VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

Affiliated to **JNTUH,** Approved by **AICTE,** Accredited by **NAAC** with **A++** Grade, **ISO 9001:2015** Certified

Kacharam, Shamshabad, Hyderabad - 501218, Telangana, India

www.vardhaman.org

CURRICULUM

For

Bachelor of Technology

Electrical and Electronics Engineering

Under

Choice Based Credit System (CBCS)

B. Tech. - Regular Four-Year Degree Program

(For batches admitted from the Academic Year 2022 - 2023)

&

B. Tech. - Lateral Entry Scheme

(For batches admitted from the Academic Year 2023 - 2024)

October 2022

Vision of the Institution:

To be a pioneer institute and leader in engineering education to address societal needs through education and practice.

Mission of the Institution:

- To adopt innovative student centric learning methods.
- To enhance professional and entrepreneurial skills through industry institute interaction.
- To train the students to meet dynamic needs of the society.
- To promote research and continuing education.

Vision of the Department:

Producing professionally competent graduates in the domain of electrical engineering to serve the industry/society addressing the challenges.

Mission of the Department:

- Provide professional skills in electrical circuit design and simulation to the students.
- Bringing awareness among the students with emerging technologies to meet the dynamic needs of the society
- Develop industry-institute interface for collaborative research, internship and entrepreneurial skills among the stakeholders (Students/Faculty)
- Encourage multi-disciplinary activities through research and continuous learning activities

Program Educational Objectives(PEOs):

PEO1: Graduates will excel to make way to give solutions to real-time problems through technical knowledge and operational skills in the field of Electrical Engineering.

PEO2: Graduates will demonstrate their ability to acquaint with the ongoing trends in the field of Electrical Engineering to address the needs of the society.

PEO3: Graduates will communicate effectively as team players to cope with building a Prospective career.

PEO4: Graduates of the program will act with Integrity and have interpersonal skills in catering the need-based requirements blended with ethics and professionalism.

Program Outcomes(POs):

PO1:Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2:Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3:Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4:Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5:Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6:The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7:Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8:Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9:Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10:Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11:Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12:Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes(PSOs):

Graduates will be able to,

PSO1: Conceptualize complex electrical and electronics systems, employ control strategies for power electronics related applications to prioritize societal requirements.
PSO2: Design, analyze and create energy efficient and eco-friendly power & energy systems.

Programme Curriculum Structure
B. Tech – Electrical and Electronics Engineering

Regulations: VCE-R22

I Year I Semester											
Induction Program (Phase – I)											
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks			
				L	T	P	C	CIE	SEE	Total	
1	A8001	Matrices and Calculus	BS	3	1	0	4	40	60	100	
2	A8006	Applied Physics	BS	3	0	0	3	40	60	100	
3	A8501	Problem Solving through C	ES	3	0	0	3	40	60	100	
4	A8201	Electrical Circuits	ES	3	0	0	3	40	60	100	
5	A8202	Electrical Power Generation	PC	2	0	0	2	40	60	100	
6	A8007	Applied Physics Laboratory	BS	0	0	2	1	40	60	100	
7	A8502	Problem Solving through C Laboratory	ES	0	0	2	1	40	60	100	
8	A8203	Electrical Circuits Laboratory	ES	0	0	2	1	40	60	100	
9	A8301	Engineering Workshop	ES	0	0	2	1	40	60	100	
10	A8021	Social Innovation	ES	0	0	2	1	40	60	100	
Total				14	01	10	20	400	600	1000	

I Year II Semester											
Induction Program (Phase – II)											
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks			
				L	T	P	C	CIE	SEE	Total	
1	A8002	Ordinary Differential Equations and Vector Calculus	BS	3	1	0	4	40	60	100	
2	A8008	Engineering Chemistry	BS	3	0	0	3	40	60	100	
3	A8010	English for Skill Enhancement	HS	2	0	0	2	40	60	100	
4	A8505	Data Structures	ES	3	0	0	3	40	60	100	
5	A8405	Analog Devices and Circuits	ES	2	0	0	2	40	60	100	
6	A8009	Engineering Chemistry Laboratory	BS	0	0	2	1	40	60	100	
7	A8011	English Language and Communication Skills Laboratory	HS	0	0	2	1	40	60	100	
8	A8507	Data Structures Laboratory	ES	0	0	2	1	40	60	100	
9	A8406	Analog Devices and Circuits Laboratory	ES	0	0	2	1	40	60	100	
10	A8302	Computer Aided Drawing	ES	0	0	2	1	40	60	100	
11	A8022	Engineering Exploration	ES	0	0	2	1	40	60	100	
Total				13	01	12	20	440	660	1100	

Programme Curriculum Structure
B. Tech – Electrical and Electronics Engineering

Regulations: VCE-R22

II Year I Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8004	Numerical Methods and Complex Variables	BS	3	1	0	4	40	60	100
2	A8206	Control Systems	PC	3	0	0	3	40	60	100
3	A8207	Electrical Machines – I	PC	3	0	0	3	40	60	100
4	A8413	Linear and Digital Circuits	ES	2	0	0	2	40	60	100
5	A8208	Electromagnetic Field Theory	PC	3	0	0	3	40	60	100
6	A8209	Control Systems Laboratory	PC	0	0	2	1	40	60	100
7	A8210	Electrical Machines – I Laboratory	PC	0	0	2	1	40	60	100
8	A8414	Linear and Digital Circuits Laboratory	ES	0	0	2	1	40	60	100
9	A8508	Python Programming Laboratory	ES	0	0	2	1	40	60	100
10	A8023	Engineering Design Thinking	PW	0	0	2	1	40	60	100
Total				14	01	10	20	400	600	1000
Mandatory Courses (Non-Credit)										
11	A8031	Gender Sensitization	MC	2	0	0	0	-	100	100
12	A8033	Universal Human Values 2: Understanding Harmony	MC	2	0	0	0	-	100	100

II Year II Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8013	Business Economics and Financial Analysis	HS	3	0	0	3	40	60	100
2	A8608	Java Programming	ES	3	0	0	3	40	60	100
3	A8213	Electrical Machines – II	PC	3	0	0	3	40	60	100
4	A8214	Power System Transmission and Distribution	PC	3	1	0	4	40	60	100
5	A8215	Power System Operation and Control	PC	3	0	0	3	40	60	100
6	A8609	Java Programming Laboratory	ES	0	0	2	1	40	60	100
7	A8216	Electrical Machines – II Laboratory	PC	0	0	2	1	40	60	100
8	A8217	Power System Transmission and Distribution Laboratory	PC	0	0	2	1	40	60	100
9	A8024	Product Realization	PW	0	0	2	1	40	60	100
Total				15	01	08	20	360	540	900
Mandatory Courses (Non-Credit)										
10	A8032	Environmental Science and Technology	MC	2	0	0	0	-	100	100

Programme Curriculum Structure
B. Tech – Electrical and Electronics Engineering

Regulations: VCE-R22

III Year I Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8218	Power System Analysis	PC	3	1	0	4	40	60	100
2	A8219	Power Electronics	PC	3	1	0	4	40	60	100
3	A8220	Power System Switchgear and Protection	PC	3	0	0	3	40	60	100
4	A8610	Relational Database Management Systems	PC	3	0	0	3	40	60	100
5		Professional Elective - I	PE	3	0	0	3	40	60	100
6	A8221	Power System Analysis Laboratory	PC	0	0	2	1	40	60	100
7	A8222	Power Electronics Laboratory	PC	0	0	2	1	40	60	100
8	A8611	Relational Database Management Systems Laboratory	PC	0	0	2	1	40	60	100
Total				15	02	06	20	320	480	800
Mandatory Courses (Non-Credit)										
9	A8034	Indian Constitution	MC	2	0	0	0	-	100	100

III Year II Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8223	Electrical Measurements and Instrumentation	PC	3	0	0	3	40	60	100
2	A8433	Microprocessors and Microcontrollers	PC	3	0	0	3	40	60	100
3	A8224	Electric Vehicles	PC	3	0	0	3	40	60	100
4		Professional Elective – II	PE	3	0	0	3	40	60	100
5		Professional Elective – III	PE	3	0	0	3	40	60	100
6	A8225	Electrical Measurements and Instrumentation Laboratory	PC	0	0	2	1	40	60	100
7	A8434	Microprocessors and Microcontrollers Laboratory	PC	0	0	2	1	40	60	100
8	A8012	Advanced English Communication Skills Laboratory	HS	0	0	2	1	40	60	100
9	A8041	Mini-Project/Internship	PW	0	0	4	2	40	60	100
Total				15	00	10	20	360	540	900
Mandatory Courses (Non-Credit)										
10	A8035	Research Methodology	MC	2	0	0	0	-	100	100

Programme Curriculum Structure
B. Tech – Electrical and Electronics Engineering

Regulations: VCE-R22

IV Year I Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1	A8226	Power Semiconductor Drives	PC	3	0	0	3	40	60	100
2	A8227	IoT and it's Applications	PC	3	0	0	3	40	60	100
3		Professional Elective – IV	PE	3	0	0	3	40	60	100
4		Professional Elective – V	PE	3	0	0	3	40	60	100
5		Open Elective – I	OE	3	0	0	3	40	60	100
6	A8228	Power Semiconductor Drives Laboratory	PC	0	0	2	1	40	60	100
7	A8229	IoT and it's Applications Laboratory	PC	0	0	2	1	40	60	100
8	A8042	Project Work Phase – I	PW	0	0	6	3	100	-	100
Total				15	00	10	20	380	420	800

IV Year II Semester										
#	Course Code	Title of the Course	Category	Hours per Week and Credit				Assessment Marks		
				L	T	P	C	CIE	SEE	Total
1		Professional Elective – VI	PE	3	0	0	3	40	60	100
2		Open Elective – II	OE	3	0	0	3	40	60	100
3		Open Elective – III	OE	3	0	0	3	40	60	100
4	A8043	Project Work Phase - II	PW	0	0	22	11	40	60	100
Total				09	00	22	20	160	240	400

Programme Curriculum Structure
B. Tech – Electrical and Electronics Engineering

Regulations: VCE-R22

List of Professional Electives

Professional Elective - I		
Domain	**Course Code**	**Title of the Course**
Power Systems	A8251	High Voltage Engineering
Power Electronics	A8252	Power Quality
Control and Automation	A8253	Robotic Systems and Control
Energy Systems	A8254	Solar Photovoltaic Systems

Professional Elective - II		
Domain	**Course Code**	**Title of the Course**
Power Systems	A8255	High Voltage DC Transmission
Power Electronics	A8256	Power Semiconductor Devices and Modelling
Control and Automation	A8257	Digital Control Systems
Energy Systems	A8258	Wind Energy Conversion Systems

Professional Elective - III		
Domain	**Course Code**	**Title of the Course**
Power Systems	A8259	Smart Grid
Power Electronics	A8260	FACTS and Custom Power Devices
Control and Automation	A8261	Process Control
Energy Systems	A8262	Energy Storage System for Electrical Vehicles

Programme Curriculum Structure
B. Tech – Electrical and Electronics Engineering

Regulations: VCE-R22

List of Professional Elective (Cont.)

Professional Elective - IV		
Domain	**Course Code**	**Title of the Course**
Power Systems	A8263	Utilization of Electrical Energy
Power Electronics	A8264	Power Electronics for Renewable Energy Systems
Control and Automation	A8265	Power Plant Instrumentation
Energy Systems	A8266	Nuclear Engineering

Professional Elective - V		
Domain	**Course Code**	**Title of the Course**
Power Systems	A8267	Power System Dynamics and Stability
Power Electronics	A8268	Battery Management System
Control and Automation	A8269	Optimization Techniques
Energy Systems	A8270	Energy Audit and Management

Professional Elective - VI		
Domain	**Course Code**	**Title of the Course**
Power Systems	A8271	Power System Transients
Power Electronics	A8272	Applications of Power Electronic Converters
Control and Automation	A8273	Control of Autonomous Vehicles
Energy Systems	A8274	Alternative Fuels

List of Open Electives

#	Course Code	Title of the Course
1	A8181	Smart Cities
2	A8182	Disaster Management
3	A8183	Environmental Pollution Management
4	A8155	Green Building and Sustainability
5	A8224	Electric Vehicles
6	A8281	Solar Energy and Applications
7	A8282	Energy Storage Systems
8	A8283	Power Generation Systems
9	A8381	Hybrid Vehicles
10	A8382	Fundamentals of Robotics
11	A8383	3D Printing
12	A8402	Digital Electronics
13	A8481	Basic Electronics
14	A8482	Principles of Communication Engineering
15	A8483	Fundamentals of IoT
16	A8484	Introduction to Embedded Systems
17	A8510	Operating Systems
18	A8514	Database Management Systems
19	A8520	Software Engineering
20	A8607	Information Security
21	A8608	Java Programming
22	A8651	Ethical Hacking
23	A8652	Cyber Security
24	A8656	Blockchain Technology
25	A8658	Robotic Process Automation
26	A8681	E-Commerce
27	A8682	Full Stack Development
28	A8702	Artificial Intelligence
29	A8781	Computer Organization and Architecture
30	A8851	Data Science for Engineers
31	A8081	Mathematical Programming
32	A8082	Transform Calculus
33	A8083	Numerical Techniques
34	A8084	Entrepreneurship Development
35	A8085	Logistics and Supply Chain Management

List of Open Electives (Cont.)

#	Course Code	Title of the Course
36	A8086	Management Science
37	A8087	Human Resource Management
38	A8088	Organizational Behaviour
39	A8089	Intellectual Property Rights
40	A8090	Professional Practice, Law & Ethics
41	A8091	National Cadet Corps (NCC)

I YEAR I SEMESTER

Course Structure

A8001 - Matrices and Calculus

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	45	15	0	4	40	60	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with the solution of system of linear equations, eigen values and eigen vectors, functions of several variables, multiple integrals. In addition, this course can be applied in many areas of engineering such as computer graphics, cryptography, wireless communication and animation.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8001.1. Solve system of linear equations using rank of a matrix.
A8001.2. Examine the nature of quadratic form using eigen values and eigen vectors.
A8001.3. Evaluate improper integrals using Beta and Gamma Functions.
A8001.4. Examine the extremum of a function of several variables.
A8001.5. Make use of multiple integrals to find the area and volume of a solid.

3. Course Syllabus

Theory of Matrices: Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss- Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

Eigen Values and Eigen Vectors: Linear Transformation and Orthogonal Transformation, Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem. Rank, index, signature and nature of quadratic forms up to three

variables using eigen values.

Calculus: Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series, Definition of Improper Integral: Beta and Gamma functions and their applications.

Multivariable Calculus (Partial Differentiation and applications): Definitions of Limit and Continuity, Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

Multivariable Calculus (Integration): Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Change of variables (Cartesian to polar), Evaluation of Triple Integrals. Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

4. Books and Materials

Text Books:

1. Grewal, B.S. Higher Engineering Mathematics, 43rd Edition, Khanna Publications, 2015.
2. Jain, R.K. and Iyengar, S.R.K. Advanced Engineering Mathematics, 3rd Edition, Narosa Publishing House, 2011.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V. Higher Engineering Mathematics, 32nd Reprint, McGraw Hill Education (India) Pvt Ltd, 2018.

Course Structure

A8006 - Applied Physics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Applied Physics course introduces the fundamental aspects of physics with applications to modern scientific world and focuses on recent trends in science and technology. This interdisciplinary knowledge which includes quantum computing, semiconductors, lasers, wave optics, optical fibers and nanomaterials encourage an understanding of technological applications of Physics. It's importance as a subject of social and industrial relevance enable the students to solve various engineering problems.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8006.1. Analyze the properties of quantum computers by quantum physics.
A8006.2. Apply wave property of light to study different optical phenomenon.
A8006.3. Interpret the charge carrier dynamics in semiconductors.
A8006.4. Develop communication systems by means of lasers and optical fibers.
A8006.5. Analyze the principles of nanoscience and technology for electronic applications.

3. Course Syllabus

Quantum Mechanics and Quantum Computing: Introduction to quantum physics, Blackbody radiation, Photoelectric effect, de-Broglie hypothesis, G.P. Thomson experiment, Concept of wave function, Heisenberg uncertainty principle, Time independent Schrödinger wave equation, One-dimensional potential box, Introduction to quantum computing, Bits and qubits, Classical and quantum logic gates, Interference and quantum entanglements, quantum teleportation and cryptography, IBM quantum, Application of quantum computers.

Wave optics: Waves and wavefronts, Huygens' principle, Superposition of waves, Constructive and destructive interference, Interference of light by Wavefront splitting – Young's double slit experiment, Amplitude splitting – Newton's rings, Diffraction: Fraunhofer and Fresnel diffraction, Diffraction of light at single slit, Diffraction grating – Intensity distribution of light.

Semiconductors and Devices: Intrinsic and extrinsic semiconductor, Density of states, Fermi-Dirac distribution function, Carrier concentration in intrinsic semiconductor, Direct and indirect bandgap semiconductor, Structure, Working principle and Characteristics of P-N junction diode, Hall effect, Light Emitting Diode (LED) and Solar cell.

Lasers and Optical fibers: Introduction to lasers, Einstein's coefficients, three and four level laser systems, Ruby laser, He-Ne laser, Semiconductor laser, Applications of lasers, Introduction to optical fibers, Structure of optical fiber, Total internal reflection, Step index and Graded index optical fibers, Acceptance angle - Numerical aperture, Optical fibers in communication System, Applications of optical fibers.

Nanoscience: Introduction of nanomaterials, Surface area to Volume ratio, Quantum confinement, Top-down fabrication: Ball milling and Chemical Vapor Deposition (CVD) methods, Bottom-up fabrication: Sol-Gel and Combustion methods, Characterization techniques: X-Ray Diffraction (XRD), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Applications of nanomaterials.

4. Books and Materials

Text Books:

1. Pandey, B. K. and Chaturvedi, S., Engineering Physics, 1st Edition, New Delhi: Cengage Learning India Pvt. Ltd, 2013
2. Bernhardt, Chris., Quantum computing for everyone, MIT Press, 2019.

Reference Books:

1. Palanisamy, P.K, Engineering Physics, 1st Edition, Scitech Publications, 2013
2. David Halliday, Jearl Walker, Robert Resnick, David G. Rethwisch, William D. Callister, Engineering Physics, 6th Edition, Wiley India Pvt Ltd, 2006
3. Brij Lal and Subrahmaniyam, A textbook of Optics, 23rd Edition, S Chand, 2006.

Course Structure

A8501 - Problem Solving through C

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

As an introductory course common to all branches, the student will be able to learn problem solving skills using 'C ' programming language, which is a pre-requisite to learn many other programming Languages. The purpose of this course is to provide the basic programming methodology in C. This course will enable the students to learn programming skills necessary to implement all the basic mathematical, scientific and real world applications. C is a structured high-level programming language. The student can write programs using structures, functions and pointers. The course enables to perform file operations to store data permanently. This course will give the foundation for a beginner to develop computer programmes effectively.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8501.1. Identify various building blocks to write a C program.
A8501.2. Use control statements for solving a given problem.
A8501.3. Write programs using arrays and strings to store and manipulate sequential data.
A8501.4. Build programs with functions and structures for solving a complex problem.
A8501.5. Make use of Pointers and Files to store and retrieve data efficiently.

3. Course Syllabus

Algorithms, Flowcharts and Introduction to C : Algorithms- Definition, characteristics and examples. Flowcharts- Definition, Symbols and examples. Structure of a C Program, Identifiers, Variables, Constants and Data Types. Operators-Arithmetic, Relational, Logical, Assignment, increment and decrement, Conditional, Bitwise and Special Operators. Evaluation of Expressions, Precedence of Arithmetic operators, Type conversions, Operator precedence and Associativity. Formatted input and output.

Control Statements: Conditional Statements- if, if else, nested if, else if ladder and switch statements. Iterative or Loop statements- while, do while and for statements. Jump statements- break, continue and goto statements.

Arrays and Strings : Arrays: Introduction, One Dimensional Arrays - Declaration and initialization, Reading and Writing. Two Dimensional Arrays - Declaration and initialization, Reading and Writing. Strings: Introduction, Declaration and initialization, Reading and writing, string handling functions, handling two dimensional strings, Command line arguments.

Functions, Structures and Unions: Functions- Introduction, Function definition and Function call, Categories of functions, Recursion, Limitations of recursive functions, Passing Arrays to functions, Common Preprocessor Directives. Structures- Definition, Declaration and Initialization, accessing structure members, Array of Structures, Arrays with in structures, Structures and functions , size of structures , Unions- Definition, Declaration and Initialization, accessing Union members.

Pointers and Files : Pointers-Declaration, Initialization, Pointer to Pointer, Pointer Arithmetic, Parameter Passing Techniques, Pointer to Arrays, Pointers to Structures. Files- Introduction, defining, opening and closing a File, Input - Output operations on Files, Random Access in files.

4. Books and Materials

Text Books:

1. Byron Gottfried., Programming with C, 4th Edition (Schaum's Outlines), New Delhi,Mc GRAW HILL Edition, 2018.
2. E Balagurusamy., Programming in ANSI C, 8th Edition, Tata McGRAW HILL, New Delhi, 2019.

Reference Books:

1. Yeshvanth Kanethkar., Let Us C,5th Edition,BPB Publications, New Delhi,India, 2017.
2. B.A. Forouzan and R.F. Gilberg., Computer Science: A Structured Programming Approach Using C, 3rd Edition, Thompson Learning, 2007.
3. P. Padmanabham., C & Data structures, 3rd Edition, B.S. Publications, 2016.
4. Jeri R. Hanly and Elliot B.Koffman.,Problem solving and Program Design in C, 7th Edition,Pearson Publication, 2016.

Course Structure

A8201 - Electrical Circuits

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course is designed to provide students with a comprehensive understanding of fundamental circuit elements, network laws, and theorems. The emphasis is on developing problem-solving skills for both simple and complex DC and AC circuits. Additionally, the course equips students with the ability to analyze the parameters of two-port networks and series RLC resonant circuits. Furthermore, it empowers students to analyze the transient behavior of RL and RC circuits, enhancing their grasp of electrical engineering principles and applications.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8201.1. Apply network reduction techniques to calculate current, voltage and power for simple and complex circuits.
A8201.2. Analyze the behaviour of voltage and current in AC circuits.
A8201.3. Apply network theorems to solve problems on simple and complex circuits with DC and AC excitation.
A8201.4. Analyze the parameters of two port network and the phenomenon of resonance.
A8201.5. Analyze the transient response of series RL, RC and RLC circuits

3. Course Syllabus

Electrical Circuit Elements: R, L, C elements, Types of sources, Ohm's Law, KVL and KCL, Network reduction Techniques (Series, Parallel and Star-Delta), Mesh and Node analysis- Numerical Problems.

AC Circuits: Representation of sinusoidal waveform, Average & RMS value, j -notation Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series & parallel), Active power, Reactive power, Apparent power, power factor, 3-phase systems-

relationship between phase and line quantities- Numerical Problems.

Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer theorem(With DC and AC Excitation)- Numerical Problems.

Two Port Networks and Resonance: Two port network parameters - Z, Y and ABCD parameters. Resonance: Series resonance, resonant frequency, concept of band width and q-factor- Numerical Problems.

Transient Analysis: Initial condition, Transient response of series RL, RC, and RLC networks using differential equations with DC excitation- Conceptual description only.

4. Books and Materials

Text Books:

1. William Hart Hayt, Jack Ellsworth Kemmerly, Steven M. Durbin (2007), Engineering Circuit Analysis, 8th Edition, McGraw-Hill Higher Education, New Delhi, India, 2018.
2. A. Sudhakar, Shyammohan S. Palli, Network Analysis, 8th Edition, McGraw-Hill Higher Education, New Delhi, India, 2018.

Reference Books:

1. A. Chakrabarthy (2018), Electrical Circuits, 7th Edition, Dhanpat Rai & Sons Publications, New Delhi, 2018.
2. M. E. Van Valkenburg/T.S. Rathore, Network Analysis by Pearson Paperback – 15 April 2019.
3. Charles K. Alexander and Matthew N. O. Sadiku, Fundamentals of Electric Circuits, 7th Edition, Tata Mc Graw Hill, New Delhi, 2015.

Course Structure

A8202 - Electrical Power Generation

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	2	40	60	100

1. Course Description

Course Overview

Electrical Energy plays a significant role in day-to-day life of entire mankind. This course deals with the generation of power along with its economic aspects and methods of tariff. It deals with the basic theory of various conventional power stations and the different components present in them. This course also helps the students to familiarize with different types of power generation from non-conventional energy resources.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8202.1. Assess the availability and environmental impacts of both conventional and non-conventional energy sources, and design schematic layouts for hydro power plants, explaining the functions of different components in power generation.

A8202.2. Generate schematic layouts for thermal power plants, illustrating the functions of diverse components in power generation.

A8202.3. Develop a schematic diagram of a nuclear power plant to facilitate understanding of the functions of different power generation components.

A8202.4. Classify non-conventional energy resource-based power plants based on their appropriateness for specific sites.

A8202.5 Examine the economic aspects of power generation, including various tariff methods.

3. Course Syllabus

Hydro Power Plants: Conventional Energy Sources and their availability, Non-Conventional Energy Sources and their availability, Environmental impact of conventional and Non- Conventional energy sources. Hydro Electric Power Plants: Site selection, Plant layout, various components, Types of turbines, Pumped storage plants- conceptual description only.

Thermal Power Plants: Site selection, Plant layout, Coal and its storage, Preparation, Handling, Feeding and burning, Cooling towers, Ash handling, Water treatment plant, High

pressure boilers and steam turbines-conceptual description only.

Nuclear Power Plants: Main components of nuclear power plant, Nuclear reactors types and applications, Radiation shielding, Radio active and waste disposal safety aspect- conceptual description only.

Non-Conventional Energy Sources: Types of Non conventional Energy generation: solar, wind, tidal, biomass and wave energy- conceptual description only.

Economic Aspects of Power Generation and Tariff Methods: Base load and peak load on power station. Inter connected grid system, Load curve, load duration and integrated load duration curves, demand, diversity, capacity, utilization and plant use factors. Costs of electrical energy - Fixed, Semi-fixed and Running Costs, Tariff, Characteristics, Types of Tariffs- Numerical Problems.

4. Books and Materials

Text Books:

1. M. L. Soni, P.V. Gupta, U.S. Bhatnagar, A. Chakrabarti (2010),"A Text Book on Power System Engineering, 2nd Edition, Dhanpat Rai & Co. Pvt. Ltd, New Delhi.
2. C. L. Wadhwa (2010),"Generation, Distribution and Utilization of Electrical Energy, 3rd Edition, New Age International (P) Limited, New Delhi.

Reference Books:

1. Leonard L. Grigsby (2012), "Electric Power Generation Transmission and Distribution, 3rd Edition, CRC press.
2. J. B. Gupta (2010), "A Course in Power Systems" 10th Edition, S. K. Kataria & Sons, New Delhi.
3. V.K. Mehta, Rohit Mehta, "Principles of Power System", 3rd Edition, S. Chand Publications 2015.

Course Structure

A8007 - Applied Physics Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Applied Physics Laboratory covers the concepts of semiconductors, communication systems and wave optics. These experiments have number of applications and are valuable tool in the arsenal of engineers across multiple domains. This course also makes students familiar with the instrumental methods and various electrical properties of semiconducting devices. This basic knowledge will enable the scientific fervor to solve various engineering problems.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8007.1. Evaluation of properties of light radiation by wave optics.
A8007.2. Interpret the principles of semiconductors.
A8007.3. Determine the properties of laser light and estimate losses in optical fibre.
A8007.4. Analyze the VI characteristics of LED and solar cell.
A8007.5. Apply resonance principle to calculate frequency of AC supply.

3. List of Experiments

1. Determination of the wavelength of Sodium light by Newton's rings method.
2. Determination of wavelengths of spectral lines of Mercury (Hg) source using diffraction grating.
3. Determination of threshold voltage and study the V-I characteristics of LED.
4. To Study the V-I characteristics of PN junction diode under Forward and Reverse bias conditions.
5. Verification of the type of semiconductor material by estimating the density of majority carriers using Hall Effect.
6. Determination of the energy bandgap of a given semiconductor.
7. Determination of quality factor of solar cells and it's V-I Characteristics.

8. Determination of the wavelength of a given source of Laser light using plane transmission grating.
9. Evaluation of the numerical aperture (NA) and transmission losses of a given optical fiber.
10. Evaluation of frequency (n) of an AC supply, using Sonometer.

4. Laboratory Equipment/Software/Tools Required

1. Newton's Ring kit
2. Spectrometer
3. Regulated power supply (DC and AC)
4. Hall Effect Setup
5. Light Emitting Diode Kit
6. Solar cell Kit
7. Sonometer Setup
8. Semiconductor Laser Source
9. Plane diffraction grating
10. Optical fiber trainer kit
11. Meters - Ammeter, Voltmeter, Digital Multimeter
12. Diodes, Resistors, Capacitors, Bread Board

5. Books and Materials

Text Books:

1. Sushil Kumar Jain, Majeet Singh, Applied Physics Experiments, JBC Press, 2013

Reference Books:

1. S B Mal, Er. Ashish Jesuja Practical Physics for Engineering Students of B.Tech, JBC Press, 2015
2. Applied Physics Laboratory Manual, Department of Physics, VCE 2022

Course Structure

A8502 - Problem Solving through C Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

As an introductory course common to all branches, the student will be able to learn problem solving skills using 'C' programming language, which is a pre-requisite to learn many other programming Languages. The purpose of this course is to provide the basic programming methodology in C. This course will enable the students to learn programming skills necessary to implement all the basic mathematical, scientific and real world applications. C is a structured high-level programming language. The student can write programs using structures, functions and pointers. The course enables to perform file operations to store data permanently.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8502.1. Use various programming constructs of C to solve a given problem.
A8502.2. Make use of arrays, pointers and structures to organize data.
A8502.3. Develop applications using functions for code reuse.
A8502.4. Write programs using files for storing and accessing data.

3. List of Experiments

1. Variables and Expressions
   a. Write a C program for Swapping of two numbers using a third variable
   b. Write a C program for the simple and compound interest.
   c. Write a C program to evaluate the expressions. (Finding y=m*x+c, displacement).
2. Operators
   a. Write a C program to implement increment, decrement and Bitwise operators
   b. Write a C program to find the greatest of 3 numbers using conditional operator.
3. Conditional Statements-I
   a. Write a C program for finding the max and min from the three numbers.

b. Write a C program to Check the given year is leap year or not.

c. Write a C program to find the roots of a quadratic equation. .

4. Conditional Statements-II

a. Write a C program to check the given number is power of 2 or not using bit wise operators.

b. Write a C program to read 3 subject Marks. Calculate and display the grade of a student based on the percentages.

c. Write a C Program to perform Arithmetic Operations using switch statement.

5. Iterative Statements-I

a. Write a C program to find sum of n natural numbers (1+2+3. . . .+n).

b. Write a C program to find factorial of a given number.

c. Write a C program to print Fibonacci numbers.

d. Write a C program to find reverse of the given number.

e. Write a C program to Check if the binary representation of a positive number is palindrome or not. For example, 101, 11, 11011, 1001001 are palindromes. 100, 110, 1011, etc., are not palindromes.

6. Iterative Statements-II

a. Write a C program to read a password until it is correct. For wrong password print "Incorrect password" and for correct password print "Correct password" and quit the program. The correct password is 1234.

b. Write a C program to check the given number is prime or not.

c. Write a C program to find the GCD of given two numbers.

d. Write a C program to print the output in various triangle patterns using Nested for loop.

e. Write a C Program to find the sum of the series Geometric Progression.

7. Arrays

a. Write a C program to find the largest and smallest number among a list of integers.

b. Write a C Program to read an array of n elements and find the mean, variance and standard deviation.

c. Given an integer array of election votes having candidate IDs, write a program to find the winner of the election.

8. Multi Dimensional Arrays

a. Write a C program to find Addition of two Matrices.

b. Write a C program to find Multiplication of two Matrices.

9. Strings

a. Write a C program to demonstrate the string handling functions.

b. Write a C program to Check whether a given string is palindrome or not.

c. Write a C program to concatenate three strings.

d. Write a C program to count the lines, words and characters in a given text.

10. Functions

a. Write a C program to find the factorial of a given number using non-recursive and recursive function

b. Write a C program to find the nth term of a Fibonacci series using recursive function.

c. Write a c program to compute x power y.

11. Structures

a. Write a C program to create a Student structure containing name, rollNo and grade as structure members. Display the name, rollNo and grade of a student.

b. Write a C program to create a Book structure containing name, author and pages as structure members. Display the name, author and pages of a Book.

c. Write a C Program to Create a Student structure containing name, rollNo and grade as structure members. Display the name, rollNo and grade of n students by using array of structures concept.

12. Structures

a. Write a C Program to Add Two Complex Numbers by Passing Structure to a Function

b. Write a C Program to Add Two Distances (in inch-feet system) using Structures

13. Pointers

a. Write a C program to swap two integers using following methods.

i) Call by Value ii) Call by Reference

b. Write a C program to demonstrate pointer arithmetic.

c. Write a C Program to Check the given string is palindrome or not using pointer.

d. Write a C program to print n cities names using pointers and strings.

14. Files

a. Write a C program to merge two files into a third file.

b. Write a C program to reverse the contents of a file.

c. Write a C Program to use random access functions in files.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open Source/ Freeware)
2. GCC Compiler (Open source / Freeware).

