and structural code style

UNIT III: Design of logic machines. Finite state machines, gate array designs. Design of energy efficient architecture

Reference/Textbooks:

1. Digital Systems-Principles and Applications., Ronald J. Tocci, Widmer and Moss, Pearson Education, 10th Edition.
2. A VHDL Primer – Jayaram Bhasker, Prentice Hall; 3 editions (1999; *ISBN*-10: 0130965758.
3. Fundamentals of Logic Design with Verilog Design– Stephen. Brown and Zvonko Vranesic, TMH, 2nd Edition 2010.

Course Articulation Matrix: (Mapping of COs with POs):

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						1			2					2		2	2

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:

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.

Assessment Scheme:

Prerequisites		Electrical Machines, Power Systems
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 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	Course Title	Teaching Scheme				
		L	T	P		Credits
EE1102	ANALOG CIRCUITS	3	0	2	0	4

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

Learning Outcomes:

On successful completion of this course, the students should 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.

Assessment Scheme:

Prerequisites		Transmission and Distribution
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	Nil
2	Assignment	10
3	Class Participation	05
4	Quiz	15
5	Theory Exam-I	15
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	15
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I (Continuous)	10
15	Lab Evaluation-II (End term Exam)	Nil
16	Course Portfolio (MOOC Course: converter circuits) (optional with Liu of assignment and quiz)	Nil
	Total (100)	**100**
Retest		
17	Theory Exam-III	30

	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**.**

Textbooks:

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 Articulation Matrix: (Mapping of COs with POs)

CO		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							

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Understanding and Managing Conflict|CC1105**
Hours per Week	**L-T-P: 2-0-0**
Credits	**2**
Students who can take	B.Tech - Sem V

Course Objective-

In today's increasingly complex and fragmented world, it is important to be able to resolve conflicts and build healthy relationships. Understanding and Managing Conflict 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 Outcome:

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

CC1105.1: Define a group and explain the stages of group development.

CC1105.2: Describe conflict and explain types and causes of conflict.

CC1105.3: Use inquiry and advocacy to engage with groups.

CC1105.4: Give and receive feedback effectively.

CC1105.5: Identify sources of conflict and manage them using difference conflict handling styles.

Prerequisites		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	30
03	Class Participation	20
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report-I	Nil
09	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**

Retest

1	Theory Exam	30

Syllabus (Theory):

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.

MOOC Reference Course:

(Certificate is not mandatory, this course is used for reference)

a. Course Title: Conflict Management Specialization
b. Offered by: University of California, Irvine
c. Duration and Course Load: 4 months, 1-2 hours/week
d. Platform: Coursera

Course Articulation Matrix: (Mapping of COs with POs)

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	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 the principles and techniques required for analog and digital communication. The course also prepares students to appraise and pursue future trends in digital communication research and technologies.

Course Outcomes:

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

EE1109.1. Apply the knowledge of signals and system to analyze communication systems
EE1109.2. Implement and analyze various analog modulation and demodulation techniques as per ITU standards
EE1109.3. Use the sampling theorem to determine optimal sampling frequency for a signal
EE1109.4 Implement and analyze various digital modulation and demodulation techniques
EE1109.5. Evaluate performance of analog and digital communication systems under AWGN by applying appropriate techniques and algorithms
EE1109.6. Analyze receiver performance in terms of BER and SNR

Assessment Scheme:

Prerequisites		Signal & System
Teaching Scheme (Hours per Week)		L T P 3 0 2
Credits		4
S. No.	**Evaluation Component**	**Marks**
1	Attendance	NA
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	20
6	Theory Exam-II	NA
7	Theory Exam-III	30
8	Report-I	5
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)	10
15	Lab Evaluation-II	10
16	Course Portfolio	NA
	Total	**100**

Evaluation Scheme for Retest		
1	Theory Exam-III	30
2	Lab Evaluation-II	10
	Total	**40**

Syllabus (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 modulation. 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 bandlimited channels - Maximum likelihood sequence detection (Viterbi receiver), Equalization Techniques, Synchronization and Carrier Recovery for Digital modulation

Syllabus (Practical):

1. MATLAB code for Amplitude modulation and demodulation
2. MATLAB code for DSB-SC modulation and demodulation
3. MATLAB code for SSB- SC modulation and demodulation
4. MATLAB code for Frequency modulation and demodulation
5. MATLAB code for PN sequence generation
6. MATLAB code for BASK (OOK) modulation and demodulation
7. MATLAB code for BFSK waveform generation and demodulation
8. MATLAB code for BPSK waveform generation and demodulation
9. MATLAB code to generate QPSK waveform for a given binary sequence
10. MATLAB code for BER of BASK(OOK) modulation scheme under AWGN
11. MATLAB code for plotting BER of BFSK under AWGN channel
12. MATLAB code for BER of BPSK and QPSK modulation scheme under AWGN

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.

Online Resources:

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. Jagannathan, IIT Kanpur. https://www.youtube.com/watch?v=XoVLa6Dqd5I
4. Principles of Communication Systems – Part II by Prof. Aditya K. Jagannathan , IIT Kanpur. https://www.youtube.com/watch?v=OyWdYkx0PmI&list=PL7EYujdHIJbZ9ZRMTBmYz7i61FppXLTop&index=1

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	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 Title and Code:	**Introduction to IoT EE1111**
Hours per Week	**L-T-P: 1-0-2**
Credits	**2**
Students who can take	B.Tech Sem V All Branches

Course Objective- The course aims to develop understanding of Internet of Things concepts and also develop skills for 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 Outcome:

On successful completion of this course, the students should 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 interfacing of I/O devices with Raspberry Pi.

EE1111.4 Implement communication protocols for ingterfacing sensors to microcontrollers.

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.

Prerequisites		Basic Programming
Sr. No	**Specifications**	**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	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 (Continuous)	35
15	Lab Evaluation-II	Nil
16	Course Portfolio (MOOC certificate)	Nil
	Total (100)	**100**

Retest

1	Theory Exam-III	30
2	Lab Evaluation-II	0
	Total (30)	**30**

Syllabus (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.

Reference Books:

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

MOOC course

The Arduino Platform and C Programming

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

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						
EE1111.2							1	1	1		1						
EE1111.3								1		1							
EE1111.4								1	1	1	1		1	1			
EE1111.5							1	1		1	1			1			
EE1111.6									1	1			1	1			
EE1111.7									1	1	1						

Course Title and Code:	**PR1101 Automation Project**	
Hours per week:	L-T-P (0 0 2)	
Credits	2	
Students who can take	B.Tech. (All programs)	

Course Objectives: This course aims to develop skills for designing, implementing and testing solutions for automation using IoT .

Learning Outcomes:

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

PR1101.1 design and implement a complete project in IoT/Automation using microcontroller/SOC interfaced with sensors or any other automation hardware/tools,

PR1101.2 apply standard IoT protocol(s),

PR1101.3 use cloud servers for data streaming and analysis,

PR1101.4 implement algorithms using the data at edge/cloud,

PR1101.5 deploy techniques to conserve bandwidth/energy/other resources and achieve cost economy for project.

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)	40
121	Project II	Nil
13	Project III (With Report)	Nil
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**

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
PR1101.1	2				2					2		2		3			
PR1101.2						2											
PR1101.3							2										
PR1101.4	2								2								
PR1101.5					2		2										

Course Title and Code: Practice School – I (PS-I), PS1101	
Total Duration	45 Days
Credits	**04**
Students who can take	B.Tech Semester-V

Course Objective:

The purpose of Practice School-I is to give an opportunity to re-understand their theoretical knowledge in the context of real-life situations.

After course completion, the student will be able to:

PS1101.1 Identify skills and capabilities that interconnect effectively with the needs of industry.
PS1101.2 Demonstrate problem solving skills in the context of some real-life situation.
PS1101.3 Reflect and evaluate on future employment opportunities.

Evaluation Scheme:

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignments	Nil
03	Class Participation	Nil
04	Quiz	Nil
05	Theory Exam-1	Nil
06	Theory Exam-2	Nil
07	Theory Exam-3	Nil
08	Report-1(Reporting Activity Fortnightly by faculty supervisor)	10
09	Report-2 (By faculty supervisor)	20
10	Report-3	Nil
11	Project-1 (Day to day task record by External supervisor)	10
12	Project-2	Nil
13	Project-3 (Presentation & Viva)	20
14	Lab Evaluation-1	Nil
15	Lab Evaluation-2	Nil
16	Course portfolio (Traits and Competencies)	40
	Total (100)	**100**

Course Articulation Matrix: (Mapping of COs with POs)

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
PS1101.1	1		2	1	2		2				2						
PS1101.2	1			1	3	2	2	2					1				
PS1101.3	1		2	2			1	1			3	2	1	1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Critical Thinking for Decisions at Workplace CC1106

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:

CC1106.1 Apply strategies of Critical Thinking to examine organisational problems through positive inquiry

CC1106.2 Describe and examine suitable problem-solving and ethical decision-making processes

CC1106.3 Choose the simplest and logical decision among multiple alternatives

CC1106.4 Evaluate solutions and count on possible risks based on purpose, context and ethics

Pre-requisites		**N/A**
Hours per Week		**L-T-P: 2-0-0**
Credits		**2**
Sr. No	**Specifications**	**Weightage**
01	Attendance	Nil
02	Assignment	**20**
03	Class Participation	**10**
04	Quiz	Nil
05	Theory Exam-1	Nil
06	Theory Exam-2	Nil
07	Theory Exam-3	**30**
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
17	Presentation	**20**
18	Viva	**20**
	Total (100)	**100**

Evaluation scheme for re-test

Sr. No	**Specifications**	**Weightage**
01	Theory Exam-3	**30**
	Total (30)	**30**

SYLLABUS

	Topic	**Sub-topics**

1	Decision Making: Definition and Type	• Organisational decision-making • Concept of thinking triangle • Importance of decision-making at work place
2	Barriers to Sound Reasoning	• Identifying barriers to Critical Thinking • Biases, prejudices, facts, opinions, assumptions. • Overcoming the obstacles
3	Steps of Decision Making	• Factors impacting decision-making • Concept of enquiry circle • Understanding arguments in business parlance
4	Ethics and Decisions	• Theories of ethics (Teleological, Deontological, Virtue Ethics, Conduct Ethics, Rights based, Utilitarianism, Hedonism, Egoism) • Concept of Moral reasoning • Role of ethics and values in Decision Making
5	Importance of purpose and context	• Role of Stakeholders in decision making.
6	Problem analysis best practices	• Root cause analysis • Identifying questions at the heart of a problem • Thinking checklist
7	Decision Implementation Techniques	• Developing intellectual virtues • Paul Elder's model (Intellectual humility, courage, empathy, integrity and confidence.
8	Comparing alternative solutions	• Ladder of Inference • Meta-thinking • Perspectives

Suggested Readings

1. Jonah Lehrer, 2009: **How we Decide.** Houghton Mifflin Harcourt, Boston, New York
2. Chip Heath and Dan Heath, 2013. **Decisive: How to Make Better Choices in Life and Work.** Crown Business, ISBN 0307956393
3. John S. Hammond, Howard Raiffa, Ralph L. Keeney, 2002. **Smart Choices: A Practical Guide to Making Better Decisions.** Crown Business, ISBN 0767908864
4. Ramesh K. Arora, **Ethics, Integrity and Values in Public Service.** New Age International Publishers, New Delhi.
5. Bradley H. Dowden, 1993. **Logical Reasoning.** Wadsworth Publishing Company, Belmont, California, ISBN 0534176887

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					

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:

EE1112.1 Analyze the characteristics of power devices under different load condition

EE1112.2 Choose appropriate power devices for different requirement of power conversion, and speed control of drives. Also analyse and evaluate their performance

EE1112.3 Design an electric vehicle charging station with solar PV system.

EE1112.4 Design battery pack using lithium ion batteries.

