HANDBOOK

COURSE STRUCTURE AND DETAILED SYLLABUS

B. Tech Programme

Batch: 2018-22

INSTITUTE OF ENGINEERING AND TECHNOLOGY

JK LAKSHMIPAT UNIVERSITY

Near Mahindra SEZ, Mahapura, Ajmer Road, Jaipur 302 026

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CONTENTS

Program Education Objectives

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

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

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

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

PEO4: Effectively communicate about technical and related issues.

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

Program Outcomes

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

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

PO 2: Citizenship, Sustainability, and Professional ethics

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

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

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

PO 3: Engineering knowledge and Modern tool usage

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

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

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

PO 4: Complex problem solving, Design and Research

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

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

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

PO 5: Individual & team work and Engineering management

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

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

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

PO 7: Innovation and entrepreneurship:

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

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

Program Specific Outcomes

B.Tech. (Electrical and Electronics Engineering)

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

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

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

JK Lakshmipat University, Jaipur

Institute of Engineering and Technology

Department of Electrical and Electronics Engineering

Course Structure for the B. Tech (Batch 2018-2022)

Semester	Courses							(L T P S) Credits	Hrs/ Week
I	Calculus and Applied Mechanics	Design and Proto-Typing	The Power of Story Telling						
	BES101	BES102	CCT101						
	(6 2 0) 6	(6 2 0)6	(2 1 0)3					15	19
II	Computational Data Analysis	Fundamentals of Automation Engineering	Fundamentals of Critical Thinking	Experimental Physics	Environmental Studies	Articulation and Elocution			
	BES201	BES202	CCT201	PH202	ID201	CCT202			
	(10 2 0) 10	(6 2 0) 6	(2 0 0)2	(1 0 4)3	(2 0 0) 1	(6 Hrs. in Sem) Audit		22	29
III	Data Structures	Computational Engineering Analysis-I	Engineering Measurements and Machines	Electronic Devices and Circuits	Perspectives on Contemporary Issues	Programming Week			
	CS1102	ES1106	ES1107	EE1101	CC1103	CS1104			
	(3 0 2) 4	(3 1 2) 5	(3 0 4) 5	(3 0 2) 4	2	2		22	25
IV	Analog Circuits	Computational Engineering Analysis-II	Advanced Electrical Machines EE1103/ Electromagnetics and Microwaves	Signals and Control Systems	Communication and Identity	Introduction to Design			
	EE1102	ES1109	EE1104	EE1105	CC1104	IL1102			
	(3 0 2) 4	(3 1 2) 5	(3 0 2) 4	(3 0 4) 5	2	2		22	25
	Practice School - I (PS 1101) – (4 to 6 Weeks Duration)							4	
V	Power Systems-I EE1107/ Digital Systems Design EE1110	Analog and Digital Communications	DE-I	OE-I	Understanding and Managing Conflict	Introduction to IoT			
		EE1109			CC1105	EE1111			
	(3 0 2) 4	(3 0 2) 4	4	4	2	2		20	22
VI	Industrial Electronics EE1112/ Digital Communication Networks EE1208	Power System- II EE1114/ Digital Signal Processing EE1115	DE-II	DE-III/OE-II	Critical Thinking for Decisions at Workplace	Emerging Tech Week	Automation Projects		
					CC1106		PR1101		
	(3 0 2) 4	(3 0 2) 4	4	4	2	2	2	22	17-22
VII	DE-IV	DE-V	DE-VI	OE-III	Minor Project PR1103				
	4	4	4	4	4			20	20
VIII*	Practice School - II /Entrepreneurial Project/Research Project/Semester at a partner University PS1102/PR1105/PR1104/							16	
Total Credits								163	

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B.Tech (EEE) Batch: 2018-22		
Course Code	**Course Name**	**Page No.**

Course Title and Code Calculus and Applied Mechanics BES101	
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:

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

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**
Evaluation policy for 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, kinematics and kinetics of particle, impulse-momentum (linear, angular); impact, projectile motion.

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 mechanicsfor 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 Title and Code Design and Prototyping: BES102	LTP (620)	Credits 6

Course Description

The objective of this course is to open the students to learn free and lateral thinking and initiate creative problem-solving. The course will encourage students to learn through hands-on experience and break away from traditional learning methods. This course will initiate by introducing the role of design thinking in process of designing a product and it will emphasize the role of research in the design process. The course will run by providing the operational skills to conduct design research and how to use the research insights for creating a product. Students will also get the exposure to manufacturing techniques such as casting, forging, joining, laser cutting, 3D printing etc. In a nutshell, the course will move around the user-centric approach of design research and methods for working out an appropriate solution for a problem space.

Prerequisites		**None**
Hours per Week		**L-T-P: 6-2-0 /In Class-Out Class: 6-12**
Credits		**6**
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	20
04	Quiz	05
05	Theory Exam	Nil
06	Theory Exam	Nil
07	Theory Exam	Nil
08	Report-1	10
09	Report-2	10
10	Report-3	10
11	Project -1	15
12	Project -2	15
13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil

16	Course portfolio	05
	Total (100)	**100**

Syllabus

Basics engineering drawing with AutoCAD, Fundamental manufacturing processes including metal joining, metal cutting, additive manufacturing, laser cutting, casting, sheet metal working etc.

Basic Design cycle, project definition, vision in product designing, base of pyramid model, context mapping, mind mapping, Life cycle analysis, process tree, SWOT analysis, VRIO analysis, perpetual mapping, Fish trap model, SCAMPER, WWWWWH, PreMo, C-Box, vALUE, Design Drawing, TecDoc.