Course Structure

A8203 - Electrical Circuits Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Electrical Circuits Laboratory is a practical course intended to enhance the problem-solving skills of the students in electric circuits by conducting various experiments. This course aims at imparting practical skills to the students on basic circuital laws, network theorems, mesh and nodal analysis. This course also aims at imparting practical knowledge to the students on AC circuit analysis and two port networks.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8203.1 Verify basic laws of electrical circuits.
A8203.2 Verify network theorems to solve simple and complex circuits.
A8203.3 Determine the resonant frequency and bandwidth for the given series RLC circuit.
A8203.4 Evaluate the different two-port network parameters.
A8203.5 Analyze the transient response of series RL and RC with DC excitation.

3. List of Experiments

1. Verification of Ohms Law.
2. Verification of KVL and KCL.
3. Verification of Node and Mesh Analysis.
4. Calculation and Verification of Impedance, Voltage and Current of RL, RC and RLC series circuits.
5. Determination of Resonant frequency and band width of series RLC circuit.
6. Verification of Super Position Theorem.
7. Verification of Thevenin's and Norton's theorems.
8. Verification of Maximum power transfer theorem.
9. Determination of Z and Y parameters.

10. Determination of Hybrid and Transmission parameters.
11. Transient analysis of series RL circuits with DC Excitation.
12. Transient analysis of series RC circuits with DC Excitation.

4. Laboratory Equipment/Software/Tools Required

1. Verification of Ohm's Law Kit
2. Verification of KVL and KCL Kit
3. Calculation and Verification of Impedance, Voltage and Current of RL, RC and RLC series circuits Kit
4. Verification of superposition theorem Kit
5. Verification of Thevenin's and Norton's theorems Kit
6. Verification of Maximum power transfer theorems Kit
7. Function generator
8. Single phase transformer
9. DRB,DLB,DCB
10. Determination of Z and Y parameters Kit
11. Determination of Hybrid and Transmission parameters Kit
12. Transient analysis of series RL/RC circuits Kit
13. Digital Oscilloscope

Course Structure

A8301 - Engineering Workshop

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Engineering Workshop is an establishment of space and facility where the students acquire the knowledge on different materials, equipment, tools and workshop practices that are the core methods of engineering industry. This course is of prime importance which makes the learner competent in handling practical work in all types and trades of engineering. It also develops the skills with dignity of labour, precision, safety at work place, team working innovative ideas in making and development of right attitude.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8301.1. Identify the trade based materials and tools to prepare the models.
A8301.2. Illustrate each trade and tool by hands on training in making the models.
A8301.3. Apply different workshop practice methods towards workshop models.
A8301.4. Analyze the trade based operations in the process of product development.
A8301.5. Develop a progressive product towards a societal need.

3. Course Syllabus

PART – A (Demonstration)

1. CNC Machining.
2. Additive Manufacturing with one Model.
3. Power Tools, Plastic Moulding, Metal Casting.
4. Welding (TIG/MIG, Gas Welding), Brazing.

PART - B (Practical)

1. Fitting : L - Fit / V - Fit / Square – Fit / Semi Circular - Fit.
2. Carpentry : Cross Lap Joint / Dovetail Joint / T – Lap Joint / Corner Lap Joint.
3. House wiring : Series / Parallel / One Bulb One Switch / Tube Light / Two-way switch.

4. Welding : Butt Joint / Lap Joint / T Joint .
5. Foundry : Single Piece / Multi Piece.
6. Tin Smithy : Open Scoop / Funnel / Rectangular Tray / Cylindrical
7. Plumbing : Pipe Threading / Pipe Joints.

Note: Minimum one experiment from each Trade with total of 12 Experiments

4. Laboratory Equipment/Software/Tools Required

1. Fitting : Bench vise, Hacksaw frame, Calipers, Files, Try Square
2. Carpentry : Carpentry vise, Chisels, Saws, Wooden Hammer, Try Square
3. House wiring : Wiring Bundles, Socket Pins, Tester, Poker, and Cutting Plier
4. Welding : Welding M/c, Safeguards, Chipping Hammer, Electrode Holder
5. Foundry : Wooden patterns, Riddle, Riser, Runner, Gate cutter, Rammers
6. Tin Smithy : Wire Gauge, Snips, Pliers, Steel rule, Soldering kit, Nylon Hammers.
7. Plumbing : Pipe Wrench, Pipe Cutter, Pliers, Pipe Die Set
8. Additional : Model Joints and Electric Boards

Course Structure

A8021 - Social Innovation

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Social Innovation is an open-ended course to develop social connectedness in engineering students through social awareness and social consciousness. This can be done through live field exposure along with faculty led conceptual presentations, real case reviews, self-study assignments, literature and field survey. Through this course, the students are expected to use their engineering knowledge to provide innovative solutions to existing social problems. This course also develops critical thinking ability among the students to develop sustainable solutions.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8021.1. Develop awareness on social issues faced by local regions.
A8021.2. Identify the mind set of human Race and interpret the societal issues as simple, complicated, and complex problems.
A8021.3. Identify the need statement along with its main causes and effects.
A8021.4. Develop an innovative and sustainable solution for social issues by thinking critically and creatively.

3. Course Syllabus

Introduction to Social Innovation: Core definitions, core elements and common features of social innovation, a typology of social innovation, Awakening social consciousness.

Create Mindsets and Wicked Problems: Seven mindsets – Empathy, Optimism, Iteration, Creative confidence, making it, embracing ambiguity, Learning from failures. Distinguish between simple, complicated, and complex problems; describe the characteristics of wicked problems, breakdown a given problem by unpacking its complexity.

Critical and Creative Thinking for Social Innovation: Definition, engineering thinking and learning, distinguish between creativity and innovation. Models of Creative thinking. [Appreciative Inquiry (AI), Asset Based Community Development (ABCD) and Concept of Bricolage.

Process of Social Innovation: Community study, develop questionnaire, identifying the causes of a particular problem, identify needs, record your learning's, generate ideas, select promising ideas, prototyping, and testing.

Social Innovation across Four Sectors: The non-profit sector, public sector, the private sector, the informal sector, links between and cross sectors. Stages of Innovation: Social organizations and enterprises, social movements, social software and open source methods, common patterns of success and failure.

4. Books and Materials

Text Books:

1. Robin Murray, Julie Caulier-Grice, Geoff Mulgan, "The open book of social innovation: Ways to Design, Develop and Grow Social Innovation", The Young Foundation, 2010.
2. Julie Caulier-Grice, Anna Davies, Robert Patrick & Will Norman, The Young Foundation (2012) Social Innovation Overview: A deliverable of the project: "The theoretical, empirical and policy foundations for building social innovation in Europe" (TEPSIE), European Commission – 7th Framework Programme, Brussels: European Commission, DG Research.

Reference Books:

1. Geoff Mulgan, "Social Innovation: What it is, Why it matters and How it can be accelerated", The Young Foundation, 2007.
2. Asset Based Community Development (ABCD) Model – http://www.nurturedevelopment.org/asset-based-community-development/
3. Diana Whitney & Amanda Trosten-Bloom, "The Power of Appreciative inquiry – A Practical Guide to Positive Change", 2nd Edition, Berrett-Koehler Publishers, Inc, 2010.

I YEAR II SEMESTER

Course Structure

A8002 - Ordinary Differential Equations and Vector Calculus

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	45	15	0	4	40	60	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with ordinary differential equations of first and higher order and Laplace transforms, vector calculus. In addition, this course can be applied in many areas of engineering such as wireless communication, signal processing, robotics and animation.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8002.1. Solve ordinary differential equations of first and higher order.
A8002.2. Make use of ordinary differential equations to solve engineering problems.
A8002.3. Apply Laplace transforms to solve ordinary differential equations.
A8002.4. Determine divergence and curl of a vector point function.
A8002.5. Make use of vector integral theorems to evaluate area, surface area and volumes

3. Course Syllabus

First Order Ordinary Differential Equations: Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

Ordinary Differential Equations of Higher Order: Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sin ax, cos ax, polynomials in x, e^{ax} V(x) and xV(x), method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Cauchy-Euler equation. Applications:

L-C-R Circuits.

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

Vector Differentiation: Vector point functions and scalar point functions, Gradient, Directional derivatives, Divergence and Curl, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

Vector Integral Calculus: Line integral, work done, Surface integrals, Volume integrals. Vector integral theorems: Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem (without proof) and their applications.

4. Books and Materials

Text Books:

1. Grewal, B.S. Higher Engineering Mathematics, 43rd Edition, Khanna Publications, 2015.
2. Jain, R.K. and Iyengar, S.R.K. Advanced Engineering Mathematics, 3rd Edition, Narosa Publishing House, 2011.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V. Higher Engineering Mathematics, 32nd Reprint, McGraw Hill Education (India) Pvt Ltd, 2018.

Course Structure

A8008 - Engineering Chemistry

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course emphasizes a strong background of Chemistry, infused with an orientation towards the applied chemistry and materials technology. A course that focuses on the general applications of chemical principles to the analysis and evaluation of engineering problems as water and its treatment for various purposes, engineering materials as plastics, fibres, elastomers, composites, non-conventional energy sources, batteries and fuel cells.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8008.1. Apply the knowledge of electrochemical series to protect different metals from corrosion.

A8008.2. Analyze the hardness and other impurities present in the water for industrial and domestic applications.

A8008.3. Evaluate the behaviour of different engineering materials.

A8008.4. Analyze the different types of fossil fuels, characteristics and their applications.

A8008.5. Compare the materials to study various physical and chemical properties.

3. Course Syllabus

Battery Chemistry & Corrosion:

Batteries: Classification – Primary battery (dry cell and lithium cell) and Secondary battery (Lithium-ion cell and lead acid battery). Fuel cells – Hydrogen-Oxygen fuel cell– Engineering applications, Solar cells - Introduction and applications of Solar cells. **Corrosion and Its Control:** Causes and effects of corrosion – Theories of Corrosion – Chemical corrosion – oxidation corrosion, Electrochemical theory of corrosion - mechanism. Types of corrosion – Galvanic corrosion – Concentration cell corrosion (Pitting corrosion and Waterline corrosion). Factors affecting the rate of corrosion, Pilling-Bedworth rule, corrosion

control methods – cathodic protection – sacrificial anodic – impressed current cathodic protection.

Water and its treatment: Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent – expression and units of hardness, Numerical problems. Boiler troubles: sludges, scales and caustic embrittlement. Internal treatment of boiler feed water – Calgon conditioning – Phosphate conditioning – Colloidal conditioning – Softening of water by ion exchange processes. Potable water – its characteristics. Desalination of water – Reverse osmosis. Sewage – Steps involved in treatment of sewage.

Polymeric Materials: Terminology, Types of Polymerization – Addition and Condensation polymerization with examples. Characteristics of Plastics, fibres and elastomers. Plastics: Thermo- plastic resins & Thermosetting resins. Preparation, properties and engineering applications of Polyvinyl chloride and Teflon. Fibers: Preparation, properties and engineering applications of Nylon-6,6 and Dacron. Elastomers: Natural rubber and its vulcanization, Artificial rubbers - Buna-S and Butyl rubber. Conducting Polymers: Classification, mechanism of conduction in trans - polyacetylene – applications.

Energy Sources: Introduction, Calorific value of fuel – HCV, LCV- Dulongs formula – Numerical Problems. Classification- solid fuels – coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, Cracking and its types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition, characteristics and applications of LPG and CNG, Biodiesel – Transesterification, advantages

Engineering Materials:
Nanomaterials: Introduction, Chemical synthesis by sol-gel, precipitation, solvo-thermolysis and thermolysis methods. Applications of nanomaterials in Industry and Engineering.
Graphene: Isolation, Structure and strength, applications in Computer, Electrical and Electronic Devices.
Alloys: Definition – Purpose of alloying, Types of alloys – Ferrous Alloys (Stainless steel, Nichrome, Alnico), Non-ferrous alloys (solder, brass and bronze).
Portland cement: Chemical constituents, Setting and Hardening and applications of cement.

4. Books and Materials

Text Books:

1. Rama Devi. B, Aparna. P, Prasanta Rath, Engineering Chemistry, 2nd Edition, Cengage

Publications, 2022.

2. Jain and Jain, Engineering Chemistry, 16th Edition, Dhanpat Rai Publication Company, 2015.

Reference Books:

1. Shikha Agarwal, Engineering Chemistry, Cambridge University Press, Delhi, 2015.
2. Shashi Chawla, Engineering Chemistry, Dhanpatrai and Company (P) Ltd. Delhi, 2011.
3. Thirumala Chary. M, Laxminarayana. E and Shashikala. K, A text book of Engineering Chemistry, Pearson Publications, 2021.

Course Structure

A8010 - English for Skill Enhancement

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	2	40	60	100

1. Course Description

Course Overview

This course has been designed to develop linguistic and communicative competencies among engineering students. The Reading and Writing skills of the students are honed during the sessions using the prescribed textbook. Additional focus is laid on grammar and vocabulary. In addition, the students are encouraged to read texts which are aimed at developing their comprehension skills.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8010.1. Build competence in grammar for effective communication.
A8010.2. Acquire suitable vocabulary required for achieving communicative competence.
A8010.3. Utilize academic reading skills to comprehend different texts effectively.
A8010.4. Develop effective writing skills for academic purposes.
A8010.5. Demonstrate basic proficiency in professional correspondence.

3. Course Syllabus

'Toasted English' by R.K.Narayan

Vocabulary : Word Formation - Prefixes and Suffixes; Synonyms and Antonyms; Conjunctions

Grammar : Identifying Common Errors in Writing with Reference to Articles and Prepositions

Reading : Techniques for Effective Reading

Writing : Sentence Structures -Use of Phrases and Clauses in Sentences- Types of sentences; Punctuation; Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

'Appro JRD' by Sudha Murthy

Vocabulary : Homophones, Homonyms and Homographs

Grammar : Identifying Common Errors in Writing with reference to Tenses, Noun-pronoun Agreement and Subject-verb Agreement

Reading : Sub-Skills of Reading – Skimming and Scanning

Writing : Essay writing; Precis writing

Lessons from Online Learning' by F.Haider Alvi, Deborah Hurst et al

Vocabulary : Words Often Confused; Idioms

Grammar : Misplaced Modifiers

Reading : Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice

Writing : Letter Writing: Letter of Request, Letter of Inquiry, Letter of Apology, Letter of Complaint.

'Art and Literature' by Abdul Kalam

Vocabulary : Standard Abbreviations in English

Grammar : Redundancies and Clichés in Oral and Written Communication

Reading : Survey, Question, Read, Recite and Review (SQ3R Method)

Writing : Information Transfer; Letter of Application and Resume/CV writing; Email writing- format, style and etiquette.

Chapter entitled 'Go, Kiss the World' by Subroto Bagchi

Vocabulary : Technical Vocabulary and their Usage

Grammar : Identify the errors with reference to Active and Passive Voice; Reported speech

Reading : Reading Comprehension: Exercises for Practice.

Writing : Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

4. Books and Materials

Text Books:

1. English: Language, Context and Culture by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

Reference Books:

1. Raman, Meenakshi and Sharma, Sangeeta, Technical Communication- Principles and Practice, 3rd Edition, Oxford University Press, New Delhi. Print, 2015.
2. Muralikrishna C. and Sunita Mishra, Communication Skills for Engineers, 2nd Edition, Pearson, 2011
3. Ashraf Rizvi M, Effective Technical Communication, 2nd Edition, McGraw Hill Education, 2017
4. Swan, Michael, Practical English Usage, Oxford University Press. Fourth Edition, 2016.
5. Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary, 2nd Edition, Sage Publications India Pvt. Ltd.

Course Structure

A8505 - Data Structures

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Data Structures is a course for an engineering graduate to improve the programming skills using C Language. It is a logical model of organizing data, used in designing and implementing efficient algorithms. Data structures are important as they are implemented in every software application. This course covers various operations on Singly Doubly Linked Lists. The linear data structures stacks and queues are implemented using both arrays and linked lists. The course also includes fundamental terminology of non-linear data structures like Trees and Graphs which are especially used to handle large amount of data. The course will also enable the use of appropriate searching and sorting method in handling collection of elements.

Course Pre/co-requisites

A8501 - Problem Solving through C

A8502 - Problem Solving through C Laboratory

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8505.1. Select appropriate sorting and searching technique for a given application.
A8505.2. Use various forms of linked lists to perform operations on data efficiently.
A8505.3. Build applications using stack data structure for real time applications.
A8505.4. Construct various forms of Queues to solve a real time problem.
A8505.5. Make use of nonlinear data structures for organizing data.

3. Course Syllabus

Searching and Sorting: Asymptotic Notations, Time Complexity and Space Complexity of algorithms, Introduction to Searching, Linear search and Binary search. Introduction to Sorting, Bubble sort, Selection sort, Insertion sort, Merge Sort and Quick sort.

Dynamic Memory Allocation and Linked Lists: Introduction, Dynamic Memory Allocation Functions: malloc, calloc, free and realloc. Self-Referential Structures. Linked List-

Introduction, Basic Terminologies, Linked Lists versus Arrays, Operations on Singly Linked Lists and Doubly Linked Lists. (Create, insert, delete, reverse, display and count).

Stacks: Introduction, Array and Linked List representation of Stacks, Operations on Stack using Array and Linked List. Applications of Stacks: Infix to Postfix conversion, Evaluation of Postfix Expression.

Queues: Introduction, Array and Linked List representation of Queues, Operations on Queue using Array and Linked List. Circular Queue and Deque implementation using arrays.

Trees and Graphs: Introduction to Trees, Basic Terminologies, Representation of Binary Tree and Tree Traversal Techniques- Pre order, In order and Post order. Introduction to Graphs, Graph Terminology, Directed Graphs, Non Directed Graphs, Representation of Graphs.

4. Books and Materials

Text Books:

1. Reema Thareja., Data Structures Using C, 2nd Edition, Oxford University Press, New Delhi India, 2014.

Reference Books:

1. Samanta Debasis., Classic Data Structures, 2nd Edition, Prentice Hall of India, New Delhi, India, 2012.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed., Fundamentals of Data Structure in C, 2nd Edition, University Press, India, 2008.

Course Structure

A8405 - Analog Devices and Circuits

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	2	40	60	100

1. Course Description

Course Overview

This course covers fundamental topics that are common to a wide variety of electronic devices, circuits, and systems. The topics include right from the inception of evolution of semiconductor devices to their real time applications. This course starts with the structure of various semiconductor devices like PN junction diode, BJT, JFET, and MOSFET, review their operation and characteristics. This course provides a basis for students to continue education by undertaking advanced study and research in the variety of different branches of semiconductor devices and applications.

Course Pre/co-requisites

A8006 – Applied Physics

A8201 – Electrical Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8405.1. Analyze the operation and characteristics of electronic devices.
A8405.2. Construct electronic circuits making use of diodes and transistors.
A8405.3 Analyze single stage amplifier circuit using low frequency h-parameter model.
A8405.4. Design amplifier and oscillator circuits for given specifications.
A8405.5. Analyze the effect of feedback and cascading in amplifiers.

3. Course Syllabus

Diode Characteristics: Current-voltage characteristics of PN-junction diode and Zener diode, diode models. Diode Applications: Rectifier circuits, rectifiers with filters (capacitor filter only), clipper circuits, clamper circuits, Zener diode as a voltage regulator circuits.

Bipolar Junction Transistor: Structure, principle of operation, different configurations (CE, CB and CC), input and output characteristics. DC analysis - load line and operating point, biasing schemes, bias stability.

Transistor Amplifiers: Transistor as an amplifier, small-signal equivalent circuits, single-stage BJT amplifier (common-emitter mode only), BJT as a switch, Cascade and Cascode amplifiers, Darlington pair.

Feedback Amplifiers and Oscillators: Concept of Feedback in amplifiers, Negative feedback - Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain and bandwidth. Positive feedback – Review of the basic concept, Barkhausen criterion, RC oscillators, LC oscillators.

Field Effect Transistor (FET): Junction Field Effect Transistor (JFET) - Structure, principle of operation, and characteristics. Metal Oxide Semiconductor Field-Effect Transistor (MOSFET) - Structure, principle of operation and characteristics. FET Applications: JFET as voltage variable resistor, MOSFET as a switch.

4. Books and Materials

Text Books:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, PHI, 2013

Reference Books:

1. Millman and Halkias, Electronic Devices and Circuits, 2nd Edition, Tata Mc GrawHill, 2008.

Course Structure

A8009 - Engineering Chemistry Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

The Chemistry Laboratory conducts fundamental studies of highway materials to understand mechanisms. It provides students with a practical approach towards the various techniques used in engineering application. Practical awareness is inculcated and students are trained both quantitatively and qualitatively during the lab sessions to enhance their understanding and problem solving abilities.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8009.1. Apply the instrumental techniques to find out the concentrations or equivalence points of solutions.

A8009.2. Analyze the impurities present in the water using volumetric analysis.

A8009.3. Make use of different titrations to measure various properties of chemical species.

A8009.4. Analyze the importance of temperature and pressure on physical properties like viscosity and surface tension of liquids.

A8009.5. Calculate the yield of synthetic drugs by maintaining specific reaction conditions.

3. List of Experiments

1. Estimation of amount of ferrous ion in a given solution by permanganometry.
2. Estimation of amount of ferrous ion in given solution by dichrometry.
3. Estimation of hardness of water by complexometry using EDTA.
4. Determination of chloride content in water by argentometry.
5. Estimation of amount of hydrochloric acid in a given sample by conductometry.
6. Estimation of amount of acetic acid in a given sample by conductometry.

7. Estimation of amount of hydrochloric acid in a given sample by potentiometry.
8. Estimation of amount of Fe^{+2} in a given sample by potentiometry.
9. Estimation of Mn^{+2} in a given sample by colorimetry.
10. Estimation of Cu^{+2} in a given sample by colorimetry.
11. Determination of viscosity of a given fluid by Ostwald's viscometer.
12. Determination of surface tension of a given liquid by using stalagmometer.
13. Preparation of Aspirin.
14. Preparation of Nylon 6

4. Laboratory Equipment/Software/Tools Required

1. Digital Conductometer
2. Digital Potentiometer
3. Digital Colorimeter
4. Electrical Water Heater
5. Wall Mount Distillation Plant
6. Analytical/Digital Weighing Balance
7. Ostwald's Viscometer
8. Stalagmometer
9. Stopwatch
10. Thermometer
11. RB Flask condenser
12. Magnetic Stirrer
13. Pipette
14. Burette
15. Beaker

5. Books and Materials

Text Books:

1. Ramadevi. B and Aparna. P, Lab manual for Engineering chemistry, S Chand Publications, New Delhi, 2022.

Reference Books:

1. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
2. Ahluwalia. V.K, College Practical Chemistry, Narosa Publications Ltd. New Delhi, 2007.

Course Structure

A8011 - English Language and Communication Skills Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course is designed to cater to the needs of students in developing their oral communication skills. It begins with an introduction to Phonetics to make them understand the received pronunciation and to help them speak with neutral accent and appropriate intonation. This course incorporates listening skills and draws exercises of listening comprehension from various general and business contexts. The speaking exercises in this course will help the students to present their ideas in different situations, besides helping them to develop team spirit by participating in pair/ group activities.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8011.1. Acquire the received pronunciation and speak in a neutral accent.
A8011.2. Use contextual vocabulary for lucid spoken communication.
A8011.3. Comprehend accent of different varieties of English.
A8011.4. Develop skills for professional presentations.
A8011.5. Demonstrate the ability to communicate by enhancing listening skills

3. Course Syllabus

CALL Lab: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening; Introduction to Phonetics – Speech Sounds – Vowels and Consonants
ICS Lab: Spoken vs. Written language- Formal and Informal English; Ice-Breaking Activity and JAM Session- Self Introduction, Importance of Non Verbal Communication; Situational Dialogues: Introducing Others – Greetings – Taking Leave.

CALL Lab: Past Tense and Plural Marker Rules, Structure of Syllables; Listening to Monologues and Dialogues

ICS Lab: Pair Activity: Asking and giving directions; Exchanging information, Making Requests and Seeking Permissions and Justifying Opinions.

CALL Lab: Stress pattern in sentences; Weak and Strong Forms; Neutralization of Mother Tongue Interference; Listening to Group Conversation
ICS Lab: Describing Place, Person and Event

CALL Lab: Intonation; Listening for Specific Information
ICS Lab: Group activity: Agreeing and/or disagreeing, Suggesting, Speculating, Comparing and contrasting; Telephone Etiquette; Introduction to Group Discussion

CALL Lab: Differences between British and American Pronunciation; Listening for General Comprehension of the Content
ICS Lab: Introduction to Interview Skills; Mock Interviews; Structured Presentations; Extempore Presentations

4. Books and Materials

Reference Books:

1. Brook-Hart, Guy, Cambridge English Business Benchmark- Upper Intermediate Business Vantage (with CD), 2nd Edition, South Asian Edition, Cambridge University Press, 2019.
2. Hancock, M., English Pronunciation in Use Intermediate, Cambridge University Press. Print, Cambridge, 2009.
3. Mohanraj, J., Let Us Hear Them Speak, 1st Edition, Sage Texts Print, New Delhi, 2015
4. Exercises in Spoken English, Parts I-III CIEFL, Oxford University Press, 1997.

Course Structure

A8507 - Data Structures Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Data Structures laboratory course provides implementation of linear and nonlinear data structures to organize data efficiently. Data structures are important as they are implemented in every software application. This course covers various operations on Singly Linked Lists and Doubly Linked Lists. The linear and nonlinear data structures are implemented using both arrays and linked lists. The course will also enable the use of appropriate searching and sorting method in handling collection of elements. The course is basis for data structures implementation in various programming languages.

Course Pre/co-requisites

A8501 – Problem Solving through C

A8502 – Problem Solving through C Laboratory

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8507.1. Implement various searching and sorting techniques on a given data.
A8507.2. Organize data efficiently using linked lists.
A8507.3. Perform various operations on data structures using arrays and linked lists.
A8507.4. Write programs to traverse tree using linked list.

3. List of Experiments

1. Write a C Program to Implement Linear Search and Binary Search.
2. Write a C Program to Implement Bubble Sort and Selection Sort.
3. Write a C Program to Implement Insertion Sort and Quick Sort.
4. Write a C Program to Implement Merge Sort.
5. a) Write a C program to Read an array of integers whose size will be specified interactively at rum time and print those elements.
   b) Write a C program to Illustrate Self Referential Structures.
6. Write a C program to implement Singly Linked List Operations: Creation, Insertion, Deletion, Reverse, Count and Traversal.

7. Write a C program to implement Doubly Linked List Operations: Creation, Insertion, Deletion, Count and Traversal.
8. Write a C program to implement Stack operations using Arrays.
9. Write a C program to implement Stack operations using Linked List
10. a) Write a C Program to implement to convert an expression from Infix to Postfix.
    b) Write a C Program to Evaluate arithmetic expression.
11. a) Write a C program to implement Queue operations using Arrays.
    b) Write a C program to implement Queue operations using Linked List.
12. Write a C program to implement Circular Queue operations using Arrays.

13. Write a C program to implement Deque operations using Arrays.
14. Write a C Program to Implement Traversals on Binary Tree using linked list.

4. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open Source/ Freeware)
2. GCC Compiler (Open source / Freeware).

Course Structure

A8406 - Analog Devices and Circuits Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

The analog devices and circuits laboratory is one of the fundamental laboratory course that a student will undergo. The students become familiar with laboratory test and measuring instruments such as CRO, regulated power supply, function generator, ammeter, voltmeter and digital multimeter. The exposure of the students to these instruments and the knowledge about basic electronic components will enable them to design, construct and test the basic electronic circuits such as power supplies, amplifiers and oscillators.

Course Pre/co-requisites

A8007 – Applied Physics Laboratory

A8201 – Electrical Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8406.1. Identify and use various electronic components, test and measuring instruments that are frequently used in experimentation of various circuits.

A8406.2. Interpret the V -I characteristics of various analog devices to realize the applications like switching, regulation and amplification.

A8406.3. Design a simple regulated power supply, amplifiers and oscillators for a given specifications.

A8406.4. Apply various biasing techniques to fix the operating point and stabilize the given transistor.

A8406.5. Analyze the transient and frequency response of single stage amplifier circuits.

3. List of Experiments

1. Study the forward and reverse bias characteristics of PN junction diode.
2. Design line and load voltage regulation circuits using Zener diode.
3. Design a capacitor filter for a rectifier circuit.
4. Design various clipping circuits using diode.
5. Design various clamping circuits using diode.
6. Analyze the input and output characteristics of Bipolar Junction Transistor.

7. Analyze transfer and drain characteristics of JFET and analyze how JFET acts asvoltage variable resistor.
8. Design Darlington Pair Amplifier using bipolar junction transistor and plot its fre-quency response.
9. Analyze RC oscillators (RC Phase shift and Wein bridge) and observe the effect ofvariation in R and C on oscillator frequency.
10. Analyze LC oscillators (Hartley and Colpitts) and observe the effect of variation of Con oscillator frequency.

4. Laboratory Equipment/Software/Tools Required

1. Cathode Ray Oscilloscope
2. Function Generator
3. Regulated Power Supply
4. DC Voltmeter and Ammeter
5. Multimeter
6. Discrete Electronic Devices (PN-junction diode, Zener diode, BJT and FET)
7. Circuit Simulator Software (Multisim/LTSpice or any other equivalent)

Course Structure

A8302 - Computer Aided Drawing

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course covers the essential core topics for working with the AutoCAD software, orthographic projections for points, lines, planes and solids in different positions, the development of lateral surfaces and the isometric projections. The students are able to create simple solid models of various domain applications.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8302.1. Illustrate various menu bars and tool bars on AutoCAD interface.
A8302.2. Differentiate first angle and Third angle projection system based on representation of orthographic views.
A8302.3. Create orthographic views of points, lines, planes and solids using appropriate tools.
A8302.4. Develop the lateral surface areas of regular solids by construction methods.
A8302.5. Model 3-dimentional views of simple objects using isometric coordinates.

3. Course Syllabus

Introduction to AutoCAD: File menu of AutoCAD with New, Open, Save, Save as and Close, Basic 2D commands like Line, Circle, Ellipse, Multi Line, Construction Line, Polyline, Point, Donut, Ellipse, Polygon, Rectangle, Arc, Erase, Snap, Redraw, Regenerate, Zoom, Pan.

Editing of AutoCAD Drawing: Modify Properties of Drawing Entity, Copy, Move, Rotate, Mirror, Offset, Array, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer, Fillet.

Orthographic Projections-I: Orthographic projections of Points, Lines and planes inclined to one plane and inclined to both the principal planes.

Orthographic Projections-II: Orthographic projections of regular solids-prism, cylinder, pyramid and cone inclined to one of the reference plane.

Isometric Projections: Isometric coordinates, Isometric Scale, Isometric Views of Lines, Planes and solids. Conversion of Isometric View to Orthographic Views and Vice-versa.

4. Laboratory Equipment/Software/Tools Required

1. PC installed with operating system (Windows)
2. Auto CAD software

5. Books and Materials

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., "Engineering Drawing", 53rd Edition, Charotar Publishing House, 2019.
2. K. Balaveera Reddy et al, "Computer Aided Engineering Drawing",2nd Edition,CBS Publications, 2015.

Reference Books:

1. Narayana, K.L. & P Kannaiah, "Text book on Engineering Drawing" , 3rd Edition, Sci-Tech Publishers, 2020.
2. Basant Agrawal B. and Agrawal C. M., "Engineering Graphics", 3rd Edition, TMH Publication, 2020.
3. Shah, M.B., Rana B.C., "Engineering Drawing and Computer Graphics", 2nd Edition, Pearson Education,2009.

Course Structure

A8022 - Engineering Exploration

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This Course provides an opportunity for freshman students to learn in new ecosystem and is one of the unique outcomes of innovative education ecosystem in digital era of our nation. The focus of this course is on Engineering Design Process, Problem Solving, Multi-disciplinary skills, Ethics and Data Acquisition and Analysis. This course is co-designed and co-taught by faculty members drawn from multiple engineering disciplines; it follows Project Based Learning (PBL) pedagogy with need statements covering broad themes of environmental, educational, smart appliances, smart agriculture, industrial needs etc. are used by students to carve out problem definitions by linking Sustainable Development Goals defined by United Nation. Students work in teams to solve identified problems and serves as a platform for peer learning and push students in Multi-disciplinary design thinking in first year itself.

Course Pre/co-requisites

A8021 - Social Innovation

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8022.1 Compare and contrast the contributions of different types of engineers in the development of a product, process, or system.

A8022.2 Apply the common engineering design process to solve complex problems and arrive at viable solution.

A8022.3 Explore various contemporary software and hardware tools to provide solutions for the problems.

A8022.4 Apply skills needed for successful teamwork including the basics of project management and written and oral communication.

A8022.5 Identify the key elements of professional codes of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world.

3. Course Syllabus

Introduction to Engineering and Engineering Study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer and Graduate Attributes.

Engineering Design Process: Design Cycle, Multidisciplinary facet of design, Importance of analysis in engineering design, general analysis procedure, generation of multiple solution, decision matrix, Concepts of reverse engineering and general mechatronics system.

Introduction to Open-source Platforms: Open-source hardware & software tools, Development (Arduino) of Programming (Tinker CAD Tools) and its Essentials, Introduction to Sensors, Transducers and Actuators and its Interfacing with Open-Source H/W & S/W tools.

Engineering Ethics: Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers. Sustainability: Introduction to sustainability, Sustainability leadership, Life cycle assessment.

Project Management & Tools: Introduction, Significance of teamwork, Importance of communication in engineering profession, Checklist, Timeline, Gantt Chart, Significance of documentation.