EE1112.5 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 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
EE1112.1	1						1									1	1
EE1112.2	1															2	2
EE1112.3			1		1		1		2	1	2	1		2	2	2	3
EE1112.4			1		2		2		2	1	2	2		2	2	2	3
EE1112.5						1							2		1	2	2

Course Title and Course Code	**Power System-II (EE1114)**
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:

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.

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 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
EE1114.1	2	1			1	1	1	1					1			1	1
EE1114.2	1				1	1	1	1					1			1	1
EE1114.3					1	1	1	2	1	1			1			1	1
EE1114.4		1		1	3	1	1	1	1							1	1
EE1114.5		1	1		1	1	1	1	1	1	1	1	1	2	2	2	1

Course Title and Code: Digital Signal Processing EE1115	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B. Tech Sem VI

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:

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

Prerequisites: (optional)

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	Nil
04	Quiz	Nil
05	Theory Exam-I	10
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report	10
09	Report-II	Nil
10	Report-III	Nil
11	Project	10
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	Nil
17	Presentation	10
18	Viva	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Theory Exam-III	30
2	Lab Evaluation-II	10
	Total	**40**

Syllabus (Theory)

UNIT I: 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

UNIT II: 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

UNIT III: 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

UNIT IV: 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

UNIT V: 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 (Practical):

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)

Reference/Textbooks:

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. Signal Processing: 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 Articulation Matrix: (Mapping of COs with POs):

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 Title and Code: Digital Communication Networks EE1208		
Hours per Week	**L-T-P: 3-0-2**	
Credits	**4**	
Students who can take	B. Tech Sem VI	
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: 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		
Prerequisites: (optional)		
Evaluation Scheme		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	Nil
04	Quiz	Nil
05	Theory Exam-I	10
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report	10
09	Report-II	Nil
10	Report-III	Nil
11	Project	10
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	Nil
17	Presentation	10
18	Viva	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Theory Exam-III	30
2	Lab Evaluation-II	10
	Total	**40**

Syllabus (Theory)

UNIT I: Evolution of Communication Networks, Layered Architecture and OSI Model, Unified View of Protocols and Services

UNIT II: 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

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

UNIT IV: 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 (Practical):

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

Reference/Textbooks:

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. "Fundamentals of wireless communication", Tse, David, and Pramod Viswanath, 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 Articulation Matrix: (Mapping of COs with POs):

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 Title and Code:	**Robotic Process Automation Lab, CS1125**
Hours per Week	**L-T-P: 0-0-4**
Credits	**2**
Students who can take	BTech Sem VI (CSE,ECE,EE,ME,CE)

Course Objective- The course aim is to develop understanding about Intelligent Automation through Robotic Process Automation for automating business processes using software robots with cost efficient digital delivery.

Course Outcome:

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

CS1125.1 Use and understand the various functionalities and features of UiPath Studio and Orchestrator.

CS1125.2 Design, implement, and use RPA activities.

CS1125.3 Develop basic robots using UiPath Community Edition.

CS1125.4 Explore various data extraction techniques.

CS1125.5 Identify processes which can be automated.

CS1125.6 Apply best practices in RPA projects.

Prerequisites		Basic Programming Skills
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	10
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	Nil
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I(Implementation)	15
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I (Test)	20
15	Lab Evaluation-II	Nil
16	Course Portfolio	10
17	Presentation	5
18	Viva	10
	Total (100)	**100**

Retest

1	Quiz	20
2	Lab Evaluation-I (Test)	20

Syllabus (Theory):

Unit I: Programming Basic & Recap: Programming concept basic; **Introduction to RPA:** scopes and techniques of automation, RPA components and various RPA platforms, Introduction to UiPath as RPA platform, Applications and Benefits of RPA, Introduction to UiPath Studio, UiPath robot, types of robots, and UiPath Orchestrator. Brief on Studio interface and components.

Unit II: **RPA Projects:** Types of Projects in RPA: Sequence, Flowcharts, and State machines; Variables, Arguments, Data Types and Control flow: flow chart activities and sequences activities. **Data Manipulation:** Text and Data Manipulation**,** Data tables, clipboard management, file operation, importing from and exporting to CSV/Excel file and data table.

Unit III: **Control of Controls:** Attach window activity, Finding the control, Waiting for a control, Act on Control- mouse and keyboard activity. Handling event driven controls as working with UiExplorer handling events. Introduction to Recorder, OCR, types of OCR and Screen Scrapping Using OCR. **Selectors:** Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge.

Unit IV: **Application with Plugins and Extensions:** Java plugins, Citrix automation, Mail plugins, PDF plugins, Web integration, excel and word plugins. Extensions- Java, chrome, firefox, and Silverlight. **UiPath Advanced Automation concepts and techniques:** Image, Text and introduction of Citrix Automation; **Excel Data Tables & PDF:** Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors. **Email Automation:** Incoming Email automation, Sending Email automation.

Unit V: **Debugging and Exception Handling:** Common exceptions and ways to tackle them, Strategies for solving issues, Catching errors **Capstone Project.**

LAB

1. Setup, configuration, and introduction of components of UiPath Studio.
2. Execution of prebuilt examples of sequence, flow chart and state machines projects.

Create a sequence/Flow chart activity defining various types of variable as:

3. Generic Value Variables, Text Variables, Boolean Variables, Number Variables,
4. Array Variables, Date and Time Variables, Data Table Variables

Managing Arguments:

5. Create two activities, one activity defined with arguments and second activity which manages the argument to receive value from first activity.
6. Create an activity to manage importing active namespaces.

Create a project to Manage the control Flow:

7. The Assign Activity, The Delay Activity, The Do While Activity, The If Activity
8. The Switch Activity, The While Activity, The For-Each Activity, The Break Activity.

The Recording toolbar Activity:

9. Exercises using basic, web, and Desktop recoding.
10. Automate manual recording projects on Left-click on buttons, check boxes, drop-down lists, GUI elements, and Text typing

Data Scrapping:

11. Bot to extract structured data from your browser, application or document to a database, .csv file or even Excel spreadsheet.
12. Image and Text Automation
13. Excel Data Tables & PDF
14. Email Automation
15. Deployment of plugins and extensions.
16. Deploying and maintaining the BOT.

Text Material & Resources:

Text Books:

T1 Tripathi, Alok Mani. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool–UiPath. Packt Publishing Ltd, 2018.

T2. Murdoch, Richard. "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant." Middletown, DE. Omakustanne (2018).

Reference Books:

R1. Abhinav Sabharwal, "Introduction To RPA", Independently Published Kindle Edition on Amazon Asia-Pacific Holdings Private Limited, 201 8

R2. Gerardus Blokdyk, "RPA Robotic Process Automation", 5Starcook, Second Edition, 2018

R3. Kelly Wibbenmeyer, "The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization" Paperback, iUniverse, 2018

R4. Willcocks, Leslie P., Mary Lacity, and Andrew Craig. "The IT function and robotic process automation." (2015).

CO		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
CS1125.1.	1				1												2
CS1125.2.						1		1						1		2	2
CS1125.3.	1				1	1				1						2	2
CS1125.4.										1						2	
CS1125.5.					1		1						1	1		2	2
CS1125.6.			1				1									2	2

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1216	Industrial IoT	3	0	2	2	04

Course Objectives:

This course aims at creating the fundamentals skills required to design, implement, and maintain industrial IoT systems.

Course Outcomes:

EE1216.1 - Explain the key components that make up an Industrial IoT system.
EE1216.2 - Discuss protocols and standards employed at each layer of the IIoT stack.
EE1216.3 - Design, deploy and test a basic Industrial IoT system, including data analysis functionalities.
EE1216.4 - Apply best practices to meet desired requirements for IIoT applications.
EE1216.5 - Analyze the environmental effects and incorporate robustness in design of IIoT system.
EE1216.6 - Choose technology for constrained nodes and network while maintaining real time data collection.
EE1216.7 - Explain the importance of cybersecurity for IIoT networks.

Assessment Scheme:

Sr. No.	Evaluation Component	Marks
01	Attendance	Nil
02	Assignment	15
03	Class Participation	Nil
04	Quiz	15
05	Theory Exam-I	Nil
06	Theory Exam-II	20
07	Theory Exam-III	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	20
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	**Theory Exam-3**	**30**

Course Syllabus:

Unit 1 IIoT Fundamentals

Industrial communication: principles, protocols and technologies. IIoT definition, architectures and use cases. Convergence of IT and OT. Design methodology.

Unit 2 Interfacing sensors and actuators-

Interfacing proximity sensor, vibration sensor, color sensors. Controlling AC motor .

Unit 3 Programming with Node Red- Injecting nodes, debugging**,** managing palettes, designing dashboard.

Unit 4 Cloud services

Basic concepts. Applications: predictive maintenance, quality monitoring, personalized dashboards.

Practical work: Design and test a basic IIoT system involving prototyping, programming, and data analysis.

Textbooks:

Bahga and Madisetti (2014). "*Internet of Things: a hands-on approach*". CreateSpace Independent Publishing Platform, 1st edition. ISBN: 978-0996025515.

Hanes, Salgueiro, Grossetete, Barton and Henry (2017). "*IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things*". Cisco Press

Reference book:

Gilchrist (2016). "*Industry 4.0: The Industrial Internet of Things*". Apress.

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																
	PO 1	PO2 a	PO2 b	PO2 c	PO3 a	PO3 b	PO3 c	PO4 a	PO4 b	PO4 c	PO5 a	PO5 b	PO 6	PO7 a	PO7 b	PSO 1	PSO 2
EE1216.1							2										
EE1216.2							2										
EE1216.3																	2
EE1216.4						2											
EE1216.5						2											
EE1216.6							2										
EE1216.7							2										

Course Title and Code: Cyber Security EE1219	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.C.A. IV semester, B. Tech VI semester

Course Objectives- This course introduces the NIST Cybersecurity framework and sensitizes the students on security risks, malware and social engineering attacks. It builds skills for ensuring good cyber hygiene, monitoring and reporting cyber-attacks for an online computer.

Course Outcomes:

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

EE1219.1. Recommend the implementation tier for the NIST framework for a specific organization.

EE1219.2 Detect malicious attempts in a network using network sniffers

EE 1219.3 Analyze network and application attacks using SIEM.

EE1219.4 Appreciate the significance of cyber forensics and carry stages of forensic investigation by taking memory backups, data recovery, analyzing registry, traffic logs etc.

EE1219.5 Apply SQL injection, Cross-site script hacking, and other ethical hacking on virtual boxes and understand how hackers work.

EE1219.6 Use automation tools for threat intelligence perception.

Prerequisites: Nil

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	**05**
3	Class Participation	Nil
4	Quiz	**15**
5	Theory Exam-I	Nil
6	Theory Exam-II	**10**
7	Theory Exam-III	**30**
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I (Scenario on Network Security)	**10**
12	Project-II (Scenario on Forensic)	**10**
13	Project-III (Scenario on Ethical Hacking)	**10**
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	**Nil**
16	Course Portfolio	Nil
17	Presentation	**Nil**
18	Viva	**10**
	Total (100)	**100**

Course Contents:

Module 1: Introduction to NIST framework, Organization functions, CyberSeek, Types of Cyber Attacks, Vulnerabilities, Risks and Exploits, Overview of zero trust.

Network and Application Security- Intrusion Detection systems (IDS), Intrusion Prevention systems (IPS), Security Information and Event Management (SIEM) log analysis- using Splunk, Snort, Demilitarized zones (DMZ), Honeypots in network. Monitoring cyberattacks using SIEM for DOS, SQLi, XXS, XXE, LFi, Command Injection, identifying False Positive and False Negatives in SIEM logs. **Authentication Protocols** -Lightweight Directory Access Protocol, Kerberos, New Technology LAN manager (NTLM), Active Directory Domain Service (AD DS).