Reference / Text Books

1. "The Design of Everyday Things" by Donald A. Norman

The Power of Storytelling

Course Code: CCT101

Credit: 3

L-T-P: 2-1-0

Course Description:

This course gets students started on the journey of storytelling by observing the world and themselves and weaving a narrative. At the end of this course the students will be able to observe, think, create and narrate their stories in an effective manner

Syllabus:

Concept of a Story- Build common understanding about the course, Introduction of the course and the concept of stories; How Stories Begin- Source of stories in our lives; Story Mapping- Introduction of Story Mapping ,Elements of Story Mapping, Use of elements in creating stories; Story Boarding- Introduction of Story Boarding, How story Boarding is used, Use of Story Boarding in creating stories; Identifying Different Narratives- Everyone and everything has a story, How different stories impact us; Power of Observation - Introduction of sensorium, How sensorium help us to create a story; The Art of Listening- Why listening, Active and passive listening, Be an active listener ; Creating Stories- Detailed practice of different importance components of storytelling- i. Delivery – Overcome stage fear, work on body language, ii. Content – Create story, Edit, iii. Voice - Voice modulation, enunciation, pronunciation

Evaluation Scheme:

Sr. No	Specifications	Marks
01	Attendance	10
02	Assignment	70
03	Class Participation	20
	Total (100)	**100**

References for Reading:

1. Unleash the Power of Storytelling: Win Hearts, Change Minds, Get Results, *Author: Rob Biesenbach , Publisher: Eastlawn Media (19 February 2018)*
2. Story worthy: Engage, Teach, Persuade, and Change Your Life through the Power of Storytelling
   Author: Mathew Dicks, Publisher: Publisher: New World Library - New World Library - New World Library (15 May 2018)

Course Title: Computational Data Analysis (BES201)

Course Description: This course introduces computational analysis of data based on Linear Algebra Principles and Statistics. The computational analysis will include learning and utilizing Python as a programming language. This course will lead to a technical project that will include learnings from the course duration.

Course Outcomes

After course completion, the student will be able to

1. Write Simple Python programs using Various Datatypes, Control Structures, Decision Statements, Libraries, Functions (M1)
2. Develop Python programs using Classes and Objects, File Handling, Exception Handling, etc. (M2)
3. Develop Programs for Analyzing and interpreting Complex situations in various domains including sustainable development by combining various Linear Algebra, Statistics and Other Problem Solving Techniques (M3)
4. Model Complex systems as Linear simultaneous equations and analyze the same using Matrix methods (M1)
5. Model Data as matrices and Find Eigen Values and Eigen Vectors and Apply the same for problem solving, e.g., ranking and performance analysis (M1)
6. Perform Support Vector Decomposition on Matrices (M1)
7. Summarize and Visualize different datasets (M2)
8. Analyze and interpret different datasets using Discrete and Continuous Probability Distributions and Apply the same for problem solving, e.g., Goodness of Fit (M2)
9. Formulate and validate parametric hypothesis with reference to different datasets (M2)
10. Apply correlation, regression, least square method and time series analysis for modeling, analysis, interpretation and forecasting (M2)

Teaching Scheme and Credits

Hrs. per Week		Credits	Duration in Weeks
In Class	Out Class	10	12
10	20		

Evaluation Scheme

Sr. No	Specifications	Weightage (in percentage)
01	Attendance	Nil
02	Assignment	16
03	Class Participation	14
04	Quiz	Nil
05	Theory Exam	10
06	Theory Exam	10
07	Theory Exam	Nil
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	10

12	Project -2	10
13	Project -3	30
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
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, Exception Handling, 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, Singular Vector Decomposition(SVD) and Principal Component Analysis (PCA)

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, Time Series Analysis, Forecasting, Reliability, Quality Control

Reference Books

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

Fundamentals of Automation Engineering BES202
Credit: 6; Contact Hours – 2 Hrs/week

Course Description: This course aims at building key technical competencies needed by automation engineers. It is focused on basic knowledge and critical understanding of different technologies in the design and maintenance of automation systems.

Course Outcomes
On successful completion of this course, the students should be able to:
1) propose and implement a complete solution for a simple automation problem, including power supply, actuator, sensor, sensitized with energy usage and effects on environment.
2) evaluate the benefits and challenges of automation technologies
3) explain the importance of adopting suitable engineering standards for automation projects
4) use basic management practices for developing automation projects

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

Evaluation Scheme

Sr. No	**Specifications**	Regular student(s)
01	Attendance	Nil
02	Assignment (04)	20
03	Class Participation & Attendance	5
04	Quizzes	5
05	Theory Exam I	10
06	Theory Exam II	Nil

07	Theory Exam III	20
08	Report -I	Included with Project
09	Report-II	Included with Project
10	Report-III	Included with Project
11	Project -I	Included with Project
12	Project -II	10
13	Project -III	10
14	Lab Evaluation I (End Term)	20
15	Lab Evaluation II	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus:

- Electric Circuit Analysis: Application of network Theorems, Laplace Transform, Application of network Theorems. Laplace Transform for solving equations for reactive components. Concept of Phasors and Phasor diagrams, power factor calculations. Smart energy meter. Single phase and three phase wiring and balancing of loads.
- Transformers and power supply(rectifiers). Safety in handling Electrical equipment.
- Working principle of DC Motors, PWM for speed control, Principle of working of Servomotors, Introduction to control system: open and closed loops. Block diagrams, PID control of servomotors, Mechanical models. Actuators, DC motor. PWM. DC servomotor, Brushless motors - AC motor, Introduction to Feedback Controllers
- Digital circuits for automation: Boolean Algebra, Karnaugh map, Logic gates, Decoders and Multiplexers, Displays, Counters and Timers (555) and applications. Architecture of ATMega328 (concepts on ALU, memory, ports). Implementing logical functions using microcontroller programs.
- Familiarization with standards on Instrumentation and Measurements. Significance of SCADA and HMI in automation projects. Working principle of Sensors and their interfacing to microcontrollers Movement detection, gyro motors, vision, sonar, laser, tactile, calibration of few analog sensors.

Textbooks:

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

Reference Books:

1. B. L. Theraja,A. K. Theraja, "A Textbook of Electrical Technology, Volume I: Basic Electrical Engineering", S. Chand Publication.
2. C. L. Wadhwa, "Basic Electrical Engineering", New Age Int. (P) Limited, Publishers.
3. Giorgio Rizzon, "Fundamentals of Electrical Engineering", McGraw-Hill Higher Education.

4. Charles A. Gross Thaddeus A. Roppel, “Fundamentals of Electrical Engineering”, CRC press.
5. B. K. Ghosh, Ning Xi, T. J. Tarn, “Control in Robotics and Automation: *Sensor- Based Integration*” Academic Press.
6. Boris J. Lurie, Paul J. Enright, “Classical Feedback Control” Marcel Dekker Inc. publication.
7. Digital Logic and Computer Design Fundamental by Morris Mano,Pearson Publication, 5th Edition.
8. Programming and Customizing the AVR Microcontroller by Dhananjay Gadre, 1st Edition, Mc Graw Hill Publication, ISBN-13: 978-0071346665
9. Computer based industrial control, Kant, Krishna, New Delhi: PHI, 2013, c2010, ISBN-9788120339880
10. Modern control system, Richard C Dorf and Robert H Bishop, New Delhi Pearson c2008, ISBN: 9788131718872

Fundamentals of Critical Thinking

Course Code: CCT201

Credit: 2

L-T-P: 2-0-0

Course Description:

This course will train students to observe and think from multiple perspectives, examine information and knowledge critically, analyze skillfully, evaluate and take a well-reasoned position.