4. Laboratory Equipment/Software/Tools Required

1. Open-source Hardware: Microchip ATmega328P (UNO/NANO/MEGA).
2. I/O Peripherals: LCD, Keypad, DC/Servo Motor, Switch, 7-Segment LED modules, GSM, GPS etc.
3. Sensor Tool Kit:Digital RED/WHITE/GREEN/BLUE Light Module, IR, Analog Sound, Soil Moisture, LM35 Analog Linear Temperature, MQ7 Analog Carbon Monoxide etc.
4. Open-source Software: Arduino IDE Version 1.8.5.

5. Books and Materials

Text Books:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, Exploring Engineering: An Introduction to Engineering and Design, Academic Press, 3rd Edition, 2012.
2. Byron Francis, Arduino: The Complete Beginner's Guide, Create space Independent Publishers, 2016.

3. M. Govindarajan, S. Natarajan & V. S. Senthil Kumar, Engineering Ethics, 1st Edition, Phi Learning, 2009.

Reference Books:

1. Neerparaj Rai, Arduino Projects for Engineers, 1st Edition, BPB Publications, 2016.
2. Simon Monk, Programming Arduino: Getting Started with Sketches, 2nd Edition, McGraw-Hill Education, 2016.
3. W. Richard Bowen, Engineering Ethics – Outline of an aspirational approach, Springer London.

II YEAR I SEMESTER

Course Structure

A8004 - Numerical Methods and Complex Variables

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	45	15	0	4	40	60	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. This course covers numerical methods to evaluate roots of algebraic and transcendental equations, find missing data values by interpolating, and perform numerical differentiation and integration, calculus of functions of single complex variable, mappings in the complex plane, region of convergence of a power series and theory of residues. In addition, this course can be applied in many areas of engineering such as circuit theory, signal analysis and control theory.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8004.1. Apply appropriate Numerical method to approximate a root of an equation.
A8004.2. Identify suitable Numerical method to approximate the values of the function at given intermediate points.
A8004.3. Test for analyticity of complex functions in the given domain.
A8004.4. Build analytic function in series of complex terms.
A8004.5. Evaluate real and complex integrals along a contour.

3. Course Syllabus

Solution of Algebraic and Transcendental Equations: Bisection method, Regula-falsi method, Fixed point iteration method and Newton-Raphson method. Jacobi and Gauss-Seidel iteration Methods for solving linear systems of equations. Finite Differences: Forward differences, backward differences, symbolic relations and separation of symbols, Interpolation using Newton's forward and backward difference formulae and Lagrange's method of interpolation.

Numerical Integration: Trapezoidal rule, Simpson's $\frac{1}{3}$rd -rule and Simpson's $\frac{3}{8}$th -rule. **Numerical solution of first order ODE:** Taylor Series, Picard's method, Euler and modified Euler's methods and Runge-Kutta method of fourth order.

Complex Differentiation: Limit, Continuity, differentiability, analyticity and properties, Cauchy-Riemann equations (without proof) in Cartesian and polar coordinates, harmonic and conjugate harmonic functions, Milne-Thomson method to construct analytic function and Conformal mapping and bilinear transformation.

Complex Integration: Line integral in complex plane, Cauchy's integral theorem and Cauchy's integral formula. Complex power series: Taylor's series and Laurent's series. Zeros, singular points and classification of isolated singular points..

Calculus of Residues: Residue, Evaluation of residue by formula and by Laurent series, Residue theorem, Evaluation of real definite integrals of the form:

$$(i)\int_0^{2\pi} f(\cos\theta,\ \sin\theta)\,d\theta \qquad (ii)\int_{-\infty}^{\infty} f(x)\,dx \qquad (iii)\int_{-\infty}^{\infty} e^{imx} f(x)\,dx$$

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4. Books and Materials

Text Books:

1. Grewal, B.S. Higher Engineering Mathematics, 43rd Edition, Khanna Publications, 2015.
2. Sastry, S.S. Introductory methods of numerical analysis, 4th Edition, PHI, 2005

Reference Books:

1. Jain, M.K., Iyengar, S.R.K and Jain, R.K. Numerical methods for Scientific and Engineering Computations, New Age International publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Churchill, R.V. and Brown, J.W. Complex Variables and Applications, 8th Edition, McGraw Hill Education (India) Pvt Ltd, 2009

Course Structure

A8206 - Control Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

In this course, students will grasp the principles and real-world applications of control systems in everyday scenarios. It covers the modeling of control systems through transfer functions and state space, illustrating system representation via block diagrams and signal flow graphs. The course delves into time domain analysis, the R-H stability criterion, and frequency domain analysis. Graphical techniques such as Root locus, Bode plot, Polar plot, and Nyquist plot are employed for analysis and design of control systems. Additionally, the course highlights the practical utilization of PID controllers within the realms of power electronics and power systems.

Course Pre/co-requisites

A8201 - Electrical Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8206.1 Develop the transfer function and state space models of electro-mechanical dynamic systems.
A8206.2 Analyze time response, steady state errors and performance indices of linear time invariant control systems.
A8206.3 Apply Routh's and Nyquist stability criterion to analyze and design of feedback control systems.
A8206.4 Examine the performance of feedback control system by using graphical techniques.
A8206.5 Design the various compensators and controllers for time invariant systems.

3. Course Syllabus

Basics of control systems: Introduction to control problem, Open loop and closed loop control systems and differences, effects of feedback. Mathematical modelling of control systems- Differential equations and transfer function of electrical systems, Block diagram representations and reduction rules, Signal flow graph representation, reduction using Mason's gain formula- Numerical Problems.

Control system components and Time response: Transfer function of DC servo motor, AC servo motor, Synchro transmitter and receiver pair. Standard test signals, characteristic equation of feedback control system, time response of first order system, Sencond order system-damping ratio, natural frequency, Classification based on damping ratio, transient response of second order under damped system, time domain specifications, steady state response, steady state errors and static error constants(Kp,Kv,Ka)- Conceptual description only.

Routh's stability and Rootl locus technique: The concept of stability, Routh's stability criterion, qualitative stability and conditional stability, limitations of Routh's stability. The root locus concept, construction of root loci, effects of adding poles and zeros to G(s)H(s)on the root loci- Numerical Problems.

Frequency response analysis: Introduction, frequency domain specifications, Polar plots, construction of Bode diagrams, phase margin and gain margin, stability analysis from Bode plots and polar plots. Nyquist stability analysis- principle of argument, Nyquist plots, Nyquist stability analysis-Numerical Problems.

Controllers and State space analysis: Compensation techniques, Lag, Lead, and Lead-Lag Compensators, P, PI & PID Controllers. Concepts of state, state variables and state model, various state models representations-CCF,OCF,DCF,JCF, state transition matrix and its properties, solving the time invariant state equations, concepts of controllability and observe ability- Conceptual description only.

4. Books and Materials

Text Books:

1. I.J. Nagrath, M. Gopal (2011), Control Systems Engineering, 5th Edition, New Age International (P) Limited, New Delhi.
2. Benjamin C. Kuo (2003), Automatic Control Systems, 8th Edition, John Wiley and Son's, USA.

Reference Books:

1. K. Ogata (2008), Modern Control Engineering, 8th Edition, Prentice Hall of India Pvt. Ltd, New Delhi.
2. N. K. Sinha (2008), Control Systems, 3rd Edition, New Age International Limited Publishers, New Delhi.

Course Structure

A8207 - Electrical Machines – I

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course aims at imparting knowledge to the students on the construction, operation and characteristics of DC machines and transformers. This course enables the students to analyze the difference between the various speed control methods employed in DC motors. This course also helps the students to familiarize with the different testing methods adopted for DC machines and transformers.

Course Pre/co-requisites

A8201- Electrical Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8207.1 Analyze DC generators' construction, operation, EMF equation, and characteristics, including parallel operation.

A8207.2 Analyze the principle, types, torque equation, performance characteristics and speed control methods of DC motors.

A8207.3 Evaluate the efficiency and losses of DC machines and apply testing methods such as Swinburne's, Brake, Hopkinson's, Field's, and Retardation tests.

A8207.4 Analyze single-phase transformers' principles, construction, EMF equation, and performance under various conditions.

A8207.5 Evaluate losses and efficiency of single-phase transformers using testing methods, and analyze connections of three-phase transformers.

3. Course Syllabus

DC Generators: Construction, Principle of Operation, Armature Reaction, Commutation, EMF Equation, Methods of Excitation, Types of Generators, Magnetization and Load Characteristics, Parallel operation- Numerical Problems.

DC Motors: Principle of operation, Types, Equivalent Circuit, Torque Equation, Performance Characteristics, Speed control Methods and 3-point and 4-point Starters- conceptual description only.

Testing of DC Machines: Losses and efficiency, Swinburne's test, Brake test, Hopkinson's test, Field's Test, Retardation Test- Numerical Problems.

Transformers: Concept of self and mutual inductance, Principle of operation of Single Phase Transformer, construction, EMF equation, No load and ON load condition, phasor diagrams, Equivalent circuit, regulation- Numerical Problems.

Testing of Transformers: Losses and efficiency- All day Efficiency- OC and SC test, Sumpner's test, Separation of core losses Test. Connections of three phase transformers, Relation between line & phase voltages and currents, Scott connection of transformers- Numerical Problems.

4. Books and Materials

Text Books:

1. J. B. Gupta (2006), Theory and Performance of Electrical Machines, 14th Edition, S. K. Kataria & Sons, New Delhi.
2. B. L. Theraja, A. K. Theraja (2002), A text book of Electrical Technology, 23rd Edition, S. Chand Publishers, New Delhi.

Reference Books:

1. E. Fritzgerald, C. Kingsley, S. Umans (2002), Electric Machinery, 5th Edition, Tata Mc Graw Hill Companies, New Delhi.
2. P. S. Bimbra (2000), Electrical Machinery, 7th Edition, Khanna Publishers, New Delhi.

Course Structure

A8413 - Linear and Digital Circuits

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	2	40	60	100

1. Course Description

Course Overview

This course will provide the fundamental background needed to understand how analog and digital systems work. It focuses on learning mathematical concepts required to design and analyze combinational circuits as well as sequential circuits. It also presents the procedure to construct the minimal (least number of gates) circuit necessary to implement a specific function. Finally signal conditioning, signal generation, timing and control circuits using IC will be designed and analyzed.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8413.1. Demonstrate the knowledge of Number System, Boolean algebra concepts, K-Map to simplify digital circuit.
A8413.2. Design combinational and sequential digital circuits.
A8413.3. Analyze various circuits used in digital systems.
A8413.4. Examine different applications constructed using IC 741 Op-Amp.
A8413.5. Evaluate different applications built using IC 555.

3. Course Syllabus

Boolean Algebra and Logic Gates: Number systems, Binary codes, Code Conversion, Logic Gates, Boolean algebra, De Morgan's laws, Sum of Products, Product of Sums, Canonical and standard forms, Karnaugh maps up to 4 variables.

Combinational Circuit Design: Adders, Subtractors, BCD Adder, Adder/Subtractor, Multiplexers, Demultiplexer, Encoder and Decoder, Implementation of Boolean Functions using Multiplexer.

Sequential Circuit Design: Flip Flops - SR, D, T and JK Flip-flops, Conversion between

Flip Flops, Counters, Registers, Finite State Machines, Design using State machines.

Operational Amplifier: Basic information of Op-Amp IC741, the ideal Op-Amp. Op-Amp Applications - summing, subtracting, differentiator, integrator. Active filters - Low pass, high pass (1st order).

Timer: Introduction to IC 555 timer, Functional diagram, Monostable and Astable modes of operations. **PLL:** Introduction, Block diagram, and applications of PLL.

4. Books and Materials

Text Books:

1. M. Morris Mano, Michael D. Ciletti (2008), Digital Design, 6thEdition, Pearson Education/ PHI, India
2. D. Roy Choudhury, Shail B. Jain (2012), Linear Integrated Circuit, 4thEdition, NewAge International Pvt. Ltd., New Delhi, India.

Reference Books:

1. Charles H Roth Jr, Larry L Kinney, Fundamentals of Logic Design, 6thEdition Cengage Learning
2. Ramakant A. Gayakwad, (2012), OP-AMPS and Linear Integrated Circuits, 4thEdi-tion, Prentice Hall / Pearson Education, New Delhi.

Course Structure

A8208 - Electromagnetic Field Theory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course enables the students to analyze the significance of the physical laws related to static electric and static magnetic fields. It helps the students to understand the behaviour of electric fields and magnetic fields in static and time varying fields. It also emphasizes the physical understanding and practical applications of Electromagnetics in Electrical Engineering..

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8208.1 Analyze the physical laws related to static electric fields.
A8208.2 Analyze the physical laws related to static magnetic fields
A8208.3 Analyze the electric and magnetic fields in materials.
A8208.4 Analyze the force and torque in magnetic fields.
A8208.5 Analyze the time varying electric and magnetic fields.

3. Course Syllabus

Static Electric Fields: Co-ordinate Systems, coulomb's Law, electrostatic fields, definition of Electric Field Intensity (EFI), EFI due to a line and a surface charge, Work done in moving a point charge in an electrostatic field, Electric Potential, Gauss's law, applications of Gauss's Law, Maxwell's first law- Numerical Problems.

Static Magnetic Fields: Biot-Savart's law, Magnetic Field intensity (MFI) due to a finite and infinite wire carrying a current I, circular and rectangular loop carrying a current I, Ampere's circuital law and its applications. MFI due to an infinite sheet of current, along current carrying filament and co-axial cable, point form of Ampere's circuital law, Maxwell's equations for static fields- Numerical Problems.

Electric and Magnetic Fields in Materials: Laplace's and Poison's equations, solution of Laplace's equation in one variable, capacitance, capacitance of parallel plate, spherical and co-axial capacitors with composite dielectrics, boundary conditions for electric fields, equation of continuity. Self and Mutual inductance, self-inductance of a solenoid- Numerical Problems.

Force in Magnetic Fields: Magnetic force, Lorentz force equation, Force on a long current carrying conductor in a magnetic field, torque on a current loop placed in a magnetic field, scalar Magnetic Potential and its limitations- Numerical Problems.

Time Varying Fields: Faraday's laws of electromagnetic induction, Its integral and point forms, Maxwell's fourth equation, Statically and Dynamically induced EMFs, modification of Maxwell's equations for time varying fields, displacement current, Poynting Theorem and Poynting vector- Numerical Problems.

4. Books and Materials

Text Books:

1. William H. Hayt, John. A. Buck (2006), Engineering Electromagnetics, 7th Edition, Tata Mc Graw Hill Companies, New Delhi.
2. Sadiku (2005), Electro Magnetic Fields, 4th Edition, Oxford Publications India, New Delhi.

Reference Books:

1. David J. Griffiths (2007), Introduction to Electro Dynamics, 3rd Edition, Prentice Hall of India, New Delhi.
2. John. D. Kraus, D. A. Fleish (1997), Electromagnetics with Applications, 5th Edition, Tata Mc Graw Hill Inc., New Delhi, India.

Course Structure

A8209 - Control Systems Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This practical course offers hands-on practice utilizing MATLAB/Simulink alongside essential hardware support. It aims to provide students with a comprehensive understanding of control systems principles and their real-world applications. Time domain analysis, Routh-Hurwitz stability criterion, and frequency domain analysis are thoroughly discussed and validated within the course. Graphical techniques including Root locus, Bode plot, Polar plot, and Nyquist plot are employed to analyze and design control systems effectively. Moreover, the course highlights the practical utilization of PID controllers within power electronics and power systems domains, enhancing students' ability to address real-world challenges in these fields.

Course Pre/co-requisites

A8201 - Electrical Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8209.1	Transform the transfer function and state space models of dynamic systems.
A8209.2	Analyze the characteristics of DC & AC Servomotors and Synchros.
A8209.3	Analyze the time domain specifications of linear time invariant II order control systems.
A8209.4	Examine the performance and stability of feedback control system by using graphical techniques uisng MATLAB
A8209.5	Design the various compensators and controllers for time in-variant systems.

3. List of Experiments

1. Time response of second order system.
2. Characteristics of Synchros.
3. Frequency response of lead and lag compensator circuits.
4. Temperature control using PID controller.
5. Characteristics of AC servomotor.
6. DC Position control system.

7. Effect of open loop poles and zeroes on Root Locus contour using MATLAB.
8. Determination of gain margin and phase margin of Linear Time Invariant system using polar and Nyquist plots using MATLAB.
9. Evaluation of stability of Linear Time-In variant system using Bode plot using MATLAB.
10. Effect of P, PI, PD and PID controller on speed control of DC motor system using MATLAB- Simulink.
11. State space model for classical transfer function using MATLAB.
12. Design of a passive RC lead and lag compensating network for the given specifications and get its frequency response using MATLAB.

4. Laboratory Equipment/Software/Tools Required

1. Time response kit.
2. Synchro transmitter – receiver pair and PLC study module.
3. DC position control systems.
4. PID module.
5. Lead – Lag Compensator.
6. Rheostat and CRO
7. AC servo motor kit.
8. Multimeters.
9. MATLAB/Simulink Software.

Course Structure

A8210 - Electrical Machines – I Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This Course, Electrical Machines-I Laboratory gives hands-on practice adequately supported by required hardware. It deals with D.C. Machines and Transformers where students will learn construction, operation and characteristics. Performance of these electrical machines will be verified by conducting various experiments in the laboratory.

Course Pre/co-requisites

A8201 - Electrical Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8210.1 Apply speed control techniques and starting methods for DC motors.
A8210.2 Select suitable test to determine the performance parameters of DC machines.
A8210.3 Analyze the performance characteristics of DC machines.
A8210.4 Analyze the performance parameters of single phase and three phase Transformers.

3. List of Experiments

1. Determination of Magnetization characteristics of DC shunt generator
2. Load characteristics of DC shunt generator.
3. Determination of Load Characteristics of DC Compound Generator.
4. Determination of Efficiency of DC Series Machine Using Field's Test.
5. Speed Control of DC Shunt Motor.
6. Determination of Performance Characteristics of DC Series Motor.
7. Brake test on DC Compound motor.
8. Predetermination of efficiency of a DC Shunt Machine (Swinburne's test).
9. Hopkinson's test on DC Shunt Machines.
10. O. C. & S. C. Tests on Single phase Transformer.
11. Sumpner's test on a pair of single phase transformers

12. Scott connection of transformers.

4. Laboratory Equipment/Software/Tools Required

1. DC Motor Generator sets.
2. DC Shunt Generators.
3. DC Series Generators.
4. DC Compound Generators.
5. DC Voltmeters
6. DC Ammeters.
7. Rheostats.
8. Tachometer.
9. Single Phase Transformers.
10. DC Shunt Motors.
11. DC Series Motors.
12. Watt meters.
13. 1-Phase Variac.
14. AC Voltmeters.
15. AC Ammeters.

Course Structure

A8414 - Linear and Digital Circuits Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course provides the fundamental understanding of Boolean algebra, minimization of Boolean functions and how digital systems are constructed from combinational and sequential circuits. In addition, this course provides the knowledge of implementing various applications using IC741 and IC555 timer. The course also furnishes insighrs on practical techniques for the generation of various signals and applying them to real time applications.

Course Pre/co-requisites

A8413 – Linear and Digital Circuits

A8405 - Analog Devices and Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8414.1. Implement any logic function using minimum number of basic gates.
A8414.2. Construct various code converters to meet the design requirements.
A8414.3. Analyze any combinational and sequential logic circuits.
A8414.4. Develop various signal processing and generation circuits for the given specifications.
A8414.5. Implement and examine linear and nonlinear applications using op-amps.

3. List of Experiments

1. Implement and analyze the functionality of Adder, Subtractor and Boolean functions.
2. Implement and analyze the functionality of Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa.
3. Implement and analyze the functionality of Encoders and Decoders.
4. Implement and analyze the functionality of Multiplexer and Demultiplexer.
5. Implement and analyze the functionality of RS, JK, D, and T FF.
6. Implement and analyze the functionality of Counters and Shift registers.
7. Analyze how Op-Amp can be used as Amplifier (Inverting, Non-Inverting and Summing).
8. Design and analyze Practical Differentiator and Integrator using Op-Amp for different input signals.

9. Design and analyze 1st and 2nd order Butterworth filters and plot the frequency response.
10. Design and analyze Monostable and Astable mode of operation using IC555.
11. Analyze the Lock in range and Capture range of Phase Locked Loop using IC565.
12. Voltage Regulators using IC 723, Three Terminal Voltage Regulators – 7805, 7809 And 7912.

4. Laboratory Equipment/Software/Tools Required

1. Computer installed with NI LabView Software
2. Cathode Ray Oscilloscope
3. Function Generator
4. Regulated Power Supply
5. Multimeters
6. IC 741, IC 555, IC 565, IC 7805, 7809, 7912, 723

Course Structure

A8508 - Python Programming Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

As an introductory course common to all branches, the student will be able to learn problem solving skills using 'PYTHON' programming language, which is a pre-requisite to learn many other programming Languages. The purpose of this course is to provide the basic programming methodology in Python. This course will enable the students to learn programming skills necessary to implement all the basic mathematical, scientific and real world applications. Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. This course will give the foundation for a beginner to develop computer programmes effectively.

Course Pre/co-requisites

A8502 - Problem Solving through C Laboratory

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8508.1. Use expressions and control statements for solving a given problem.
A8508.2. Build programs on sequence of characters using string operations and built in functions.
A8508.3. Implement fundamental data structures for manipulating data.
A8508.4. Build user defined functions and modules to improve code reusability.

3. Course Syllabus

Introduction to Python Programming: Introduction to Python, Features of Python, Identifiers, Reserved Words, Data Types, Variables and Constants, Input / Output Statements, Type Casting, Operators, Operator Precedence and Associativity, Expressions Evaluation.

Control Statements: Conditional Statements –if, if-else, if-elif-else. Iterative Statements –for, while. Jump / Transfer Statements –break, continue, pass.

Strings and Operations: String definition, Slicing, Mathematical Operations on Strings, Checking Membership, Comparison, Formatting Strings, Built in Functions and Methods.

Data Structures and Operations: Sequence, Lists, Tuple, Set and Dictionary – Definition, operations and functions.

Functions and Modules: Introduction, Function Definition, Function call, Type of Arguments, Return Statement, Recursive Functions, Lambda function, Range, Modules.

4. List of Experiments

1. Introduction to Python Lab : Installation and Simple Output Display.
   a) Write a python program to read a string "Python Programming" and display it on the screen.
   b) Write a python program to read integer, float & string values and display them on the screen..
2. Programs using Input Output Statements, Variables and Expressions.
   a) Write a python program to read a float value and convert Fahrenheit to Centigrade.
   b) Write a python program to find the area of triangle.
   c) Write a python program to read the Marks in 4 Subjects and Display the average. .
3. Programs using various operators in Python.
   a) Write a python program for demonstrating the usage of comparison operators
   b) Write a python program to swap / interchange two numbers.
   c) Write a python program for demonstrating the usage of unary, shift, logical, membership and identity operators. .
4. Programs using Conditional Statements.
   a) Write a python program to check a given number is Even or Odd.
   b) Write a python program to find the greatest of 3 integer numbers.
   c) Write a python program to demonstrate nested if statement.
5. Programs using Iterative Statements.
   a) Write a Python program to reverse the digits of a given number.
   b) Write a Python program to find the factorial of a given number.
   c) Write a python program to display factors of a given integer number.
6. Programs using Iterative Statements.
   a) Write a python program to print Fibonacci numbers.
   b) Write a python program to display all prime numbers between 0 to n.
7. Programs using Strings and Its Operations. Write a program that asks the user to enter a string and perform the following:
   i) The total number of characters in the string.
   ii) Repeat the string 10 times.
   iii) The first character of the string. iv) The first three characters of the string.
   v) The last three characters of the string. vi) The string in backwards.
   vii) The seventh character of the string if exist otherwise display a message "Not exist".
   viii) The string with its first and last characters removed.

ix) The string into capital case. x) The string with everya replaced with ane.
xi) The string with every letter replaced by a space.

8. Programs using Python Data Structures (Lists).Write a Python program to perform following operations on a list of integers.
   i) Print the total number of items in the list.
   ii) Print the last item in the list. iii) Print the list in reverse order.
   iv) Print Yes if the list contains a 5 and No otherwise.
   v) Print the number of occurrences of a element in the list.
   vi) Remove the first and last items from the list and sort the remaining items.
   vii) Print how many integers in the list is less than a given value.
   viii) Print the average of the elements in the list.
   ix) Print the largest and smallest value in the list.
9. Programs using Python Data Structures (Dictionary).
   a) Write a python program for demonstrating the creation of dictionary, accessing dictionary elements, modifying dictionary elements, finding length and possible operations.
   b) Write a python program to create a dictionary of students with keys as roll numbers and values as names. Perform operations like insert, update and modify student data.
10. Programs using Python Data Structures (Tuples and Set).
    a) Write a python program to demonstrate various operations on tuples.
    b) Write a python program to demonstrate various operations on sets. .
11. Programs using User Defined Functions.
    a) Write a python program to find factorial of a given number using function.
    b) Write a python program to find factorial of a given number using Recursive function.
12. Programs using Modules.
    a) Write a Python program to display the date and time using the Time module.
    b) Write a Python program that prints the calendar of a particular month.

5. Laboratory Equipment/Software/Tools Required

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. Python and Python IDE (Open Source/ Freeware)

6. Books and Materials

Text Books:

1. Reema Thareja., Python Programming using Problem solving Approach. Oxford University Press, New Delhi India, 2017.

Reference Books:

1. Timothy A Budd. Exploring Python, Tata McGraw Hill Education Private Limited. New Delhi India, 2011.
2. Mark Lutz., Learning Python,5th Edition,O'Reilly, USA, 2015.

Course Structure

A8023 - Engineering Design Thinking

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course links the primary fields of engineering, explores the engineering design process from conceptual design and optimal choice evaluation to prototyping for project construction. It also provides insights into particular design challenges within their specific fields of engineering and enables the learners to apply the knowledge in real time - designing, constructing and testing a prototype (actual physical build) to solve a real-world engineering problems. In extent, this course is an excellent roadmap for the design engineers seeking to broaden their engineering knowledge to design concepts to their current work.

Course Pre/co-requisites

A8021 - Social Innovation

A8022 - Engineering Exploration

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8023.1. Interpret the problem-solving skills and product design skills.
A8023.2. Apply foundational knowledge of the primary fields of engineering and scientific concepts to find sustainable solution.
A8023.3. Customize the HCD model to the traditional engineering design process.
A8023.4. Inspect the design and assess a prototype that solves real engineering problem.
A8023.5. Expound the solutions for identified problems and document the findings/reflections for further design.

3. Course Syllabus

Introduction & Case Studies: Definition of design, design process, different problem types, characteristics of novice and informed designers, enhance negotiation and iteration in design, Recognized organizations for design and innovation, shopping cart case study, benefits of failure in design.

Human Centered Design: Introduction to HCD (Human Centered Design), HCD as a Mindset, personas and scenarios, best practice working with communities.

Development of Specification and prototyping: Definition of specification, three examples of ways to generate specifications, how to manage specifications, functional de- composition, three kinds of prototypes, how prototypes can be used in the design process,how to use prototypes can be used to elicit input from users.

Ideation, Innovation & Creativity in Design: Con- cept Selection, Interpretation of Creativity and Innovation, Brain storming and expanding the design Space, case study using decision matrix.

Design for Robustness: Review the design, Brainstorm potential failure models, List the potential effects of failure & causes for each failure.

4. Laboratory Equipment/Software/Tools Required

1. Computers installed with operating system

5. Books and Materials

Text Books:

1. William C. Oakes, Les L. Leone, and Craig J. Gunn, Engineering Your Future, Okemos, MI: Great Lakes Press, 2004.
2. Crismond, D., Contrasting strategies of beginning and informed designers: One representation of learning progressions in engineering design, 2007.
3. Ryan Jacoby and Diego Rodrigue, Innovation, Growth, and Getting to Where You Want to Go, Design Management Review, Vol. 18 No. 1, Winter, 2007.
4. G.Pahl and W.Beitz, Engineering design: A systematic approach, Springer 2nd Editon.
5. Dean Nieusma, Seeing Social Power: Technology Design for User Empowerment, Great Lakes Press, 2012
6. Avery, C. M., Teamwork is an Individual Skill: Getting Your Work Done When Sharing Responsibility. San Francisco, CA: Berrett-Koehler Publishers, Inc., 2001.
7. Astin, A. W., & Astin, H. S., Leadership reconsidered: Engaging higher education in social change - Battle Creek, MI: W. K. Kellogg Foundation, 2000.

Reference Books:

1. Ali K.Kamrani, Emad Abouel Nasr, Engineering design and Rapid Prototyping, 2nd Edition, Springer, 2010
2. Ken Hurst, Engineering design principles, Elsevier Science, 2nd Edition, 2005.

Course Structure

A8031 - Gender Sensitization

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	0	-	100	100

1. Course Description

Course Overview

Gender Sensitization is a course that introduces students to different dimensions of gender issues. It is one of the basic requirements for the normal development of an individual and primarily highlights the contribution of both the genders in creation and development of a well balanced society. A curriculum-based approach to bring a change is desired to inculcate sensitivity towards issues concerning the relationship between men and women, caste, declining sex ratio, struggles with discrimination, sexual harassment, new forums for justice, eve-teasing, etc., The need for this sensitivity has been felt and realized through times immemorial and in almost all kinds of human existence, across the globe.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8031.1. Interpret gender sensitization and problems of other genders.

A8031.2. Identify the reasons for the female feticide.

A8031.3. Attain a finer grasp of how gender discrimination works in our society and how to counter it.

A8031.4. Develop sensitivity towards sexual and domestic violence.

A8031.5. Recognize gender sensitivity issues through literature and media.

3. Course Syllabus

Understanding Gender: Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men Preparing for Womanhood. Growing up Male. First lessons in Caste.

Gender Roles and Relations: Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences Gender Spectrum: Beyond the Binary.

Gender and Labour: Division and Valuation of Labour-Housework: The Invisible Labor-"My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. -Gender Development Issues-Gender, Governance and Sustainable Development Gender and Human Rights-Gender and Mainstreaming.

Gender - Based Violence: The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No!-Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu". Domestic Violence: Speaking Out: Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life. . . ."

Gender and Culture: Gender and Film-Gender and Electronic Media Gender and Advertisement Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks- The Brave Heart.

4. Books and Materials

Text Books:

1. Towards a World of Equals: A Bilingual Textbook on Gender". Telugu Akademi, Hyderabad, 2015

Additional Resources:

1. www.worldofequals.org.in

Course Structure

A8033 - Universal Human Values 2: Understanding Harmony

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	0	-	100	100

1. Course Description

Course Overview

Values are individual beliefs that motivate people to act in one way or the other, it has an inherent worth, and it prepares an individual to adapt in the family, community and society. The basic five Human Values: Love, Peace, Truth, Right Conduct and Non-violence are hidden in every human being; they are our candid attributes. These fundamental human values contain mankind's deepest moral aspirations and form the basis of our lives as individuals and as societies. A didactic system based on human values helps in holistic development of students and it aids to their understanding of true happiness which can only be found within, not in the transient outside world. All objects in the world are subjected to change, however, the ideals, virtues and values established in human hearts remain as a perpetual source of inspiration to the humankind. The course is an overview of human values that are universally accepted and it highlights the need to incorporate these values in students so that they can contribute their service to human race fruitfully. It briefly discusses their role in their family, society and nature and sensitises them towards harmonious living.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8033.1. Analyze the process of self-exploration, right understanding, relationships, natural acceptance for achieving ultimate happiness .
A8033.2. Examine human being as a co-existence of self 'I' and the material 'Body'.
A8033.3. Correlate the universal harmonious order in society, undivided society and from family to world family.
A8033.4. Interpret the harmony in nature, holistic perception at all levels of existence.
A8033.5. Analyze professional competence for augmenting universal human order, ethical human conduct for acceptance of human values.

3. Course Syllabus

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Purpose and motivation for the course, recapitulation from Universal Human Values-1; Self-Exploration what is it? –its content and process; 'Natural Acceptance' and Experiential Validation – as the process for self-exploration; Continuous Happiness and Prosperity- A look at basic human aspiration; Right Understanding, Relationship and Physical facility; Understanding Happiness and Prosperity correctly; Method to fulfill the above Human Aspirations; Understanding and living in harmony at different levels.

Understanding harmony in the Human Being- Harmony in Myself!: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body'-happiness and physical facility; Understanding the body as an instrument of 'I'; Understanding the characteristics and activities of 'I' and harmony 'I'; Understanding the harmony of 'I' with the body: Sanyam and health; Correct appraisal of physical needs, meaning of prosperity in detail; Programs to ensure Sanyam and Health.

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship: Understanding values in human-human relationship; meaning of justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness: Trust and Respect as the foundational values of relationship; Understanding the meaning of Trust; difference between intention and competence; Understanding the meaning of respect, Difference between respect and differentiation; the other salient values in relationship; Understanding harmony in the society; Visualizing a universal harmonious order in society.

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence: Understanding the harmony in the Nature; Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature; Understanding Existence as Co-existence of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence.

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural Acceptance of Human Values; Definitiveness of Ethical Human Conduct; Basics for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics; Case studies of typical holistic technologies, management models and productive systems; Strategy for transition from the present state to Universal Human Order.