Module 2- Forensic - Introduction, Benefits and Challenges of Digital Forensic, Methodology, setting up Forensic workstation, NIST catalog for searching forensic tools and techniques, Computer, Registry, Mobile forensic tools, difference between Digital and Electronic Forensic, Hands-on using tools-Autopsy, Scalpel and Binwalk for data carving, extracting Botnet from memory, RAM triage., Network Miner and Wireshark for traffic analysis, Registry acquisition using FTK Imager, Shellbag explorer ,Registry viewer. Anti-forensic methods, Steganography tools-Openstego.

Module 3: **Ethical Hacking -**White hat hackers, Big bounty programs, familiarization with Common Vulnerabilities and Exploits (CVE), Nmap to locate attack vectors, Metasploit framework, Burp Suite for automated scanning. **Threat Intelligence -**Attackers vs Defenders, TI cycle, Online Anonymity, Trend analysis-Webscapper, Elastic search, Monitoring and alerting.

Text Books:

1. Introduction to Cybersecurity: Guide to World of Cybersecurity-Anand Shinde, Notionpress, India
2. Cryptography and Network security-Atul Kahate, Second Edition, Tata Mc Graw Hill.

Online Resources:

1. **https://www.nist.gov/cyberframework**
2. **https://www.cyberseek.org/**
3. **https://www.wireshark.org/**
4. **https://www.splunk.com/en_us/download**
5. **https://www.volatilityfoundation.org/**

Course Articulation Matrix: (Mapping of COs with POs)

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
EE1219.1.	1			2									2			2	1
EE1219.2.						1			2							2	2
EE1219.3.						1			2							2	2
EE1219.4	2		1			1					1					2	2
EE1219.5.			1							2						2	2
EE1219.6	2														2	1	2

1. **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1220	Electric Vehicle Technology Open Elective (BTech VI Sem. and MTech II Sem.)	3	1	0	0	04

Course Objectives:

This course will prepare students to provide a comprehensive knowledge of technology behind electric cars. This course will also enable students to battery pack construction and battery technology, EV charging, and about future trends in the development of electric cars.

Course Outcomes:

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

EE1220.1 Identify and describe the history and evolvement of electric & hybrid electric vehicles to emphasize on the need, and importance of EV/HEV for sustainable future.

EE1220.2 Analyze the drive train configurations of electric drive vehicles.

EE1220.3 Apply the design methodologies and control strategy on hybrid electric vehicles

EE1220.4 Calculate the required motor rating, and battery pack for different type of E-Vehicles to operate in different conditions.

EE1220.5 Realize battery charger topologies for electric vehicles

Assessment Scheme:

Prerequisites		
Teaching Scheme (Hours per Week)		In Class-L T P (3 1 0)
Credits		4
Sr. No.	**Evaluation Component**	**Marks**
01	Attendance	Nil
02	Assignment	15
03	Class Participation	10
04	Quiz	15
05	Theory Exam-I	Nil
06	Theory Exam-II	15
07	Theory Exam-III	30
08	Report-I	10
09	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

17	Presentation	05
18	Viva	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	**Theory Exam-3**	**30**

Syllabus (Theory):

UNIT-I Introduction: Basics of vehicles mechanisms, history of electric vehicles (EV) and hybrid electric vehicles (HEV), need and importance of EV and HEV, Power/Energy supplies requirements for EV/HEV applications, vehicle power source characterization, and transmission characteristics

UNIT II: Electric Vehicle Modelling – Consideration of Rolling Resistance, Transmission Efficiency, Consideration of Vehicle Mass, Tractive Effort, Modelling Vehicle Acceleration, Modelling Electric Vehicle Range, EV Motor Sizing, Energy Consumption. General Issues in Design.

UNIT-III Battery Technology for EVs: Types of Battery and Classification, Commercially available lithium ion cells, Li ion cell Parameters: : Capacity, C-rate, impedance, DOD, SOC, SOH, Life cycles, Mechanical characteristics, Form factor, Battery Management System, Safety, Battery modules and complete battery pack system.

UNIT-IV Charging Infrastructure : Introduction to EV Charging technology , Onboard charging and Off-board charging, AC charging vs DC charging , AC charging – Type-1/2/3 , DC charging - Chademo, Tesla, CCS, Electric Vehicle Supply Equipment

UNIT-V Future Electric Mobility: Energy Management Strategies: V2G, G2V, V2B, V2H, Future Trends in Electric Cars, Wireless Charging of EVs, Battery Swap Technology, Charging EVs From Renewables, Govt. Policies and Regulations.

Activity:

- Design a battery pack using Lithium-Ion batteries
- Design Electric Motor and Lithium Battery Capacity of Electrical Bike.

Text Books/ Reference Books:

- Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003.
- Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 2010.
- Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons, 2012.
- Tariq Muneer and Irene Illescas García, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017.
- Electric Vehicle Battery Systems – Sandeep Dhameja – Newnes – New Delhi – 2002.

Online Resources:

- E-materials available at the website of NPTEL- http://nptel.ac.in/
- MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

Course Articulation Matrix: (Mapping of COs with POs)

Course Outcomes	CORRELATION WITH PROGRAM OUTCOMES															CORRELATION WITH MTech (Automation and Robotics) 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	ARPSO 1	ARPSO 2
EE1220.1	1	2						1		1				1		1	1
EE1220.2					1	2							1			2	2
EE1220.3		1			1	1	2					1				2	2
EE1220.4					1		2	1				2		1		2	2
EE1220.5	1	2						2	2			2				2	1

Course Title and Code: Disaster Management: CE 1206	
Hours per Week	**L-T-P: 3-1-0**
Credits	**4**
Students who can take	B.Tech SemVI sem (2019-2023) (OE)
Course Objective: This course aims to develop understanding of various natural and manmade disasters. Natural disasters include earthquake, Tsunami, Flood, forest fires and Land Slides. Manmade disasters include fire, Industrial Pollution, embankment failure, structural failure and due to electric supply. Topics includes the causes for these disasters and remedial measures which can minimize the losses to the life and property. The course also includes the identification and description of electric supply resilience and restoration.	

Course Outcomes

On completion of the course, the student should be able to:

CE1206.1 Asses the types of disasters, causes and their impacts.
CE1206.2 Assess vulnerability and various methods of risk reduction measures and mitigation.
CE1206.3 Draw the hazard and vulnerability profile of a given region.
CE1206.4 Analyze the impact of Storms and Severe Weather on electric utility.
CE1206.5 Plan and execute framework to black start and restoration procedure with considering security criteria and power system reliability.

Prerequisites		
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	Nil
2	Assignment	10
3	Class Participation	5
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	15
7	Theory Exam-III	35
8	Report-I/ Case Study	5
9	Report-II/Case Study	5
10	Report-III/Case Study	5
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
17	Presentation	10
18	Viva	10
	Total (100)	
	Evaluation scheme for retest	

	Theory Exam III	35

Syllabus (Theory)

Unit-1 Introduction to Disasters, Various types of disaster, Natural: Flood, Earthquake, cyclone, Land slide, Manmade: Fire, Industrial Pollution, embankment failure, structural failure, Loss of resources.

Unit-2

Risk and Vulnerability:

Risk: Its concept and analysis, Risk reduction, Vulnerability: Its concept and analysis, strategic development for vulnerability reduction

Unit 3

Disaster Management in Electrical Systems:

Causes of Extended Outages, System Impact of the Loss of Major Components, Methods to Reduce Energy System Vulnerability, Development of an On-Site and Off-site Disaster management Plan, Accident prevention techniques and Reporting procedures, Investigation reports, Impacts of Blackouts.

Unit – 4

Management- Objectives, Processes, Events, analysis, base-line data, forecasting and Warnings. Disaster preparedness plan concept and nature, Emergency operation center and IT aids- physical environment, Applications.Public-private agency co-ordination-federal, state and local disaster response organization and network, Citizen and community role in disaster response and recovery.

Case Studies

11. A Case study on flood Hazard
12. A case study on Tsunami Hazard
13. A case study on Earthquake
14. A case study on Forest fire
15. A case study on structural failure
16. A case study on Electrical Disaster Recovery Operations for a Hospital
17. A Case study of Impacts of Cyclones on the Power Sector in India.
18. Impact assessment of Storms and Severe Weather on electric utility infrastructure.

Text /Reference Books:

10. M. Pandey, “Disaster Management” Wiley India Pvt. Ltd.
11. Tushar Bhattacharya, “Disaster Science and Management” McGraw Hill Education (India) Pvt. Ltd.
12. Crisis and disaster management plan for power sector by central electricity authority of India
13. N. Malla, S. Poudel, N. R. Karki and N. Gyawali, "Resilience of electrical power delivery system in response to natural disasters," 2017 7th International Conference on Power Systems (ICPS), Pune, 2017, pp. 806-811.doi: 10.1109/ICPES.2017.8387400
14. Sahni, Pardeepet. al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.

Course Articulation Matrix: (Mapping of COs with POs) (EEE)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
CE1206.1	2	2	2					2	2		2	2		1	1		
CE1206.2	2	2	2	1				1	1	1	2	2		1	1		
CE1206.3		1	1	1	1	1	1	2	2	2	2	2		1	1	2	2
CE1206.4					1	1	1									2	2
CE1206.5					1	1	2									1	1

Course Code and Title	**ME1207: MECHATRONICS**
Scheme	**L T P: 3 0 4**
Credits	**5**
Students who can take	**M. Tech: Semester II, Automation & Robotics** **B. Tech: Semester VI (open elective)**

Course Objective:

To develop an understanding of basic and advanced topics of Mechatronics such as sensors and signal conditioning, actuators, microprocessor and microcontroller systems, system models, and industrial applications.

Course Outcomes:

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

ME1207.1. acquire a mix of skills in mechanical engineering, electronics and computing which is necessary to comprehend and design mechatronics systems.

ME1207.2. operate and communicate across the range of engineering disciplines necessary in mechatronics.

ME1207.3. design mechatronic systems.

Prerequisites	Mathematics concepts, basic mechanical and electrical concepts.
Teaching Scheme (Hours per Week)	3 0 4
Credits	5

Sr. No.	**Specifications**	**Marks**
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	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 (Examination)	10
16	Course Portfolio	NIL
17	Presentation	NIL
18	Viva	NIL
	Total	**100**

Retest Scheme:

1	Theory Exam-III	30
2	Lab Evaluation-II (Examination)	10
	Total	**40**

COURSE SYLLABUS (Theory)

UNIT I: Introduction

Introduction to Mechatronics system, key elements, Mechatronics Design process, Design Parameters, Traditional and Mechatronics designs, Advanced approaches in Mechatronics, Industrial design ergonomics and safety.

UNIT II: Sensors and Actuators

Sensor and transducers, digital logic, signal processing devices, relays, contactors and timers. Actuation systems, pneumatic and hydraulic system, control valves, cylinders, rotary actuators, mechanical systems, drives, bearings, electrical systems, electrical and mechanical switches, solenoids, motors, signal conditioning, filtering, power transfer, digital signals, A-D and D-A converters.

Unit III: Microprocessor

Microprocessor, microcontroller, programming, application examples, interfacing and applications, PLC, ladder programming, timers and counters, PLC system.

Unit IV: System Models and Micro Mechatronic System

System Models
Mathematical models, building blocks for mechanical systems, electrical systems, fluid systems, thermal systems, description of PID controllers.

Micro Mechatronic System
Introduction, System principle, Component design, System design, Scaling laws, Micro actuation, Micro robot, Micro pump, Applications of micro mechatronic components.

Unit V: Case Studies

Introduction, Fuzzy based washing machine, Motion control using DC Motor & Solenoids, Engine management systems, controlling temperature of a hot/cold reservoir using PID, Control of pick and place robot.