Course Outcomes:

Students will be able to

- Formulate intelligent questions
- Evaluate information and evidence for correctness, consistency, and relevance
- Compose well-structured and well-reasoned arguments
- Evaluate an argument for consistency, logical validity, coherence, breadth and width, and relevance.

Course Content:

- **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.
- **Application of Critical Thinking-** Students will learn to use critical thinking in workplace and business scenarios, case studies and write with a critical voice. They will learn to critique the information they gather.

Evaluation Scheme:

Sr. No	**Specifications**	**Weightage (in percentage)**
01	Attendance	10
02	Assignments (4)	35

03	Class Participation	10
04	Theory Exam	25
05	Report-1	10
06	Project -1	10
	Total (100)	**100**

References for Readings:

1. Fisher, A. (2011). *Critical thinking: An introduction*. Cambridge University Press.
2. Fisher, A., & Scriven, M. (1997). *Critical thinking its definition and assessment*. Centre for research in Critical Thinking.
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.

Articulation and Elocution

Course Code: CCT202

Credit: Audit Course

Total Number of Contact Hours: 6 Hrs.

Course Outcomes:

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

- Use richer vocabulary in their communication appropriate to the context.
- Use appropriate grammar, vocabulary and style which are essential to professional-level reading, writing, speaking, listening, and editing.
- Apply various strategies to make the speeches/ conversation interesting and captivating.
- Using the sentence structure effectively and connect ideas logically within a paragraph.
- Write descriptions on various objects and topics.

Course Outline (Tentative Session Plan):

Sessions	Content	Activities
1	Listening	• To inculcate the skills of content prediction, inference and discourse coherence. • Acquire proficiency in Prosodic Features (Pronunciation, enunciation, pitch, intonation/voice modulation)
2	Ideation and Expression	• Proving situation/context to trigger thinking process • Just Minutes • Role Play/ Situational Dialogues • (Oral Narration) Describing people, places, events and things
3	Reading	• Distinguishing the main idea and supporting ideas • Transcoding information to diagrammatic display, recognizing indicators in discourse, understanding conceptual meaning and summarizing. • Reading and writing skills will be targeted simultaneously.
4.	Writing	• To throw some light on the features of the connected speech/ composition such as use transitional words, connectives, etc. • To explain various strategies for the organization of ideas such as introduction, development, transition, conclusion, emphasis, explanation and anticipation.
5	Vocabulary Building	• Introducing Idioms, Proverbs, Phrasal verbs and asking them to use the same. • Connotative and denotative meaning of the words.
6	Collecting and Analyzing Information	• Assigning students to read books, newspapers, magazines and stories to learn from, assess and improve analytical ability. • Allotment will be done before the class.

Evaluation Scheme:

Sr. No.	Evaluation Component	Weightage (%)
1	Attendance	10
2	Assignment(s)	30
3	Class Participation	10
4	Quiz	10
5	Project-I	15
6	Lab Evaluation-I	25
	Total (100)	100

References for Reading :

1. Sanjay Kumar & Pushp Lata “Communication Skills”. New Delhi: Oxford University Press, 2011.
M Ashraf Rizvi “Effective Technical Communication”. Chennai, McGraw Hill Education, 2018

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
ID 201	Environmental Studies	2	0	0	0	2

Evaluation Scheme (Theory)					Evaluation Scheme (Practical)				
Mid Term Test – I	Mid Term Test – II	End Term Test	Class Participation/ Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks
20	20	40	20	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Course Syllabi (Theory):

- Understanding environment, The global crisis, Basic Concepts
- Forest and Grassland ecosystems, Desert Ecosystems, Aquatic Ecosystems
- Introduction to Biodiversity, Biodiversity Conservation
- Water Resources, Energy Resources, Forest Resources
- Land, Food, and Mineral Resources
- Air and Noise Pollution, Water, Soil, and Marine Pollution
- Solid Waste Management and Disaster Management
- Population Growth, Environment and Human Health, Sustainable Development
- Global Warming, Acid Rain, and Ozone Depletion
- Different types of laws and regulations

Text Books:

1. Rajagopalan, R., "Environmental Studies: From Crisis to Cure", Oxford University Press, New Delhi, 2e, 2011.

Reference Books:

1. Ranjit Daniels & J. Krishnaswamy "Environmental Studies", Wiley India.
2. Davis & Cornwell "Environmental Engineering", Mc-Graw Hill.

Course Title and Code

Experimental Physics: PH202

Hours per Week	**L-T-P: 1-0-4**
Credits	**3**

Course Objective

This course is designed to familiarize the student with the fundamental concepts of different phenomenon related with optics, electromagnetism, and modern physics. This course will expose the students with experimental methods of physics and integrates theoretical knowledge and concepts to practical experience.

Course Outcomes:

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

1. analyze ferromagnetic properties of any magnetic material and differentiate Soft and hard materials.
2. analyze thermoelectric effect of metal junctions due to temperature difference.
3. analyze nuclear radiation with respect to distance and thickness of absorbing media.
4. measure electrical properties e.g. specific resistance, high resistance, dielectric constant, time constant of various electrical components.
5. measure resolving power of telescope, dispersive power of prism, specific rotation of optically active medium, e.g., sugar solution, wavelength of radiation, height of objects, coherent length and coherent time of Lasers.
6. measure numerical aperture of Optical Fibre and classify its structures.
7. use Schroedinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials.