4. Books and Materials

Text Books:

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

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A. N. Tripathi, 3rd Edition New age Intl. Publishers, New Delhi, 2019.
3. The Story of My Experiments with Truth- by Mohandas Karamchand Gandhi, 1st Edition, Fingerprint Publishing, 2009.

II YEAR II SEMESTER

Course Structure

A8013 - Business Economics and Financial Analysis

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course addresses the concepts, principles and techniques of Business Economics and Financial Analysis. It covers the fundamentals of Business Economics and its various aspects. Financial analysis gives clear idea about concepts and conventions of accounting, accounting procedures like journal, ledger, trial balance, final accounts and interpretation of financial statements through ratios.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8013.1. Examine the types of business and impact of macroeconomic variables on business.

A8013.2. Analyze interrelationship among various economic variables and its impact.

A8013.3. Classify the market structure to decide the fixation of suitable price.

A8013.4. Apply accounting principles & rules for preparing financial statements.

A8013.5. Analyze financial statements to assess financial health of business.

3. Course Syllabus

Introduction to Business and Economics: Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance. **Economics:** Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist.

Demand and Supply Analysis: Elasticity of Demand: Elasticity, Types of Elasticity, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of

Demand, Law of Demand. Demand Forecasting: Methods of Demand Forecasting.
Supply Analysis: Determinants of Supply, Supply Function and Law of Supply. .

Production, Cost, Market Structures & Pricing: Production Analysis Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.
Cost analysis: Types of Costs, Short run and Long run Cost Functions.
Market Structure: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis (simple problems).

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts (Simple Problems).

Financial Ratios Analysis: Concept of Ratio Analysis, Importance and Types of Ratios-Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

4. Books and Materials

Text Books:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.

Reference Books:

1. A.R. Aryasri (2011), Managerial Economics and Financial Analysis, TMH, India.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

Course Structure

A8608 - Java Programming

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides Object Oriented Programming concepts using Java. The course focuses on different aspect of core Java Environment suitable to write efficient, maintainable, and portable code. It also ignites Object Oriented thinking and explores with the evolution of Java and its basics. It provides strong foundation on Inheritance, Packages and Interfaces and also illustrates Exception Handling and Multithreaded mechanisms. It also provides Collection framework for manipulating data. This course also focuses on file handling using Java API.

Course Pre/co-requisites

A8505 - Data Structures

A8508 - Python Programming Laboratory

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8608.1 Make use of various constructs to write a console application.
A8608.2 Use principles of OOP to develop real time applications.
A8608.3 Identify the need of exception handling to deal with runtime errors.
A8608.4 Build applications for parallel processing using Multithreading.
A8608.5 Choose Collection framework and I/O to manipulate and store data.

3. Course Syllabus

Introduction to OOP : Evolution of Java, OOP principles, Java Buzzwords, Implementing Java program, JVM, Data Types, Variables, Type conversions and Casting, Operators, Control statements, Arrays. Classes, Objects, Methods, Constructors, this keyword, Overloading Methods and Constructors, Argument passing, Exploring String class.

Inheritance, Interfaces and Packages: Inheritance- Inheritance Basics, Using super, Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Abstract classes, final keyword. Packages and Interfaces: Defining a Package, Finding Packages and CLASSPATH,

Access Protection, Importing Packages, Defining and Implementing interfaces, Extending interfaces.

Exception Handling: Exception Handling Fundamentals, Exception Types, using try catch, throw throws and finally keywords, Built-in Exceptions, Creating own exception subclasses.

Multithreading: Multithreading: Multithreading- Life cycle of a thread, Thread class methods, creating threads, thread priorities, Synchronizing threads, Interthread Communication.

Collections and I/O : Collections - Introduction to Collection Framework, Collections Hierarchy, ArrayList, LinkedList, HashSet, TreeSet. The Date and StringTokenizer. I/O – Basics, reading and writing console input and output, PrintWriter class, operations of files – reading, writing and copying files.

4. Books and Materials

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 11th Edition, Tata McGraw-Hill Education, 2019.

Reference Books:

1. Y.Daniel Liang, Introduction to Java Programming-Comprehensive Version, 10th Edition,Pearson Education,2018.
2. Kathy Sierra, Bert Bates, OCA Java SE 8 Programmer, 1st Edition, McGraw-Hill Education, 2017.

Course Structure

A8213 - Electrical Machines – II

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course deals with Induction Motors and Synchronous generators where the students will learn about the construction and operation. The performance characteristics of these machines are also discussed. This course also enables the students to understand the different speed control methods employed for three phase induction motors. It helps the students to understand the regulation and parallel operation of alternators

Course Pre/co-requisites

A8207 - Electrical Machines - I

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8213.1 Analyze the construction, working principle, torque equation, and torque-slip characteristics of three-phase induction motors.
A8213.2 Analyze the techniques for starting and speed control of induction motors.
A8213.3 Evaluate double revolving field theory and construction of different single pase induction motors.
A8213.4 Analyze the construction, operation, and windings of synchronous generators, including EMF equation, characteristics, and factors affecting performance such as harmonics and reactance.
A8213.5 Evaluate regulation techniques, two-reaction theory, load sharing and parallel operation of synchronous generators.

3. Course Syllabus

Three Phase Induction Motors: Production of rotating magnetic field, construction, working principle, Torque Equation, starting and running torque, torque–slip characteristics, Equivalent circuit, Cogging & Crawling- Numerical Problems.

Starting and Speed Control Methods of Induction Motors: Methods of starting, speed control-change of frequency, poles, cascade connection and Injection of an EMF into rotor circuit- conceptual description only.

Single Phase Induction Motors: Double revolving field theory, capacitance starting motor, Capacitance start and capacitor run motor, permanent capacitor motor, Shaded pole motor- conceptual description only.

Synchronous Generators: Construction & Operation, Armature windings, Integral slot and fractional slot windings, Distributed and concentrated windings, pitch and winding factors, E.M.F Equation, Characteristics, Harmonics, armature reaction, leakage reactance, synchronous reactance and impedance- Numerical Problems.

Regulation of Synchronous Generators: Regulation by E.M.F., M.M.F., Z.P.F. and A.S.A. methods. Two reaction analysis, determination of Xd and Xq (Slip test)- Numerical Problems. Parallel Operation of Synchronous Generators: Synchronizing alternators with infinite bus bars, parallel operation and load sharing-conceptual description only.

4. Books and Materials

Text Books:

1. J. B. Gupta (2006), Theory and Performance of Electrical Machines, 14th Edition, S. K. Kataria & Sons, New Delhi.
2. B. L. Theraja, A. K. Theraja (2002), A text book of Electrical Technology, 23rd Edition, S. Chand Publishers, New Delhi.

Reference Books:

1. E. Fritzgerald, C. Kingsley, S. Umans (2002), Electric Machinery, 5th Edition, Tata Mc Graw Hill Companies, New Delhi.
2. P. S. Bimbra (2000), Electrical Machinery, 7th Edition, Khanna Publishers, New Delhi.

Course Structure

A8214 - Power System Transmission and Distribution

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	45	15	0	4	40	60	100

1. Course Description

Course Overview

This course deals with basic theory of transmission lines modeling and their performance analysis. This course also gives emphasis on mechanical design of transmission lines, cables and insulators. Concepts like Transmission line parameters, Cables, Performance of Transmission lines, efficiency, Sag, tension calculations, insulators, string efficiency, Underground cables and distribution system concepts are emphasized.

Course Pre/co-requisites

A8202 - Electrical Power Generation

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8214.1 Apply the knowledge of Electromagnetic fields to calculate the transmission line parameters.
A8214.2 Analyze the voltage regulation and efficiency of different power transmission lines.
A8214.3 Analyze the sag and corona in transmission lines.
A8214.4 Categorize the types of insulators based on string efficiency and grade the under ground cables based on application.
A8214.5 Analyze the different topologies of AC distribution system.

3. Course Syllabus

Transmission Line Parameters: Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical conductor configuration, concept of transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical single and three phase, single and double circuit lines- Numerical Problems.

Performance of Short, Medium and Long Length Transmission Lines: Classification of Transmission Lines, Short, medium and long line and their model representations, Nominal-T, Nominal-Pie and A, B, C, D Constants for symmetrical networks. Mathematical

solutions to estimate regulation and efficiency of all types of lines. Long Transmission Line, evaluation of A, B, C, D Constants- Numerical Problems.

Factors Governing the Performance of Transmission Line: Skin and Proximity effects, Ferranti effect, charging current, effect on regulation of the transmission line, shunt compensation. Corona, description of the phenomenon, factors affecting corona, critical voltages and power loss- Numerical Problems. SAG and tension calculations: Sag and Tension Calculations with equal and unequal heights of towers, effect of wind and ice on weight of conductor- Numerical Problems.

Overhead Line Insulators & Underground Cables: Types of Insulators, String efficiency and Methods for improvement, voltage distribution, calculation of string efficiency, capacitance grading and static shielding. Types of cables, construction, types of Insulating materials. Capacitance of Single and 3-Core belted cables- Numerical Problems.

AC Distribution Systems: Classification of AC Distribution Systems, Under Ground and Over Head Distribution Systems, Voltage Drop Calculations in Radial A.C Distribution system fed at one end and at both ends (equal/unequal Voltages) and Ring Main Distributor-Numerical Problems.

4. Books and Materials

Text Books:

1. C. L. Wadhwa (2011), Electrical Power Systems, 6th Edition, New Age International (P) Limited, New Delhi.
2. M. L. Soni, P.V. Gupta, U.S. Bhatnagar, A. Chakrabarti (2011), A Text Book on Electrical Engineering, 2nd Edition, Dhanpat Rai & Co. Pvt. Ltd, New Delhi.

Reference Books:

1. B. R. Gupta (2008), Power System Analysis and Design, Revised Edition, S. Chand & Company Limited, New Delhi.
2. Hadi Saadat (2010), Power System Analysis, 3rd Edition, Public Affairs Information Service, New Delhi.
3. I. J. Nagarath, D. P .Kothari (2006), Modern Power System Analysis, 3rd Edition, Tata Mc Graw Hill Higher Education, New Delhi.

Course Structure

A8215 - Power system Operation and Control

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course addresses the operational and control challenges encountered in contemporary power systems, offering effective solutions. It explores the economic optimization of thermal and hydroelectric power plants, with a focus on hydro-thermal scheduling and fundamental modeling of power system components. Special attention is dedicated to mastering load frequency control and reactive power control mechanisms within power systems.

Course Pre/co-requisites

A8202 - Electrical Power Generation.

A8206 - Control Systems.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8215.1 Choose the optimal scheduling of generator units problems employed in thermal plants.
A8215.2 Analyze the optimal hydrothermal load scheduling problems.
A8215.3 Model various components of an isolated power system.
A8125.4 Analyze the Load Frequency Control of single area and two area systems for static and dynamic cases.
A8215.5 Analyze the techniques and devices used for reactive power compensation.

3. Course Syllabus

Introduction to Economic Operation of Power Systems: Optimal operation of generators in thermal power stations, Heat rate curve, Cost curve, Incremental fuel costs, Production costs, Input-output characteristics, Optimum generation allocation with and without line losses, Loss coefficients, General transmission line loss formula.

Hydrothermal Scheduling: Optimal scheduling of hydrothermal system, Hydroelectric power plant models, Scheduling problems, Short term hydrothermal scheduling problem.

Modeling of Turbine, Speed Governor and Excitation System: First order turbine model, Block diagram representation of steam turbines and approximate linear models, Mathematical modeling of speed governing system, Derivation of small signal transfer function, Fundamental characteristics of an excitation system Transfer function.

Load Frequency Control: Necessity of keeping frequency constant, Definition of control area, Single area control, Block diagram representation of an isolated power system, Steady state analysis, Dynamic response, Load frequency control of 2-area system, Uncontrolled case and controlled case, Tie-line bias control. **Load Frequency Controllers:** Proportional plus integral control of single area and its block diagram representation, Steady state response, Load frequency control, Economic dispatch control.

Reactive Power Control: Principle of reactive power control, Load compensation, Specifications of load compensator, Uncompensated and compensated transmission lines, Shunt and series compensation.

4. Books and Materials

Text Books:

1. I. J. Nagrath, D.P. Kothari(2006), Modern Power System Analysis, 3rd Edition, McGraw Hill Publishers, New Delhi.
2. P.S.R. Murthy(2008), Power System Operation and Control, 1st Edition, Tata McGraw Hill Publishers, New Delhi.

Reference Books:

1. Hadi Saadat(2010), Power System Analysis, Revised edition, PSA publishers, New Delhi.
2. O.I. Elgerd(2007), Electric Energy Systems Theory, 2nd Edition, Tata McGraw Hill Publishers, New Delhi.

Course Structure

A8609 - Java Programming Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course focuses on different aspect of core Java Environment suitable to write efficient, maintainable, and portable code for real world application. It provides strong foundation on OOP Principles, Packages, and Interfaces and also illus- trates Exception Handling and Multi threaded mechanisms. The course provides In depth knowledge to implement Collection framework. Emphasis on AWT and Swing concepts used for GUI applications is given with event handling. The course plays a vital role in developing front-end interface for Mini and Major Projects.s

Course Pre/co-requisites

A8508 - Python Programming Laboratory

A8505 - Data Structures

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8609.1 Make use of various constructs to write a console application.
A8609.2 Use principles of OOP to develop real time applications.
A8609.3 Identify the need of exception handling to deal with runtime errors.
A8609.4 Build applications for parallel processing using Multithreading.
A8609.5 Implement Collection framework and I/O to organize, manipulate and store data.

3. List of Experiments

1. Write a Java Program to read three integers and find the greatest among them.
2. Write a Java Program to check a number is amstrong or not.
3. Write a Java Program to check a number is prime or not.
4. Define a class Rectangle with data member's length and width. Write methods to find perimeter and area of a rectangle. (class and object)
5. Create a class Account with data members name, acno and balance. Use appropriate methods to perform various operations like deposit, withdraw, balnce Check.

6. Create a class Student with appropriate data and methods using constructor.
7. Create overloaded methods to find area of rectangle,triangle and square.
8. (a) To sort given list of elements in ascending order.
   (b) Check a string is palindrome or not.
9. Declare a class called Employee having employee_id and employee_name as members. Extend class Employee to have a subclass called Salary having designation and monthly_salary as members. Define following:
   (i) Required constructor
   (ii) A method to find and display all details of employees drawing salary more than Rs.20000/-
10. (a) Write a Java program that create an abstract base class Shape with two members base and height, a member function for initialization and a function to compute shapeArea().
    (b) Derive two specific classes Triangle and Rectangle which override the function shapeArea(). Write a driver classes (main) to display the area of the triangle and the rectangle.(Use super keyword).
11. (a) Create a Package Measure, in which store a class named Convertor that contains methods to convert mm to cm, cm to m and m to km.
    (b) Define a class Need_Convertor that imports the Convertor class, now store Need_Convertor outside the package Measure, and Perform path settings accordingly.
12. Write a Java program that implements an interface Student which has two methods displayGrade() and attendance(). Implement two classes PG_Student and UG_Student with necessary inputs of data.
13. (a) Write a Java Program to handle Arithmetic Exception and Number Format Exception
    (b) Write a Java Program to handle custom exceptions.
14. Create a multithreaded java program by creating a subclass of Thread and then creating, initializing, and staring two Thread objects from your class. The threads will execute concurrently and display "Java is object oriented" in console window.
15. (a) Use ArrayList class methods to perform operations on collection of data.
    (b) Use HashSet class methods to perform operations on collection of data.

4. Laboratory Equipment/Software/Tools Required

1. A Computer With Ubuntu Operating System.
2. JDK 8 or AboveVersion.

5. Books and Materials

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 11th Edition, Tata McGraw-Hill Education, 2019.

Course Structure

A8216 - Electrical Machines – II Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This Course gives hands-on practice adequately supported by required hardware. It deals with A.C. Machines where students will learn construction, operation and characteristics. Performance of these electrical machines will be verified by conducting various experiments in the laboratory.

Course Pre/co-requisites

A8207 - Electrical Machines - I

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8216.1 Apply the basic laws of electrical circuits to study the construction and operation of Induction motors and Alternators.
A8216.2 Analyze the characteristics and performance of Induction motors and Alternators.
A8216.3 Apply suitable test to determine the performance parameters of Synchronous machines and Induction motors.
A8216.4 Compare various methods to find voltage regulation of Alternators.

3. List of Experiments

1. Regulation of a three phase alternator by synchronous impedance method.
2. Determination of sequence reactance's of Synchronous machine.
3. Equivalent Circuit of a single phase Induction motor.
4. Determination of Xd and Xq of a salient pole synchronous machine.
5. Synchronization of alternators.
6. Brake test on a single phase Induction motor.
7. Efficiency of Three phase alternator.
8. Speed control of slip ring Induction Motor by Variable rotor resistance method.
9. No-load & Blocked rotor tests on a three phase Induction motor.
10. Brake Test on a three phase Induction motor.

11. Verification of Relationship between Voltages and Currents of a Three Phase Transformer (Star-Delta, Delta-Delta, Delta-star, Star-Star).
12. Separation of core losses of a Single phase Transformer.

4. Laboratory Equipment/Software/Tools Required

1. Three Phase Induction Motors
2. Three Phase Alternators
3. AC Voltmeter and Ammeters
4. Single Phase Induction Motors
5. UPF and LPF Watt meters

Course Structure

A8217 - Power System Transmission and Distribution Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This laboratory course provides practical, hands-on experience with PSCAD for modeling transmission and distribution networks. Students will conduct experiments in the laboratory to verify the performance characteristics of transmission lines, exploring the impact of various insulating mediums and materials. The focus is on applying theoretical knowledge to real-world scenarios and gaining practical insights into the behavior of transmission lines.

Course Pre/co-requisites

A8202 - Electrical Power Generation

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8217.1 Analyze the compensation techniques in power system using PSCAD.
A8217.2 Determine the ABCD parameters pf a long power transmission lines.
A8217.3 Measure low resistance of conducting materials using Milli volt-drop test.
A8217.4 Analyze the breakdown characteristic of air and oil insulators.
A8217.5 Plot electric field of charged electrode using electrolytic bath.

3. List of Experiments

1. Measurement of low Resistances (Milli Volt Drop Test).
2. Simulation of Mid-Point compensation using PSCAD.
3. End point compensation under light load using PSCAD.
4. Line compensation under lagging PF Conditions using PSCAD.
5. Simulation of load compensation using PSCAD.
6. Verification of Ferranti effect in along transmission line.
7. Determination of ABCD parameters for along transmission line.
8. Plotting of e –fields using electrolytic bath.
9. Overhead Transmission line modelling using PSCAD.
10. Break down Characteristics of Sphere – Sphere Geometry.
11. Breakdown Characteristics of Sphere–Point Geometry.

12. Determination of Break down strength of oil for distance electrodes.

4. Laboratory Equipment/Software/Tools Required

1. Milli Volt Drop Test kit.
2. PSCAD Software
3. Long Transmission lines simulator kit.
4. High voltage testing kit.
5. Electrolytic bath.
6. Oil Testing Kit.

Course Structure

A8024 - Product Realization

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Making the students socially responsible is the main motto. In this process introducing technological concepts and creating innovating product is carried out for the community. The Product Realization introduces communication with community, planning of product realization, design and development of the product added with skill sets of leadership. This course given an exposure on converting an innovative idea to physical product to meet the need of the community. It improves skill of research paper writing, patent drafting and also developing the skill of preparation of business models.

Course Pre/co-requisites

A8021 - Social Innovation

A8022 - Engineering Exploration

A8023 - Engineering Design Thinking

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8024.1. Interpret the specifications of product and solve for practical realization.
A8024.2. Analyse the customers mind set and design the product.
A8024.3. Develop Gantt chart to define timeline for product realization.
A8024.4. Conceptualize the terms called product, purchase, production and monitoring of products.
A8024.5. Communicate the process of converting an idea to physical product to the community.

3. Course Syllabus

Theory

Introduction and Planning of Product Realization: Introduction to Product Realization, Need for Product Realization, Product realization process, Case Study of Product Realization for Global Opportunities. Plan and develop the processes needed for product realization, Defining Quality objectives and requirements, establish processes documents.

Needs - verification, validation, monitoring inspection and test activities (inspection nodes) and criteria for product acceptance and record needed. Case study on timeline of Product realization planning (Gantt Chart).

Customer-Related Processes: Product information Enquiries, contracts or order handling Customer feedback including customer complaints, A field survey.

Design and Development: Review verification and validation of each design and development stages, Functional and performance requirements, Information for purchasing, production and service provisions, review and validation, Develop a Design model of the product.

Purchasing, Production and Service Provision: Purchasing information, Vendors evaluation and approval process, Verification of purchased product. Control of production, service provision, validation of processes for production and service provision, Identification and tractability, Customer property and Preservation of product.

Scope of Product Perseverance: Writing proficiency for papers, Patent drafting and development of business model.

Practice

1. Introducing oneself to the steps of Product realization.
2. Case Study to define the necessity.
3. Brainstorming Session on Product Realization in teams.
4. Watching videos on Planning of product realization in real time scenario from R Labs.
5. Verification of the Product specifications which satisfies all the needs.
6. Discussion with Customers about the product and the specifications.
7. Discussion about the finished product and taking feedback.
8. Feedback Analysis and redesign if required.
9. Verification of redesigned product and market study.
10. Discussion on different Purchasing and Services for the product development.
11. Data from the customer for market and feedback of market is acquired.
12. Activity on Observation skills to know how to use one's observation skills in understanding the parameters
13. Brainstorming deliberations on the initial observations and measuring of the product.
14. Familiarization of the respective templates with the help of sample case study.

4. Books and Materials

Text Books:

1. Mileta M Tomovic, Sowping Wang, Product Realization – A Comprehensive Approach, 1st Edition, Spinger, 2009.
2. Stark, John, Product Life Cycle Management, 21st century Paradigm for Product Realisation 2011, Springer.

Reference Books:

1. Verna J. Bowen, Lucy V. Fusco, The Competitive Edge Research Priorities for U.S. Manufacturing, National Academy of Sciences.
2. Renuka Thota, Suren Dwivedi, Implementation of product realization concepts in design and manufacturing courses, University of Louisiana-Lafayette.

Course Structure

A8032 - Environmental Science and Technology

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	0	-	100	100

1. Course Description

Course Overview

This course enables the students to engage with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world. This course requires that the students should identify and analyze the natural and human-made environmental problems and evaluate the relative risks associated with these problems. It provides the scope to examine alternative solutions for resolving or preventing them. It is essentially a multidisciplinary approach that brings out an appreciation of our natural world and human impact on its existence and irrigational control measures. Its components include Biology, Geology, Chemistry, Physics, Engineering, Sociology, Health, Anthropology, Economics, Statistics, Computers and Philosophy, engineering technology, Integrating sustainable development into their engineering practice.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8032.1. Illustrate the important components of environment.

A8032.2. Identify global environmental problems to come out with best possible solutions.

A8032.3. Make use of environmental laws & environmental ethics for the protection of forest and wildlife..

A8032.4. Apply to maintain harmonious relation between nature and human being and integrating sustainable development goals into their engineering practice.

A8032.5. Analyse the major environmental effects of exploiting natural resources.

3. Course Syllabus

Fundamentals of Environment and Ecology: The multidisciplinary nature of environmental studies, environmental ethics, Global environmental issues, Planetary boundaries, Fundamentals of ecology - ecosystem definition, structure and functions of ecosystem, food

chain and food web, feedback loops, Ecosystem services.

Natural Resources and Management: Classification of resources: Renewable and Non-renewable re- sources. Forest resources: Uses and over exploitation of forests. Dams and their environmental impacts. Water resources: Use and over utilization of surface and ground water, conflicts over water. Energy resources: Renewable energy resources: solar energy, wind energy and geothermal energy. Food resources: Problems with Chemical fertilizers and pesticides. Biofertilizers (organic farming) and their importance. Bio-geo chemical cycles, Socio-ecological systems

Biodiversity and Its Conservation: Introduction and definition. Genetic diversity, species diversity and ecosystem diversity. Values of biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and Option values. Man-wildlife conflicts. In-situ and Ex-situ conservation of biodiversity, Biodiversity Law.

Environmental Pollution and Control: Definition, causes, effects and control measures of Environmental pollution, Air pollution, water pollution, Soil pollution, solid and hazardous waste management, Noise pollution, E-waste, bio-medical waste, Wastewater treatment and emerging pollutants, Standards for Air and Water.

Concept of sustainable development: Sustainable development goals, Carbon footprints, Net-Zero-Emissions, Montreal protocol a success story, Conference of parties (CoP), IPCC, Kyoto protocol, Environmental Acts, Life cycle analysis, Circular Economy, Sustainable Living, Ecological Engineering- ecological restoration, natural and constructed wetlands, nature-based solutions. Case Studies: Mission Kakatiya, Chipko Movement, Water Man of India (Dr. Rajendra Singh), Watershed management.

4. Books and Materials

Text Books:

1. Anubha Kaushik, C.P. Kaushik. Perspectives in Environmental Studies. 6th Edition, New age international publishers, 2018.
2. M. Anji Reddy. Textbook of Environmental Science and Technology, Revised Edition, BS Publications, 2014.

Reference Books:

1. Erach Bharucha. Textbook of Environmental Studies for Undergraduate Courses, 2nd Edition, Orient BlackSwan Publishers, 2013.
2. Benny Joseph, Environmental studies, 3rd Edition, McGraw Hill Education (India) Private Limited, 2018.

III YEAR I SEMESTER

Course Structure

A8218 - Power System Analysis

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	45	15	0	4	40	60	100

1. Course Description

Course Overview

Power System Analysis deals with load flow studies, computer control of power systems, short circuit studies and stability studies. The course provides an in-depth knowledge to the students in the formation of Y bus matrix, Z bus matrix and per unit system.

Course Pre/co-requisites

A8214-Power System Transmission and Distribution.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8218.1. Develop per unit reactance diagrams, bus incidence, YBus matrices for modeling the actual power system.
A8218.2. Analyze symmetrical and unsymmetrical power system faults.
A8218.3. Apply iterative techniques like Gauss Seidel and Newton Raphson methods to determine the steady state power flow analysis of the given power system.
A8218.4. Examine steady state and transient stability of power system.
A8218.5. Organize the scheduling of generators in a power system for its economic operation.

3. Course Syllabus

PER-UNIT REPRESENTATION OF POWER SYSTEM: Single-line diagram, per-unit system, per-unit equivalent impedance and reactance diagram of a three-phase power system. Bus Incidence Matrix, Bus admittance matrix (Y-Bus), properties of Y Bus, Formation of Y-bus by direct inspection and singular transformation methods.

FORMATION OF Z BUS: Partial network, Algorithm for the Modification of Z Bus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old buses.

POWER FLOW ANALYSIS: Necessity of Power Flow Studies, Static Power Flow Equation, Acceleration Factor, Algorithm with and without P-V buses, Determination of Bus Voltages, Injected Active and Reactive Powers. Numerical Load flow Solution for Simple Power Systems (Max. 3-Buses) - conceptual description only. Load Flow Solution with or without PV Busses. Derivation of Jacobian Elements. Comparison of different load flow methods-conceptual description only.

SYMMETRICAL & UNSYMMETRICAL FAULT ANALYSIS: Purpose of Fault analysis, Short Circuit Current and MVA Calculations, Fault levels, Current limiting reactors. Symmetrical Components: Positive, Negative and Zero sequence components, Sequence impedances, Sequence Networks, Single Line to Ground (SLG), Line to Line (LL), and Double Line to Ground (LLG) faults with and without fault impedance

POWER SYSTEM STABILITY: Classification of power system stability, Swing equation, Swing curve, Power angle equation, Equal area criterion, Critical clearing angle, Numerical solution of Swing Equation (Point by Point method), Methods of improving stability.

4. Books and Materials

Text Books:

1. G. W. Stagg, A. H. El-Abiad (2008), Computer Methods in power System Analysis, 2nd Edition, Tata McGraw Hill Publications, New Delhi
2. M. A. Pai (2008), Computer Techniques in Power System Analysis, 2nd Edition, Tata McGraw Hill Publications, New Delhi, India
3. P.S.R. Murthy(2008), power system operation and control, 1st Edition, Tata McGraw Hill Publishers, New Delhi.

Reference Books:

1. Hadi Saadat (2007), Power System Analysis, 5th Edition, Tata McGraw Hill Publications, NewDelhi
2. I. J. Nagrath, D. P. Kothari (2005), Modern Power system Analysis, 3rd Edition, Tata McGraw Hill Publications, New Delhi, India.
3. M. L. Soni, P. V. Gupta, U. S. Bhatnagar, A. Chakraborti (1999), A Text Book on Electrical Engineering, 1st Edition, Dhanpat Rai & Co. Pvt. Ltd, New Delhi

Course Structure

A8219 - Power Electronics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	45	15	0	4	40	60	100

1. Course Description

Course Overview

The objective of this course is to make the students familiar with the operation and characteristics of various power semiconductor devices (BJT, power MOSFET, IGBT, SCR and GTO). Additionally, it deals with Phase Controlled Rectifiers, AC Voltage Controllers, Cycloconverter, Choppers, and Inverters, discussing their operations, control techniques, and practical applications in electrical systems.

Course Pre/co-requisites

A8405-Analog Devices and Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8219.1. Apply knowledge of electronic devices to analyze and predict the switching characteristics of power semiconductor devices under different operating conditions.
A8219.2. Apply the phase control techniques to design and analyze AC-DC and converters.
A8219.3. Apply the phase control techniques to design and analyze AC-AC converters.
A8219.4. Analyze the performance of dc-dc converters for multi-quadrant application
A8219.5. Apply pulse width modulation techniques for voltage control in inverters in practical scenarios.

3. Course Syllabus

Power Semiconductor Devices: BJT, power MOSFET, power IGBT, GTO - Operation and their switching characteristics. Silicon Controlled Rectifiers (SCR) - Basic operation, Static characteristics, Dynamic characteristics, two transistor analogy, Protection and ratings of SCR, Turn-on and turn-off methods.

Phase Controlled Rectifiers: Phase control technique, Single-Phase Controlled Converter - Half controlled converter and fully controlled converter with R and RL loads, without and

with freewheeling diode. Three-Phase Controlled Converter - half controlled converter and fully controlled converter with R and RL loads. Derivation of average load voltage and current, performance parameters, effect of source inductance. Dual Converters (principle of operation only).

AC Voltage Controllers: Single-phase Full wave AC Voltage Controllers with R and RL loads, derivation of RMS load voltage, current and input power factor. Cycloconverter: Single phase midpoint cycloconverter with resistive and inductive load (principle of operation only), bridge configuration of single phase cycloconverter, principle of operation and waveforms.

Choppers: Classification, Control strategies, time ratio control and current limit control, step down chopper, step up chopper and step up/down chopper, fly back converter, forward converter, derivation of load voltage expression. Morgan's chopper and Jones's chopper.

Inverters: Basic series inverter, basic parallel inverter, single-phase half bridge and full bridge inverters, operation and waveforms, Three-phase inverters (120^0 and 180^0 operation). Voltage control techniques for inverters – Pulse width modulation techniques.

4. Books and Materials

Text Books:

1. M. H. Rashid (2017), Power Electronics: Circuits, Devices and Applications, 4^{th} Edition, Pearson Education.
2. M. D. Singh, K. B. Kanchandhani (2008), Power Electronics, 3^{rd} Edition, Tata Mc graw hill publishing company, New Delhi.

Reference Books:

1. P. S. Bimbra (2022), Power Electronics, 7th Edition, Khanna Publishing, New Delhi.
2. Vedam Subramanyam (2018), Power Electronics: Devices, Converters, Application, New Age International (P) Limited, New Delhi.
3. Ned Mohan, Tore M. Undeland, William P. Robbins (2002), Power Electronics: Converters, Applications, and Design, 3rd Edition, Wiley.

Course Structure

A8220 - Power System Switchgear And Protection

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces all varieties of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars from over voltages and other hazards. It emphasis on neutral grounding for overall protection. This is very interesting and useful subject for a power system engineer.

Course Pre/co-requisites

A8214-Power System Transmission and Distribution.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8220.1. Analyze the operational aspects of different types of circuit breakers.
A8220.2. Distinguish various types of relaying schemes such as differential, distance, over current /under voltage, Instantaneous, DMT and IDMT relays.
A8220.3. Develop protection schemes for generators, bus-bars, feeders and transformers.
A8220.4. Analyze different neutral grounding methods and protection schemes against over voltages.

3. Course Syllabus

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking voltage and Recovery voltages, Restriking Phenomenon, Average and Max. RRRV. Current Chopping and Resistance Switching, CB ratings and Specifications, Types. Auto reclosures description and Operation of following types of circuit breakers, Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

Electromagnetic and Static Relays: Principle of Operation and Construction of Attracted armature, Balanced Beam, Induction Disc and Induction Cup relays. Relays Classification: Instantaneous, DMT and IDMT types. Application of relays: Over current/Under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays. Universal torque equation, distance relays: Impedance, Reactance and Mho and Off-Set Mho

relays, Comparison. Static Relays: Static Relays verses Electromagnetic Relays.

Protection of Transformers and Transmission Lines: Percentage Differential Protection, Buchholtz relay Protection. Over Current, Three-zone distance relay protection using Impedance relays. Translay Relay.

Generator, Feeder and Bus-Bar Protection: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on percentage Winding Unprotected. Protection of Bus bars – Differential protection.

Neutral Grounding: Grounded and Ungrounded Neutral Systems.- Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance - Arcing Grounds and Grounding Practices. Protection Against Over Voltages: Generation of Over Voltages in Power Systems.-Protection Against Lightning Over Voltages - Valve type and Zinc-Oxide Lightning Arresters.