COURSE SYLLABUS (Laboratory)

1. Responses of First and Second Order Mechanical Systems
2. Basics of Frequency Domain Signal Analysis
3. Frequency Response of Mechanical Systems
4. Time-Frequency Analysis of Mechanical Systems
5. Gearbox Fault Detection
6. Pump Impeller Fault Detection
7. Vibration Monitoring of Machineries by Wireless Technique
8. Electrical Motor Fault Detection by MCSA

Exp. No. 1 to 8: http://vlabs.iitkgp.ernet.in/mssp/#

9. Identification and familiarisation of the following components: resistors, inductors, capacitors, diodes, transistors, LED's.
10. Familiarization with the following components: CRO, transformer, function generator, multimeter, power supply.
11. Familiarization with the following electrical machines: Induction motors, DC motors, synchronous motors, single phase motors.
12. Familiarization with the following mechanical components: gears, gear train, bearings, couplings, tachometer.
13. Implementation Logic Gates
14. Implementation of PID Controller

Exp. 13 and 14: http://plc-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering

15. Case study: modeling and control of combustion engines.
16. A case study: automotive transmission as a "gear reducer".

BOOKS

1. David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill Education.
2. William Bolton, "Mechatronics electronic control systems in mechanical and electrical engineering", Pearson Education Limited.
3. Paul P. L. Regtien, "Sensors for Mechatronics", Elsevier.
4. Dean C. Karnopp, Donald L. Margolis, Ronald C. Rosenberg, "System Dynamics: Modeling, Simulation, and Control of Mechatronic Systems", John Wiley & Sons, Inc.

ONLINE COURSES

1. https://onlinecourses.nptel.ac.in/noc21_me27/preview
2. https://www.edx.org/course/mechatronics
3. https://www.coursera.org/specializations/embedding-sensors-motors

COURSE ARTICULATION MATRIX: (Mapping of COs with POs)

CO	Rate the level of course specific CO's corelated with POs/PSOs (1: Low Corelation; 2: Moderate; 3: Substantial corelation). Leave Blank if Not Corelated																
	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
ME1207.1	1				1			1			1					1	
ME1207.2		1	2		1			1		1		1					2
ME1207.3						1		1	2	1		1					

Course Title and Code **Geographical Information Systems Lab (GIS): CE1114**	
Hours per Week	**L-T-P: 1 0 2**
Credits	**2**
Students who can take	B. Tech Sem VI sem (B Tech CSE, EEE and ME)
Course Objective: This course aims to develop understanding of various methods of remote sensing, satellite images data acquisition, data format, data analyze and data output. It also explains the major applications of GIS i.e. climate change, natural resources management and water resources management.	
Course Outcomes: **On completion of the course, the student should be able to:** CE1114.1 Asses the various sources for remote sensing data. CE1114.2 Analyze the data from various type of images. CE1114.3 Analyze the data acquisition and data output through GIS. CE1114.4 Incorporate GIS in resources management and climate changes.	

Prerequisites		
Teaching Scheme (Hours per Week)		L-T-P: 1 0 2
Credits		2
Sr. No.	**Evaluation Component**	**To be Announced Later**
1	Attendance	5
2	Assignment	Nil
3	Class Participation	10
4	Quiz (2)	20
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	10
12	Project-II	15
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	20
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	10
	Total (100)	
	Evaluation scheme for retest	
	Quiz	10
	Lab Evaluation-II	20

Syllabus (Theory)

1. Remote sensing satellites and their data products, Sensors and orbital characteristics, Spectral reflectance curves and resolution, Satellite Image - Characteristics and formats, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Supervised Classification
2. Basic concepts of geographic data, GIS and its components, Data acquisition, Raster and Vector formats, topology and Data models, Spatial modelling, Data output
3. Application of GIS: Climate change, Natural resources management, Forest management, Water Resources management, Drought Management

Syllabus (Practical)

1. Creating and Exploring a Basic Map
2. Classifying and Creating Vector Data
3. Laying Out of the Maps
4. Classifying and Creating Raster Data
5. Terrain Analysis
6. Raster to Vector Conversion
7. Hydrologic Analysis

Text /Reference Books:

1. Bhatta B., "Remote sensing and GIS", Oxford University Press, 2011.
2. Satish G., "Advanced Surveying: Total Station, GIS and Remote Sensing", Pearson, 2011.
3. Joseph George, "Fundamentals of Remote Sensing", University Press, 2011.
4. Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins. GPS Theory and Practice. Springer, 1994. ISBN: 9780387824772.

https://nptel.ac.in/courses/105/108/105108077/

Course Articulation Matrix: (Mapping of COs with POs) (EEE)

CO		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
CE1114.1					1	1	2	2	1	2	1	2					
CE1114.2					2	1	2	2	2	1				1	1		
CE1114.3	2	1	2		2	1	3	1	1	2				2	2	1	1
CE1114.4	2		2		2	2	2				2	2		1	2	1	1

Course Title and Code:	**Advanced Statistics; AS1202**
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech Sem VII (Open Elective)

Course Objective- To familiarize students with concepts of probability theory and random variables and use them to analyze real life problems. This course also focuses on developing an understanding of regression models, data analysis, model building, interpretation of results and statistical computation.

Course Outcome:

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

AS1202.1. Identify and formulate fundamental probability distributions and density functions.

AS1202.2. Analyze continuous and discrete-time random variables and processes.

AS1202.3. Analyze system of multiple random variable.

AS1202.4. Compute cumulative distribution function and normalizing constant for the probability density function of one or more random variables.

AS1202.5. Apply the concept of algebra of random variables to analyze various linear systems.

AS1202.6. Design experiments as processes and analyze these using appropriate statistical tool.

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	**5**
03	Class Participation	**10**
04	Quiz	**15**
05	Theory Exam-I	**Nil**
06	Theory Exam-II	**20**
07	Theory Exam-III	**30**
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	**20**
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**

Retest

1	Theory Exam	30

Syllabus (Theory):

RANDOM VARIABLES
Random variables, Distribution and density functions of random variables, Discrete and continuous random variables, Gaussian, Exponential, Rayleigh, Uniform, discrete Uniform and conditional distributions, distribution mean, variance, moments and characteristics functions.

MULTIPLE RANDOM VARIABLES
Function of two random variables, Distributions of two random variables, correlation coefficient, Joint moments, Joint characteristics functions, Conditional distributions, conditional expected values, statistical independence. Multiple random variables, distribution of sums of random variables, Central limit theorem.

OPERATIONS ON MULTIPLE RANDOM VARIABLES
Mean or expected value of multiple random variables, Variance, standard deviation, moments, Chebyshev's Inequality, moment generating function, characteristic function, covariance, variance of a linear combination of random variables.

REGRESSION ANALYSIS

Introduction to regression model, Types of regression models, Estimation of the regression coefficients and error variance, Inferences for the regression coefficients, Predicting future observations, Inverse prediction and regulation. An introduction to multiple linear regression models.

DESIGN OF EXPERIMENTS
Analysis of variance, one way classification, two way classification.

Reference Books:

- J. Susan Milton and Jesse C. Arnold, 'Introduction to Probability and Statistics', McGraw Hill Education.
- Papoulis, 'Probability, Random Variables And Stochastic Processes', TMH.
- VK Rohatgi and AK Saleh, 'An Introduction to Probability and Statistics', Wiley India.
- Ross, 'Stochastic Processes', 2ed, Wiley.
- Shumway & Stoffer (2011) Time Series Analysis and its applications, with examples in R , 3rd edition, Springer.
- K. L. Chung, 'Introduction to Probability Theory with Stochastic Processes', Springer International Student Edition.
- Applied Linear Statistical Models by Kutner, Nachtsteim, Neter and Li (5th edition).

Course Articulation Matrix: (Mapping of COs with POs and PSOs (EEE))

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
AS1202.1						1		1									
AS1202.2					1	1		1		1						1	
AS1202.3		1			1	1	1	1		1			1	1		1	
AS1202.4						2		1									
AS1202.5						2		2	1	2						1	
AS1202.6	1	1	1		2	2	1	2		2	1		1	2	1	2	1

Course Title and Code:	**Minor Project; PR1103**
Hours per Week	**L-T-P: 0-0-2**
Credits	**4**
Students who can take	B.Tech Sem VII

Course Objective- This course offers an opportunity to apply and extend knowledge learned throughout the program to solve real world issues. The minor projects undertaken span a diverse range of topics, including design, simulation, and experimental studies. The course emphasizes, facilitating student learning in technical, project implementation and presentation spheres.

Course Outcome:

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

PR1103.1. Identify and formulate industrial and societal problems.
PR1103.2. Design engineering solutions for complex problems.
PR1103.3. Develop/fabricate, and implement solutions for identified problem.
PR1103.4. Demonstrate the knowledge, skills and attitudes of a professional engineer.

Operation Procedure:

Students are expected to achieve the objective of the project work. The students are expected to submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The students are expected to report to their mentor(s) frequently and will be evaluated continuously. Department committee will evaluate the work through seminars and progress reports as per the evaluation scheme. At the end there would be a demonstration of the solution and possible future work for the work done.

- Student must devote full semester for Minor Project.
- Student must report to the mentor(s) regularly.
- Seminar evaluation must be carried out in the presence of at least two-committee members.
- Experts in the relevant area constituted by the supervisor.
- Final Seminar Report to be submitted must be in formal hard bound cover bearing of the Institute emblem.
- Assessment is by means of a synopsis presentation, submission of a thesis, and a public demonstration of work undertaken.

Prerequisites

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**

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO 1	PSO 2
PR1103.1	1			2	1	2	1	2	2							1	1
PR1103.2			1	2	2	1		1	2		1	2		2	2	2	2
PR1103.3	1			2	1		1									2	1
PR1103.4			1	2	2	1	2				1	2		2	2	2	2

Course Title and Code:	**EE1214 Real Time Operating Systems**
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech Sem V ECE

Course Objective- The course gives an insight to MSP430 and embedded software in general. The students will learn to implement a basic task scheduler. They will also learn real time programming concepts starting from setting up ports and registers, to more advanced topics like call-back functions, structs, and timers.

Course Outcome:

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

EE1214.1 Demonstrate a basic understanding of operating systems functionalities.

EE1214.2 Perform scheduler analysis for an application.

EE1214.3 Develop program for Real-time scheduler for an application.

EE1214.4 Program timers, registers and ports of low power microcontroller to implement timing constraints.

EE1214.5 Deploy a task scheduler for multitasking using real time operating system.

Prerequisites		Nil
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	20
03	Class Participation	Nil
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	10
07	Theory Exam-III	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	20
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**

Retest

1	Theory Exam	30

Syllabus (Theory):

Introduction to low power microcontrollers, architecture, programming (timers, ports, registers) interfacing sensors, simple applications and sophisticated applications like pulse oximeter.

Functions of operating systems, Real time systems, Task scheduler, Cyclic and event driven schedulers, Implementing Task scheduler with MSP430

Resource sharing and handling priorities.

Textbooks:

1. The Theory (The engineering of real-time embedded systems) Jim Cooling, Kindle Edition.
2. Real-Time Systems: Theory and Practice-Rajib Mall , Kindle Edition.

Web Resources:

1. Introduction to Operating Systems Prof. Chester Rebeiro https://onlinecourses.nptel.ac.in/noc20_cs75
2. Real Time Operating systems -Prof Rajib Mall https://nptel.ac.in/courses/106/105/106105172
3. https://www.ti.com/tool/TI-RTOS-MCU#technicaldocuments

CO		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
EE1214.1	1					2											
EE1214.2																	
EE1214.3							2										
EE1214.4										1		2					
EE1214.5					2		2					2					

Course Title and Code:	**Urban and Regional Planning CE1215**
Hours per Week	**L-T-P: 3-1-0**
Credits	**4**
Students who can take	B. Tech (V Sem) OE

Course Objective- To introduce the issues,concept and frameworks for urban and regional developement and planning.

Course Outcome:

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

CE1215.1 Demonstrate a broad concept in urban and regional planning, including deep understanding of underlying principles and concepts.

CE1215.2 Address land-use and built-environment problems in a range of social, economic and environmental contexts.

.CE1215.3 Analyze the various components of water supply, sanitation, transportation and waste management.

CE1215.4 Analyze the various types of plans and their execution.