Prerequisites		**Knowledge of Basic Science**
Sr. No	**Specifications**	**Marks**
01	Attendance	5
02	Assignment	Nil

03	Class Participation	5
04	Quiz	10
05	Theory Exam	Nil
06	Theory Exam	Nil
07	Theory Exam	20
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	10
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	10
14	Lab Evaluation-1	20
15	Lab Evaluation-2	20
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus

1. To determine the ferromagnetic constants retentivity, permeability and susceptibility by tracing I-H curve using C.R.O.
   Description: CRO, ferromagnetic property of materials, retentivity, permeability and susceptibility, hysteresis loop, Soft and hard materials.
2. To study the variation of thermo-e. m. f. of iron copper thermocouple with temperature.
   Description: Thermocouple, thermos-emf, Seeback effect, Peltier Effect, Thomson effect, Effect of temperature difference on metal junctions.
3. To study the Charge & Discharge of a capacitor and determine time constant.
   Description: Capacitor, types, time constant of RC and LR Circuits, application
4. To determine the high resistance by method of leakage, using a Ballistic Galvanometer.
   Description: Ballistic Galvanometer, high resistance determination.
5. To determine dielectric constant of a material using moving coil Ballistic Galvanometer.

Description: Property of Insulators and Dielectric materials, dielectric constant and dielectric loss

6. To determine the specific resistance of the material of a wire by Carey Fosters Bridge.
   Description: Carey Fosters Bridge, Cell, Specific resistance determination of different materials and study of material property.
7. To convert a Galvanometer in to an Ammeter of range 1.5/3 amp and calibrate it.
   Description: Working principle and different types of Galvanometer and Ammeter and conversion
8. To convert a Galvanometer in to a Voltmeter of range 1.5/3 volt and calibrate it.
   Description: Working principle and different types of Galvanometer and Voltmeter and conversion
9. To study characteristics of G.M. Counting System.
   Description: Nuclear Detectors and Counters, GM Counter, dead time, quenching process, Characteristics, Quantitative analysis of nuclear radiation with distance.
10. To determine the absorption coefficient of lead using lead sheet by G.M. Counting System.
    Description: Nuclear Detectors and Counters, GM Counter, dead time, quenching process, Absorption Coefficient.
11. To measure the Numerical Aperture of an Optical Fibre.
    Description: Optical Fibre, Numerical Aperture, and Maximum Angle of Acceptance.
12. To determine coherent length and coherent time of laser using He-Ne Laser
    Description: Coherence, Coherence length, Coherence time and 'Q' factor for light, Theory of Laser Action, Threshold Conditions for Laser Action, He-Ne Laser, Semiconductor Lasers.
13. To verify the expression for the resolving power of a Telescope.
    Description: Diffraction, Resolving Power, Rayleigh Criterion for resolution
14. To determine the wave length of prominent lines of mercury by plane diffraction Grating with the help of spectrometer.
    Description: Diffraction, Grating, determine the wave length of radiations, intensity analysis, XRD, spectrometer
15. To determine the dispersive power of material of a Prism for Violet Red and Yellow colours of Mercury light with the help of a spectrometer.
    Description: Diffraction, dispersion, Grating, determine the wave length of radiations, spectrometer
16. To determine the wave length of monochromatic light with the help of Fresnel's Biprism
    Description: Interference, Determination of wavelength of unknown light

17. To determine the wave length of sodium light by Newton's Ring

    Description: Interference, Determination of wavelength of unknown light, Determination of refractive index of unknown medium.

18. To determine the wavelength of sodium light by Michelson Interferometer

    Description: Interference, Determination of wavelength of unknown light

19. To determine the specific rotation of Glucose (Sugar) solution using a Polarimeter.

    Description: Polarization, Half Wave plate, Quarter wave plate, Optical Activity, Specific Rotation.

20. To determine the height of object with the help of a Sextant.

    Description: Principle, Sextant

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. Lab Manuals for Physics

Reference Books:

1. Arther Beiser, "Concept of Modern Physics" Tata McGrawHill, New Delhi, 5thedn. 1997.
2. Ajoy Ghatak, "Optics", Tata McGraw Hill, 4th edn.
3. Eyvind H Wichman, "Quantum Physics" Tata McGraw Hill, Volume 4.
4. B.K. Pandey, S. Chaturvedi, "Engineering Physics", Cengage Learning, 2012.
5. D.K. Bhattacharya, Poonam Tondon, "Engineering Physics", Oxford University Press, 2015.

Perspectives on Contemporary Issues

Course Code: CC1103

Credit: 2

L-T-P: 2-0-1

Course Description:

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

Course Outcomes:

The students will be able to:

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

Teaching Pedagogy:

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

Course Content:

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

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

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

- **Nationalist Movement**
  There is a sense that excesses of globalization have created an identity crisis across the world, facilitating the rise of nationalist movements. Rising nationalism is seen everywhere, from the election of Donald Trump to Brexit, the success of far-right parties in Italian, German and Austrian elections in 2017 and 2018, nationalism appears to be on rise globally. We will look at its reasons and implication**.**

- **Technology**
  Impact of unprecedented technological growth, challenges and opportunities.

- **Social justice and human rights**
  An understanding of the impact of inequality and discrimination, the importance of standing up for our own rights and our responsibility to respect the rights of others

Evaluation Scheme:

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

References for Reading:

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

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

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

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

Course Outcomes:

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

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

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

Syllabus (Theory)

Unit I: Introduction to linear Data Structures: Types of Data Structures - Linear & Non-Linear Data Structures. Linear Structures: Arrays: Types, Operations and

applications (searching sequential and binary, Sorting: bubble, Insertion, Selection, Quick and Merge sorting algorithms for different characteristics of input data. Complexity analysis, Comparison of sorting algorithms in term of complexity-time and space.

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

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

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

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

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

Syllabus (Lab):

DS Lab:

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

    i. Insert a node at the front of the linked list.
    ii. Insert a node at the end of the linked list.

iii. Insert a node such that linked list is in ascending order. (according to info. Field)
iv. Delete a first node of the linked list.
v. Delete a node before specified position.
vi. Delete a node after specified position.

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

Text Books:

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

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

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

Reference Books:

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

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

Course Name: Programming Week
Course Code: CS1104
Credits: 2

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

Course Outcomes:

1. On successful completion of this course, the students should be able to:
2. Name and apply some common object-oriented design patterns and give examples of their use.
3. Write programs in Core JAVA.
4. Design, develop and debug software applications taking into account coding and documentation standards.
5. Apply concepts like interfaces and abstract classes in Java program design and implementation.
6. Design and create web based and other applications using practices of object oriented concepts.
7. Use java collection API.
8. Evaluate different integrated development environment e.g. NetBeans, Eclipse with respect to creation.
9. Use energy saving programming practices.

Enterprise Programming Using Java

Unit 1: 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.