4. Books and Materials

Text Books:

1. Badari Ram, D. N. Viswakarma (2007), Power System Protection and Switchgear, 1st Edition, Tata McGraw Hill Publications, New Delhi.
2. C. L. Wadhwa (2011), Electrical Power Systems, 6th Edition, New Age International (P) Limited, New Delhi.

Reference Books:

1. Sunil S. Rao (1999), Switchgear and Protection, 10th Edition, Khanna Publishers, New Delhi.
2. M. L. Soni, P. V. Gupta, U. S. Bhatnagar, A. Chakraborti (1999), A Text Book on Electrical Engineering, 1st Edition, Dhanpat Rai & Co. Pvt. Ltd, New Delhi.

Course Structure

A8610 - Relational Database Management Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces the core principles and techniques required in the design and implementation of database systems. This course focus on relational database management systems, including database design theory: E-R modeling, data definition and manipu- lation languages, database security and administration. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery and vari- ous types of databases like distributed database, and intelligent database, Client/Server. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8610.1 Demonstrate design and implementation of a database for a given problem domain.
A8610.2 Construct Queries in Relational algebra, relational calculus and SQL.
A8610.3 Apply Normalization techniques to reduce data redundancy in data base.
A8610.4 Analyze various transaction control and recovery methods to keep data base consistent.
A8610.5 Construct the file of data records by using appropriate storage and access structure.

3. Course Syllabus

Introduction: Introduction to database management systems, database system applications, database systems versus file systems, View of Data, Database System Structure, Data models, DBMS languages and examples, Database Users and Administrators. Relational Algebra Operators, Relational Calculus.

SQL: Overview, Form of a basic SQL Query, Set Operators, Clauses: Group by, Order by, Having clauses, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Joins, Introduction to views. Introduction to PL/SQL: Procedures, Functions, Cursors, Triggers.

Schema Refinement and Normal Forms: Functional Dependencies, Reasoning about FDs. Normal Forms: 1NF, 2NF, 3NF, BCNF, Properties of decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies: 4NF, 5NF.

Transaction Management: Transaction concept, Transaction state, ACID properties, Concurrent executions, Transaction Anomalies, Serializability, Types of Serializability, Introduction to Schedule, Types of Schedules, Recoverability.

Concurrency Control and Recovery System: Concurrency control - Lock based protocols, Timestamp based protocols, Validation based protocols, Deadlock handling, Introduction to RAID.

4. Books and Materials

Text Books:

1. Raghurama Krishnan, Johannes Gehrke (2007), Database Management Systems, 3rd Edition, Tata McGraw-Hill, New Delhi, India.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2010), Database System Concepts, 6th Edition, McGraw- Hill, New Delhi, India.

Reference Books:

1. Elmasri Navate (2014), Fundamentals of Database Systems, Pearson Education, India.

Course Structure

A8221 - Power System Analysis Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

Power System Analysis Laboratory deals with load flow studies, computer control of power systems, and short circuit studies. This laboratory course analyses and verifies the characteristics of Circuit Breaker in power systems. Students can analyze and simulate Z & Y Bus matrices and load flow analysis of power transmission lines using MATLAB Software. Students can also explore knowledge on Design and fault analysis and protection of transmission lines.

Course Pre/co-requisites

A8202-Electrical Power Generation.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8221.1. Develop Z-bus and Y-bus matrices for power transmission lines using MATLAB.
A8221.2. Analyze various faults in power system using PSCAD.
A8221.3. Analyze and verify the load flow analysis of transmission network using MATLAB.
A8221.4. Characterize and verify the operational aspects of different types of circuit breakers and Protective devices.

3. List of Experiments

1. Determination of bus admittance matrix (Y-Bus) using MATLAB.
2. Determination of bus impedance matrix (Z-Bus) using MATLAB.
3. Load flow analysis using Gauss – Seidal Method using MATLAB.
4. Load flow analysis using Newton Raphson Method Using MATLAB.
5. Determination of symmetrical components using MATLAB.
6. Study of LG, LLG, LLL, and LLLG faults using PSCAD.
7. PSCAD Simulation of a circuit breaker operation.
8. IDMT Characteristics of a fuse.

9. IDMT Characteristics of a circuit breaker.
10. LG Fault of a long transmission line.
11. Measurement of earth resistivity.
12. Protection of Transmission Line with distance relays using PSCAD

4. Laboratory Equipment/Software/Tools Required

1. Earth Resistance test kit.
2. Hammer (3kgs).
3. Miniature Circuit Breaker(MCB) Test Kit (50A).
4. Fuse Testing unit (50A).
5. Transmission line Protection simulation unit.
6. Desktop Computers.
7. PSCAD Software.
8. MATLAB Software.

Course Structure

A8222 - Power Electronics Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course offers the exploration of power electronic devices and converter topologies. Through practical experiments, students explore SCR, MOSFET, and IGBT characteristics, analyzing various single-phase and three-phase converters, choppers, and inverters. MATLAB simulations enhance understanding, enabling students to design and evaluate these systems for diverse load conditions, emphasizing their applications in modern electrical systems.

Course Pre/co-requisites

A8405-Analog Devices and Circuits.

A8219-Power Electronics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8222.1. Analyze the performance of controlled converter and chopper circuits.
A8222.2. Analyze the performance of various AC/DC-AC converter circuits.
A8222.3. Simulate and analyze various converter and chopper circuits using MATLAB/Simulink.
A8222.4. Simulate and analyze various AC/DC – AC circuits using MATLAB/Simulink.

3. List of Experiments

1. Study of SCR, MOSFET and IGBT Characteristics.
2. Analysis of Single-Phase Half-controlled Converter with R and RL loads.
3. Analysis of Single-Phase Full-controlled Converter with R and RL loads.
4. Study of DC Jones Chopper.
5. Single Phase AC Voltage Controller with R and RL Loads.
6. Single Phase Series inverter with R and RL loads.
7. Simulation of Three-Phase Full Controlled Converter using MATLAB/Simulink.
8. Simulation of Buck-Boost Chopper with R and RL Load using MATLAB/Simulink.

9. Simulation of Fly back/Forward Converter using MATLAB/Simulink
10. Simulation of Single-Phase Cyclo converter with R and RL loads using MATLAB/Simulink.
11. Simulation of Single Phase PWM inverter using MATLAB/Simulink.
12. Simulation of Three-Phase Inverter using MATLAB/Simulink.

4. Laboratory Equipment/Software/Tools Required

1. DESKTOPs with MATLAB/SIMULINK.
2. SCR, MOSFET and IGBT kit.
3. Regulated Power Supply and loads.
4. Jones chopper kit, Regulated Power Supply and loads.
5. AC voltage controller kit, AC supply and loads.
6. Full converter kit, AC supply and loads.
7. Cyclo converter kit, AC supply and loads.
8. Series inverter kit, Regulated Power Supply and loads.
9. Half converter kit, Regulated Power Supply and loads.

Course Structure

A8611 - Relational Database Management Systems Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course introduces the core principles and techniques required in the design and implementation of database systems. This course focus on relational database management systems, including database design theory: E-R modeling, data definition and manipu- lation languages, database security and administration. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery and vari- ous types of databases like distributed database, and intelligent database, Client/Server. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8611.1 Apply the basic concepts of Database Systems design and Applications.
A8611.2 Design a Commercial database for a given problem using E-R diagrams and Relational Model.
A8611.3 Construct Queries in SQL for a given case study.
A8611.4 Implement various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views.
A8611.5 Use PL/SQL concepts to access database in web based/standard applications.

3. List of Experiments

1. a. Case Study on designing ER diagrams for university database. b. Practice on SQL data definition language (DDL) commands.
2. a. Case Study on designing ER diagrams for company database to store information about employees
   b. Practice on SQL data manipulation language (DML) commands to retrieve and modify data.

3. Practice on different types of SQL operators and aggregate operations.
4. Practice on different types of SQL built in functions like Date functions, string functions, Numeric and conversion functions, Analytic functions etc.
5. a. Practice on queries using Group by, Order by, and Having Clauses.
   b. Practice on queries involving commit, roll back and save point operations.
6. Practice on different types of SQL Set Operators and Aggregate operations.
7. Practice on queries involving different types of Joins.
8. Practice on queries using Co-related sub Queries and Nested queries.
9. Practice on PL/SQL basics for writing programs using programming constructs like variables, operators and conditional, control statements.
10. Practice on PL/SQL programs using cursors.
11. Practice on PL/SQL programs using triggers.
12. Practice on PL/SQL programs involving stored procedures and functions.

4. Laboratory Equipment/Software/Tools Required

1. A Computer With Ubuntu Operating System.
2. Oracle 11 Version

5. Books and Materials

Text Books:

1. Raghurama Krishnan, Johannes Gehrke (2007), Database Management Systems, 3rd Edition, Tata McGraw-Hill, New Delhi, India.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2010), Database System Concepts, 6th Edition, McGraw- Hill, New Delhi, India.

Reference Books:

1. Elmasri Navate (2014), Fundamentals of Database Systems, Pearson Education, India.

Course Structure

A8034 - Indian Constitution

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	0	-	100	100

1. Course Description

Course Overview

This course enables the students to understand the constitution of India as the Supreme law of India. The student will also gain knowledge about the parliament of India and how it functions. This course will survey the basic structure and operative dimensions of the Indian constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian constitution.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8034.1. Identify the important components of Indian Constitution.
A8034.2. Apply the fundamental rights in right way and become a more responsible citizen.
A8034.3. Illustrate the evolution of Indian Constitution.
A8034.4. Identify the basic structure of Indian Constitution.
A8034.5. Relate the basic concepts of democracy, liberty, equality, secular and justice.

3. Course Syllabus

Evolution of Indian constitution: Indian independence act 1947, formation of constituent assembly of India, committees of the constituent assembly, constitution of India drafting committee, brief study about Indian Constitution drafting committee Chairman, time line of formation of the constitution of India.

Structure of the constitution of India: Parts, schedules, appendices, constitution and government, constitution and judiciary.

Preamble to the constitution of India: Brief study about sovereignty, socialist, secularism, democracy, republic, justice (political justice, social justice, economic justice), liberty, equality, fraternity, unity & integrity.

Acts: Salient Features, Provisions of the acts: Right to education act, right to information act, anti-defection law, Jan Lokpal bill.

Fundamental rights: Right to equality, right to freedom (freedom of speech and expression, right to practice any profession etc.), right against exploitation, right to freedom of religion, cultural & education rights, right to property, right to constitutional remedies

4. Books and Materials

Text Books:

1. Dr. Durga das basu.Introduction to the constitution of India, 21st Edition, Lexis Nexis books publication Ltd, 2013.

Reference Books:

1. Subhash C. Kashyap, Our Constitution, National Book Trust, New Delhi, 2011.
2. Arun K Thiruvengadam, The Constitution of India, 1st Edition, Hart publishing India, 2017.

III YEAR II SEMESTER

Course Structure

A8223 - Electrical Measurements and Instrumentation

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course comprehensively covers the working principles and dynamics of various electromechanical instruments, including ammeters, voltmeters, ohmmeters, wattmeters, and energy meters. Students will learn about the measurement of resistance, inductance and capacitance, as well as the application of bridges and potentiometers for precise measurements. Instrument transformers are also discussed in detail. Furthermore, the course explores different types of instrument devices, focusing particularly on transducers and their functions within measurement systems.

Course Pre/co-requisites

A8201-Electrical Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8223.1. Measure voltage and current using PMMC instruments, moving iron meters, and instrument transformers, and analyze the accuracy of these measurements.

A8223.2. Measure power and energy using different methods, and analyze the sources of error.

A8223.3. Apply the principles of D.C. Crompton's potentiometer and digital measurement tools for the measurement of unknown resistance, current, and voltage.

A8223.4. Analyze the working principles of A.C. bridges and apply these principles to measure inductance and capacitance.

A8223.5. Apply the principles of operation of various transducers to measure the physical quantities in various applications.

3. Course Syllabus

Measuring Instruments: Classification of instruments, Deflecting, control and damping torques. Construction and operation of PMMC instrument, deflecting torque and control torque, Voltage and currents Measurements, Extension of range using shunts and multipliers in PMMC - Numerical Problems. Construction and operation of moving iron type

instruments-expression for the deflecting torque and control torques. CT & PT: Nominal ratio, turns ratio and transformation ratio of Current Transformer and Potential Transformer. Ratio error, phase angle error and Burden of Current Transformer. Power Factor meters: Single phase dynamometer type and Single phase moving iron type - conceptual description only.

Measurement of Power and Energy: Power Measurement: Single phase dynamo meter wattmeter, expression for deflecting and control torques, LPF wattmeter. Power measurement using three voltmeter and three ammeter methods, Iron loss in a Bar specimen-conceptual description only. Energy Measurement: Single phase induction type energy meter-driving and braking torques- errors and compensations- Numerical Problems on percentage error in Energy meter.

Potentiometer & Digital Measurement Techniques: Principle and operation of D.C. Crompton's potentiometer, standardization, Measurement of unknown resistance, current, voltage. Digital Measurement Techniques: Types of tools used in digital systems, Digital voltmeters for DC and AC voltage measurement, Measurement of current and resistance by Digital multimeter, Digital frequency meter.

A.C. Bridges: Measurement of inductance using Anderson bridge. Measurement of capacitance and Dissipation factor using Schering Bridge-Numerical problems. Measurement of frequency using Wien's Bridge. Resistance Measurements using Kelvin's double bridge and loss of charge method - conceptual description only.

Transducers: Classification of transducers, Principle of operation of LVDT and LVDT applications, Strain gauge and its principle of operation, gauge factor, Piezo-electric effect, Hall effect, optical and digital transducers, Elements of data acquisition system, Smart Sensors, Thermal Imagers.

4. Books and Materials

Text Books:

1. A. K. Sawhney (2011), A Course in Electrical & Electronic Measurement & Instruments, 19th Edition, Dhanpat Rai & Co. Publications, New Delhi
2. W. Golding, F.C. Widdis (2010), Electrical Measurements and Measuring Instruments, 5th Edition, Wheeler Publishing, New Delhi

Reference Books:

1. J. B. Gupta (2010), Electronics and Electrical Measurements and Instrumentation, 10th

Edition, S.K. Kataria sons, New Delhi.

2. Reissland, Martin.U (2010), Electrical Measurements: Fundamentals, Concepts, Applications, New Age International (P) Limited, New Delhi.
3. H. S. Kalsi (2010), Electronic Instrumentation, 3rdEdition, Tata McGraw Hill Publications, New Delhi.

Course Structure

A8433 - Microprocessors and Microcontrollers

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a comprehensive introduction to microprocessors (8086), microcontrollers (8051) and their architectures with an emphasis on its interfacing with external devices. Focus is on 8086 & 8051 families which include internal architecture, pin diagram, instruction set, register organization, addressing modes, and operating modes, interrupt structure, assembly language programming and etc. Various aspects of hardware design, such as interfacing of memory and different types of I/O devices will be covered in detailed. The course is accompanied by laboratory experiments directly linked to the lecture topics for hands-on learning of the material. This course will be useful to students as a first level course for embedded systems domain and provides an opportunity to develop RISC type embedded systems starting with electronic components, data sheets and progressing through construction of hardware and firmware.

Course Pre/co-requisites

A8413 – Linear and Digital Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8433.1. Analyze features of 8086 microprocessor and 8051 microcontroller to use it for desired applications.
A8433.2. Develop assembly language programs using instruction set of 8086 microprocessor and 8051 microcontrollers.
A8433.3. Interface peripheral devices to 8086 microprocessor and 8051 microcontroller to realize practical applications.
A8433.4. Interface memory and IO devices to 8086 microprocessor and 8051 microcontroller to make it a functional model.
A8433.5. Analyze interrupt structure of 8086 microprocessor and 8051 microcontroller for the execution of interrupt request.

3. Course Syllabus

Introduction to 8086: Architecture of 8086 microprocessor, Register organization, 8086 flag register and its functions, addressing modes of 8086, Minimum mode system operation, Timing diagrams.

8086 Assembly Language Programming: 8086 Assembly Language Programming Process, Assembly language instructions involving evaluation of arithmetic expressions, branch, call instructions, sorting, string manipulation, assembler directives, procedures and macros, Simple programs. **8086 Memory Interfacing:** Interfacing RAM, ROM, EPROM to 8086, Direct Memory Access (DMA8257) Data Transfer.

Interrupts and Programmable Interrupt: 8086 Interrupts and Interrupt Responses, 8259A Priority Interrupt Controller. Serial Data Transfer Schemes: Asynchronous and synchronous data transfer schemes, RS - 232C Serial data standard, USART, sample program of serial data transfer (Transmit & Receive).

The 8051 Architecture: Introduction, 8051 micro controller hardware, external memory interfacing, 8051 instruction set and simple programs, counter, timer and Interrupt programming.

I/O Interfaces and Its Driver Mechanisms: 8255 (Programmable Peripheral Interface), various modes of operation and interfacing to Microprocessor, CMOS 4511 or TTL 7447, L293D, ULN2003, ADC0808/0809, DAC0800, Keypad and Alphanumeric Displays (LCD) interfacing with 8051.

4. Books and Materials

Text Books:

1. Douglas V. Hall (2007), Microprocessors and Interfacing, 2nd edition, Tata McGraw Hill, New Delhi.
2. Kenneth J. Ayala (2008), The 8051 Microcontroller, 3rd edition, Cengage Learning, India.

Reference Books:

1. Walter A. Triebel, Avtar Singh (2003), The 8088 and 8086 Microprocessors 4th edition, Prentice Hall of India, New Delhi.
2. Mazidi (2000), The 8051 Microcontroller and Embedded System, Prentice Hall of India, New Delhi.
3. Deshmukh (2004), Microcontrollers, Tata McGraw Hill Edition, New Delhi

Course Structure

A8224 - Electric Vehicles

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces the fundamental concepts, principles, architectures and analysis of electric vehicles. Student will explore the working principle of electric vehicles, delve into key roles played by motors as propulsion systems and requirements for battery and its management systems. In addition to this, focuses on various charging systems and charging infrastructure. This course also emphasizes the EV business and the future trends in the development of electric vehicles.

Course Pre/co-requisites

A8213-Electrical Machines-II

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8224.1. Infer the electric vehicle system and its impact on environment.
A8224.2. Analyze the various hybrid vehicle configurations and its performance.
A8224.3. Interpret the electric drives used in hybrid and electric vehicles.
A8224.4. Choose proper energy storage systems for electric vehicle applications.
A8224.5. Identify the different charging systems and charging infrastructure for EVs.

3. Course Syllabus

Introduction To Electric Vehicles: EV System: EV Configuration-Fixed & variable gearing, single & multiple motor drive, In-wheel drives. Components of an EV, Components of ICEVs, EV History, the early years, recent EVs and HEVs, Types of EVs, EV Advantages, Comparison of EVs and ICEVs w.r.t to efficiency, pollution, capital & operating cost.

Hybrid Electric Vehicles: Types of Hybrids Vehicles- Series, parallel, series-parallel and complex HEVs, Advantages and Disadvantages of HEVs, Concept of Hybrid Electric Drive Trains, Architectures and power flow control of Hybrid Electric Drive Trains.

Electric Propulsion Systems: Choice of electric propulsion systems, block diagram of

EV propulsion system, BLDC Machine Construction and Classification, Basic Principles of BLDC Motor Drives, application to Electric Vehicles. Switched Reluctance Motor Drives, Basic Magnetic Structure, Torque Production, SRM Drive Converter, Modes of Operation, Generating Mode of Operation.

Introduction To Energy Storage Requirements: Electrochemistry of battery cells, Battery parameters, Types of Batteries- Lead–Acid Batteries, Ni Cd Batteries, NiMH Batteries and Lithium-Ion Batteries. EV Charging: Types of charging systems- Conductive charging On board & off-board charging, inductive charging, Wireless charging.

Charging Infrastructure: Domestic Charging Infrastructure, Public Charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Move-and charge zone. Key Battery Management Technologies, Typical Structure of Battery Management Systems. Business: E-mobility business, electrification challenges, Connected Mobility and Autonomous Mobility- case study, E-mobility Indian Roadmap, social dimensions of EVs.

4. Books and Materials

Text Books:

1. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003
2. Iqbal Husain, "ELECTRIC and HYBRID VEHICLES: Design Fundamentals", CRC PRESS Boca Raton London New York Washington, D.C., 2003
3. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wi- ley and Sons, 2012.

Reference Books:

1. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wi- ley and Sons, 2012.
2. Reissland, Martin.U (2010), Electrical Measurements: Fundamentals, Concepts, Applications, New Age International (P) Limited, New Delhi.
3. Shen, Weixiang Xiong, Rui, "Advanced battery management technologies for electric vehicles" 2019, John Wiley & Sons

Course Structure

A8225 - Electrical Measurements and Instrumentation Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This laboratory course offers hands-on experience with a range of measuring instruments, including PMMC, MI, Power, and Energy Meters. Students have the opportunity to calibrate different instruments and to measure unknown resistance, inductance, and capacitance using bridges. Additionally, the course covers the analysis and verification of transducers such as strain gauges and LVDTs, allowing students to understand their characteristics and operation in practical settings.

Course Pre/co-requisites A8201-Electrical Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8225.1. Measure voltage and current using PMMC instruments, moving iron meters, and instrument transformers, and analyze the accuracy of these measurements.

A8225.2. Measure power and energy using different methods, and analyze the sources of error.

A8225.3. Apply the principles of D.C. Crompton's potentiometer and digital measurement tools for the measurement of unknown resistance, current, and voltage.

A8225.4. Analyze the working principles of A.C. bridges and apply these principles to measure inductance and capacitance.

A8225.5. Apply the principles of operation of various transducers to measure the physical quantities in various applications.

3. List of Experiments

1. Calibration and Testing of Single Phase Energy Meter
2. Calibration of Dynamometer Power Factor Meter
3. Calibration of PMMC ammeter and PMMC voltmeter using Crompton D.C. Potentiometer
4. Measurement of Resistance using Kelvin's double bridge
5. Measurement of unknown Inductance using Anderson Bridge

6. Calibration of UPF wattmeter by Phantom testing
7. Measurement of Iron loss in a bar specimen using a wattmeter
8. Characteristics and Calibration of LVDT
9. Strain measurements and Calibration by Resistance Strain Gauge
10. Measurement of Parameters of a choke coil using 3 Voltmeter and 3 Ammeter method
11. Measurement of unknown Capacitance by Schering Bridge
12. Measurement of 3-phase power with single wattmeter and two current transformers

4. Laboratory Equipment/Software/Tools Required

1. Single phase energy meter
2. Stop watch
3. Power factor meter
4. Ammeters
5. Voltmeters
6. Crompton potentiometer kit
7. Kelvin's double bridge kit, standard resistances
8. Anderson bridge kit, head phones
9. UPF wattmeter, phantom load
10. Iron bar, wattmeter, voltmeter and ammeter
11. LVDT trainer kit
12. Strain measuring unit
13. Chock coil
14. Schering bridge kit, head phones
15. Wattmeter, current transformers

Course Structure

A8434 - Microprocessors and Microcontrollers laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This laboratory covers the experiments related to 8086 microprocessor and 8051 microcontroller. The objective of this course is to train students on assembly language programming of 8086 microprocessor and 8051 microcontroller using the tools DOS Box .74 assembler and Keil C compiler. This course also introduces the embedded C programming through simple IO interfacing. All the basic requirements to develop a product using processor/controller will be covered in this course.

Course Pre/co-requisites

A8414 – Linear and Digital Circuits Laboratory

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8434.1. Develop error free program logic in assembly language for processor or controller.
A8434.2. Utilize the modern tools for programming processor and controller.
A8434.3. Identify the hardware requirements of a peripheral device to interface with processor or controller.
A8434.4. Configure the IO peripherals according to the device to be connected.
A8434.5. Compare processors and controllers to use them for real time applications.

3. List of Experiments

PART-A: Testing in Hardware Laboratory (Any 6 Experiments)

1. To perform arithmetic, logical and shift operations.
2. To find GCD and Factorial of given operand, ASCII operations.
3. To find the sum of a series, squares & cubes of 8-bit or 16 bit numbers in a given array of 5 numbers.
4. To perform code conversion i.e. conversion of unpacked to packed BCD and vice versa.
5. To find the largest and smallest number in an array of data & to arrange a given series of numbers in ascending and descending order.
6. To perform string manipulation operations on the string stored in the memory.

7. Programming using arithmetic, logical and bit manipulation instructions of 8051.
8. To generate 5ms delay with and without interrupt for timer & Count no of pulses in the external clock using counter in 8051.
9. To interface 8255 to 8086 and observe the following:
   a. Blink all LEDs connected to port B on/off with 2ms delay
   b. Blink LEDs alternatively connected to port A with 10 ms time delay.
10. To interface stepper motor to 8051 and observe the following:
    a. 5 rotations in clockwise direction
    b. 5 rotations in anticlockwise direction
11. To interface A/D converter to 8086.
12. To interface D/A converters to 8086/8051 and observe the following:
    a. Square wave
    b. Ramp signal
    c. Sinusoidal wave
13. To observe traffic signals by interfacing controller to 8086/8051 & observe the changes in signals like Red, Green, Amber & straight, left, right, pedestrian etc.
14. 16x2 LCD interfacing
15. Seven segment display interfacing
16. To interface Matrix/Keyboard to 8051

4. Laboratory Equipment/Software/Tools Required

1. 8086 ESA trainer kits
2. 8255 PPI study card
3. DosBox.74 assembler
4. 8051 ESA trainer kits
5. Stepper motor and driver board
6. ADC and DAC study card
7. Traffic Signal module
8. Seven segment display
9. Keil C compiler
10. Matrix keyboard module

5. Books and Materials

Text Books:

1. Douglas V. Hall (2007), Microprocessors Interface, 2nd edition, Tata McGraw Hill, New Delhi.
2. Kenneth J. Ayala (2008), The 8051 Microcontroller, 3rd edition, Cengage Learning, India.

Reference Books:

1. Walter A. Triebel, Avtar Singh (2003), The 8088 and 8086 Microprocessors 4th edition, Prentice Hall of India, New Delhi.
2. Mazidi (2000), The 8051 Microcontroller and Embedded System, Prentice Hall of India, New Delhi.
3. Deshmukh (2004), Microcontrollers, Tata McGraw Hill Edition, New Delhi.

Course Structure

A8012 - Advanced English Communication Skills Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This Lab focuses on grooming the students professionally and empowering them through language development. This course facilitates them to hone their vocabulary and listening skills enabling them to prepare for competitive examinations. This course also polishes the students' presentation skills in different professional contexts besides developing proficiency in reading and writing. Further, they would be outfitted to communicate their ideas relevantly in group discussions and develop proficiency in preparing for interviews, thus making students ready for industry.

Course Pre/co-requisites

A8010 - English for Skill Enhancement
A8011 - English Language and Communication Skills Laboratory

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8012.1. Improve comprehensive skills in listening and reading.
A8012.2. Develop effective technical writing skills and e- correspondence.
A8012.3. Build communication skills in different socio-cultural and professional contexts.
A8012.4. Organize the dynamics of group discussion for effective participation.
A8012.5. Analyze strategies to succeed in interviews.

3. Course Syllabus

Theory

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills Laboratory **Activities on Listening and Reading Comprehension:** Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques of Reading – Basic Steps to Effective Reading – Common Obstacles – Discourse Markers or Linkers - Sub-skills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading — Reading Comprehension – Exercises for Practice.

Activities on Writing Skills: Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing – Free Writing and Structured Writing - Letter Writing –Writing a Letter of Application –Resume vs. Curriculum Vitae – Writing a Résumé – Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette – Report Writing – Importance of Reports – Types

and Formats of Reports– Technical Report Writing– Exercises for Practice.

Activities on Presentation Skills: Starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Glossophobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation.

Activities on Group Discussion (GD): Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas – Do's and Don'ts - GD Strategies – Exercises for Practice.

Interview Skills: Concept and Process - Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

4. Laboratory Equipment/Software/Tools Required

1. Audio Visual Equipment (Public Address System, LCD Projector and Camcorder).
2. One PC with latest configuration for the teacher.
3. Delta's key to the Next Generation TOEFL, Test: Advanced Skill Practice.
4. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
5. Oxford Advanced Learner's Dictionary, 10th Edition.
6. Cambridge Advanced Learner's Dictionary.
7. Lingua TOEFL CBT Insider, by Dreamtech.

5. Books and Materials

Text Books:

1. M. Ashraf Rizvi, Effective Technical Communication, 2nd Edition, McGraw Hill Education, 2018.
2. Suresh Kumar E, Engineering English, 1st Edition, Orient BlackSwan Pvt. Ltd, 2015.
3. Bailey, Stephen, Academic Writing: A Handbook for International Students (5th Edition), Routledge, 2018.
4. Koneru, Aruna, Professional Communication, McGraw Hill Education (India) Pvt. Ltd, 2016.

Reference Books/Additional Resources:

1. Meenakshi Raman & Sangeeta Sharma, Technical Communication, 3rd Edition, Oxford University Press, 2015.
2. Paul V. Anderson, Technical Communication, 8th Edition, Cengage Learning pvt. Ltd., New Delhi. 2013.
3. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart, English Vocabulary in Use Series.

Cambridge University Press, 2017.
4. Sen, Leela, Communication Skills, PHI Learning Pvt Ltd., New Delhi, 2009.
5. Elbow, Peter, Writing with Power. Oxford University Press,1998.
6. Goleman, Daniel, Emotional Intelligence: Why it can matter more than IQ. Bloomsbury Publishing,2013.

Course Structure

A8035 - Research Methodology

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	0	-	100	100

1. Course Description

Course Overview

Research is an art of scientific investigation. Research is an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison, and experiment. This course will help students to understand the research process, tools, and importance of ethics. Also, this course helps students to write technical reports.

Course Pre/Co-requisites

This course has no core requisites/pre-requisites

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8035.1. Identify an appropriate research problem in their suitable domain.
A8035.2. Explain the concepts and procedures of sampling, data collection, analysis, and reporting.
A8035.3. Analyze the complex issues inherent in selecting a research problem, research design, and implementing a research project.
A8035.4. Construct a well-structured research paper and scientific presentations.
A8035.5. Express the importance of research ethics in the scientific community.

3. Course Syllabus

Research Methodology: Introduction, meaning, objectives, motivation, types of research, research approaches, significance of research, research methods versus methodology, research and scientific method, research process, criteria of good research. **Defining a Research Problem:** Research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem.

Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design, different research designs, basic principles of experimental designs.

Measurement and Scaling: Measurement in research, measurement scales, sources of error in measurement, techniques of developing measurement tools, scale classification bases, scaling techniques.

Data Collection: Collection of primary data, observation method, interview method, collection of secondary data, selection of appropriate method for data collection, case study

method.

Interpretation and Report Writing: Meaning of interpretation, technique of interpretation, precaution in interpretation, significance of report writing, different steps in writing report, layout of the research report, types of reports, oral presentation, mechanics of writing a research report, precautions for writing research reports. **Research Tools and Techniques:** Methods to search required information effectively, reference management software like Zotero, Mendeley and EndNote, LaTeX (writing paper, thesis, report, bibliography), BEAMER for presentation, software for detection of plagiarism. ethical issues related to publishing, plagiarism and self-plagiarism.

4. Books and Materials

Text Books:

1. C.R. Kothari, Gaurav Garg "Research Methodology: Methods and Techniques" 4th Edition, New Age International, 2018
2. Ranjit Kumar "Research Methodology a step-by step guide for beginners", 3rd Edition, SAGE Publications Ltd, 2011.

Reference Books:

1. Trochim, Research Methods: the concise knowledge base, Atomic Dog Publishing, 2005
2. Fink A "Conducting Research Literature Reviews: From the Internet to Paper" Stage Publications, 2009

IV YEAR I SEMESTER

Course Structure

A8226 - Power Semiconductor Drives

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course explores various DC and AC motor drive systems. It covers Thyristor-controlled drives for DC motors, including converters and chopper-fed drives, and their operation, waveforms, speed-torque characteristics, and braking methods. Additionally, it covers Induction Motor Drives, Synchronous Motor Drives, and Brushless DC Motor Drives, discussing control techniques, closed-loop operations.

Course Pre/co-requisites

A8219-Power Electronics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8226.1. Analyze the steady-state performance of controlled rectifiers fed DC drives.
A8226.2. Analyze the multi-quadrant operations and its speed-torque characteristics of chopper fed DC drives.
A8226.3. Apply the concept of variable voltage and frequency control to design effective induction motor control strategies.
A8226.4. Apply control techniques to achieve precise control of inverter-fed synchronous motor and Brushless DC motor drives.

3. Course Syllabus

Single-Phase Controlled Converter fed DC Drives: Introduction to Thyristor controlled Drives, Single Phase Semi and Full controlled converters connected to D.C separately excited and D.C series motors, continuous operation, output voltage and current waveforms. Speed and Torque expressions, Speed – Torque Characteristics.

Three-Phase Controlled Converter fed DC Drives: Three phase semi and fully controlled converters connected to D.C separately excited and D.C series motors, output voltage and current waveforms. Speed and Torque expressions, Speed –Torque characteristics.

Chopper fed DC Drives: Single quadrant, Two-quadrant and four-quadrant chopper fed separately excited dc motor. Continuous operation, Output voltage and current waveforms, Speed torque expressions, speed torque characteristics. Closed loop operation of DC motor (Block Diagram Only). Electric Braking – Plugging, Dynamic and Regenerative Braking.