CE1215.5 Plan and design various types of social infrastructure projects.

Prerequisites		None
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	10
04	Quiz	10
05	Theory Exam-I	Nil
06	Theory Exam-II	20
07	Theory Exam-III	30
08	Report-I	10
09	Report-II	10
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**

Retest

Evaluation scheme for retest	
Theory Exam III	30
Total	**30**

Syllabus (Theory):

Introduction to Planning: Defining planning as a discipline, multidisciplinary nature, role of a planner, fields of planning, Urban, regional, environmental, transport and infrastructure,

Concepts of garden City, City beautiful, linear city, Various definitions of town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning; Arguments for and against planning. Economics and social planning as bases of physical planning. Planning Process. Levels of planning in India.

Types of Plans: Definition of development plan; Types of development plans: Master plan, City development plan, Structure plan, District plan, Action area plan, Subject plan, Comprehensive planning, Zonal plans, special area development plan e.g. SEZ (special economic zones), SIR (special investment regions).

Water Supply System: Water supply systems and networks, water sources, quality and quantity requirements, collection and water requirement for various land uses; Factors affecting water demand; Storage facilities; Distribution Systems; rainwater harvesting system.

Sanitation, Sewer system and SWM: Sanitation and Sewer System, types of sewers: General considerations, Sewage Disposal and treatment, Low cost appropriate technologies for sanitation, Elements of Solid Waste Management, Best practices for solid waste management.

Transport System Types and characteristics of transport systems; Principles of transport infrastructure planning and, pedestrian and cyclist infrastructure; parking facilities; principles of traffic management, urban mass transport systems

Regional planning: definition, need and importance, function, objective, concept of region, types of regions, types and contents of regional planning for block, district, state, national, NCR, resource region, agro–climatic region, topographic region and sectoral planning, major regional problems and their solutions.

Text books:

1. Hutchinson, B.G., Principles of Urban Transport Systems Planning, Scripta,McGraw-Hill, New York, 1974.

2. Claire, Hand Book of Urban Planning, Van Nostrand Book Company, 1974.

3. Gallian, B. Arthur and Simon Eisner, The Urban Pattern - City Planning andDesign, Affiliated Press Pvt. Ltd., New Delhi, 1985.

4. RobertsM., An Introduction to Town Planning Techniques, Hutchinson,London, 1980.

5. Hiraskar, G. K., Fundamentals of Town Planning, Dhanpat Rai Publications,1992

6. Grigg, Neil, Infrastructure Engineering and Management, Wiley, (1988).

7. Kopardekar & Diwan (1994), 'Urban and Regional Planning-Principles, Practice and Law' S.H.

8. Kopardekar, Talegaon – dabhade.

8 . Kulshrestha S.K. (Ed. 2006), 'Dictionary of Urban and Regional Planning', Kalpaz Publications, Delhi.

CO		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
CE1215.1	2	2	1										1				
CE1215.2	2	1	1									1					
CE1215.3	1				1			1	2		1						
CE1215.4	1	1	2		2	2		2	1		1	2		1	1		
CE1215.5	1	1	2		1	2		2	2		2	2	2	1	2		

Course Title and Code:	Introduction to User-Experience**; IL1204**	
Hours per Week	**2-2-0**	
Credits	**4**	
Students who can take	B.Tech Sem III/V (All Branches)	
Course Objective- The course takes a student through the complete User-Experience (UX) life-cycle including problem-identification, problem-framing, design exploration and design-evaluation.		
Course Outcome: On successful completion of this course, a student should be able to: IL1204.1 Appreciate UX holistically with respect to different types of user-needs. IL1204.2 Conduct User-Studies. IL1204.3 Synthesize a Problem-Statement. IL1204.4 Conduct Creative Design-Exploration. IL1204.5 Conduct Systematic Design Evaluation.		
Prerequisites		None
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	20
03	Class Participation	10
04	Quiz	Nil
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III (Certification Exam by IBM)	Nil
08	Report-I	20
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	50
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**

Retest

1	Project-I	50

Syllabus (Theory):

UNIT-I Introduction to User-Experience

UXLife Cycle, Layers of User-Experience, Maslow's Hierarchy of Needs.

UNIT-II User-Studies

Ethnography-based Methods, Data-Synthesis, Problem Framing

UNIT-III Design

Design-Exploration, Prototyping

UNIT-IV Evaluation

Planning and Conducting UX-Evaluation, Analyzing Data, Recommending Design Directives.

Studio

- Contextual User-Studies.
- Data Analysis.
- Problem-Synthesis.
- Design-Exploration

- Design-Evaluation.

Text Material & Resources:

Reference Books:

- Buxton, B. (2010). *Sketching user experiences: getting the design right and the right design*. Morgan kaufmann.
- Beyer, H., & Holtzblatt, K. (1999). Contextual design. *interactions*, *6*(1), 32-42.
- Mayhew, D. J. (1999, May). The usability engineering lifecycle. In *CHI'99 Extended Abstracts on Human Factors in Computing Systems* (pp. 147-148).
- Cooper, A., Reimann, R., Cronin, D., & Noessel, C. (2014). *About face: the essentials of interaction design*. John Wiley & Sons.

Recommended MooC:

- NPTEL Course: Interaction Design: Dr. A. Srivastava, IIT Guwahati. Available at https://nptel.ac.in/courses/107/103/107103083/ (accessed 03-sep-2021)

Course Articulation Matrix: (Mapping of COs with POs)

CO		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
IL1204.1	1	0	0	0	0	0	0	0	1	0	0	0	3	1	0	0	0
IL1204.2	3	0	1	0	0	1	0	0	3	0	2	0	0	1	0	0	2
IL1204.3	3	0	1	0	0	1	0	0	3	0	2	0	0	1	0	1	2
IL1204.4	3	0	0	0	0	1	0	0	3	0	2	0	0	1	0	2	0
IL1204.5	3	0	0	0	0	1	0	0	3	0	2	0	0	1	0	0	2

Course Title and Code:	**Idea to Business Model ED1102**
Hours per Week	**L-T-P: 3-0-0**
Credits	**4**
Students who can take	B.Tech Sem V

Course Objective- To encourage students to nurture their entrepreneurial traits and think creatively to develop innovative ideas/products for commercial exploitation.

Course Outcome:

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

ED1102.1. Identify problem worth solving through design thinking.
ED1102.2. Identify customer segment and niche for specific markets.
ED1102.3. Craft Value Preposition Canvas.
ED1102.4. Create business model using Lean Canvas Template
ED1102.5. Build 'A' team for new start-ups.
ED1102.6. Design and validate solution demo and MVP.
ED1102.7. Analyse cost, revenue, key channels and pricing model for the venture.
ED1102.8. Craft positioning statement of a new venture.
ED1102.9. Classify the different sources of funding.

Prerequisites		Basic IT Literacy Skills
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	Nil
03	Class Participation	Nil
04	Quiz	Nil
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III (End Term)	40
08	Report-I	20
09	Report-II	20
10	Report-III	Nil
11	Project-I	20
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**

Retest

1	Theory Exam	40
2	Project-I	20

Syllabus:

- **Overview of Entrepreneur and Entrepreneurship**
- **Self-Discovery**
- **Opportunity Discovery**
- **Identify Customer**
- **Value Preposition Canvas**
- **Business Model**

- **Validation**
- **Money (Revenue, Costs, Pricing and Financing)**
- **Team Building**
- **Marketing and Sales**
- **Sources of Fund**
- **Support (Institutional and Government policies)**
- **Project**

Text Book And Additional Reading Materials

LearnWISE™ (It is a leading digital learning platform provided by Wadhwani Foundation)

Additional Reading Material

1. Robert D Hisrich, Michael P Peters, Dean A Shepherd (2017). **Entrepreneurship/10e.**. New Delhi; Tata McGraw-Hill.
2. Poornima M Charantimath (2012). **Entrepreneurship Development Small Business Enterprises**. New Delhi: Pearson.
3. Rajeev Roy (2011). **Entrepreneurship**. New Delhi: Oxford
4. Arya Kumar (2015). *Entrepreneurship: Creating and Leading an Entrepreneurial Organisation.* New Delhi: Pearson.
5. Vasant Desai (2016). *Dynamics of Entrepreneurial Development and Management*. Himalaya Publishing House.

Note: Latest edition of the readings will be used

Course Articulation Matrix: (Mapping of COs with POs) - IET

CO		CORRELATION WITH PROGRAM OUTCOMES (IET)														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
ED1102.1					1	2		1	1	1				2	1		
ED1102.2					1			1							1		
ED1102.3					2									2			
ED1102.4			2		1									2	2		
ED1102.5											2	1	1				
ED1102.6								1					1	2	2		
ED1102.7					2					1							
ED1102.8																	
ED1102.9					2												

Course Title and Code	EE1217 Machine Vision
Hours per Week	**L-T-P: 3-0-0**
Credits	**4**
Students who can take	B.Tech Sem VII EEE/CSE

Course Objective- This course imparts knowledge on image preprocessing and machine learning for image recognition and classification. It develops understanding various fundamental concepts for design of Convolutional Neural Networks (CNN) for image classification. Various advanced Neural networks developed during ImageNet challenges are introduced.

Course Outcome:

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

EE1217.1 Implement Image Processing Algorithms using OpenCV tools.

EE1217.2 Design, Train and Test Neural Networks and deploy suitable activation functions using Keras/Tensorflow libraries.

EE1217.3 Identify suitable Performance Parameters and evaluate technique for best performance.

EE1217.4 Use transfer learning from existing trained networks to develop innovative solutions.

		Nil
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	20
03	Class Participation	Nil
04	Quiz	10
05	Theory Exam-I	Nil
06	Theory Exam-II	10
07	Theory Exam-III	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	30
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**

Retest

1	Theory Exam	30

Syllabus:

Module 1: Introduction to Image Processing system- Thresholding, Image Enhancement, Contrast Stretching- Linear, Logarithmic, Power Law, Image Histograms, Filters, Image Sharpening. Edge Detection and Segmentation

Module 2: Deep Learning for Computer Vision, Gradient Descent, Stochastic Gradient Descent and Backpropagation, pooling, dropout and optimization of learning rates. Convolutional Neural Networks, CNN architecture, Designing CNN architecture for image classification / object detection

Module 3: Applications using Transfer Learning from ILSVRC networks, Generative Adversarial Networks, and its applications.

References:

1. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar
2. Deep Learning book by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

Course Articulation Matrix: (Mapping of COs with POs)

CO		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
EE1217.1					2											2	1
EE1217.2					2		2									2	2
EE1217.3	2				2			2								1	2
EE1217.4	1						2							2		2	2

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
EE1206	Industrial Drive and E-Vehicle	3	0	2	4

Course Objectives: This course is aimed at developing the required understanding to design various control strategies for AC & DC machines and select proper size & type of motor as per industry requirements. It focuses to develop power electronics applications for electrical machines and industrial equipments.

Course Outcomes:

On successful completion of this course, the student will be able to:
EE1206.1. Apply the theories of electrical machines, power electronic converters and control system design to implement electric drive systems and analyze transient behaviour of electric drives.
EE1206.2. Design BJT, MOSFET and IGBT gate drive circuits, protection circuits as well as cooling requirements for power semiconductor devices.
EE1206.3. Implement the control techniques in DC to AC or AC to DC converters for efficient starting, braking and speed control operation of electric motors.
EE1206.4. Use 3002.7-2018 - IEEE standards for minimizing transient losses and starting time.
EE1206.5. Select efficient motor for different type of E-Vehicles to operate in different conditions.
EE1206.6. Utilize Matlab as simulation tool to accurately analyze the electric drive system

Syllabus (Theory)

INTRODUCTION: - Definition & classification of different type of drives, Dynamics of electrical drives, Review of characteristics and components of electric drives, acceleration and retardation time, energy consideration.

BRAKING and SPEED CONTROL OF DRIVES: - Various methods of braking of a.c. and d.c drives, Automatic control arrangement, Speed control methods of various a.c. and d.c. drives, its advantages and applications, Transient analysis.