Unit 2: Control Structures, Methods & Constructors - Object Oriented Programming in Java: Object Life time & Garbage Collection. Methods & Constructors - Constructor & initialization code block, Parameterized Constructor, Loops, Methods.

Unit 3: 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,

Unit 4: 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,

Unit 5: Interfaces - Inner Class & Anonymous Classes, Abstract Class, Interfaces. Exception Handling - Introduction to Exception handling.

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

Prerequisites		
Teaching Scheme (Hours per Week)		Programming Week
Credits		2
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	
2	Assignment	10
3	Class Participation	10
4	Quiz	10
5	Theory Exam-I	
6	Theory Exam-II	40
7	Theory Exam-III	
8	Report-I	
9	Report-II	
10	Report-III	
11	Project-I	
12	Project-II	
13	Project-III	
14	Lab Evaluation-I*	30
15	Lab Evaluation-II	
16	Course Portfolio	
	Total (100)	100

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

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

Course Outcomes:

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

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

Assessment Scheme:

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

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

Syllabus (Theory):

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

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

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

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

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

Syllabus (LABORATORY):

1. V-I characteristics of Reverse Biased PN junction diode
2. V-I characteristics of Forward Biased PN junction diode
3. V-I characteristics of Zener diode
4. Zener diode as a voltage regulator
5. V-I characteristics of LED
6. Input & Output characteristics of BJT Common Emitter configuration
7. Input & Output characteristics of BJT Common Base configuration

8. Frequency Response of Common Emitter amplifier
9. Drain and Transfer characteristics of FET Common Source configuration
10. Frequency Response of Common Source FET amplifier

Textbooks

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

Reference Books

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

MOOCs

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

Other Web Resources

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

Course Title and Code

Computational Engineering Analysis – I: ES1106

Teaching Scheme	**L-T-P: 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:

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

Prerequisites		**Nil**
Sr. No	**Specifications**	**Marks**
01	Attendance	NA
02	Assignment	NA
03	Class Participation	10
04	Quiz	20
05	Theory Exam I	20

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

Evaluation Scheme for Re-Test		
1	Theory Exam-III	30
	Total	30

Syllabus

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

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

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

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

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

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

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

Textbook:

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

References :

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

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

Course Objectives:

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

Course Outcomes:

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

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

Prerequisites	**Basics of Physics**

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	5
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	20
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	10
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio (MOOC Course)	10
Total (100)		**100**
Evaluation scheme for Retest		**Marks**
1	Theory Exam	20
2	Lab Evaluation (Exam)	10
Total		**30**

Syllabus (Theory):

Unit-I: Measurement, Instrumentation and Calibration

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

Unit-II: Transducers

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

Unit-III: Transformers

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

Unit-IV: Rotating Machines

DC Machines

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

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

Unit-V: Mechanical Machines

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

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

Power Transmission Systems: Mechanical drives and their performance analysis.

List of Experiments:

Measurement

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

Electrical Machines

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

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

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

Mechanical Machines

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

Text Books:

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

Reference Books:

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

Online sources:

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

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

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

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

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

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

Communication and Identity

Course Code: CC1104

Credit: 2

L-T-P: 2-0-1

Course Description:

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

Course Outcomes:

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

Course Contents

1. **Self- identity**
2. **Personal Statement**
3. **Internal confidence or "principle centered living"**
4. **External and internal locus of Identity**
5. **Steps to build Personal Identity**
6. **Online presence**
7. **Elevator Pitch, Cover Letter**

Evaluation Scheme:

Sr. No	Specifications	Weightage	
01	Attendance	Nil	
02	Assignment	30	
03	Class Participation	30	
04	Quiz	Nil	
05	Theory Exam II	Nil	
06	Theory Exam III	25 (Continuous Evaluation)	
07	Theory Exam	15	
	Total (100)	**100**	**100**

References for Reading:

1. O'Brien, T. (2019). When your job is your identity, professional failure hurts more. *Harvard Business Review*.
2. Anca, C., & Aragón, S. (2018). The 3 types of diversity that shape our identities. *Harvard Business Review*.
3. Craig, N., & Snook, S. (2014). From purpose to impact. *Harvard business review*, *92*(5), 104-111.
4. Detert, J. R. (2018). Cultivating everyday courage. *Harvard Business Review*, *96*(6), 128-135.
5. Dutta, S. (2010). What's your personal social media strategy? *Harvard business review*, *88*(11), 127-30.

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

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

Course Outcomes:

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

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

Assessment Scheme:

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

13	Project III	Nil
14	Lab Evaluation I	10
15	Lab Evaluation II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

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

Syllabus:

UNIT I: Feedback topologies

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

UNIT II: Oscillators

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

UNIT III: Differential amplifier

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

UNIT IV: Active filters

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

UNIT V: Design and Standards

Projects using Linear Integrated circuits for minimum power consumption as well as low cost.

Familiarize with 1801-2013 - IEEE Standard for Design and Verification of Low-Power Integrated Circuits.

Projects:

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

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

Text Books:

1. *Op-amps and linear integrated circuit technology,* Gayakwad, Ramakant A. Englewood Cliffs, NJ: Prentice-Hall, 1983**,** ISBN. 0136373550..

2. *Microelectronic circuits*, Adel S. Sedra and Kenneth C. Smith, 5th Edition, Oxford International Student Edition, 2004, *ISBN*-10: 0195142527.

Reference Books:

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

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

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

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

Course Outcomes:

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

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

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

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1104	ELECTROMAGNETICS AND MICROWAVES	3	0	2	0	4

Course Objectives: This course aims to provide fundamental concepts of electrostatics & magnetostatics. Focus is given to field effects in transmission of EM waves & its propagation in guided medium. The course further introduces the concept of microwave network theory, passive devices & microwave generators. There is emphasis on important microwave properties and applications of the various devices & networks like klystrons, magnetrons, couplers, circulators, isolators, etc.

Course Outcomes:

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

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

Sl. No	Evaluation Component	
1	Attendance	2
2	Assignments	25
3	Class Participation	3
4	Quiz	10

5	Theory Exam-I	10
6	Theory Exam-II	0
7	Theory Exam-III	20
8	Report-I/Case Study	5
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	5
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I (Continuous)	10
15	Lab Evaluation-II (Examination)	10
16	Course Portfolio	Nil
Total (100)		**100**
Retest Evaluation Scheme:		
1	Theory Exam-III	20
2	Lab Evaluation-II (Examination)	20
Total (40)		40

Syllabus(Theory):

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

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

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

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

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

UNIT VI: Microwave Generators
Transit-time effect, Limitations of conventional tubes, Two-cavity and multi-cavity Klystrons,

Reflex Klystron, TWT, Magnetrons.