Induction Motor Drives: Variable voltage characteristics, Stator Voltage control by AC voltage controllers. Variable frequency characteristics, Voltage Source Inverter Control, Current Source Inverter Control, Static Rotor Resistance Control, Static Scheribus Drive, Static Kramer Drive. Closed loop operation of induction motor drives (Block Diagram Only).

Synchronous Motor and Brushless DC Motor Drives: Variable frequency control, True Synchronous mode, Self-controlled Synchronous motor drive, Closed Loop operation of synchronous motor drives (Block Diagram Only). Brushless DC Motor Drives – Three-phase and Single-phase Drives.

4. Books and Materials

Text Books:

1. G. K. Dubey (2002), Fundamentals of Electric Drives, 2nd Edition, Narosa Publications, New Delhi.
2. Gopal K. Dubey (1993), Power Semiconductor Controlled Drives, International ed., Simon & Schuster.

Reference Books:

1. M. H. Rashid (2017), Power Electronics: Devices, Circuits and Applications, 4th Edition, Pearson Education
2. S. K. Pillai (2007), A First course on Electrical Drives, 2nd Edition, New Age International (P) Ltd., New Delhi
3. R. Murthy (2005), Power Electronics, 1st Edition, Oxford University Press, New Delhi.

Course Structure

A8227 - IoT and it's Applications

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course aims to train students to be equipped with a solid theoretical foundation, systematic professional knowledge and strong practical skills in the IoT Platform and System Design. This IoT course provides an overview of IoT fundamentals. It explores components like sensors, Node MCU, and Raspberry Pi, detailing programming basics and interfacing techniques. Additionally, it explores IoT applications, showcasing real-world implementations of IoT technology.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8227.1. Apply the IoT architecture concepts for specific IoT applications.
A8227.2. Select and use devices, sensors, actuators, and various processing paradigms for IoT.
A8227.3. Design and program IoT devices for the given specifications.
A8227.4. Use web servers and cloud platforms for IoT applications and services.

3. Course Syllabus

Introduction to IoT: Internet of Things, Definition & Characteristics of IoT, Physicaldesign of IoT, IoT Architectural View, M2M, Difference between IoT and M2M, Examples of IoT.

IoT Components: Sensors–voltage, current, temperature, light, gyroscopic and acceleration. Actuators–DC Motor, servo motor, stepper motor, relay. Node MCU, Raspberry Pi – Architecture, Specifications, Features and Pinouts.

Programming and Interfacing: Programming – Basic commands for Node MCU and Raspberry Pi. Interfacing - Connecting LED, Buzzer, Controlling AC Power devices with

Relays, Controlling servo motor, speed control of DC Motor, uni polar and bipolar Stepper motors, Control over web browser and Bluetooth.

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs, Web server for IoT, Cloud for IoT - Sensor Data Logger with Thing Speak Server.

IoT Applications: Home automation–Smart lighting, Intrusion detection. Cities–Smart parking, Environment–Weather monitoring, Pollution monitoring. Agriculture–Smart irrigation.

4. Books and Materials

Text Books:

1. Arshdeep Bahga, Vijay Madisetti (2014), Internet of Things: A Hands-on Approach, 1st Edition, Universities Press, Orient Blackswan Private Limited, New Delhi.
2. Raj Kamal (2017), Internet of Things: Architecture and Design Principles, McGraw Hill Education (India) Private Limited.

Reference Books:

1. Muhammad Azhar Iqbal, Sajjad Hussain, Huanlai Xing, Muhammad Ali Imran (2021), Enabling the Internet of Things: Fundamentals, Design and Applications, First Edition, Wiley – IEEE.
2. Adrian McEwen, Hakim Cassimally, (2013), Designing the Internet of Things, Cassimally, First Edition, Wiley.

Course Structure

A8228 - Power Semi Conductor Drives Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course explores techniques for controlling motors, covering various converters, choppers, and simulation methodologies using MATLAB/Simulink. Students explore speed control mechanisms for DC, single-phase, and three-phase motors, gaining practical insights into design, implementation, and evaluation of motor control systems for diverse applications.

Course Pre/co-requisites

A8219-Power Electronic

A8207-Electrical Machines-I

A8213-Electrical Machines-II

A8226-Power Semiconductor Drives

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8228.1. Analyze the steady-state performance of converter and chopper fed DC drives.

A8228.2. Analyze the steady state performance of converter fed AC drives.

A8228.3. Simulate and analyze control strategies of converter and chopper fed DC drives using MATLAB/Simulink.

A8228.4. Apply and Simulate control techniques to achieve precise control of AC Drives using MATLAB/Simulink.

3. List of Experiments

1. Speed Control of DC Motor using Single Phase Half Converter
2. Speed Control of DC Motor using Single Phase Full Converter
3. Speed control of PMDC motor using MOSFET based Buck/Boost Converter
4. Speed Control of DC Motor using Jones's Chopper
5. Study of SCR to drive small load
6. Speed Control of Single-phase AC Motor using Single-Phase AC Voltage Controller
7. Simulation of Three-phase Full Controlled Converter fed DC Drive using MATLAB/ Simulink
8. Simulation of Closed loop control of Converter fed DC Drive using MATLAB/ Simulink

9. Simulation of Four Quadrant Chopper fed DC Drive using MATLAB/ Simulink
10. Simulation of Single-Phase AC Voltage Controller fed Induction Motor Drive
11. Simulation of Three-phase Induction Motor drive with VVVF control using MATLAB/ Simulink
12. Simulation of Three-phase Brushless DC Motor Drive using MATLAB/Simulink

4. Laboratory Equipment/Software/Tools Required

1. Speed Control of DC motor using Full converter
2. Speed Control of DC motor using Half converter
3. Speed Control of DC motor using Three phase Half Controlled Bridge converter
4. Speed Control of DC motor by using Jones Chopper.
5. SCR Circuit to Drive Small Load
6. Speed control of single phase motor using SCR.
7. Single Phase cyclo converter
8. Three phase AC induction motor drive with VVVF control
9. Speed measurement and control of PMDC motor using Closed Loop
10. Thyristorised drive for speed measurement and control of PMDC motor using closed loop Series Inverter
11. MOSFET based buck Boost converter.
12. Single Phase AC Motor
13. PMDC Motor
14. Isolation Transformer
15. Tachometer
16. Rheostat (290/2.8A, 360/1.2A).
17. Light Load

Course Structure

A8229 - IoT and it's Applications Laboratory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	30	1	40	60	100

1. Course Description

Course Overview

This course explores the fundamentals of Internet of Things (IoT) technology through practical experiments. Students will learn to configure, control, and connect various devices using development boards like Node MCU and Raspberry Pi, enabling them to create innovative IoT applications for data transfer, sensor monitoring, and device control.

Course Pre/co-requisites

A8228 - IoT and it's Applications

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8229.1. Identify various development boards and their installation processes.
A8229.2. Select and use devices, sensors, actuators, and various processing paradigms for IoT.
A8229.3. Design and program IoT devices for the given specifications.
A8229.4. Use web servers and cloud platforms for IoT applications and services.

3. List of Experiments

1. Write a program using Node MCU to create an automatic street lighting system using LDR.
2. Control the speed and direction of DC motor using Node MCU.
3. Write a Program to control two LEDs through Node MCU web server.
4. Write a Program to control two devices with web server and a physical switch simultaneously using Node MCU.
5. Write a program to transfer the sensed information to the cloud using Node MCU.
6. Connect a device to Node MCU and control it through Bluetooth.
7. Installation and Configuration Process of Raspberry Pi and explore the features.
8. Write a program to measure the battery level of the Li-ion battery.
9. Write a program to control a device with Raspberry Pi using a relay.
10. Implement IoT based weather monitoring system using Raspberry Pi.

11. Develop an IoT application for writing and reading the data in Thing Speak.
12. Connect two IoT development boards and share data.

4. Laboratory Equipment/Software/Tools Required

1. A Computer System with Ubuntu Operating System (Open source/ Free Ware)
2. Python (Open source/ Freeware)
3. Arduino IDE (Open source/ Freeware)
4. Raspberry Pi, Node MCU
5. Breadboards, Resistors, Sensors, LEDs, Battery, and Jumper Wires

Professional Electives

Course Structure

A8251 - High Voltage Engineering

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides an introduction to fundamental techniques involved in generating and measuring high voltages and currents. It covers various breakdown mechanisms in diverse dielectric materials, offering insights into the testing procedures for electrical apparatus employed in the field of High Voltage Engineering.

Course Pre/co-requisites

A8201 – Electrical Circuits

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8251.1. Identify the various insulating materials in elctrical apparatus and examine the electric stress by various methods.
A8251.2. Classify the generation of high DC, AC and Impulse voltages and currents.
A8251.3. Analyze the different measuring instruments used for high power applications.
A8251.4. Categorize the methods used for testing of material and electrical apparatus.

3. Course Syllabus

Theory

Introduction to High Voltage Technology and Applications: Electric Field Stresses, Estimation and Control of Electric Stress, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

Break Down in Gaseous, Liquid Dielectrics and Solid Dielectrics: Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids. Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics, Breakdown in composite dielectrics.

Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents.

Measurement of High Voltages and Currents: Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High

Currents-direct, alternating and Impulse.

Non-Destructive Testing and High Voltage Testing of Material and Electrical Apparatus: Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements. Testing of Insulators and bushings, Testing of Isolators and circuit breakers, testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements.

4. Books and Materials

Text Books:

1. M. S. Naidu, V. Kamaraju (2009), High Voltage Engineering, 4th Edition, Tata McGraw Hill Publications, New Delhi.
2. E. Kuffel, W. S. Zaengl, J. Kuffel (2000), High Voltage Engineering: Fundamentals, 2nd Edition, Elsevier Publishers, New York, USA.

Reference Books:

1. C. L. Wadhwa (2007), High Voltage Engineering, New Age Internationals (P) Limited, New Delhi.
2. Ravindra Arora Wolfgang Mosch (2011), High Voltage Insulation Engineering, 1st Edition, New Age International (P) Ltd., New Delhi.

Course Structure

A8252 - Power Quality

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course delves into diverse aspects of power quality within power systems. It comprehensively explains concepts such as transients, flickers, voltage sag, voltage swell, and the defined limits for voltage sag. Additionally, the course explores power quality monitoring, shedding light on power harmonics and effective mitigation techniques..

Course Pre/co-requisites

A8214 - Power System Transmission and Distribution

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8252.1. Analyze the severity of power quality problems in distribution system.
A8252.2. Identify the various causes of voltage flicker and their effects and various means to reduce flickers.
A8252.3. Apply the advanced techniques to minimise sag/swell and interruptions for improve power quality.
A8252.4. Apply the knowledge of harmonic mitigating techniques to improve the performance of system.
A8252.5. Identify the best approaches followed in power quality monitoring

3. Course Syllabus

Theory

Introduction: Importance of power quality, terms and definitions of power quality as per IEEE std. such as transients, short and long duration voltage variations, interruptions, short and long voltage fluctuations, imbalance, flickers and transient. Definitions and terminology of grounding, purpose of groundings, good grounding practices and problems due to poor grounding.

Transient Voltages and Flickers: RMS Voltage variations in power system and voltage regulation per unit system, complex power. Principle of voltage regulation, basic power flow and voltage drop, various devices used for voltage regulation and impact of reactive power management. Various causes of voltage flicker and their effects, Short term and long term flickers.

Voltage Sag, Swell and Interruptions: Definitions of voltage sag and interruptions, Voltage sags versus interruptions. Economic impact of voltage sag, Major causes and con-

sequences of voltage sags, Voltage sag characteristics, Voltage sag assessment. Influence of fault location and fault level on voltage sag, Areas of vulnerability.

Limits and Measures fFor Voltage Sag & Waveform Distortion: Assessment of Equipment sensitivity to voltage sags and analysis, voltage sag indices, mitigation measures for voltage sags, such as UPS, DVR, SMEs, CVT etc. Definition of harmonics, inter-harmonics, sub-harmonics. Causes and effect of harmonics, voltage versus current distortion. Harmonic indices and analysis.

Power Quality Monitoring: Need of power quality monitoring and approaches followed in power quality monitoring. Power quality monitoring objectives and requirements. Initial site survey. Power quality instrumentation. Selection of power quality monitors, selection of monitoring location and period.

4. Books and Materials

Text Books:

1. M. H. J. Bollen (2000), Understanding Power Quality Problems, voltage sag and interruptions, 1st Edition, IEEE Press, New Delhi..
2. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H. Wayne Beaty (2008), Electrical Power Systems Quality, 2nd Edition, Tata McGraw Hill Publications, New Delhi.

Reference Books:

1. 1. J. Arrillaga, M. R. Watson, S. Chan (2007), Power system quality assessment, 1st Edition, John Wiley and sons, New Delhi.

Course Structure

A8253 - Robotic Systems and Control

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course delves into robotic systems and their control mechanisms, enabling the movement and functionality of different robot components while accommodating unforeseen errors. Topics include manipulator motions, dynamic modeling, and control strategies for manipulators. Additionally, the course covers robotic sensors and vision systems. Emphasis is placed on understanding control system challenges and implementing effective solutions to address them. Students explore various control system issues and learn strategies for troubleshooting and resolution.

Course Pre/co-requisites

A8206 - Control Systems

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8253.1. Develop the dynamic modeling of robotics.
A8253.2. Investigate the differential Motion and statics of robotic manipulator.
A8253.3. Analyze various control of robotic manipulator.
A8253.4. Analyze various robotic sensors and vision.

3. Course Syllabus

Theory

Introduction to Robotics: Brief History, Elements of Robotic Systems-Robot anatomy, DOF, Classification of Robotic systems on the basis of various parameters such as work volume, type of drive. Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot.

Manipulator Differential Motion and Statics: Linear and angular velocity of rigid body, linear velocity due to angular motion, combined linear and angular motion. Relationship between transformation matrix and angular velocity. Static analysis-force and moment balance, Jacobian in statics.

Dynamic Modelling of Robotics: Lagrangian mechanics, dynamic model of two degree of freedom manipulator, Lagrange-Euler formulation-velocity of a point on the manipulator, kinetic and potential energy, equation of motion. Newton-Euler formulation-Newtons and Eulers equations, kinematics of links, link acceleration, recursive Newtons- Eulers formula-

tion.

Control of Manipulators: Open loop and closed loop control, the manipulator control problem, linear control schemes, characteristics of second order linear systems, linear second order SISO model of a manipulator joint. Joint actuators-Model of DC motor, partitioned PD control scheme and PID control scheme, computed torque and force control robotic manipulators.

Robotic Sensors and Vision: Human sensing, the problem of robot sensing, status sensors, environment sensors, quality control sensors, safety sensors, industrial application of vision controlled robotic systems-object identification, visual inspection and visual guidance.

4. Books and Materials

Text Books:

1. R.K. Mittal and I J Nagrath , Robotics and Control, 1e, McGraw Hills Education (2017).
2. S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education (2014). Companies, New Delhi.
3. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, (2019).

Reference Books:

1. S. B. Niku, Introduction to Robotics – Analysis, Control, Applications, 3rd edition,John 8. Wiley & Sons Ltd., (2020).
2. J. Angeles, Fundamentals of Robotic Mechanical Systems Theory Methods and Algorithms,Springer (1997).
3. Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press 3. (2006).

Course Structure

A8254 - Solar Photovoltaic Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The course on Solar Photovoltaic Systems provides a comprehensive understanding of photovoltaic (PV) technology, its various applications, and the design principles associated with both standalone and grid-connected systems. It also explores hybrid systems that combine solar energy with other renewable and non-renewable sources. Through a combination of theoretical knowledge and practical case studies, students will gain the skills needed to design, install, and maintain PV systems for a wide range of applications.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8254.1. Apply knowledge of solar cell structures and their electrical properties to assess their performance.
A8254.2. Analyze and compare standalone versus grid-connected PV systems to determine their suitability for different applications.
A8254.3. Apply the principles of charge controllers, inverters and MPPT to enhance the performance of a PV system.
A8254.4. Design a battery storage system for a PV system based on the requirements.
A8254.5. Develop a PV system design, considering solar radiation, sizing, and cost factors.

3. Course Syllabus

Theory

Photovoltaic Basics : Structure and working of Solar Cells - Types, Electrical properties and Behavior of Solar Cells - Cell properties and design - PV Cell Interconnection and Module Fabrication – PV Modules and arrays – Basics of Load Estimation.

Standalone and Grid Connected PV Systems : Types of Solar PV Systems – Standalone, Grid-connected and Hybrid - Schematics, Design Methodology, Components, Batteries, Charge Conditioners - Typical applications for lighting, water pumping etc.

Charge Controller, MPPT and Inverters: Need For Balance of System (BoS) , Power Converters and their efficiency , DC to AC Converters (Inverters) , DC to DC Converters , Charge Controllers, Maximum Power Point Tracking (MPPT), Types of Wires and Wire

Sizing, Junction Box.

Batteries and Their Applications: Types of batteries , Parameters of Batteries, How to select a battery, Connecting Batteries together–Series , Parallel and mixed combination, Estimating Number of Batteries to be Connected in a battery Bank, Testing and Maintenance of Batteries , Fault Detection, Instruments used for Maintenance.

Design of PV Systems : Solar radiation, radiation measuring instruments, radiation measurement and predictions, atmospheric effects, seasonal effects, environmental effects on standard test conditions, Solar PV system installation for different Applications and cost – Sizing and Reliability Economics of PVSystems - sample payback period, lifecycle costing, Introduction to Solar Advisory Model (SAM)Software..

4. Books and Materials

Text Books:

1. CS Solanki, Solar Photovotaics – Fundamentals, Technologies and Applications, (2011) PHI Learning Pvt. Ltd.
2. Martin A. Green, Solar Cells Operating Principles, Technology, and System Applications, 2008 , Prentice- Hall.
3. Nelson, J The Physics of Solar Cells. Imperial College Press, 2003. Thomas Markvart, Solar Electricit, John Wiley and Sons, 2001.
4. Stuart R. Wenham, Martin A. Green, Muriel E. Watt, Richard Corkish (Editors), Applied Photovoltaics, Earthscan, 2008.

Reference Books:

1. Michael Boxwell, The Solar Electricity Handbook, Code Green Publishing, UK, 2009.
2. Rik DeGunther, Solar Power Your Home for Dummies, Wiley Publishing Inc, 2008.

Course Structure

A8255 - High Voltage DC Transmission

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The course gives an overview of High Voltage Direct Current technologies, their operation, control and interactions with AC systems. The traditional thyristor-based HVDC is introduced with basic 6-pulse rectifiers and analyzed on typical large systems with the main control loops. The interactions with AC systems through controls and harmonics are analyzed. The modern VSC HVDC are introduced using basic self-commutating converter principles. The course also analyses the latest Modular Multilevel HVDC topologies. In the last segment of this course, the students will learn about multi-terminal HVDC and DC grids.

Course Pre/co-requisites

A8214 - Power System Transmission and Distribution

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8255.1.	Apply the basic knowledge of AC transmission to understand the modern trends and different terminologies used in HVDC transmission.
A8255.2.	Examine the characteristics of converter configuration to infer its suitability and method of control in HVDC transmission.
A8255.3.	Examine the power flow analysis in HVDC transmission.
A8255.4.	Analyze the nature of faults in converter stations to select a suitable protection scheme for the same.
A8255.5.	Illustrate the generation of harmonics, its adverse effects and possible solutions to mitigate them

3. Course Syllabus

Theory

HVDC Concepts: Introduction to HVDC, Types of HVDC Links, Apparatus required for HVDC Systems. Comparison of AC & DC Transmission, Application of DC Transmission System, Planning & Modern trends in D.C. Transmission, Economics of HVDC transmission systems.

HVDC Converters and System Control: Choice of Converter configuration, characteristics of 6 Pulse converters, Principle of DC Link Control, Converters Control Characteristics, Firing angle control. Current and extinction angle control, Problems.

Power Flow Analysis and Reactive Power Control in HVDC: Modeling of DC Links-DC Network-DC Converter, Controller Equations-Solution of DC load flow. P.U. System for DC quantities-solution of AC-DC Power flow-Simultaneous method, Sequential method. Reactive Power Requirements in steady state, Conventional control strategies.

Converter Fault & Protection: Converter faults – protection against over current and over voltage in converter station – surge arresters –smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference.

Harmonics and Filters: Generation of Harmonics –Characteristics harmonics, Non- Characteristics harmonics, adverse effects of harmonics – Calculation of voltage and Current harmonics – Effect of Pulse number on harmonics. Types of AC filters, Design of Single tuned filters –Design of High pass filters.

4. Books and Materials

Text Books:

1. K. R. Padiyar (2005), HVDC Power Transmission Systems: Technology and system Interactions, 1st Edition, New Age International (P) Ltd, New Delhi.

Reference Books:

1. E. W. Kimbark (2006), Direct Current Transmission, 2nd Edition, John Wiley & Sons, New Delhi.

Course Structure

A8256 - Power Semiconductor Devices and Modelling

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a comprehensive understanding of power semiconductor devices and their modeling. Students will investigate the fundamental principles, characteristics, and operational aspects of various power diodes, BJTs, MOSFETs, and IGBTs. The course also covers essential topics related to drive and protection circuits for these devices. By the end of the course, students will have a strong foundation in power semiconductor devices and be equipped with the knowledge to model and analyze their behavior.

Course Pre/co-requisites

A8219 - Power Electronics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8256.1. Analyze the performance characteristics of power semiconductor devices and their suitability for specific applications.

A8256.2. Create basic models of power semiconductor devices and use them to predict device behavior in typical operational scenarios.

A8256.3. Design the drive circuits for various power semiconductor devices, considering drive requirements.

A8256.4. Designing and implementing snubber circuits for power semiconductor devices, to enhance the reliability of power electronic systems.

3. Course Syllabus

Theory

Power Diodes: Basic structure and V-I characteristics, breakdown voltages and control, on-state losses, switching characteristics-turn-on transient, turn off transient and reverse recovery transient,Schottky diodes – Structure, Conduction and Blocking, modelling of powerdiodes

Power BJTs: Basic structure and V-I characteristics, breakdown voltages and control, secondary breakdown and its control- FBSOA and RBSOA curves - on state losses, switching characteristics, resistive switching specifications, clamped inductive switching specifications, turn on transient, turn off transient, storage time, switching losses, modelling of power BJT.

Power MOSFETs: Basic structure, V-I characteristics, turn-on process, on state operation, turn off process, switching characteristics, resistive switching specifications, clamped

inductive switching specifications - turn-on transient and di/dt limitations, turn-off transient, turn off time, switching losses, effect of reverse recovery transients on switching stresses and losses - dv/dt limitations, gating requirements, FBSOA and RBSOA curves, modeling of power MOSFETs.

Insulated Gate Bipolar Transistors (IGBTs): Basic structure and operation, latch up IGBT, switching characteristics, resistive switching specifications, clamped inductive switching specification - turn-on transient, turn off transient- current tailing, FBSOA and RBSOA curves, switching frequency capability.

Drive and Protection Circuits: Diodes - Snubber requirements, BJTs - base drive requirements, base drive control, snubber requirements and design, MOSFETs - gating requirements, gate drive circuits, snubber requirements, IGBTs - gate drive requirements, snubber requirements and snubber design.

4. Books and Materials

Text Books:

1. Baliga, B. Jayant, "Power semiconductor devices", Boston: PWS Publishing Company, 1996.
2. Giuseppe Massobrio, Paolo Antognetti, "Semiconductor Device Modeling with SPICE", McGraw-Hill, 2nd Edition, 2010.

Reference Books:

1. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", Wiley India Pvt Ltd., 3rd Edition 2011.
2. V. Benda, J. Gowar, D. A. Grant, "Power Semiconductor Devices - Theory and Applications", JohnWiley & Sons, 1999.

Course Structure

A8257 - Digital Control Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces fundamental concepts, principles, and applications of digital control system analysis. It delves deeply into various aspects of digital control engineering, including sampling operations, z-plane analysis, and discrete-time systems. Participants will analyze stability, pole placement, and observer design methods specific to discrete-time systems. Each topic is logically developed with the latest information, providing a comprehensive understanding of digital control system theory and practice.

Course Pre/co-requisites

A8206 – Control Systems

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8257.1.	Apply the Sampling quantization and reconstruction in ADC conversion and DCA conversion.
A8257.2.	Analyse a discrete system in time domain, frequency domain and Z domain.
A8257.3.	Inspect state space representaions of discrete time systems.
A8257.4.	Analyse the stability, pole placement and observer design methods of discrete time systems.

3. Course Syllabus

Theory

Sampling Operation: Introduction, Examples of Digital control systems, Digital to Analog conversion and Analog to Digital conversion, sample and hold operations, Principle features of discrete time control system, Signal sampling, quantizing and coding.

Z-Plane Analysis of Discrete - Time Control System: Introduction to Z-transforms, Linear difference equations, pulse response, Z - transforms, Theorems of Z - Transforms, the inverse Z - transforms, Z - Transform method for solving difference equations, Pulse transfer function, block diagram analysis of sampled data systems.

State Space Analysis of Discrete - Time Control System: State Space Representation of discrete time systems, Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations.

Stability Analysis in Closed loop system in the Z-plane: Mapping between S - plane and Z – plane, mapping of the left half of the s-plane to z plane, primary strips and complimentary strips, constant attenuation loci, constant frequency loci, constant damping ratio loci, Methods for testing absolute stability using Jury stability test, bilinear transformation and Routh stability test.

Pole Placement and Observer Design of Discrete - Time Control System: Controllability and observability of discrete time systems, useful transformations in state space analysis and design, Design via pole placement, state observers and servo systems.

4. Books and Materials

Text Books:

1. K. Ogata (2011), Discrete-Time Control systems, 2^{nd} Edition, Pearson Education/Prentice Hall of India, New Delhi.
2. Kuo (2003), Digital Control Systems, 2^{nd} Edition, Oxford University Press, New Delhi.

Reference Books:

1. M. Gopal (2009), Digital Control and State Variable Methods, New Delhi, 3^{rd} Edition, Tata McGraw Hill Publications.

Course Structure

A8258 - Wind Energy Conversion Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The course on Wind Energy Conversion Systems provides students with a comprehensive understanding of wind energy, from resource assessment to the practical implementation of wind turbines in grid-connected systems. The course covers topics such as wind resource assessment, wind turbine technology, electrical systems, grid integration, and financial considerations. By the end of this course, students will have the knowledge and skills necessary to participate in the design, operation, and management of wind energy projects.

Course Pre/co-requisites

This course requires no pre-requisites

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8258.1. Apply knowledge of wind measurement instruments and Weibull parameters to analyze wind speed distributions.

A8258.2. Apply blade element theory and other design considerations for optimizing rotor and blade design.

A8258.3. Apply fixed-speed and variable-speed schemes to enhance the efficiency of wind energy systems in different scenarios.

A8258.4. Apply knowledge of wind interconnection requirements to ensure compliance with grid standards.

A8258.5. Calculate the Levelized Energy Cost and assess the financial viability of wind energy projects.

3. Course Syllabus

Theory

Review on Wind Resource Assessment: Wind regime modelling, measurement instruments, Weibull parameters, height dependency, wind resources worldwide and in India, wind energy forecast.

Wind Turbines: Review on basic aerodynamics, air foils, types and characteristics of wind turbine, turbine design, blade element theory, HAWT, VAWT, Power developed, Thrust, Efficiency, Rotor selection, Rotor design considerations, Tip speed ratio, Number of Blades, Blade profile, Power Regulation, Yaw control, Pitch angle control, Stall control, Schemes for maximum power extraction.

Fixed and Variable Speed Systems: Fixed speed and variable speed systems. Electrical machines for wind energy systems, synchronous and asynchronous generators and power electronics. Integration of wind energy systems to electrical networks, converters, inverters, directly connected, wind energy storage solutions, Variable speed variable frequency schemes.

Grid Connected Systems: Wind interconnection requirements, low-voltage ride through (LVRT), ramp rate limitations, and supply of ancillary services for frequency and voltage control, current practices and industry trends wind interconnection impact on steady-state and dynamic performance of the power system including modelling issue.

Implementation and Financial Considerations: Site selection and turbine spacing, rotor selection, Annual Energy Output (AEO), optimal placement of wind turbine in a wind park, ICT based monitoring and control of wind farms. Installed costs, payback time, Levelized Energy Cost (LEC), simulation oriented case studies.

4. Books and Materials

Text Books:

1. Joshua Earnest and Tore Wizelius, "Wind Power Plants and Project Development", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. L.L.Freris "Wind Energy conversion Systems", Prentice Hall, 1990
3. Tony Burton, David Sharpe, Nick Jenkins, Ervin Bossanyi, "Wind Energy Handbook" JOHN WILEY & SONS, LTD , Second Edition,2011.

Reference Books:

1. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
2. N. Jenkins," Wind Energy Technology" John Wiley & Sons,1997
3. S.Heir "Grid Integration of WECS", Wiley 1998.

Course Structure
A8259 - Smart Grid

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course covers the basics of smart grids, the main difference between the smart grid and traditional grids. The course starts with an overview of smart grid systems and covers the standards and communication technologies applied to smart grids. Next, the challenges related to the smart grid and IOT for Smart Grid Applications are.

Course Pre/co-requisites

A8202 – Electrical Power Generation

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8259.1. Analyze the characteristics of smart grid and internet of Energy Systems.
A8259.2. Compare the different measuring instruments and techniques used in smart grid.
A8259.3. Analyze the advanced architectures used in Smart Grid Network.
A8259.4. Analyze the different smart grid technologies used for information exchange and security
A8259.5. Analyze the usage of IoT in smart grid applications

3. Course Syllabus

Theory

Introduction to Smart Grid and Internet of Energy Systems: Overview of smart grid evolution, Fundamental components of smart grids, sensors, networks, PMU, meters. Evolution of internet of energy concept, Energy internet as smart grid 2.0.

Smart Metering and Smart Monitoring Systems: Smart metering concept and systems, Hardware and accurate metering, Communication interface, Remote control features, Demand side management, Theft and fraud control.

Smart Grid Network Architectures: Premises network schemes, HAN, BAN, IAN. Neighbour area networks (NANs), Field area networks (FANs), Wide area networks (WANs) QoS requirements for SG networks.

Smart Grid Technologies: Communication Technologies for Smart Grid, Interoperability and connectivity, Layered Architecture and Protocols, Standards for Information Exchange. Information Security in smart grid - Encryption and decryption, Authentication, Digital

Signatures, Cyber Security standards.

Internet of Things for Smart Grid Applications: Driving factors of IoT for smart grid, Smart grid applications in generation, transmission, consumption level, IoT applications in smart home environment, IoT-based metering and monitoring applications.

4. Books and Materials

Text Books:

1. Ersan Kabalci, Yasin Kabalci "From smart grid to internet of energy "academic press, Elsevier, 2019..
2. Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.

Reference Books:

1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, 'Smart Grid: Technology and Applications', Wiley, 2012.
2. A. James Momoh, "Smart Grid: Fundamentals of Design and Analysis", Wiley-IEEE Press, March 2012.
3. Ali Keyhani and Muhammad Marwali, "Smart Power Grids 2011", Springer, 2011.

Course Structure

A8260 - FACTS and Custom Power Devices

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

FACTS and custom power devices is a theory course intended to enhance the knowledge of students in various reactive power electronic devices which are used in both transmission and distribution systems. To learn the concept of power flow control through various power electronic controllers including state of art FACTS controllers, operational aspects and their capabilities and their integration in power flow analysis. The merits and demerits of all active filters and reactive compensation devices are discussed in this course.

Course Pre/co-requisites

A8219-Power Electronics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8260.1 Distinguish between the performance of Transmission line with and without FACTS Devices.
A8260.2 Compare the SVC and STATCOM.
A8260.3 Analyze the operation of various Static Series Compensators.
A8260.4 Analyze the control techniques of Unified Power Flow Controller.
A8260.5 Distinguish various power quality issues and how are they mitigated by various FACTS Devices.

3. Course Syllabus

Theory

Reactive Power Flow Control in Power Systems: Control of dynamic power unbalances in Power System. Power flow control -Constraints of maximum transmission line loading – Benefits of FACTS Transmission line compensation. Uncompensated line -Shunt compensation - Series compensation –Phase angle control. Reactive power compensation. Shunt and Series compensation principles – Reactive compensation at transmission and distribution level.

Static Versus Passive VAR Compensator, Static Shunt Compensators: SVC and STATCOM - Operation and control of TSC, TCR and STATCOM - Compensator control. Comparison between SVC and STATCOM.

Static Series Compensation: TSSC, SSSC -Static voltage and phase angle regulators – TCVR and TCPAR Operation and Control –Applications, Static series compensation –

GCSC,TSSC, TCSC and Static synchronous. Series compensators and their Control.

SSR and Unified Power Flow Controller: Circuit Arrangement, Operation and control of UPF. Basic Principle of P and Q control- Independent real and reactive power flow control- Applications.

FACTS Controllers: Introduction to interline power flow controller. Modeling and analysis of FACTS Controllers – Simulation of FACTS controllers Power quality problems in distribution systems, harmonics. Loads that create harmonics, modeling, harmonic propagation, series and parallel resonances, mitigation of harmonics, passive filters, active filtering – shunt , series and hybrid and their control.

4. Books and Materials

Text Books:

1. K R Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International Publishers, 2007.
2. X P Zhang, C Rehtanz, B Pal, "Flexible AC Transmission Systems- Modelling and Control", Springer Verlag, Berlin, 2006.
3. N.G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC
4. Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.