INDUCTION MOTOR (A.C) DRIVES: - Basic principle of induction motor drives, 3 Ø a.c voltage controller fed I.M drive, variable frequency control, voltage source inverter (VSI) and current source inverter (CSI), cycloconverter fed IM drive, Slip Power control, static rotor resistance control, chopper control of 3 -Ø slip ring induction motor.

DC DRIVES: - Rectifier controlled circuits, Single phase fully controlled and half controlled rectifier fed separately excited d.c motor, 3Ø fully and half controlled fed separately excited d.c. multiquadrant operation of dc separately excited motor, Motor, performance and characteristics, Control techniques of d.c. Drives using chopper.

ELECTRICAL VEHICLES: -Motor Drive for EV: Permanent Magnet Brushless DC Motor Drives (PM-BLDC), Switched Reluctance Motor (SRM) Drive, Modeling PM-BLDC and SRM drive for EV, Sensors and actuators for EV.

Syllabus (Practical)

1. Three phase voltage source inverter simulation using MATLAB
2. Three phase voltage source converters with space vector PWM simulation using MATLAB.
3. Buck converter simulation using MATLAB.
4. Boost converter simulation using MATLAB.
5. Speed control DC Motor using BJT-H bridge simulation using MATLAB
6. Three phase thyristor converter simulation using MATLAB

7. Chopper fed DC motor drive simulation using MATLAB
8. Three phase permanent magnet synchronous motor drive simulation using MATLAB

Course Assessment:

Prerequisites		Transmission and Distribution
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	Nil
2	Assignment	10
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	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 (Continuous)	10
15	Lab Evaluation-II (End term Exam)	10
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	Nil
	Total (100)	
Retest		
17	Theory Exam-III	30
	Total (30)	30

Text / Reference Books:

1. G.K.Dubey," Fundamentals of Electric Drive". Narosa Publishing House.
2. Bimbhra.P.S. "Power Electronics" Khanna Publisher.
3. Singh M.D. & Khanchandani K.B. "Power Electronics" Tata McGraw Hill
4. Sen P.C. "Power Electronics", Tata McGraw Hill
5. Chau K.T. "Electrical Vehicle Machines and Drives Design, Analysis and Application", Willey, IEEE Press.
6. M. Ramamurthy: An Introduction to Thyristors and their Applications, East West Press Pvt Ltd.
7. Mohammad H. Rashid: Power Electronics Circuits, Devices and Applications, Prentice Hall of India Pvt Ltd.
8. Seth Leitman Bob Brant: Build Your Own Electrical Vehicle, Tata McGraw Hill.

MOOC Course

Introduction to Power Electronics (Coursera)
https://www.coursera.org/learn/power-electronics
Converter Circuits (Coursera)
https://www.coursera.org/learn/converter-circuits
NPTL Lectures

https://nptel.ac.in/courses/108/108/108108077/
https://nptel.ac.in/courses/108/104/108104140/

Course Outcomes	CORRELATION WITH PROGRAM OUTCOMES															CORRELATION WITH MTech (Automation and Robotics) 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**	**ARPSO 1**	**ARPSO 2**
EE1206.1			1		1	2		2			1			1		2	2
EE1206.2		2		1		1						1				1	2
EE1206.3	1	1				1	2			1				1		2	2
EE1206.4		1	1				2									2	1
EE1206.5	1	2			1		2			2		1		1		2	2
EE1206.6								1	2	2		1				1	1

Course Title and Course Code	**Industrial Robotics**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B.Tech & M. Tech Semester-IL2203**

Course Objective:

To provide understanding of robots and manipulators in different fields of application, also to synthesis planar and spatial manipulator and its control strategy.

Course Outcomes:

On successful completion of this course, the students will be able to:
identify the use of robots and its application in industry and everyday life.

IL2203.1. analyze kinematic parameters of different robots.
IL2203.2. analyze dynamic parameters of robots and method to improve its performance including energy requirements.
IL2203.3. develop open and close loop control system for a manipulator.
IL2203.4. perform trajectory planning for a manipulator.

Prerequisites		**Basics of Physics**
Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	NIL
4	Quiz	20
5	Theory Exam-I	10
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	20
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 Re-Test	
Lab Evaluation-II (Exam)	10
Theory Exam-III	20
Total (30)	30

COURSE SYLLABUS (Theory):

UNIT - I

Introduction:

Robotics trends and the future. Introduction: serial robot, parallel robot, exoskeleton, mobile robot, under water robot, flexible & space robot. Robot anatomy: links, joints and joint notation scheme, Degrees of Freedom (DOF), required DOF in a manipulator, arm configuration, wrist configuration; end-effector, human arm characteristics, design & control issues, manipulation & Control, robotics sensors, robot specification, different robot programming platform.

UNIT - II

Robot Motion Analysis:

Introduction to co-ordinate frames mapping, mapping between rotated frames, mapping between translated frames, description of objects in space, transformation of vectors - rotation & translation of vectors, composite transformations, inverting a homogeneous transform, fundamental rotation matrices – principle axes rotation fixed, Euler and equivalent angle axis representations.

Kinematics Manipulators:

The kinematic modeling of manipulator, direct kinematics, Denavit – Hartenberg notation, kinematic relationship between links, manipulator transformation matrix, the inverse kinematics manipulator: workspace, solvability of inverse kinematic model, singularities of manipulators.

UNIT – III

Differential Motion, Statics:

Linear and angular velocity of a rigid body, relationship between transformation matrix and angular velocity, mapping velocity vectors, velocity propagation along links. manipulator Jacobian, Jacobian inverse, Jacobian singularities, static analysis. Jacobian in statics.

UNIT – IV

Dynamics:

Introduction, Lagrangian mechanics, Lagrange – Euler formulation, velocity of a point on the manipulator, the inertia tensor, the kinetic energy, the potential energy. equations of motions, the Lagrangian-Euler (LE) dynamic model algorithm. Introduction to robot control, Open loop, close loop system, and differential equation, control of movements of mechanical joints.

UNIT – V

Trajectory Planning

Definition and planning tasks, joint space techniques, Cartesian space techniques, joint space versus Cartesian space tp. Introduction to machine vision.

COURSE SYLLABUS (Practical):

1. To determine the forward kinematic of a 1-DOF robot using virtual platform
2. To determine the forward kinematic of a 3-DOF robot using virtual platform
3. To determine the forward kinematic of a 6-DOF robot using virtual platform
4. To determine the inverse kinematic of a 1-DOF robot using virtual platform
5. To determine the inverse kinematic of a 3-DOF robot using virtual platform
6. To determine the forward dynamic of a 3-DOF robot using virtual platform
7. To determine the inverse dynamics of a 3-DOF robot using virtual platform
8. To determine the trajectory control of a 3-DOF robot using virtual platform
9. To determine the trajectory control of a 6-DOF robot using virtual platform
10. To write a MATLAB program to interface camera for data acquisition.
11. To write a MATLAB program to determine pattern in an image.

Lab software Link:

1. http://www.roboanalyzer.com/
2. https://cyberbotics.com/doc/guide/puma
3. https://www.autodesk.com/education/edu-software/overview?sorting=featured&page=1

Virtual Lab link

1. Mechanisms and Robotics Lab: http://vlabs.iitkgp.ac.in/mr/

Text Books:

1. Saha, Subir Kumar. Introduction to robotics. Tata McGraw-Hill Education, 2014.
2. Mittal, R. K., and I. J. Nagrath. Robotics and control. Tata McGraw-Hill, 2003.
3. Fu, King Sun, Ralph Gonzalez, and CS George Lee. Robotics: Control Sensing. Vis. Tata McGraw-Hill Education, 1987.
4. Craig, John J. Introduction to robotics: mechanics and control, 3/E. Pearson Education India, 2009.
5. Waldron, Kenneth J., Gary L. Kinzel, and Sunil K. Agrawal. Kinematics, dynamics, and design of machinery. John Wiley & Sons, 2016.
6. Groover, Mikell P., Mitchell Weiss, and Roger N. Nagel. Industrial robotics: technology, programming and application. McGraw-Hill Higher Education, 1986.
7. Schilling, Robert J. Fundamentals of robotics: analysis and control. Vol. 629. New Jersey: Prentice Hall, 1990.

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
IL2203.1					1	1		1									
IL2203.2								1		1							
IL2203.3					1	1			1								
IL2203.4					1				1	1							

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1218	Information Theory and Coding	3	0	2	0	4

Course Objectives: This course is designed to disseminate knowledge of information theory and its application to optimize channel capacity and hence design and implement optimal coding techniques for efficient communication via noisy channels.

Course Outcomes:

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

EE1218.1. Implement various coding strategies like Huffman Coding, Turbo coding, etc.
EE1218.2. Optimize various codes like Shannon codes, Trellis codes etc.
EE1218.3. Characterize Error Free Communication Over A Binary Symmetric Channel
EE1218.4. Analyse Channel Capacity of a Band Limited Continuous Channel
EE1218.5. Analyse various encryption and decryption standards
EE1218.6. Analyse security goals, types of attacks, steganography, symmetric and asymmetric key encipherment and implement cryptanalysis
EE1218.7. Analyse different aspects of digital signature, key management & network layer security
Implement IEEE Information Theory Society (ITSOC) standards

Assessment Scheme:

S. No.	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	20
6	Theory Exam-II	Nil
7	Theory Exam-III	30
8	Report I	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	Nil
	Total (100)	**100**
Evaluation Scheme for Re-Test		
1	**Theory Exam - III**	30
2	**Lab Evaluation - II**	10
	Total (40)	**40**

Syllabus (Theory):

UNIT 1: Introduction to Information Theory Society (ITSOC) standards, Information Measure and Entropy, Properties of Joint and Conditional Information, Properties and Problem Solving in Entropy, Block Codes, Kraft-McMillan Inequality and Compact Codes, Digital Signature

UNIT 2: Properties of Mutual Information and Introduction to Channel Capacity, Calculation of Channel Capacity for Different Information Channels, Error Free Communication Over Noisy Channel, Error Free Communication Over A Binary Symmetric Channel, Differential Entropy and Evaluation of Mutual Information for Continuous Sources and Channels

UNIT 3: Shannon's Theorem, Coding Strategies, Huffman Coding and Optimality, Reliability-Based Soft-Decision Decoding for Linear Block Codes, Trellis-Based Soft-Decision Decoding for Linear Block Codes

UNIT 4: Shannon-Fano Coding, Equivocation and Mutual Information, Properties of Different Information Channels, Turbo Coding, Low-Density Parity Check Codes, GF(2^n) Fields, modern block ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES), message integrity and authentication

Syllabus (LABORATORY):

21. Implementation of Cipher Encryption and Decryption
22. Implementation of one time padding for maintaining secrecy
23. Implementation of message authentication codes
24. Application of cryptographic hash functions
25. Implementation of symmetric key Data Encryption Standard (DES)
26. Implementation of symmetric key Advanced Encryption Standard (AES)
27. Diffie – Hellman key establishment
28. Public key encryption and decryption
29. Implementation of the RSA algorithm
30. Application of digital signatures

Textbooks:

1. Error Control Coding, Shu Lin, Daniel J. Costello, 2/e Pearson India, 2011
2. Cryptography and Network Security, Behrouz Forouzan, Debdeep Mukhopadhyay, Tata McGraw Hill, 2010
3. **Modern Digital and Analog Communication Systems, B.P. Lathi**, Oxford University Press, 4/e, 2017

Reference Books:

1. Communication systems engineering, J. G. Proakis and M.Salehi, Prentice Hall, 2002
2. Cryptography and Network Security Principles and Practices, William Stallings, 4/e, Prentice Hall, 2005

MOOCs:

1. **https://www.coursera.org/learn/crypto-info-theory**
2. **https://www.coursera.org/learn/information-theory**
3. **https://www.coursera.org/specializations/applied-crypto**

Other Web Resources:

1. https://nptel.ac.in/courses/108/102/108102117/
2. https://freevideolectures.com/course/3052/information-theory-and-coding/27 - *Error Free Communication Over Noisy Channel*
3. https://tbc-python.fossee.in/book-details/961/

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
EE1218.1				1	2		1	2	1	1						1	1
EE1218.2				1	2	1	1	2	1	1						2	1
EE1218.3					2		2	1	1							1	2
EE1218.4					1		1	2	2	1						2	2
EE1218.5			2	2	1	1	2	2	1							1	1
EE1218.6			1	1	1	1	2	2	2	1						2	2
EE1218.7			1	1	1			1	1				1	2		2	2

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1211	Advanced Communication Systems	3	0	2	0	4

Course Objectives: This course is focused on application of advanced communication techniques in Wireless communication, fibre optic communication and antenna design. The course also emphasizes issues of electromagnetic interference and compatibility.