Syllabus (LABORATORY):

1. Set up Microwave components and instruments
2. Characterize Reflex Klystron
3. Measurement of guide wavelength, cutoff frequency, SWR (X band) using microwave test bench
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

Text books:

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

Reference Books:

1. Introduction to Electrodynamics: David J Griffiths, Pearson Education, 2015.
2. Microwave Devices and Circuits by S.Y. Liao, Pearson, 2008.

Web Resources:

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

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1105	Signals and Control Systems	3	0	4	0	5

Course Objective:

To develop an understanding of different type of signals and systems, their conversion and solutions, and control system concepts with more focus on mathematical model formulation, stability analysis, simulation, and industrial applications.

Course Outcomes:

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

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

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

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

Evaluation Scheme:

Sr. No	Specifications	
1	Attendance	NIL
2	Assignment	05
3	Class Participation	NIL
4	Quiz	NIL
5	Theory Exam-I	10
6	Theory Exam-II	NIL
7	Theory Exam-III	30
8	Report-I	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 (Continuous)	20

15	Lab Evaluation-II (Examination)	10
16	Course Portfolio	NIL
	Total	**100**
Retest Evaluation Scheme:		
1	Theory Exam-III	20
2	Lab Evaluation-II (Examination)	10
	Total (30)	**30**

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 software i.e. ANSYS Fluent and MATLAB. Few numerical methods will also be introduced to find the numerical solutions of various problems.

Course Outcomes:

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

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

Assessment Scheme:

Prerequisites		**Elementary Calculus**
Teaching Scheme (Hours per Week)		L T P 3 1 2
Credits		5
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	NA
2	Assignment	10
3	Class Participation	NA
4	Quiz	5
5	Theory Exam-I	15

6	Theory Exam-II	15
7	Theory Exam-III	30
8	Report-I	NA
9	Report-II	NA
10	Report-III	NA
11	Project-I	NA
12	Project-II	NA
13	Project-III	NA
14	Lab Evaluation-I	10
15	Lab Evaluation-II (Continuous)	15
16	Course Portfolio	NA
	Total (100)	100
Evaluation Scheme for Re-Test		
1	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 m-derived type, Advantages of active filters over passive filters.

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

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

Textbook:

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

Reference Books –

1. Thomas' Calculus, M.D. Weir and J. Hass, Pearson.
2. Engineering Mathematics, Srimanta Pal and Subodh C. Bhunia, Oxford University Press, New Delhi, India.
3. Higher Engineering Mathematics, B.V. Ramana, Mc Graw Hill Education.
4. Fox and McDonald, "Introduction to fluid dynamics", John Wiley & Sons.
5. Cengel Y. "Heat and Mass Transfer" Tata McGraw-Hill, New Delhi.
6. J. D. Anderson Jr. "Computational Fluid Dynamics" McGraw-Hill International Edition.
7. Roy Choudhary, "Network Theory", TMH, 3rd Edition, 2004.
8. Edminister Joseph A., "Electrical Circuits, Schaum's Outline Series", Tata McGraw Hill, 3rd edition, 2012.

Course Title: Introduction to Design

Course Code: **IL1102**

Hours per Week	30
Credits	2
Students who can take	2nd Year B. Tech

Course Objective: Taking an idea forward from an intangible thought to a material-based product or visually communicable form requires a definitive plan of action. Using the methods of design thinking and design process the students will be able to bring their ideas to life.

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

1. Sketch their ideas on paper to visualize and assess viability.
2. Create a plan for process and management to materialize the desired idea.
3. Test the material for possibilities and capabilities.
4. Develop skills of joinery, material manipulation and various hand tools.
5. Develop technical and narrative skills useful for both film and animation.
6. 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:

Introduction to Design Process.
Material properties – wire and wood.
Material joinery – Mortise and Tenon, Dowel Joints.
Use of tools – plier, grinder, saw.
Developing creative thinking.
Basic drawing and visualisation skills including 2D to 3D - Form exploration.
Principles of animation.
Technical aspects of animation and film making (Frame rate, persistence of vision).
Building a Narrative – Start, Middle and End of a story.
Mediums of animation.

Suggested Reading Materials:

1. https://www.familyhandyman.com/woodworking/wood-joints/simple-joinery-options/
2. Simple wooden toymaking by Mathias, available at MP Ranjan LRC Call number: 745.592
3. https://www.hsn.com/article/wire-working-how-to-manipulate-wire-to-create-art/449
4. https://savedbylovecreations.com/2013/10/50-awesome-things-to-make-from-wire.html

   (Craft based, to be used as a reference for wire malleability)
5. https://in.pinterest.com/pin/768004542687478864/
6. https://in.pinterest.com/pin/619174648753039614/
7. https://www.youtube.com/watch?v=_ppedXZHhE0 (Stop Motion Basics)
8. https://www.youtube.com/watch?v=p5SygzMSLhM (Stop Motion in Movies)
9. https://www.youtube.com/watch?v=GcryIdriSe4 (12 principles of animation)

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

Course Description

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

Course Outcomes

The students will be able to:

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

Prerequisites		**N/A**
Hours per Week		**L-T-P: 2-0-0**
Credits		**2**
Sr. No	**Specifications**	**Marks**
1.	Attendance	Nil
2.	Assignment	30
3.	Class Participation	20
4.	Quiz	20
5.	Theory Exam-I	Nil
6.	Theory Exam-II	Nil
7.	Theory Exam-III	30
8.	Report-I	Nil
9.	Report-II	Nil
10.	Report-III	Nil
11.	Project-I	Nil

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

Course Content

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

References for Reading:

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

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

Course Objectives:

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

Course Outcomes:

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

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

Assessment Scheme:

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

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

Course Syllabi (Theory):

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

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

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

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

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

Course Syllabi (Practical):

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

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

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

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

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

Course Outcomes:

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

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

Assessment Scheme:

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

7	Theory Exam-III	20
8	Report-I	5
9	Report-II	NA
10	Report-III	NA
11	Project-I	10
12	Project-II	NA
13	Project-III	NA
14	Lab Evaluation-I (Continuous)	15
15	Lab Evaluation-II	15
16	Course Portfolio (partly in lieu of Quiz and Assignments)	10
	Total	100
Evaluation Scheme for Retest		
1	Theory Exam-III	20
2	Lab Evaluation-II	15
	Total	35

Course Syllabi (Theory):

1. Introduction to International Standards Organization (ISO), International Telecommunications Union-Telecommunications Sector(ITU-T), Institute of Electrical and Electronics Engineering (IEEE), American National Standards Institute(ANSI) for Analog and Digital Communication
2. Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals
3. Spectral characteristics of angle modulated signals. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.
4. Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation

(PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

5. Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter Symbol Interference and Nyquist criterion. Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.
6. Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.
7. Use of Digital Communication standards & technique to develop the high data rate communication projects.