Reference Books:

1. K.S. Sureshkumar, S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda Digital Library, NIT Calicut, 2003.
2. G. T.Heydt, "Power Quality", McGraw-Hill Professional, 2007.
3. T. J. E. Miller, "Static Reactive Power Compensation", John Wiley and Sons, Newyork, 1982.

Course Structure

A8261 - Process Control

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides an overview of key process control concepts and strategies. It covers different types of processes, such as continuous, batch, and semi-batch, and their control requirements. The dynamic behavior of processes is examined, focusing on how systems respond to different inputs and the impact of time delays. Key control strategies, including feedback and feedforward control, are discussed, along with methods for designing and tuning controllers. Advanced topics like cascade, adaptive, and multivariable control techniques are also explored.

Course Pre/co-requisites

A8206 - Control Systems

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8261.1.	Analyze various process control strategies and their applications to different types of processes, such as blending and distillation.
A8261.2.	Analyze dynamic behevior of process systems.
A8261.3.	Examine PID controller for feedback process systems.
A8261.4.	Investigate various feedforward and ratio control for process systems.
A8261.5.	Apply advanced control strategies, including cascade, inferential, and multivariable control, to optimize process performance and stability.

3. Course Syllabus

Theory

Introduction to Process Control: Representative process Control problems-Continuous Processes,Batch and Semibatch Processes,Example— A Blending Process.Classification of Process Control Strategies-Process Control Diagrams, Example-A Distillation Column. The Hierarchy of Process Control Activities. General Modeling Principles with example, Degrees of Freedom Analysis with example.

Dynamic Behavior of Processes: Introduction to Transfer Function Models, Property of Transfer Functions- Additive Property and Multiplicative Properties of Transfer Functions. Standard Process Inputs, Response of First-Order Processes, Response of Integrating Processes, Step and Sinusoidal Responses of Second-Order Processes. Processes with Time Delays and its approximation.

Feedback Control of Processes: Feedback Controllers-Basic Control Modes,Features of PID Controllers. Performance Criteria for Closed-Loop Systems, Model-Based Design Methods-Direct Synthesis Method,Internal Model Control (IMC). Controllers with Two Degrees of Freedom, On-Line Controller Tuning-Continuous Cycling Method,Relay Auto-Tuning,Step Test Method.

Feedforward and Ratio Control of Processes: Introduction to Feedforward Control,Ratio Control, Feedforward Controller design based on steady-state models, Feedforward Controller design based on dynamic models, Relationship between the steady-state and dynamic design methods, Configurations for Feedforward–Feedback Control, Tuning Feedforward Controllers.

Advanced Process Control: Enhanced Single Loop Control Strategies-Cascade Control,Inferential Control, Adaptive Control Systems. Multiloop Control Strategies-Process Interactions and Control Loop Interactions, Block Diagram Analysis, Closed-Loop Stability,Pairing of Controlled and Manipulated Variables-Bristol's Relative Gain Array Method. Decoupling Control and General Multivariable Control Techniques.//

4. Books and Materials

Text Books:

1. Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle III, Process Dynamics and Control,Wiley Publications, Fourth Edition, 2017.

Reference Books:

1. Curtis D. Johnson, Process Control & Instrumentation Technology , Willey publications, 8th edition, 2012.
2. Stephanopoulos, G., Chemical Process Control – An Introduction to Theory and Practice, Prentice Hall of India, 2005

Course Structure

A8262 - Energy Storage System for Electrical Vehicles

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a comprehensive understanding of Energy Storage Systems (ESS) tailored specifically for Electric Vehicles(EV). It covers EV, mechanism application of Energy storage solutions for Electric Vehicles and its Efficiency improvement.

Course Pre/co-requisites

This course doesnot require any prerequisites

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8262.1. Understand the basic history of electric vehicles
A8262.2. Discuss the various energy storage systems
A8262.3. Analyze the battery characteristics & parameters
A8262.4. Enlighten the battery management system.
A8262.5. Apply the knowledge battery testing, disposal & recycling to avoid environmental pollution for the betterment of society

3. Course Syllabus

Theory

Electric vehicle Mechanism : Basics of vehicle mechanisms, history of electric vehicles (EV) and hybrid electric vehicles (HEV), need for and Importance of EV and HEV, Power/Energy supply requirements.

Energy Storage System: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zine Chloride battery; Ultra capacitors; Flywheel Energy Storage System; Hydraulic Energy Storage System; Comparison of different Energy Storage System

Cells and Batteries: Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics; Efficiency of batteries; Electrical parameters Heat generation.

Batteries for Electric Vehicles: Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation

methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation.

Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery thermal management system, Battery Pack Safety, Battery Standards & Tests, Environment and Human Health impact assessments of batteries, methods of recycling of EV batteries.

4. Books and Materials

Text Books:

1. Chris Mi, Abul Masrur & David Wenzhong Gao, Hybrid electric Vehicle- Principles & Applications with Practical Properties, Wiley, 2011.
2. Arno Kwade, Jan Diekmann, Recycling of Lithium-Ion Batteries: The LithoRec Way, Springer, 2018.

Reference Books:

1. Ibrahim Dinçer, Halil S. Hamut and Nader Javani, Thermal Management of Electric Vehicle Battery Systems, JohnWiley & Sons Ltd., 2016.
2. Pistoia, J.P. Wiaux, S.P. Wolsky, Used Battery Collection and Recycling, Elsevier, 2001

Course Structure

A8263 - Utilization of Electrical Energy

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course deals with the fundamentals of illumination and its classification and the electric heating and welding. It gives the detailed study of all varieties of Electric drives and electrical traction systems and to clearly understand the basic concepts related to use of electric energy in various industrial, commercial and residential applications and important issues related to such usage.

Course Pre/co-requisites

A8202 - Electrical Power Generation
A7208 - Power System Transmission and Distribution

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8263.1. Identify the types of electric drives based on their duty and application.
A8263.2. Classify the types of electric heating and welding practiced in industries.
A8263.3. Apply the laws of illumination to select a suitable scheme of lighting based on ambient conditions.
A8263.4. Analyze the different methods of braking employed in traction drives.

3. Course Syllabus

Theory

Electric Drives: Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

Electric Heating & Welding: Advantages and methods of electric heating, resistance heating induction heating and dielectric heating. Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

Illumination: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, source of light, Introduction to LED lights.

Electric Traction-I: Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking-plugging rheostat braking and regenerative braking.

Electric Traction-II: Mechanics of train movement. Speed-time curves for different services, trapezoidal and quadrilateral speed time curves. Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation adhesive weight and coefficient of adhesion.

4. Books and Materials

Text Books:

1. G. C. Garg (2005), Utilization of Electrical Power & Electric traction, 8^{th} Edition, Khanna publishers, New Delhi.
2. N. V. Suryanarayana (2005), Utilization of Electrical Power including Electric drives and Electric traction, 1^{st} edition New Age International (P)Ltd., New Delhi.

Reference Books:

1. Partab (2007), Art & Science of Utilization of electrical Energy, 2^{nd} Edition, Dhanpat Rai & Sons, New Delhi.
2. C.L.Wadhwa (2005), Generation, Distribution and Utilization of Electrical Energy, 2^{nd} Edition, New Age International (P)Ltd., New Delhi.

Course Structure

A8264 - Power Electronics for Renewable Energy Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a comprehensive understanding of the application of power electronics in renewable energy conversion. It covers key topics related to electrical machines for renewable energy conversion, converters for wind and photovoltaic energy systems, and hybrid renewable energy systems. This course equips students with the practical knowledge and skills needed to harness renewable energy sources efficiently using power electronics.

Course Pre/co-requisites

A8219 – Power Electronics
A8213 - Electrical Machines-II

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8264.1. Apply knowledge of electrical machines to analyze and select suitable generators for specific renewable energy applications.
A8264.2. Select appropriate power converter solutions for wind and photovoltaic energy systems.
A8264.3. Design standalone and grid-integrated PV and wind energy systems, considering various factors.
A8264.4. Apply design principles to create hybrid renewable energy systems by integrating wind and PV sources, addressing the needs and constraints of specific applications.

3. Course Syllabus

Theory

Electrical Machines for Renewable Energy Conversion: Review of reference theory fundamentals, Principle of operation and analysis: Self Excited Induction Generators, Squirrel Cage Induction Generator, Double Fed Induction Generator, Permanent Magnet Synchronous Generator, Switched Reluctance Generator.

Converters for Wind and PV Energy Systems: Buck-Boost Converters, AC-DC-AC converters, Matrix converters, Line commutated converters (inversion-mode), Grid Interactive Inverters, Micro-inverter, multi-input power electronic converters.

Wind Energy Systems: Standalone operation of fixed and variable speed wind energy conversion systems, Standalone Operation of Stator Converter Controlled IG, Grid con-

nected SCIG, Converters for SRG, PMSG based WECS.

PV Systems: Selection of inverter, Battery sizing, PV array sizing, standalone PV systems, Grid connection Issues, Grid integrated PV Systems.

Hybrid Renewable Energy Systems: Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Wind-PV Systems, MPPT (Maximum Power Point Tracking) Techniques for PV Systems, MPPT Techniques for Wind energy systems.

4. Books and Materials

Text Books:

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Ion Boldea, "Variable Speed Generators", 2nd Edition, CRC Press, 2016
3. S. N. Bhadra, D. Kastha, S. Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
4. R. Seyezhai and R. Ramaprabha, "Power Electronics for Renewable Energy Systems", Scitech Publications, 2015.

Reference Books:

1. G. L. Johnson, "Wind Energy Systems," Prentice Hall, 1995
2. Andrzej M. Trzynadlowski, "Introduction to modern power electronics", John Wiley & Sons, 2010.
3. B.H. Khan, " Non-conventional Energy sources", Tata McGraw-hill Publishing Company.
4. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.

Course Structure

A8265 - Power Plant Instrumentation

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course is meticulously crafted to acquaint students with the intricacies of functions and instrumentation within a contemporary power generation plant. Students will gain a comprehensive understanding of the various operations and monitoring tools employed in state-of-the-art power generation facilities. The course covers a spectrum of topics, ranging from the fundamental functions of power generation plants to an in-depth exploration of the advanced instrumentation used in these modern facilities. Through theoretical insights and practical applications, students will develop the skills necessary to navigate and contribute to the efficient operation of today's cutting-edge power generation plants.

Course Pre/co-requisites

A8202 - Electrical Power Generation

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8265.1.	Provide an overview of different methods of power generation with a particular stress on thermal power generation
A8265.2.	Bring out the various measurements involved in power generation plants
A8265.3.	Provide knowledge about the different types of devices used for analysis.
A8265.4.	Impart knowledge about the different types of controls and control loops.

3. Course Syllabus

Theory

Overview of Power Generation : Brief survey of methods of power generation – Hydro, thermal, nuclear, solar and wind power – Importance of instrumentation in power generation – Thermal power plants – Block diagram – Details of boiler processes - UP&I diagram of boiler – Cogeneration.

Measurements in Power Plants: Electrical measurements – Current, voltage, power, frequency, power factor etc. – Non electrical parameters – Flow of feed water, fuel, air and steam with correction factor for temperature – Steam pressure and steam temperature – Drum level measurement – Radiation detector – Smoke density measurement – Dust monitor.

Analysers in Power Plants: Flue gas oxygen analyser – Analysis of impurities in feed water and steam – Dissolved oxygen analyser – Chromatography – pH meter – Fuel analyser

– Pollution monitoring instruments.

Control Loops in Boiler : Combustion control – Air/fuel ratio control – Furnace draft control – Drum level control – Main steam and reheat steam temperature control – Super heater control – Air temperature – Deaerator control – Distributed control system in power plants – Interlocks in boiler operation.

Turbine Monitoring and Control : Speed, vibration, shell temperature monitoring and control – Steam pressure control – Lubricant oil temperature control – Cooling system.

4. Books and Materials

Text Books:

1. Sam G. Dukelow, 'The Control of Boilers', Instrument Society of America, 1991.
2. P.K. Nag, 'Power Plant Engineering', Tata McGraw Hill, 2001.

Reference Books:

1. S.M. Elonka and A.L. Kohal, 'Standard Boiler Operations', Tata McGraw Hill, New Delhi,1994.
2. R.K.Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi, 1995.
3. E.Al. Wakil, 'Power Plant Engineering', Tata McGraw Hill, 1984.

Course Structure

A8266 - Nuclear Engineering

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a comprehensive exploration of nuclear energy and its application in nuclear reactors for the generation of useful power. From the fundamental principles of nuclear and atomic structure to the economics and environmental considerations of nuclear power, students will gain a deep understanding of this complex and important field.

Course Pre/co-requisites

"The course has no specific prerequisite and co-requisites"

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8266.1. Understand the fundamental principles of nuclear physics and their relevance to energy generation.
A8266.2. Gain insights into the operation of nuclear reactors and their role in power production.
A8266.3. Acquire knowledge about heat removal and radiation shielding techniques in nuclear reactors.
A8266.4. Evaluate the economic and environmental aspects of nuclear power plants.
A8266.5. Compare and contrast nuclear power with other forms of energy generation, considering safety and sustainability.

3. Course Syllabus

Theory

Fundamentals of Nuclear Physics : Principles of the conversion of nuclear energy to useful power, Fundamental Particles, Atomic and Nuclear Structure, Atomic and Molecular Weight, Atomic and Nuclear Radii, Mass and Energy, Particle Wavelengths, Excited States and Radiation, Nuclear Stability and Radioactive Decay.

Nuclear Reactors and Nuclear Power: The Fission Chain Reaction, Nuclear Reactor Fuels, Non-Nuclear Components of Nuclear Power Plants, Components of Nuclear Reactors, Power Reactors and Nuclear Steam Supply Systems, Radioactive Waste Disposal.

Heat Removal from Nuclear Reactors: General Thermodynamic Considerations, Heat Generation in Reactors, Heat Flow by Conduction, Heat Transfer to Coolants, Boiling Heat Transfer, Thermal Design of a Reactor.

Radiation Shielding : Gamma-Ray Shielding: Buildup Factors, Infinite Planar and Disc Sources, The Line Source, Internal Sources, Multilayered Shields, Nuclear Reactor Shielding: Principles of Reactor Shielding, Removal Cross-Sections, Coolant Activation, Ducts in Shields.

Economics of nuclear power plants : Accounting for capital costs, fuel costs and O&M (operations and maintenance) costs, as well as environmental aspects - sustainability, proliferation, safety. Compare and contrast the relative merits of different types of power plants.

4. Books and Materials

Text Books:

1. John R. Lamarsh and Anthony J. Baratta, Introduction to Nuclear Engineering, 3rd Edition, Prentice Hall (2001).

Reference Books:

1. M. M. El-Wakil, Nuclear Energy Conversion, American Nuclear Society; Revised edition (1982)

Course Structure

A8267 - Power System Dynamics and Stability

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides an understanding of the electro mechanical dynamics of the interconnected electric power grid. It also gives an overview about the modeling of different types of excitation systems. This course deals with the different types of stability problems that arise in an interconnected power system. It gives a clear insight on the different techniques adopted to improve power system stability.

Course Pre/co-requisites

A8206 - Control Systems

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8267.1	Model and analyze dynamical systems to address various power system stability problems.
A8267.2	Execute digital simulation of large power system for small signal and transient stability analyses and develop stability enhancement methods.
A8267.3	Analyze the performance of single and multi-machine systems under transient, steady and dynamic conditions.
A8267.4	Model and analyze voltage stability of power system.

3. Course Syllabus

Theory

Introduction to Power System Stability : Introduction to Power System Stability - Basic Concepts and definitions of Power System Stability - Classical Machine Model - Small-Disturbance Stability Analysis of SMIB system - Linearizing SMIB system swing equation - Equal area criterion - Critical Clearing Angle and Time.

Machine Modelling: Disadvantages of Classical Model Representation of Synchronous Generators - Representation of Synchronous Machine Dynamics - Stator and rotor windings equations - Synchronous Reference Frame - Per Unit Representation - Sub-transient and transient reactance - Effect of Saturation on Synchronous Machine Modelling.

Small Signal Stability: Small signal angle instability (low frequency oscillations) - Power System Model for Low Frequency Oscillation Studies, damping and synchronizing torque analysis, Eigen value Analysis, Introduction to Non-linear stability Analysis. Improvement

of System Damping with Supplementary Excitation Control, Standard models for PSS representation – sub synchronous frequency oscillations - Sub Synchronous Resonance and Countermeasures.

Transient Stability: Transient Stability Problem, Modeling of Synchronous Machine, Loads, Network, Excitation Systems, Turbine and Governing Systems, Trapezoidal Rule of Numerical Integration Technique for Transient Stability Analysis, Simultaneous Implicit Approach for Transient Stability Analysis of Multi-machine Systems, Data for Transient Stability Studies, analysis using digital simulation - Transient Stability Enhancement Methods.

Voltage Stability: Voltage Stability Problem. Real and Reactive Power Flow in Long Transmission Lines. Effect of ULTC and Load Characteristics on Voltage Stability. Voltage Stability Limit. Voltage Stability Assessment Using PV Curves. Modal analysis for voltage stability assessment. System Modelling-Static and Dynamic Analysis-Voltage Collapse Proximity Indices. Voltage Stability Improvement Methods.

4. Books and Materials

Text Books:

1. Vijay Vittal, James D. McCalley, Paul M. Anderson, A. A. Fouad, Power System Control and Stability (IEEE Press Series on Power and Energy Systems), 3rd Edition, Willey IEEE Press, 2019
2. Prabha S. Kundur, Om Malik, Power System Stability and Control, 2nd Edition, McGraw Hill 2022
3. M A Pai, D P Sen Gupta, K R Padiyar, Small Signal Analysis of Power Systems, Narosa Series in Power and Energy Systems, 2004

Reference Books:

1. K.R. Padiyar, Power System Dynamics, Stability & Control, 2nd Edition, B.S. Publications, Hyderabad, 2002
2. P.M Anderson and A.A Fouad, Power System Control and Stability, lowa State University Press, Ames, lowa, 1978
3. C. Van Custem, T. Vournas, Voltage Stability of Electric Power Systems, Rlever Academic Press, 1998. item J. Arrilaga, C.P. Arnold, B.J. Harker, Computer Modeling of Electrical Power Systems, Wiley, New York, 1983
4. Yao-Nan-Yu, Electric Power System Dynamics, Academic Press, 1983
5. https://nptel.ac.in/courses/108102080/

Course Structure

A8268 - Battery Management System

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The objective of this course is to introduce learner to batteries, its parameters, modelling and charging requirements. The course will help learner to develop battery management algorithms for batteries

Course Pre/co-requisites

"The course has no specific prerequisite and co-requisites"

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8268.1. Interpret the role of battery management system
A8268.2. Identify the requirements of Battery Management System
A8268.3. Interpret the concept associated with battery charging /discharging process
A8268.4. Calculate the various parameters of battery and battery pack
A8268.5. Design the model of battery pack.

3. Course Syllabus

Theory

Introduction: Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging

Battery Management System Requirement: Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State of charge estimation, Cell total energy and cell total power.

Battery State of Charge and State of Health Estimation: Cell Balancing- Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing.

BMS Modelling: Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach.

Design of battery BMS: Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system

4. Books and Materials

Text Books:

1. Plett, Gregory L. Battery management systems, Volume I: Battery modeling. Artech House, 2015.
2. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002.

Reference Books:

1. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010.
2. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008.

Course Structure

A8269 - Optimization Techniques

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Optimization methods are used in many areas of study to find solutions that maximize or minimize some study parameters, such as minimize costs in the production of a good or service, maximize profits, minimize raw material in the development of a good, or maximize production. In this course conventional optimization methods in power system operation are discussed. This course also deals with constrained and unconstrained optimization methods. Studnents will learn new technologies used in optimization methods of load dispatch and optimal power flow problems.

Course Pre/co-requisites

The course has no specific prerequisite and co-requisites.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8269.1. Apply the concepts of geometry optimization methods.
A8269.2. Implement traditional optimization methods in power system operation.
A8269.3. Analyze constrained and unconstrained optimization methods.
A8269.4. Apply new technologies in optimization methods of load dispatch and optimal power flow problems.

3. Course Syllabus

Theory

Concepts from geometry: Line segments, Hyper planes and linear varieties, Convex set, Neighborhoods, Polyhedra and polytopes.

Unconstrained Optimization Methods: Introduction, Basics of set-constrained and unconstrained Introduction, Analysis of Newton method; Line search method; Gradient methods: Introduction, Method of steepest descent, Analysis of gradient method, Convergence, Convergence rate, Exercises.

Conventional methods: Linear Programming: Brief history of linear programming, Simple examples of linear programs, two dimensional linear programs, Convex polyhedral and linear programming; Quadratic programming.

Constrained Optimization Methods: Constrained optimization methods with Equality Constraints: Introduction, Problem Formulation, Tangent and Normal Spaces, Lagrange

Condition, Second order conditions, minimizing quadratics subject to linear constraints, Exercises. Constrained Optimization Methods with Inequality Constraints: Karush Kuhn Tucker Conditions, Second order Conditions, exercises.

Application of Optimization in Power System: Optimal Power Flow using Newton method: Neglecting line security constraints, considering line security constraints; Economic Dispatch using Gradient method, Security constrained economic dispatch using linear programming and quadratic programming, Interior point method for VAR optimization.

4. Books and Materials

Text Books:

1. An Introduction to Optimization: Edwin K. P. Chong and S. H. Zak, Wiley Publication.
2. Optimization of Power system Operation: Jizhong Zhu, Wiley Publication.

Reference Books:

1. Computer Analysis Methods for Power systems: G.T. Heydt, Stars in a Circle Publication.

Course Structure

A8270 - Energy Audit and Management

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Energy management can help industry control its operating costs. Energy management is also important for reducing local, regional and global emissions and can help mitigate the problem of global warming. This course will help industry professionals acquire the skills and techniques required to implement energy management. This course will also benefit researchers and students who are interested in working on energy management. In the context of the Energy Conservation Act 2001, the Bureau of Energy Efficiency has emphasised the importance of Energy Managers and Certified Energy Auditors. This course is designed to provide the background required for engineers to meet this role.

Course Pre/co-requisites

"The course has no specific prerequisite and co-requisites"

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8270.1. Compare Energy Audit and Safety Audit in the present energy management scenario.
A8270.2. Analyze the energy conservation techniques adopted in electric motors and transformers.
A8270.3. Analyze the energy conservation techniques adopted in pumps, fans and compressors.
A8270.4. Select suitable lighting scheme for various environments.
A8270.5. Analyze the significance of Energy Management in the present scenario.

3. Course Syllabus

Theory

Electrical Energy and Safety Audit: Overview of Electricity Act – Energy conservation act – Electrical energy audit – Types – Tools – Tariff – Load factor improvement – Power factor correction – Power demand control and shifting – Electrical safety Auditing.

Energy Conservation in Electric Motors: Motors efficiency – Motor selection – Factors affecting motor performance – Efficiency at low load – Rewound motors – Variable speed drives – Load reduction – High efficiency motors – Energy savings in transformers-Case studies..

Electrical Energy Conservation in Driven Equipments: Input electrical energy requirements in pumps, fans and compressors – Load factor estimation in the equipment - Energy conservation potential.

Energy Conservation in Industrial Lighting: Concept of lighting systems – Choice of lighting – Different lighting technologies – Energy saving – Control of lighting – Lighting standards and requirements – Light meter audit – Methods to reduce costs.

Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting – Energy manager, Qualities and functions.

4. Books and Materials

Text Books:

1. W. R. Murphy, G. McKay (2008), Energy Management, 1st Edition, B.S. Publications, New Delhi.
2. Tripathy S. C., "Electric Energy Utilization and conservation", Tata McGraw Hill.
3. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982.

Reference Books:

1. B. Smith (2007), Energy Management Principles, 1st Edition, Pergamon Press, Inc., England.
2. Energy Management Handbook, Edited by W.C.Turner, Wiley, New York, 1982.
3. IEEE Bronze Book, 'Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities, IEEE Press.

Course Structure

A8271 - Power System Transients

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course is designed to provide a comprehensive understanding of switching transients and their control circuit, covering theoretical concepts, the mechanism of lightning strokes, and the generation of lightning surges. The curriculum delves into the intricacies of traveling wave phenomena, exploring aspects such as propagation, reflection, and refraction. Additionally, it offers an insightful overview of transients within an integrated power system.

Course Pre/co-requisites

A8208 - Electromagnetic Field Theory

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8271.1. Identify the sources of transients and its effects on power system.
A8271.2. Develop equivalent circuit for resistance switching, load switching and capacitance switching.
A8271.3. Analyze the nature of lighting transients on power system.
A8271.4. Analyze the behavior of travelling waves on transmission lines.
A8271.5. Examine the nature of different transients that arise on an integrated system.

3. Course Syllabus

Theory

Survey and Switching Transients: Source of transients, various types of power systems transients, effect of transients on power systems, importance of study of transients in planning. Introduction, circuit closing transients: RL circuit with sine wave drive, double frequency transients, observations in RLC circuit and basic transforms of the RLC circuit.

Resistance Switching: Equivalent circuit for the resistance switching problems, equivalent circuit for interrupting the resistor current. Load switching: Equivalent circuit, waveforms for transient voltage across the load, switch; normal and abnormal switching transients. Current suppression, current chopping, effective equivalent circuit. Capacitance switching, effect of source regulation, capacitance switching with a restrike, with multiple restrikes, illustration for multiple restriking transients, ferro resonance.

Lightning Transients: Causes of over voltage, lightning phenomenon, charge formation in the clouds, rate of charging of thunder clouds, mechanisms of lighting strokes, characteristics of lightning strokes, factors contributing to good line design, protection afforded by ground

wires, tower footing resistance, Mathematical model for lightning.

Travelling Waves on Transmission Line Computation of Transients: Transient response of systems with series and shunt lumped parameters and distributed lines. Travelling wave concept: step response, Bewley's lattice diagram, standing waves and natural frequencies, reflection and refraction of travelling waves.

Transients In Integrated Power System: The short line and kilometric fault, distribution of voltage in a power system: Line dropping and load rejection; voltage transients on closing and reclosing lines; over voltage induced by faults; switching surges on integrated system; EMTP for transient computation.

4. Books and Materials

Text Books:

1. Allan Greenwood (1991), Electrical Transients in Power Systems, 2^{nd} Edition, Wiley Inderscience, New York.
2. C. L. Wadhwa (2011), Electrical Power Systems, 2^{nd} Edition, New Age International (P) Limited, New Delhi.

Reference Books:

1. R. D. Begamudre (2011), Extra High Voltage AC Transmission Engineering, 4^{th} Edition, Wiley Eastern Ltd., New Delhi, India.

Course Structure

A8272 - Applications of Power Electronic Converters

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The course focuses on presenting concepts for conversion and control of electrical energy using power electronic converters. The principles for designing power electronic converters, including their power semiconductors and passive elements are established. The application of power electronic converters in lighting systems and induction heating are presented. Furthermore, the application of power electronic converters in the fields of sustainable energy technologies such as wind energy, solar power, and electrified transportation are described.

Course Pre/co-requisites

A8219 - Power Electronics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8272.1. Analyze the requirements of power electronic converters in lighting systems.
A8272.2. Analyze the converter configurations used in induction heating applications.
A8272.3. Identify suitable power converter for electric vehicles from the available configurations.
A8272.4. Identify configuration of power converters required for a given renewable energy system.
A8272.5. Develop power converters for utility application requirements.

3. Course Syllabus

Theory

Power Converters For Lighting Systems: Buck-Based LED Drivers, Non-isolated PFC based LED drivers, Isolated PFC based LED drivers, Selecting Components for LED Drivers, EMI and EMC Issues.

Power Supplies For Induction Heating: Analysis of Induction heating load, Power-frequency combinations, Two-stage induction heating power supply, Single-stage Induction heating power supply, Multi-frequency Induction Heating power supply, Considerations for induction heating power supplies.

Power Converters For Electric Vehicles: Electric traction, Bidirectional Converter Topologies, Non-isolated converters, Isolated converters, Multi-input DC-DC Converters, Multi-phase converters.

Power Converters In Renewable Energy Systems: Fixed Speed Wind Energy Conversion Systems, Variable Speed Wind energy conversion systems with partial-scale and full-scale power converters, Stand-alone PV Systems, Grid-Connected PV Systems.

Utility Applications Of Power Converters: Converters for HVDC systems, Solid State Transformers, Static transfer switches, solid state circuit breakers, Active power filters.

4. Books and Materials

Text Books:

1. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics: Converters, Applications, and Design, 3rd Edition, Wiley.
2. Bimal K. Bose, Power Electronics in Renewable Energy Systems and Smart Grid: Technology and Applications, Wiley-IEEE Press, 2019.

Reference Books:

1. Steve Winder, Power Supplies for LED Driving, 2nd Edition, Newnes, 2017.
2. Valery Rudnev, Don Loveless, Raymond L. Cook, Handbook of Induction Heating, CRC Press, 2003.

Course Structure

A8273 - Control of Autonomous Vehicles

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course is designed to equip students with the skills to analyze diverse dynamic loads impacting vehicles, enabling them to tailor vehicle systems to meet market demands. It encompasses an examination of various vehicle systems prevalent in traditional automobiles. the syllabus includes a qualitative exploration of factors influencing the ride and handling of vehicles. Moreover, students will delve into driver assistance systems and the longitudinal control of vehicles, enhancing their understanding of these crucial aspects in automotive engineering.

Course Pre/co-requisites

A8206-Control Systems

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8273.1. Analyze vehicle dynamics and road-driver models.
A8273.2. Diagnosis the vehicle faults using fault models .
A8273.3. Analyze the ABS control systems in autonomous vehicles.
A8274.4. Develop a complete driver model with path, road surface and wind strength.
A8273.5. Design and develop controllers for braking system in Electric vehicle.

3. Course Syllabus

Theory

Overview of Control System: Overview of Control System: Modeling, Time/Frequency Response Analysis and Stability Analysis: PID, State Variable Analysis. Model Based Diagnosis: Characteristics, Faults, Fault Modeling, Principles of Model Based Diagnostics-Residual Generator Design, Residual Evaluation, Engineering of Diagnosis Systems, Application Example.

Vehicle Control Systems: Vehicle Control Systems: ABS Control Systems- Torque Balance at Vehicle- Road Contact, Control Cycles of the ABS System, ABS Cycle Detection; Control of Yaw Dynamics- Deviation of Simplified Control Law, Derivation of Reference Values.

Road and Driver Models: Road Model- Requirements of the Road Model, Definition of the Course Path, Road Surface and Wind Strength; PID Driver Model; Hybrid Driver Model – Vehicle Control Tasks, Characteristics of Human as a Controller, Information Handling,

Complete Driver Model.

Introduction to Driver Assistance Systems: : Introduction to Driver Assistance Systems, Active Stability Control, Ride Quality, Technologies for Addressing Traffic Congestion, Emissions and Fuel Economy; Lateral Vehicle Control: State Feedback, Steady State Analysis. Understanding Steady State Comering, the Output Feedback Problem, Compensator Design with Look Ahead Measurement.

Longitudinal Vehicle Control: Introduction: Cruise Control, Control System Architecture, Adaptive Cruise Control, Individual Vehicle Stability and String Stability, String Stability with Constant Spacing, String Stability with Constant Time Gap, Controller for Transitional Maneuvers, Automated Highway Systems.

4. Books and Materials

Text Books:

1. Thomas D. Gillespie, Fundamentals of Vehicle Dynamics, SAE International, 1992
2. R. Rajamani, Vehicle Dynamics and Control, Second Edition, Springer Verlag 2012. .
3. Uwe Kiencke and Lars Nielsen, Automotive Control Systems: For Engine Driveline, and Vehicle, Second edition,Springer, 2005.

Reference Books:

1. John C Dixon, Tyres, Suspension and handling, 2nd Revised Edition, SAE International, 1996
2. Hans B. Pacejka, Tyre and Vehicle Dynamics, Second Edition, Butterworth-Heinemann, 2006
3. James. Northcote – Green Robert Wilson, Control and Automation of Electrical Distribution Systems, CRC Press.

Course Structure

A8274 - Alternative Fuels

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides an in-depth exploration of alternative fuels and drivetrain technologies that are shaping the future of the automotive industry. From the classification of alternative fuels to the study of specific fuel types like biodiesel, hydrogen, vegetable oils, and synthetic alternatives, students will gain a comprehensive understanding of the various options available for sustainable transportation. Additionally, the course will cover dual fuel technology and its applications, as well as the regulatory and safety aspects associated with alternative fuel vehicles.

Course Pre/co-requisites

This course has no prerequisite

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8274.1. Evaluate the environmental, economic, and regulatory aspects of alternative fuels.

A8274.2. Explore the production, properties, and potential of biodiesel as an alternative fuel source.

A8274.3. Analyze the characteristics, production methods, and safety considerations associated with hydrogen as a fuel.

A8274.4. Assess the performance and emission characteristics of vegetable oils and synthetic alternative fuels.

3. Course Syllabus

Theory

Introduction: Classification of alternative fuels and drivetrains, scenario of conventional auto fuels, Oil reserves of the world, fuel quality aspects related to emissions, Technological upgradations required, Need for alternative fuels, Regulatory framework for CNG/LPG vehicles in India, Third-party inspection checklist for alternative fuel vehicles, comparison of alternative fuel technologies, Roadmap for alternative fuels.