Course Outcomes:

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

EE1211.1 Characterize fibre optic system components and classify optical fibres
EE1211.2 Design optical link for specific bit error rate
EE1211.3 Analyze evolution of mobile radio communications (from 2G/3G/4G systems to 5G infrastructure)
EE1211.4 Design cellular system for specified handoffs and call drop probabilities
EE1211.5 Analyse EMI/EMC standards and procedures
EE1211.6 Characterize Antenna Radiation Hazards and implement AISG (The Antenna Interface Standards Group) standards
EE1211.7 Design and analyse Planar Antenna Arrays, Microstrip Antennas and Broadband and Compact antennas

Assessment Scheme:

S. 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 (Continuous)	10
15	Lab Evaluation II (Exam)	10
16	Course Portfolio (MOOC)	10
	Total (100)	**100**
Evaluation Scheme for Re-Test		
1	**Theory Exam - III**	30
2	**Lab Evaluation - II**	10
	Total (40)	**40**

Syllabus (Theory):

Module 1: Optical Fiber Communication

UNIT-I: Evolution of Light wave systems, System components, Optical fibers - Step Index & Graded index - Mode theory, Dispersion in fibers, Dispersion shifted and dispersion flattened fibers - Fiber Losses - Non-linear effects, OPTICAL TRANSMITTERS/SOURCES: - LED structures - Spectral Distribution - Semiconductor lasers - Structures – Threshold conditions - SLM and STM operation - Transmitter design

UNIT-II: OPTICAL DETECTORS AND AMPLIFIERS: Basic Concepts - PIN and APD diodes structures, Photo detector Noise, Receiver design, Coherent detection Semiconductor optical amplifiers; Raman - and Brillouin amplifiers - Erbium-doped fiber amplifiers, pumping requirements, cascaded in-line amplifiers, COHERENT LIGHTWAVE SYSTEMS: Homodyne and heterodyne detectors - Modulation formats - Demodulation schemes - BER in synchronous receivers - Sensitivity degradation – Post - and pre compensation techniques - Optical solitons - Soliton based communication system

Module 2: Wireless Communication

UNIT-I: Evolution of Mobile radio communications – Mobile radio systems in the U.S. and around the world, Evolution of 1 G and 2G systems. OFDM, MIMO concepts, Evolution of 3G and 4G systems, 5G infrastructure

UNIT-II: Cellular concept – Frequency reuse – Channel Assignment strategies – Handoff strategies – Interference and System capacity – Improving capacity in cellular systems, MOBILE RADIO PROPAGATION: Small-scale multipath propagation – Impulse response of a multipath channel – Parameters of mobile multipath channel – Types of small-scale fading – Rayleigh and Rician distributions – Statistical models for multipath fading channels

Module 3: EMI/EMC and Antenna Design

Unit I: EMI/EMC standards and procedures, Antenna design parameters, IEEE 149-1977 test procedure, Antenna Fundamentals, Antenna Radiation Hazards, Introduction to AISG (The Antenna Interface Standards Group)

Unit II: Loop Antennas, Slot Antennas, Planar Arrays, Microstrip Antennas, MSA Parametric Analysis, Broadband & Compact MSA, Tunable MSA, MSA Arrays, PIFA, Design of low power Antenna having controlled EM radiation

Syllabus (LABORATORY):

31. Characterization of Step Index and Graded Index optical fibres
32. Measurement of Numerical Aperture of optical fibres
33. Fibre Optic Analog and Digital Link establishment
34. Characterization of mobile fading channels w.r.t

(a) Simple pathloss model

(b) Pathloss with shadowing model

35. Characterization of Cellular Frequency Reuse
36. Characterization of Co-Channel Cells and Cell cluster
37. Characterization of Frequency Handoff
38. Design of Microstrip Patch Antennas
39. Design of Microstrip Patch Arrays
40. Characterization of EIRP and EMI/EMC certification issues w.r.t IEEE and AISG standards for radiating systems

Textbooks:

1. G. Keiser, "Optical Fiber Communication Systems", McGraw Hill, New York 2000
2. John M. Senior, "Optical Fiber Communication", Pearson education, 3rd Edition, 2010
3. Rappaport, T.S., "Wireless Communications", Principles and Practice, Prentice Hall, NJ, 1996
4. Constantine A. Balanis "Antenna Theory: Analysis and Design", Wiley Student Edition, 2006

Reference Books:

1. Optical Fiber Communications– – John M. Senior, Pearson Education. 3/e, 2007
2. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2012
3. William Stallings, "Wireless Communication and Networking", Pearson Education, 2002
4. John D Kraus," Antennas for all Applications", 3rd Edition, McGraw Hill, 2005

MOOCs:

1. **https://www.coursera.org/specializations/optical-engineering**
2. **https://www.coursera.org/learn/smart-device-mobile-emerging-technologies**
3. **https://www.coursera.org/learn/wireless-communications**
4. **https://www.coursera.org/learn/life-health-radiation**

Other Web Resources:

1. Optical fibre communication: https://nptel.ac.in/courses/117/101/117101054/
2. Wireless communication: https://nptel.ac.in/courses/117/102/117102062/
3. Antenna design: https://nptel.ac.in/courses/108/101/108101092/

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
EE1211.1					1		1		1							2	2
EE1211.2						1			1	1						1	2
EE1211.3	2		2		1		1	1	1							2	1
EE1211.4			2	2	1	1	1	1								2	1
EE1211.5			2	2	1	1	1	1	2				1	1		2	2
EE1211.6			2	2	1		1	1	2	1			1	1		1	2
EE1211.7						1		1		1				2	1	2	2

Course Title and Code:	**Advances in Power Delivery; EE1213**
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech Sem VII EE

Course Objective- This course will prepare students to provide a comprehensive knowledge of distribution automation, extra high voltage transmission and HVDC systems. This course will also enable students to design and simulate FACTs devices and protection systems. This course builds upon the foundation laid in the courses on power systems.

Course Outcome:

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

EE1213.1 Assess the role of candidate distribution automation in distribution system and analyze challenges and applications in distribution automation system.

EE1213.2 Analyze converter performance for HVDC systems.

EE1213.3 Design protection systems for generators, transmission lines, and transformers.

EE1213.4 Design and evaluate voltage improvement strategies for reactive power injection

EE1213.5 Modeling and performance evaluation of extra high voltage transmission system.

Prerequisites		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	25
03	Class Participation	05
04	Quiz	Nil
05	Theory Exam-I	Nil
06	Theory Exam-II	20
07	Theory Exam-III	30
08	Report-I	Nil
09	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)	**100**

Retest

1	Theory Exam	30
2	Lab Evaluation-II	10

Syllabus (Theory):

UNIT-I Distribution System & Automation

Distribution of power, future distribution systems, distribution system topology and structure, distribution automation (DA) and control, DA function, distribution

management systems, voltage/var control, reconfiguration of distribution systems, intelligent systems in DA, concept of smart metering, area network, advanced metering infrastructure, information flow of system monitoring, typical distribution with communication link.

UNIT-II EHV AC transmission

Engineering Aspects of EHV AC Transmission System: Principles, configuration, special features of high voltage AC lines, power transfer ability, reactive power compensation, bundle conductors, right of way, tower configuration

UNIT-III HVDC transmission

Types of D.C. links, advantages, and disadvantages of HVDC transmission, Basic scheme and equipment of converter station, Ground return, DC link control and basic converter control characteristics, HVDC circuit breaker, Applications.

UNIT-IV FACTs

Introduction to FACTs controllers, types of FACTs controllers, Brief description of STATCOM, Thyristor controlled series capacitors and unified power flow controller, Thyristorised static VAR compensators, and UPFC.

UNIT-V Protection Schemes

Overcurrent and overvoltage protection of transmission lines, differential protection, transformer protection, generator protection, induction motor protection, Bus bar protection, distance protection scheme.

Course Syllabi (Practical):

19. Fault scenario simulation in a feeder , Transformer and Bus
20. Load Transfer from one Feeder to other during Transformer Maintenance
21. Monitoring Feeder parameter from workstation
22. Development of 11KV/433 volts substation automation scheme using PLC for normal load operation
23. Development of 11KV/433 volts substation automation scheme using PLC for cyclic ON/OFF load control
24. Calculation of ABCD Parameters for Short, Medium and Long Transmission Lines.
25. Reactive power compensation of a transmission line using STATCOM
26. Modeling of FACTS devices using MATLAB.
27. Study under/over frequency relay and check it's setting experimentally.
28. To study the directional over-current relay in virtual lab environment.

Text Books:

1. Nagrath Kothari, "Modern Power System Analysis", TMH
2. R. D. Begamudre, "EHV AC. Transmission Engineering" Wiley Easter Ltd. New Delhi.
3. K. R. Padiyar,"HVDC Power Transmission Systems", New Age International.

4. Badari Ram, D.N Viswakarma, "Power System Protection and Switchgear" by TMH Publications.

Reference Books:

1. J. J. Grainger & W. D. Stevenson, "Power System Analysis", TMH.
2. H.V.D.C. Transmission – P.Kundur, TMH.
3. B Ravindranath and M Chander, "Power System Protection and Switchgear" TMH
4. Sunil S Rao, "Switchgear and Protection" by Khanna Publishers.

Online Resources:

- Virtual lab available on http://sa-nitk.vlabs.ac.in/index.html#
- Introduction to Smart Grid: https://nptel.ac.in/courses/108/107/108107113/
- FACTs Devices: https://nptel.ac.in/courses/108/107/108107114/
- Power System Protection and Switchgear: https://nptel.ac.in/courses/108/107/108107167/

CO		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
EE1213.1			1				1								1	2	1
EE1213.2			1				1									1	1
EE1213.3							2		2		1	2		2	2	2	2
EE1213.4			1				2		2		1	2		2	2	2	3
EE1213.5							2		2		1	2		2	2	2	2

Course Title: Fintech in Retail Banking and Insurance
Course Code: FA1151
Credits: 3
Semester: B.Tech VII, BBA V

Course Objective:

The course provides overview of how fintech is transforming retail banking and insurance in India.
It provides an overview of various retail banking products (liabilities, 3rd party sales, assets) and insurance products covering in brief product features, sales channels and associates risks.
The course will help prepare students for career in retail financial services industry,

Course Outcomes:

FA1151.1 Introduction to retail banking & its various facets
FA1151.2 Introduction to insurance and its various facets
FA1151.3 How Fintech is transforming functions across insurance and retail banking and opportunities ahead

Course Content/Topics to be covered:

- Chapter 1: History of banking and evolution of retail banking
- Chapter 2: History of Insurance and introduction to Insurance business
- Chapter 3: Evolution of Fintech and introduction to Fintech
- Chapter 4: Retail liability products
- Chapter 5: Third party products
- Chapter 6: Loan calculator
- Chapter 7: Retail asset products
- Chapter 8: Credit Bureau
- Chapter 9: Life insurance products & roadmap
- Chapter 10: General insurance products and roadmap
- Guest lecture by Insurance experts
- Chapter 11: Fintech… payment gateways
- Chapter 12: Fintech… lending
- Chapter 13: Fintech… third party products brokerage, insurance, mutual funds
- Guest lecture by Fintech industry experts
- Chapter 14: Life journey of an individual… saving, insurance and retirement planning
- Chapter 15: Introduction to financial inclusion, small finance banks, microfinance and guest lecture by Small Finance Bank/ MFI expert… Optional
    - Presentation by students

Evaluation Scheme:

Component	Weightage (100)
Minor Projects (5, 10% each)	50%
Mid Term Quiz (30th Sep)	10%
End Term Exam	40%

References (Textbooks/case studies/articles):

Retail Banking by Indian Institute of Banking by Mocmillan Education… 2018 edition
India Fintech Report 2020-> presentations shared with students Project works assigned Course Material presented by the instructor Praveen Arora

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
FA1151.1	1				1								1	1			
FA1151.2	1				1								1	1			
FA1151.3	1				1		1	1	1				1	1			

PS1102/ PR1105

Practice School-II/ Entrepreneurial Project/ Semester at a partner University

Course Syllabi:

This course is for five four and half months (summer and one semester) in VII or VIII Semester. The objective of this programme is to provide the students, an opportunity to work on live projects of corporate world in various fields. During this programme, they will work on real world applications of their curricula through organizational function of their choice. The students are expected to be involved directly in problem solving efforts of specific interest to the host organization. The learning of PS-I will help them in completing PS-II successfully. PS-II duration of internship is 4 - 4.5 months. PS -II Winter internship Dec to May.