Course Syllabi (Practical):

Software

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

References:

1. Communication Systems-B.P. Lathi, BS Publication, 2006.
2. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
3. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
4. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill,2001.

5. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering'',John Wiley, 1965.
6. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication'', Kluwer Academic Publishers, 2004.
7. Proakis J.G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.

Video Lecture:

1. Analog Communication By Prof. Goutam Das, IIT Kharagpur
   https://onlinecourses.nptel.ac.in/noc20_ee69/announcements?force=true#registration_confirmation
2. Digital Communication Systems by Dr. K. Vinoth Babu, VIT
   https://www.youtube.com/playlist?list=PL2ICMuWYlLBjqr9RmrQSx8zi1Q-XJOkbV
3. Principles of Communication Systems – Part I By Prof. Aditya K. Jagannatham, IIT Kanpur.
   https://www.youtube.com/watch?v=XoVLa6Dqd5I
4. Principles of Communication Systems – Part II By Prof. Aditya K. Jagannatham , IIT Kanpur.
   https://www.youtube.com/watch?v=OyWdYkx0PmI&list=PL7EYujdHIJbZ9ZRMTBmYz7i61FppXLT0p&index=1

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

Course Objectives:

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

Course Outcomes:

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

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

Assessment Scheme:

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

8	Report-I (Case Study on Raspberry Pi, IoT)	20
9	Report-II	NA
10	Report-III	NA
11	Project-I	NA
12	Project-II	NA
13	Project-III	NA
14	Lab Evaluation-I (Continuous)	30
15	Lab Evaluation-II	NA
16	Course Portfolio (MOOC certificate)	10
	Total (100)	100
Evaluation Scheme for Retest		
1	Theory Exam-III	20
2	Lab Evaluation-II	0
	Total (40)	20

Course Syllabi (Theory):

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

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

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

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

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

server.

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

References:

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

Video lectures:

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

MOOC course

The Arduino Platform and C Programming

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

Course code	Course Title	Teaching Scheme	
		Sessions	Credits
EE1110	Digital Systems Design	3	4

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

Course Outcomes:

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

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

Syllabus

Review of Combinational and Sequential Circuits

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

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

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

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

Assessment Scheme:

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

Textbooks:

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

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

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

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

Course Outcomes:

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

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

   Or

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

Assessment Scheme:

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

15	Lab Evaluation II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation scheme for retest.		
	Project III (with Report)	**40**
	Total (100)	**40**

Course Title and Code: Minor Project PR1103	
Prerequisites	**Nil**
Hours per Week	**L-T-P:**
Credits	**04**
Students who can take	**B.Tech. Semester VII**

Course Objective:

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

Operation Procedure

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

Assessment Scheme:

Sr. No	**Specifications**	**Marks**
01	Attendance	NIL
02	Assignment	NIL
03	Class Participation	NIL
04	Quiz	NIL

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

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:

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

Pre-requisites		**N/A**
Hours per Week		**L-T-P: 2-1-0**
Credits		**2**
Sr. No	**Specifications**	**Weightage**
01	Attendance	Nil
02	Assignment	**20**
03	Class Participation	**20**
04	Quiz	Nil
05	Theory Exam-1	Nil
06	Theory Exam-2	Nil
07	End term Viva	**30**
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Presentation	**30**
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 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	• Developing intellectual virtues • Paul Elder's model (Intellectual humility, courage, empathy, integrity and confidence.

	Techniques	
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 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 power electronics devices and passive components, their practical applications in power electronics
2. Provide the essential background for analyse, design and synthesis of different power conversion circuits and their applications.
3. Equip students with basic experimental and modeling skills for handling problems associated with power electronic circuits and systems

Course Outcomes:

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

1. Analyze the characteristics of power devices under different load condition
2. Choose appropriate power devices for different requirement of power conversion,
3. Design power electronics system for different requirement and analyse their performance
4. Use technical data of inverter, solar module and lithium ion cell for design and analysis of power electronics system

Assessment Scheme:

Prerequisites		**Power Engineering, Electrical Machines, Electronics Devices and Circuits**
Teaching Scheme (Hours per Week)		L T P (3 0 2)
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	10
15	Lab Evaluation-2	10
16	Course portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Theory Exam-3	30
2	Lab Evaluation-2	10
	Total (40)	**40**

Course Syllabi (Theory):

Unit – I: Power Devices: Brief description of members of Thyristor family with symbol, VI characteristics and applications, AC and DC harmonic analysis ,two transistor model of SCR, Turning method, switching characteristics, ratings, SCR protection, MOSFETS, IGBT and GTO.

Unit – II: Phase controlled converters: Principle of operation of single phase and three phase half wave, half controlled, full controlled converters with R, RL and RLE loads, effects of freewheeling diodes, lithium ion batteries, PV module, data sheet of PV module,

solar inverter and electrical vehicle charging station

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

Unit – IV: Inverters: Classification of inverters, wave shape of output voltage, method of commutation & connections, operation of single phase and three phase bridge inverter with R and RL loads, performance parameters of inverters, harmonic reduction of inverters.

Unit – V: 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. Single Phase Half Wave Uncontrolled Rectifier for R and L load(http://vlabs.iitb.ac.in/vlabsdev/labs/mit_bootcamp/power_electronics/labs/exp1/index.php)
2. Simulation of single phase half wave and full wave diode rectifier with R and R-L load on MATLAB
3. Simulation of single phase half wave phase controlled converter with R and R-L load on MATLAB
4. Simulation of single phase full wave phase controlled converter with R and R-L load on MATLAB.
5. Simulation of single phase full bridge inverter with R load on MATLAB
6. Simulation of single phase full wave AC voltage regulator with R load on MATLAB
7. Simulation of single phase half wave AC voltage regulator with R& RL load on MATLAB.
8. Simulation of DC to DC Buck converter.
9. Design a solar power fed electrical charging station using data sheet of PV module, solar inverter and electrical vehicle.
10. Study and design a battery pack using Lithium Ion batteries.