Course Code	Course Title	Teaching Scheme	
		Total Duration	Credits
PS1102/ PR1105	Practice School-II/ Entrepreneurial Project/ Semester at a partner University	4 months	16

Evaluation Scheme:			
Expert Evaluation	Evaluation Component	Mid-Term	Final Term
Industry Expert	Day to Day Task Record	20	40
	Report Content & Presentation	10	30
JKLU faculty	Reporting Activity Fortnightly	8	18
	Presentation, Viva, Report	20	50
	PS-2 Coordinator Feedback	2	2
	Total	**60**	**140**

Course Title and Course Code	**Research Project (PR1104)**
Duration	**16 weeks**
Credits	**16**
Students who can take	**B. Tech Semester-VIII**

Course Objectives:
The aim of this course is to expose students to the research conducted in computer science. The students are expected to identify, formulate and solve a research problem.

Course Outcomes: On successful completion of Research Project, the students will be able to:
PR1104.1: Apply skills and knowledge to identify research problems.
PR1104.2: Analyze the related work around the identified research problem.
PR1104.3: Design efficient solutions to solve the identified problem.
PR1104.4: Evaluate, test and compare the methodology used to solve the problem.

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	NIL
2	Assignment	NIL
3	Participation (Interaction with guide)	15
4	Quiz	NIL
5	Theory Exam-I (Synopsis)	15
6	Theory Exam-II	NIL
7	Theory Exam-III	NIL
8	Report-I	30
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)	NIL
15	Lab Evaluation-II (Examination)	NIL
16	Course Portfolio	NIL
17	Presentation	20
18	Viva	20
Total (100)		**100**

Evaluation scheme for Retest		Marks
1	Report-I	30
2	Viva	20
Total		**50**

Course specific CO's contribution to PO/PSO	Rate the level of course specific CO's corelated with POs/PSOs (1: Low Corelation; 2: Moderate; 3: Substantial corelation) Leave Blank if Not Corelated																
	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
PR1104.1		1	1	1	1	1	1									2	2
PR1104.2					1	1	1	1	2	2				2	2	2	2
PR1104.3					1	1	2	1	2	2	1	1				2	3
PR1104.4					2	2	1	3	2	2	1	1				2	3

Program Articulation Matrix - (B. Tech EEE) Batch 2019-23

S.No.	Course Code	Course Title	Credit	Year	Semester	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
1	ES1101	Computational Data Analysis	10	1	1	0.00	0.33	0.56	0.00	1.00	0.78	0.00	0.67	0.00	0.33	0.89	0.00	0.56	0.56	0.00	0.00	0.00
2	ES1102	Design and Prototyping	6	1	1	1.17	0.17	0.17	0.17	1.17	0.67	0.67	0.17	0.00	0.00	0.33	0.33	0.33	0.67	0.00	0.00	0.00
3	AS1101	Experimental Science	3	1	1	1.00	0.00	0.25	0.00	0.38	0.13	0.25	0.00	0.00	0.00	0.50	0.00	0.25	0.13	0.13	0.00	0.00
4	CC1101	Fundamentals of Communication	2	1	1	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.60	0.00	0.40	0.00	0.00	0.00	0.00
5	ES1103	Calculus and Applied Mechanics	6	1	2	0.50	0.00	0.00	0.00	0.38	1.75	1.38	0.00	0.25	0.00	0.88	0.00	0.75	0.00	0.00	0.00	0.00
6	ES1104	Fundamentals of Automation Engineering	6	1	2	0.50	0.00	0.00	0.00	0.92	0.33	0.25	0.33	0.25	0.00	0.00	0.50	0.17	0.67	0.00	0.00	0.00
7	CS1101	Object Oriented Programming	3	1	2	0.00	0.00	0.00	0.00	0.50	0.50	0.25	0.00	0.00	0.00	0.50	0.50	0.00	0.50	0.00	0.00	0.00
8	ES1105	Energy and Environment Studies	2	1	2	0.67	0.33	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00
9	CC1102	Critical Thinking and Story telling	2	1	2	0.00	0.00	0.50	0.00	0.00	0.25	0.00	0.25	0.00	0.00	0.25	0.00	0.75	0.00	0.00	0.00	0.00
10	AS1102	Scientific Perspectives	2	1	2	0.50	0.25	0.00	0.00	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00
11	CS1102	Data Structures	4	2	3	0.83	0.17	0.33	0.33	1.00	0.50	0.33	0.00	0.00	0.17	0.17	0.50	0.33	0.00	0.00	1.33	2.00
12	ES1106	Computational Engineering Analysis - I	5	2	3	0.10	0.10	0.00	0.00	1.40	1.00	0.80	1.00	0.40	0.20	0.60	0.60	0.00	0.10	0.10	0.00	0.00
13	ES1107	Engineering Measurements and Machines	5	2	3	0.80	0.40	0.40	0.20	1.20	1.20	1.00	0.80	0.60	0.00	0.80	0.40	0.40	0.20	0.00	0.00	0.00
14	EE1101	Electronic Devices & Circuits	4	2	3	0.40	0.00	0.40	0.00	0.80	0.60	0.20	0.60	1.00	0.60	0.00	0.00	0.00	0.40	0.00	1.40	1.00
15	CC1103	Perspectives on Contemporary Issues	2	2	3	0.50	0.00	0.50	0.00	0.00	0.25	0.00	0.25	0.00	0.00	0.75	1.00	0.75	0.00	0.00	0.00	0.00
16	IL1101	Management Perspectives	2	2	3	1.25	0.25	0.25	0.25	0.50	0.00	0.00	0.00	0.00	0.00	0.75	0.25	0.50	0.00	0.00	0.00	0.00
17	ES1109	Computational Engineering Analysis - II	5	2	4	0.57	0.14	0.43	0.00	1.00	1.43	1.00	1.00	0.00	0.29	0.57	0.00	0.14	0.71	0.00	0.00	0.00
18	EE1105	Signals and Control Systems	5	2	4	0.91	0.09	0.09	0.18	0.82	0.27	0.73	0.09	0.09	0.09	0.09	0.00	0.18	0.18	0.09	0.91	0.55
19	CC1104	Communication and Identity	2	2	4	0.25	0.00	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.75	0.00	0.00	0.00
20	IL1102	Introduction to Design	2	2	4	1.14	0.00	0.14	0.00	0.00	0.14	0.86	0.43	0.14	0.14	0.00	0.00	0.57	0.43	0.00	0.00	0.00
21	EE1109	Analog and Digital Communications	4	3	5	0.50	0.33	0.33	0.17	0.50	0.33	0.83	1.00	1.00	0.33	0.67	0.33	1.00	0.50	0.00	1.33	2.00
22	EE1102	Analog Circuits	4	3	5	1.14	0.00	0.00	0.00	0.43	0.00	0.00	1.14	0.00	0.29	0.00	0.00	0.00	0.29	0.00	1.14	0.57
23	CC1105	Understanding and Managing Conflict	2	3	5	1.00	0.00	0.20	0.00	0.00	0.00	0.00	0.20	0.20	0.00	1.20	0.40	0.80	0.00	0.00	0.00	0.00
24	EE1111	Introduction to Internet of Things (IoT)	2	3	5	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.71	0.57	0.86	0.71	0.00	0.29	0.43	0.00	0.00	0.00
25	PR1101	Automation Projects	2	3	5	0.80	0.00	0.00	0.00	0.80	0.40	0.80	0.00	0.40	0.40	0.00	0.40	0.00	0.60	0.00	0.00	0.00
26	CC1106	Critical Thinking for Decisions at Workplace	2	3	6	0.75	0.00	0.00	0.00	0.00	0.25	0.25	1.00	0.25	0.00	0.75	1.00	1.00	0.00	0.00	0.00	0.00
27		Flexi core (EE1104 : Electromagnetics and Microwaves)	4	2	4	0.13	0.00	0.38	0.13	0.63	0.25	0.13	0.38	0.75	0.50	0.00	0.25	0.25	0.38	0.00	1.88	1.13
28		Flexi core (EE1110: Digital System Design)	4	3	5	1.00	0.00	0.00	0.00	0.60	0.40	0.00	0.20	0.40	0.40	0.00	0.00	0.00	0.80	0.00	1.60	1.40
29		Flexi core (EE1115: Digital Signal Processing)	4	3	6	0.14	0.00	0.29	0.29	0.86	0.43	0.57	1.14	1.00	1.00	0.00	0.43	0.29	0.43	0.00	2.00	1.29
30		Flexi core (EE1208 : Digital Communication Networks)	4	3	6	0.25	0.00	0.75	0.63	0.88	0.13	1.00	0.75	1.63	0.75	0.00	0.00	0.13	0.38	0.00	1.88	1.88
31		Emerging Tech Week (CS1121)	3	6	4	0.333	0	0.167	0	0.5	0.333	0.333	0.167	0	0.333	0	0	0.167	0.333	0	1.667	1.667
32	PR1103	Minor Project	4	7	4	0.5	0	0.5	2	1.5	1	1	0.75	1	0	0.5	1	0	1	1	1.75	1.5
33		DE-I (EE1214)	4	3	5	0.10	0.00	0.00	0.00	0.20	0.20	0.40	0.00	0.00	0.10	0.00	0.40	0.00	0.00	0.00	0.00	0.00
34		DE-II (EE1216)	4	3	6	0.00	0.00	0.00	0.00	0.00	0.57	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29
35		DE-III (EE1219)	4	3	6	0.5	0	0.2	0.2	0	0.3	0	0	0.4	0.2	0.1	0	0.2	0	0.2	0.6	0.4
36		DE-IV	4	4	7	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	2.00	2.00
37		DE-V	4	4	7	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	2.00	2.00
38		DE-VI	4	4	7	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	2.00	2.00
					Total	18.63	2.57	7.33	4.78	18.77	14.98	14.45	13.03	10.53	6.98	11.94	8.30	11.70	10.41	1.52	23.49	21.65
	Desired Competence Level (N - Novice, AB - Advanced Beginner, C - Competent)					C	N	N	N	C	AB	AB	AB	AB	N	AB	AB	AB	AB	N	C	C

Note:
The above-mentioned contributions of the already taught flexicore/emerging tech and department elective courses is the minimum contribution out of multiple options given to students.
Contribution of courses to be taught is specified as minimum expected contribution.
Open Electives, Practice School 1 and Practice School 2 are excluded from above calculation and their contribution towards attainment of PS and PSO is in addition.
* TBD: To be decided.