Text Book(s)

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

Reference Book(s)

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

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

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

Course Outcomes:

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

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

Sr. No	Specifications	Marks (Existing)
1	Attendance	NIL
2	Assignment	10
3	Class Participation	05
4	Quiz	05
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	20
8	Report-I (case study)	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 (Exam)	10
16	Course Portfolio	10
Total (100)		**100**

Evaluation Scheme for Retest:

S. No.	Specifications	Marks
1	Theory Exam-III (End Term)	30

2	Lab Evaluation-II (Exam)	10
3	**Total**	**40**

Syllabus (Theory)

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

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

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

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

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

Syllabus (Practical)

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

Textbooks

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

Reference books

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

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

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

Course Outcomes:

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

1.Analyze the various classifications & operations on signals

2. Analyze the frequency & time domain representations of signals

3. Implement fast Fourier transforms on signals

4. Implement discrete time systems

5. Analyze and solve problems using z transform

6. Implement digital filter design techniques

7. Implement IEEE standards for efficient signal processing

Assessment Scheme:

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

121	Project II	Nil
13	Project III	Nil
14	Lab Evaluation I	10
15	Lab Evaluation II	10
16	Course Portfolio	10
	Total (100)	100
Evaluation Scheme for Re-Test		
1	**Theory Exam - III**	20
2	**Lab Evaluation - II**	20
	Total (40)	40

Syllabus (Theory):

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

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

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

Efficient Computation of the DFT: Fast Fourier Transform Algorithm

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

Implementation of Discrete-Time Systems:

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

Filter Design Techniques:

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

Transformation methods; Design of FIR filters by windowing techniques

Syllabus (LABORATORY):

1. (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

2. Verify the Sampling Theorem
3. Adding and subtracting two given signals (Continuous and Discrete)
4. Analyze and compare Linear and Circular Convolution
5. 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)
6. Computation of DFT and IDFT using direct and FFT methods
7. Generate sum of sinusoidal signals
8. Compute frequency response of analog filters (Low Pass/High Pass)
9. Design and simulate FIR Rectangular/Hamming/Kaiser windows digital filter (Low Pass/High Pass)
10. Design and simulate IIR Butterworth/Chebyshev digital filter (Low Pass/High Pass)

Textbooks:

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

Reference Books:

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

Web Resources:

1. *Digital Signal Processing and its Applications*
   https://onlinecourses.nptel.ac.in/noc21_ee20/preview

2. https://nptel.ac.in/courses/108/105/108105055/

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

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

Course Outcomes:

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

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

Assessment Scheme:

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

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

Syllabus (Theory):

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

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

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

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

Syllabus (LABORATORY):

1. NS2/3 Implementation of congestion control protocol (TCP over IP) after creating a duplex link using nodes in a network
2. Analyze performance of IEEE 802.4 token bus LAN protocol in MAC layer
3. Analyze performance of IEEE 802.5 token ring LAN protocol in MAC layer
4. Implement ARQ stop and wait protocol/sliding window protocol in Data Link layer
5. Implement the different frames of HDLC protocol
6. Execute the Distance Vector Routing and Link State Algorithms
7. Analyze the performance of IEEE 802.3 CSMA/CD LAN protocol operating at MAC layer

8. Execute the go back N protocol/ selective repeat transmission flow control protocol
9. Design and Analyze a wireless sensor network architecture (also with TCP)
10. Design and Analyze a mobile ad-hoc network architecture

Textbooks:

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

Reference Books:

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

Web Resources:

1. *Computer Networks and Internet Protocol*
   https://onlinecourses.nptel.ac.in/noc21_cs18/preview

2. https://nptel.ac.in/courses/117/105/117105076/

Course code	Course Title	Teaching Scheme	
		NA	Credits
EE1217	Machine Vision	3 Hrs	4

Learning Outcomes:

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

4. Implement Image Processing Algorithms using OpenCV tools.
5. Design, Train and Test Neural Networks and deploy suitable activation functions image processing function using Keras/Tensorflow libraries.
6. Identify suitable Performance Parameters and evaluate valuate technique for best performance.
7. Use transfer learning from existing trained networks to develop innovative solutions.

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.

Assessment Scheme:

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

10	Report III	Nil
11	Project I	30
121	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 Re-Test		
1	Theory Exam-III	30
	Total (30)	30

References:

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

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.

Prerequisites: Electrical Machines and Industrial Electronics.

Learning Outcomes

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

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.
2. Design BJT, MOSFET and IGBT gate drive circuits, protection circuits as well as cooling requirements for power semiconductor devices.
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.
4. Analyze square wave, PWM single phase and three phase voltage source inverters for output voltage amplitude and frequency control to drive AC motors.
5. Use 3002.7-2018 - IEEE standards for minimizing transient losses and starting time.
6. Select efficient motor for different type of E-Vehicles to operate in different conditions.
7. 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	15
3	Class Participation	05
4	Quiz	15
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	15
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 (MOOC Course: converter circuits) (optional with Liu of assignment and quiz)	Nil
	Total (100)	
Retest		
17	Theory Exam-III	20
18	Lab Evaluation-II (End term Exam)	10
	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 Title and Course Code	**Industrial Robotics**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**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.

Learning 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.

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

1. Implement various coding strategies like Huffman Coding, Turbo coding, etc.
2. Optimize various codes like Shannon codes, Trellis codes etc.
3. Characterize Error Free Communication Over A Binary Symmetric Channel
4. Analyse Channel Capacity of a Band Limited Continuous Channel
5. Analyse various encryption and decryption standards
6. Analyse security goals, types of attacks, steganography, symmetric and asymmetric key encipherment and implement cryptanalysis
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):

11. Implementation of Cipher Encryption and Decryption
12. Implementation of one time padding for maintaining secrecy
13. Implementation of message authentication codes
14. Application of cryptographic hash functions
15. Implementation of symmetric key Data Encryption Standard (DES)

16. Implementation of symmetric key Advanced Encryption Standard (AES)
17. Diffie – Hellman key establishment
18. Public key encryption and decryption
19. Implementation of the RSA algorithm
20. 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/