Dual fuel Technology: Introduction, history of dual fuel technology, Applications of dual fuel technology, Dual fuel engine operation, power rating of dual fuel engine, dual fuel Vs SI engine operation, advantages and disadvantages of dual fuel technology, conversion of CI engine to dual fuel engine, dual fuel engine emissions, dual fuel vehicles.

Bio Diesel: Introduction, History of Biodiesel, biodiesel feedback selection, Raw materials for biodiesel production, biodiesel production, properties of biodiesel, biodiesel storage, biodiesel transportation, advantages and disadvantages of biodiesel, hazards of biodiesel, biodiesel emissions, biodiesel vehicles, biodiesel scenario in India.

Hydrogen: Introduction, History of hydrogen, properties of hydrogen, production of hydrogen, On-board storage of hydrogen, material compatibility for hydrogen, stationery storage for hydrogen, piping for hydrogen, dispensers for hydrogen, transportation of hydrogen, advantages and disadvantages of hydrogen, hazards of hydrogen, safety systems for hydrogen, hydrogen use in IC and SI engines.

Vegetable Oils: Various Vegetable oils for Engines – Esterification – Performance and emission characteristics. Synthetic Alternative Fuels: Di-Methyl Ether (DME), P-Series, Eco Friendly Plastic fuels (EPF), Muncipal waste to energy.

4. Books and Materials

Text Books:

1. Dr. S. S. Thipse (2014), Alternative Fuels Concepts, Technologies and Developments, 5^{th} Edition, Jaico Publications.

Reference Books:

1. Arumugam S Ramadhas(2011), Alternative fuels for Transportation, CRC Press Taylor & Francis Group, Boca Raton, London, New York.

Open Electives

Course Structure

A8181 - Smart Cities

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The purpose of this course is to provide a deep understanding about smart and sustainable cities. The course will begin with the basic concepts and theories of urbanization and elements. The course will cover the global practices in the smart cities and technologies in shaping new and existing cities. The course will include the feasibility for smart cities and financing approaches for urban development. The course will also include the role of electric vehicles and energy rating system for smart cities.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8181.1 Interpret the concepts, history and evolution of smart cities.
A8181.2 Identify the elements of smart city such as smart people, smart living, smart economy, smart infrastructure, smart governance and smart environment.
A8181.3 Analyze the concepts, discourses and practices of smart cities across globe.
A8181.4 Develop the road map for planning smart cities and benchmarking their performance for Indian context.
A8181.5 Apply relevance for smart cities of developing economies considering issues as inclusiveness, feasibility and sustainability.

3. Course Syllabus

Introduction to Smart and Sustainable Cities: Concepts and theories of Urbanization, City Planning, Emergence of Sustainability, Liveability, Green to Smart Cities; Understanding smart cities – Concepts, History and Evolution of Smart Cities.

Dimensions of Smart Cities: Elements of Smart City – Smart People, Smart Living, Smart Economy, Smart Infrastructure, Smart Governance, Smart Environment.

Global Experience of Smart Cities: Case studies from European, Middle East and Asian Contexts, specifically cases of Barcelona, Amsterdam, Majhdhar, and Singapore, Review of Global Standards.

Smart City Planning and Development: How to plan for smart cities, Concepts of Retrofitting, Redevelopment, Extension and Pan city approaches, Review of Smart financing approaches, Tools, concepts of special purpose vehicles, Land pooling-based financing approaches of urban development.

Sustainable Development in Smart Cities: Energy storage and utilization, role of electric vehicles, autonomous vehicles in urban mobility, Green Audit, Energy saving system.

4. Books and Materials

Text Books:

1. M.Barlow and C. Levy-Bencheton. Smart Cities, Smart Future: Showcasing Tomorrow
2. Gassmann, J.Böhm Smart Cities: Introducing Digital Innovation to Cities

Reference Books:

1. UN-Habitat; Inclusive and sustainable urban planning: a guide for municipalities; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978- 92-1-132024-4)
2. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science
3. Draft Concept Note on Smart City Scheme. Government of India - Ministry of Urban Development.

Course Structure

A8182 - Disaster Management

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The course has been framed with an intention to provide a general concept in the dimensions of disasters caused by nature beyond human control as well as the disasters and environmental hazards induced by human activities with emphasis on Natural disaster, Man-made disaster, vulnerability and risks of disasters, Disaster Management Mechanism, Capacity Building and disaster coping Strategies and Disaster management planning.

Course Pre/co-requisites

A8032 - Environmental Science and Technology

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8182.1 Identify basic concepts of hazards, vulnerabilities and risks of disaster phenomena.
A8182.2 Interpret various types of disasters and disaster coping strategies.
A8182.3 Examine Disaster Impacts and suggest suitable capacity building frame work for disaster management.
A8182.4 Select appropriate steps in Disaster management cycle for Disaster Risk Reduction.
A8182.5 Develop Strategies for disaster management planning and sustainable development.

3. Course Syllabus

Introduction: Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation, disaster phenomena, events global National & Regional.

Disasters: Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile

of India, Covid 2019 in India, mountain and coastal areas, ecological fragility, coping with disaster- strategies, safety norms & survival kits.

Disaster Impacts: Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters, capacity building – concepts, assessment –structural & non-structural measures, legislative support.

Disaster Risk Reduction: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Disasters, Environment and Development: Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environment friendly recovery; reconstruction and development methods.

4. Books and Materials

Text Books:

1. Manual on Disaster Management, National Disaster Management Authority, Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2017.
4. National Disaster Management Plan, Ministry of Home affairs, Government of India.

Reference Books:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.

Course Structure

A8183 - Environmental Pollution Management

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The course has been designed to improve the understanding of the students about different pollution control strategies and the skills of application of remediation techniques to combat pollution in three environmental compartments i.e., air, water and soil. The course will also be dealing about the sources of pollution in air, soil, water, and noise and the impacts these sources on the environment and health. In addition, the students will be given the knowledge to develop the particular skills required in pollution related structured research and environmental management.

Course Pre/co-requisites

A8032 - Environmental Science and Technology

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8183.1 Identify water pollution sources, types and treatment methods.
A8183.2 Apply knowledge on Prevention and control of air pollution.
A8183.3 Inspect sources, effects and mitigation methods of noise pollution.
A8183.4 Examine soil pollution sources, effects and control measures.
A8183.5 Develop Environmental management plan to minimize environmental pollution.

3. Course Syllabus

Water pollution: Water Pollution - Introduction - Sources and types of water pollutants Physical, Chemical and Biological. Ground water - Surface water - lake water - seawater. Effects of water pollution. Water Quality standards (Drinking and Industrial) - water treatment - physical, chemical and biological. Water Pollution Prevention and Control Act, 1974.

Air pollution: Structure and composition of atmosphere – classification, sources and effects of air pollution – Acid rain – greenhouse effect – global warming – Ozone depletion, Prevention and control of air pollution particulate control – settling chamber, scrubber, bag filter, cyclones electrostatic precipitators. Gaseous emission control methods. Air pollution

prevention and control Act 1981.

Noise Pollution: Noise Pollution Basics of acoustics- propagation of indoor and outdoor sound- noise profiling effects of noise – measurement, index and mitigation methods- health effects of noise- Vibration and its Effects, Whole body vibration problems in opencast mines-ground vibration and Air blast. Green Belt Development–Principles and design considerations, Industrial Noise Pollution Control methods.

Soil Pollution: Sources - solid waste disposal and their effects - pesticides - types and effect of pollutants on Plants - animals and human beings - biomagnification - fertilizers and its Effect of pollutants on plants - animals and human beings - soil pollution Control measures - soil microbes and function - biofertilizer.

Environmental management: Environmental impact assessment and statement; Government strategies in pollution control: subsides, polluter pays principle and regulations; Government Agencies and Programs – The Tiwari committee – creation of NCEPC, Department of Environment & Forest – Function of State Pollution Control Board. Sources of environmental information and regulations; Sustainable development and environmental protection.

4. Books and Materials

Text Books:

1. C. S. Rao, Environmental Pollution Control Engineering, 3^{rd} Edition, New Age International Pvt Ltd, 2018.
2. Rao, M. N and H.V.N. Rao, Air Pollution, Tata McGraw – Hill Publishing Company Limited. New Delhi, 2017.
3. Kudesia, V.P and Ritu Kudesia, Water Pollution, Pragati Prakashan Publication, Meerut, 2017.
4. Murphy, E., King,E., Environmental Noise Pollution, 1^{st} Edition , Amsterdam : Elsevier, 2014.

Reference Books:

1. H.S Peavy, D. R. Rowe, G. Tchobanoglous, Environmental Engineering, Indian Edition, McGraw Hill Education (India) Pvt Ltd, 2014.
2. De Nevers, N., Air Pollution Control Engineering, 3^{rd} edition, Waveland Press Inc 2017.
3. Sagar Pal Singal, Noise Pollution and Control Strategy, 2^{nd} Edition, Alpha Science International Ltd, 2005.

Course Structure

A8155 - Green Building and Sustainability

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces concepts of sustainability in the context of construction building materials. It also discusses the role of low carbon cements and recycled aggregate in minimizing consumption of natural resources. The course also emphasizes the concepts of embodied, operational, life cycle energy and minimizing energy consumption. It also intends to make students aware of rating systems like LEED, GRIHA etc.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8155.1 Identify green building and green building materials.
A8155.2 Make use of different rating agencies to classify the type of building.
A8155.3 Analyze sustainability and its implications for the practice of engineering.
A8155.4 Evaluate the potential of the alternative construction materials for sustainability.
A8155.5 Examine the green building rating systems and its contribution to sustainability.

3. Course Syllabus

Green Building: Concept of Green building, Principles of green buildings, Eco-friendly materials, Certification systems – Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED).

Green Building Materials: Green Building Materials and Equipment in India, what are key requisites for Constructing a Green Building, Important Sustainable features for Green Building. **Building Services:** Fire protection – classes of fire and causes, development of fire, fire resisting materials, means of escape, Standing Fire Advisory Council norms. Water supply -Water distribution and plumbing fixtures.

Applications in the Built Environment: Concepts of green buildings, climate responsive building - Reduction of energy consumption, direct and indirect methods - Reduction of water consumption, direct and indirect methods - Carbon footprint and eco footprints of buildings - New concepts and trends in green buildings, national and international.

Sustainability: The Concept of Sustainability; Definition of Sustainability, Dimension of Sustainability. Three Pillars of Sustainability, Principles of Sustainability - 5R, Construction Materials Resource Efficiency, Operational Reuses of the Construction Materials, Sustainability Goals for construction Industry.

Sustainability in Built Environment: Environmentally sensitive design, low impact development, green infrastructure and conservation design, Green buildings and land use planning, Energy use and buildings.

4. Books and Materials

Text Books:

1. Frederick S. Merritt, Jonathan T. Ricketts, Building design and construction Handbook, McGraw-Hill Inc., 5^{th} edition,1994.
2. Fred hall and Roger Greeno, Building Services Handbook, Routledge, 7^{th} edition, 2013.
3. Bradley A. Striebig, Adebayo A. Ogundipe and Maria Papadakis, Engineering Applications in Sustainable Design and Development, 1^{st} edition, 2016.

Reference Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.

Course Structure

A8224 - Electric Vehicles

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces the fundamental concepts, principles, architectures and analysis of electric vehicles. Student will explore the working principle of electric vehicles, delve into key roles played by motors as propulsion systems and requirements for battery and its management systems. In addition to this, focuses on various charging systems and charging infrastructure. This course also emphasizes the EV business and the future trends in the development of electric vehicles.

Course Pre/co-requisites

A8213-Electrical Machines-II

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8224.1. Infer the electric vehicle system and its impact on environment.
A8224.2. Analyze the various hybrid vehicle configurations and its performance.
A8224.3. Interpret the electric drives used in hybrid and electric vehicles.
A8224.4. Choose proper energy storage systems for electric vehicle applications.
A8224.5. Identify the different charging systems and charging infrastructure for EVs.

3. Course Syllabus

Introduction To Electric Vehicles: EV System: EV Configuration-Fixed & variable gearing, single & multiple motor drive, In-wheel drives. Components of an EV, Components of ICEVs, EV History, the early years, recent EVs and HEVs, Types of EVs, EV Advantages, Comparison of EVs and ICEVs w.r.t to efficiency, pollution, capital & operating cost.

Hybrid Electric Vehicles: Types of Hybrids Vehicles- Series, parallel, series-parallel and complex HEVs, Advantages and Disadvantages of HEVs, Concept of Hybrid Electric Drive Trains, Architectures and power flow control of Hybrid Electric Drive Trains.

Electric Propulsion Systems: Choice of electric propulsion systems, block diagram of

EV propulsion system, BLDC Machine Construction and Classification, Basic Principles of BLDC Motor Drives, application to Electric Vehicles. Switched Reluctance Motor Drives, Basic Magnetic Structure, Torque Production, SRM Drive Converter, Modes of Operation, Generating Mode of Operation.

Introduction To Energy Storage Requirements: Electrochemistry of battery cells, Battery parameters, Types of Batteries- Lead–Acid Batteries, Ni Cd Batteries, NiMH Batteries and Lithium-Ion Batteries. EV Charging: Types of charging systems- Conductive charging On board & off-board charging, inductive charging, Wireless charging.

Charging Infrastructure: Domestic Charging Infrastructure, Public Charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Move-and charge zone. Key Battery Management Technologies, Typical Structure of Battery Management Systems. Business: E-mobility business, electrification challenges, Connected Mobility and Autonomous Mobility- case study, E-mobility Indian Roadmap, social dimensions of EVs.

4. Books and Materials

Text Books:

1. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003
2. Iqbal Husain, "ELECTRIC and HYBRID VEHICLES: Design Fundamentals", CRC PRESS Boca Raton London New York Washington, D.C., 2003
3. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wi- ley and Sons, 2012.

Reference Books:

1. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wi- ley and Sons, 2012.
2. Reissland, Martin.U (2010), Electrical Measurements: Fundamentals, Concepts, Applications, New Age International (P) Limited, New Delhi.
3. Shen, Weixiang Xiong, Rui, "Advanced battery management technologies for electric vehicles" 2019, John Wiley & Sons

Course Structure

A8281 - Solar Energy and Applications

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces students about the solar energy technologies and potentials. The course aims to introduce the concepts of Photo Voltaic cells, their properties, and its societal needs. The applications of solar cells will be explained in detail also the environmental issues of solar systems will be explained. It also covers the economic analysis of a solar energy system and its environmental benefits.

Course Pre/co-requisites

"The course has no specific prerequisite and co-requisites"

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8281.1. Compare the present and future available electrical power from solar energy based on the knowledge of global solar horizontal irradiation.

A8281.2. Assimilate and acquire the skills for design and engineering of solar thermal and solar photovoltaic technology and systems.

A8281.3. Identify the problems involved in solar thermal energy conversion technique used in the solar heating and cooling systems for buildings/societal needs.

A8281.4. Examine the components of a solar photo voltaic system and their function by utilizing the previous literature knowledge on different photovoltaic solar cells.

A8281.5. Analyze the techno-economics performance and issues in the solar energy system.

3. Course Syllabus

Theory

Principles of Solar Radiation: Role and potential of solar energy, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and Sun shine, solar radiation data.

Solar Energy Collectors: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Different methods of solar energy storage, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating /cooling technique, solar distillation and drying.

Photo Voltaics (PV): Fundamentals of solar cells, types of solar cells, absorption of photons, excitations and photo emission of electrons.
PV Cell Properties: Solar cell properties and design, p-n junction photodiodes, depletion region, electrostatic field across the depletion layer, electron and holes transports, device physics, charge carrier generation, recombination and other losses, I-V characteristics, output power.

Solar Cell Applications:PV cell interconnection, module structure and module fabrication, Equivalent circuits, load matching, efficiency, fill factor and optimization for maximum power, Design of stand-alone PV systems, system sizing, device structures, device construction, DC to AC conversion, inverters.

Cost Analysis and Environmental Issues: Cost analysis and pay back calculations for different types of solar panels and collectors, installation and operating costs, Environmental and safety issues, protection systems, performance monitoring.

4. Books and Materials

Text Books:

1. G. D. Rai (2009), Non-Conventional Energy Sources, 4^{th} Edition, Khanna Publishers, New Delhi.
2. Martin A. Green (2008), Solar Cells: Operating Principles, Technology and system Applications, 1^{st} Edition, Prentice Hall, New Delhi.

Reference Books:

1. B. H. Khan (2016)- Non Conventional Energy Resources-3^{rd} Edition, McGraw Hill Education (India) Private Limited.
2. Sukatme (2008), Solar Energy, 3^{rd} Edition, McGraw Hill Companies, New Delhi.
3. D. Yogi gosuami, Frank Kreith, Jan F. Kreider (2000), Principles of Solar Engineering, 3^{rd} Edition, Taylor & Francis, USA.

Course Structure

A8282 - Energy Storage Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces students to impart fundamental knowledge on energy storage systems considering the operation and design of various energy storage devices. This course provides a foundation for understanding the general principles and fundamentals of lithium-ion rechargeable battery engineering, fuel cells and super capacitors.

Course Pre/co-requisites

"The course has no specific prerequisite and co-requisites"

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8282.1. Apply the knowledge of concepts of science to understand the concepts of electro chemical cell.

A8282.2. Apply the knowledge of electro chemistry to describe the components and process in batteries.

A8282.3. Describe the electrical, thermal, and mechanical behavior of Li-Ion batteries under various operating conditions.

A8282.4. Apply the knowledge of basic science concepts to distinguish various types of fuel cells and their functionalities

A8282.5. Apply the knowledge of science to interpret the operation and characteristics of super capacitors.

3. Course Syllabus

Theory

Battery Technology Overview: Battery definitions, terms and terminology, Primary cells, Secondary cells. Electro chemistry - Electro chemical energy sources, Voltage and potential energy, Reduction and oxidation, Reduction potentials and electro chemical couples.

Battery Construction : Electro chemical cell, Cell mechanical structure, Resistance and polarization, Electrode design, Discharging and charging. Major Battery Chemistries and performance comparison.

Lithium-Ion Batteries: Lithium-ion cell reaction, construction - pouch cells, cylindrical, flexible foil. Principle of operation, Charge and discharge characteristics, State of charge (SOC), State of health (SOH), State of function (SOF), Charging procedures, Safety of

lithium-ion batteries, Lifetime. Types of Lithium-ion Batteries .

Fuel Cells: Introduction – working, performance characteristics and efficiency, types of fuel cell – Alkaline Fuel Cell, Polymer Electrolyte Membrane Fuel Cell, Molten Carbonate Fuel Cell, Solid-Oxide Fuel Cell, hydrogen fuel cells.

Super Capacitors: Introduction, Electro chemical Double-Layer Super capacitors, Charge-Discharge characteristics, Energy and power density, Design Considerations, Stacking and Voltage cell balancing.

4. Books and Materials

Text Books:

1. John Warner, The Handbook of Lithium-Ion Battery Pack Design: Chemistry, Components, Types and Terminology, 1^{st} Edition, Elsevier Science, 2015.
2. 2. Reiner Korthauer, Lithium-Ion Batteries: Basics and Applications, 1^{st} Edition, Springer, 2018.

Reference Books:

1. R. O'hayre, S.W. Cha, W.G. Colella, F.B. Prinz, Fuel Cell Fundamentals, 3^{rd} Edition, Wiley, 2016.
2. Masaki Yoshio, Ralph J. Brodd, Akiya Kozawa, Lithium-Ion Batteries: Science and Technologies, 1^{st} Edition, Springer, 2009.
3. Aiping Yu, Victor Chabot, Jiujun Zhang, Electrochemical Supercapacitors for Energy Storage and Delivery: Fundamentals and Applications, CRC Press, 2013.

Course Structure

A8283 - Power Generation Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Electrical Energy plays a significant role in day-to-day life of entire mankind. This course deals with the generation of power along with its economic aspects. It deals with the basic theory of various conventional power stations and the different components present in them. The course also helps the students to familiarize with different types of substations and its advantages and disadvantages. It also deals with the economic aspects of power system, power factor correction techniques and suitable pricing methods.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8283.1 List the different components of an electric power system.
A8283.2 Categorize the conventional methods of generating electrical power to meet the required load demand.
A8283.3 Categorize the Non-conventional methods of generating electrical power to meet the required load demand.
A8283.4 Model a power system to reduce economic losses.

3. Course Syllabus

Introduction: Conventional Energy Sources and their availability, Non-Conventional Energy Sources and their availability, Environmental impact of conventional and Non-Conventional energy sources.Hydro Electric Power Plants: Site selection, Plant layout, various components, Types of turbines, Governor and speed regulation, Pumped storage, Small scale hydroelectric plants (mini and micro).

Thermal Power Plant: Site selection, Plant layout, Coal its storage, Preparation, Handling, Feeding and burning, Cooling towers, Ash handling, Water treatment plant, High pressure boilers and steam turbines.

Nuclear Power Plant: Main components of nuclear power plant, Nuclear reactors types and applications, Radiation shielding, Radioactive and waste disposal safety aspect.

Non-Conventional Energy: Types of Non conventional Energy generation: solar, wind, tidal, biomass and wave energy.

Economic Aspects of Power Generation and Tariff Methods: Base load and peak load on power station. Interconnected grid system, Load curve, load duration and integrated load duration curves, demand, diversity, capacity, utilization and plant use factors. Costs of electrical energy - Fixed, Semi-fixed and Running Costs, Selection of type of generation and generation equipment, Performance and operating characteristics of power plants, Economic scheduling principle. Tariff, Characteristics, Types - Flat Rate, Block-Rate, two-part, three-part, and power factor tariff methods.

4. Text Books:

1. M. L. Soni, P. V. Gupta, U. S. Bhatnagar, A. Chakrabarti (2010), "A Text Book on Power System Engineering", 2nd Edition, Dhanpat Rai & Co. Pvt. Ltd, New Delhi.
2. C. L. Wadhwa (2010), "Generation, Distribution and Utilization of Electrical Energy", 3rd Edition, New Age International (P) Limited, New Delhi.

Reference Books:

1. Leonard L. Grigsby (2012), "Electric Power Generation Transmission and Distribution, 3rd Edition, CRC press.
2. J. B. Gupta (2010), "A Course in Power Systems", 10th Edition, S. K. Kataria & Sons, New Delhi.

Course Structure

A8381 - Hybrid Vehicles

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The Basics of Hybrid Vehicles course introduces fundamental concepts in hybrid technology, combining internal combustion engines with electric propulsion. Students learn about hybrid vehicle architectures, regenerative braking, and battery systems. The curriculum covers energy management strategies, efficiency considerations, and the environmental impact of hybrid vehicles. Practical insights and case studies provide a foundation for understanding the design and operation of hybrid transportation systems.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8381.1 Identify different types of hybrid vehicles and their power train configurations
A8381.2 Analyze the energy management strategy for hybrid vehicles
A8381.3 Develop and optimize the hybrid vehicles subsystems
A8381.4 Apply advanced technologies and materials in hybrid vehicles design
A8381.5 Evaluate the performance and environmental impact of hybrid vehicle.

3. Course Syllabus

Introduction to Hybrid Vehicles:

Overview of hybrid vehicles and their advantages, types of hybrid vehicles (series, parallel, series-parallel), comparison with conventional vehicles and electric vehicles, historical background and evolution of hybrid vehicles, current market trends and future prospects.

Powertrain and Energy Storage Systems: Overview of powertrain configurations for hybrid vehicles, electric motors and their control systems, internal combustion engines and their optimization for hybrid use, energy storage systems (batteries, capacitors, flywheels) and their selection criteria, power electronics and electrical systems for energy conversion and distribution.

Energy Management and Control Systems: Overview of energy management strategies for hybrid vehicles, energy flow diagrams and efficiency maps, control systems for hybrid powertrains (electronic controls, sensors, actuators), algorithm development for optimal energy management, real-time operating systems and software architectures for vehicle control.

Aerodynamics and Thermal Management: Overview of aerodynamic principles relevant to hybrid vehicles, drag reduction techniques and wind tunnel testing, cooling system design and optimization for hybrid vehicles, climate control systems and cabin comfort considerations, NVH (noise, vibration, harshness) management in hybrid vehicles.

Challenges and Opportunities in Hybrid Vehicle Design: Discussion of challenges unique to hybrid vehicle design (e.g., packaging, weight, cost), opportunities for innovation and advancement in hybrid technology, case studies of successful hybrid vehicle designs and their lessons learned, future outlook for hybrid vehicles and their role in sustainable transportation, emerging trends in alternative propulsion technologies (fuel cells, hydrogen fuel cell vehicles, autonomous vehicles)

4. Books and Materials

Text Books:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management

Reference Books:

1. . M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge.

Course Structure

A8382 - Fundamentals of Robotics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces students to the basics, types and elements of robots. The course exposes students to the theoretical concepts of robot kinematics. Path planning and trajectory planning concepts gives the perception on control of robotics. The concepts on actuators and sensors gives clear understanding and design ability for mobility systems. It gives an overview on application of robotics in manufacturing industry.

Course Pre/co-requisites

A8002 - Ordinary Differential Equations and Vector Calculus

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8382.1 Illustrate the basic concepts and components of a robotic system
A8382.2 Select appropriate actuators and sensors for designing robot mobility system
A8382.3 Solve transformation problems to describe the robot position and orientation of robot
A8382.4 Apply the concepts of robot work cell design and control
A8382.5 Choose appropriate robots for various applications suitable to modern manufacturing systems.

3. Course Syllabus

Introduction to Robotics: Classification of Robots, Advantages and Disadvantages of Robots, Degree of freedom, joints, Robot coordinates, Robot workspace, Robot characteristics, Robot Components, types of robot arms, end effectors, grippers.

Actuators: Characteristics of Actuating Systems, Comparison of Actuating Systems, Hydraulic and Pneumatic Devices, Electric Motors in Robotics.Sensors: Sensor Characteristics, Position Sensors, Velocity Sensors, Acceleration Sensors, Touch and Tactile Sensors, Proximity Sensors, Range Finder.

Manipulator Kinematics: Specifications of matrices, Homogeneous Transformation, D-H notation, joint coordinates and world coordinates, Forward and inverse kinematics, Simple problems.Path Planning:Trajectory planning and avoidance of obstacles, Path planning, introduction to robot programming.

Robot Work Cell Design and Control: Robot Cell Layouts, Multiple Robots and Machine Interface, Some Consideration in Work Cell Design, Interlocks, Error Detection and Recovery, Robot Cycle Time Analysis.

Robotic Applications: Robots in manufacturing and non- manufacturing applications, Health Service, Intelligent Home Applications, Military Applications, Space Application, Entertainment robots, Service robots, Domestic or household robots.

4. Books and Materials

Text Books:

1. Richard D. Klafter, Robotic Engineering, 2nd Edition, Prentice Hall of India, New Delhi.
2. M.P. Groover, Industrial Robotics, 3rd Edition, Pearson Education, New Delhi.

Reference Books:

1. R.K. Mittal, I.J. Nagrath, Robotics and Control, 1st Edition, Tata Mc Graw Hill, New Delhi.
2. P. Coiffet, M. Chaironze, An Introduction to Robot Technology, 3rd Edition, Kogam Page Ltd,London.
3. Ganesh S. Hegde, A Textbook of Industrial Robotics, 2nd Edition, University Science Press.

Course Structure

A8383 - 3D Printing

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

3D printing is an additive manufacturing process whereby objects are built up from plastic filament, liquid resin, layers of powder, or even bio-compatible and edible materials.Desktop 3D printing is today's printing press, putting rapid prototyping, customizable products, and individualized medical appliances in reach of the general public. Literacy in basic 3D modeling and manufacturing is an essential skill for future STEM success in this country. In this course students will learn how to be "makers" by using various types of 3D modeling software and imaging equipment, printing actual physical objects that they have designed and modeled themselves, and participating in educational outreach in the institute and the community.

Course Pre/co-requisites

A8302 - Computer Aided Drawing

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8383.1 llustrate the fundamental concepts of Additive Manufacturing and 3-D printing, its advantages and limitations
A8383.2 Apply engineering knowledge, techniques, skills and modern tools to analyze problems in 3D Printing
A8383.3 Appraise additive manufacturing through 3d printing
A8383.4 Solve Complex manufacturing problems for significant technological and societal development
A8383.5 Evaluate engineering products using the knowledge of mathematics, science, engineering and IT tools.

3. Course Syllabus

Introduction to 3D Printing: Fundamental of 3D printing, Need for 3D printing Generic 3d printing process, Distinction between 3D printing and CNC, Classification of 3D printing Processes, Steps in 3D printing process, Advantages of 3D printing, standards for 3D printing, Major Applications. VAT Photo Polymerization 3d Printing Processes: Stereo

lithography (SL), Materials, SL resin curing process, Process Benefits and Drawbacks, Applications of Photo polymerization Processes.

Material and Binder Jetting 3D Printing Processes: Evolution of Printing as a 3D printing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes. Binder Jetting 3d Printing Processes: Materials, Process Benefits and Drawbacks, Research achievements in printing deposition, Technical challenges in printing, Applications of Binder Jetting Processes.

Extrusion-Based 3D Printing Processes: Fused Deposition Modeling (FDM), Principles, Materials, Plotting and path control, Bio-Extrusion, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes. Powder Bed Fusion 3d Printing Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.

Directed Energy Deposition 3D Printing Processes: Process Description, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Benefits and drawbacks, Applications of Directed Energy Deposition Processes. Wire arc based additive manufacturing methods, Advantages and disadvantages, comparison with conventional 3D printing and WAAM. Post Processing of 3d Printing Parts: Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Preparation for use as a Pattern, Property Enhancements using Non-thermal and Thermal Techniques. Inspection of 3D printing parts: Different destructive and non-Destructive testing of 3D printing parts, acceptance standards for 3D printing parts.

3D Printing Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries.

4. Books and Materials

Text Books:

1. Ian Gibson, David W Rosen, Brent Stucker,Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, 2nd Edition, Springer.
2. Ali K. Kamrani, EmandAbouel Nasr,Rapid Prototyping: Theory & Practice,2nd Edition, Springer.

Reference Books:

1. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling,1st Edition, Springer.
2. Rafiq Noorani,Rapid Prototyping: Principles and Applications in Manufacturing,1st Edition, John Wiley & Sons.

Course Structure

A8402 - Digital Electronics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course aims to teach students the fundamentals of digital electronics. Starting from learning the basic postulates of Boolean algebra, to cover map method for simplifying Boolean expressions, to outline the formal procedures for the analysis and design of combinational and sequential circuits, to design combinational and sequential programmable devices. These digital components are the basic building blocks from which more complex digital systems are constructed.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8402.1. Apply fundamental theorems and properties of Boolean algebra to simplify a Boolean function.
A8402.2. Apply the map method to obtain simplified and optimized logical expressions.
A8402.3. Build combinational circuits using logic gates for real time digital systems.
A8402.4. Analyze the behaviour of latches and flipflops for designing sequential logic. .
A8402.5. Make use of programmable logic devices in the design of digital systems.

3. Course Syllabus

Boolean Algebra and Logic Gates: Introduction, basic definitions, axiomatic definition of Boolean algebra, basic theorem and properties, Boolean functions, canonical and standard forms, digital logic gates.

Gate-Level Minimization: The map method, two-variable, three-variable and four-variable K-maps, sum-of-products, product-of-sums simplification, don't-care conditions, NAND and NOR implementation.

Combinational Logic: Combinational circuits, analysis procedure, design procedure, binary adder-subtractor, magnitude comparator, decoders, encoders, multiplexers, demulti-

plexers.

Synchronous Sequential Logic: Sequential circuits, storage elements – latches and flip-flops, analysis of clocked sequential circuits. **Registers and Counters:** Registers, shift registers, ripple counters, synchronous counters.

Memory and Programmable Logic: Random-Access Memory, read-only memory, programmable logic array, programmable array logic.

4. Books and Materials

Text Books:

1. M. Morris Mano, Michael D. Ciletti (2017), Digital Design With an introduction to the Verilog HDL, 6thEdition, Pearson Education/ PHI, India

Reference Books:

1. Ronald J Tocci, Ronald J Tocci, Neal S Widmer , Gregory L Moss , Digital Systems - Principles an Applications , 10th Edition, Pearson Education International
2. Charles H RothJr, Larry L Kinney, Fundamentals of Logic Design,6th Edition, Cengage Learning

Course Structure

A8481 - Basic Electronics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course covers fundamental topics that are common to a wide variety of analog and digital electronics. This course starts with basics of semiconductors, review the operation and characteristics of semiconductor devices (namely, semiconductor diodes and BJTs), and buildup to more advanced topics in analog circuit designs.

Course Pre/co-requisites

A8006 - Applied Physics.
A8204 - Basic Electrical Engineering.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8481.1 Analyze the operation and characteristics of electronic devices.
A8481.2 Construct electronic circuits making use of diodes and transistors.
A8481.3 Analyze single stage amplifiers using small signal low frequency transistor model.
A8481.4 Analyze the effect of negative and positive feedback on amplifiers.
A8481.5 Design single stage amplifier for given specifications.

3. Course Syllabus

Diode and its Characteristics: P-N junction diode, operation in forward and reverse bias conditions, V-I characteristics, Zener diode and its characteristics, rectifiers - half wave, full wave and bridge rectifiers (simple problems), Filters (qualitative treatment), voltage regulation using Zener diode.

Transistors: Bipolar Junction Transistor (BJT) - construction, operation, CE, CB and CC transistor configurations and characteristics. **BJT Biasing:** Need for biasing, operating point, load line analysis, biasing and stabilization techniques: fixed bias, collector to base bias, self-bias.

BJT Amplifiers: Transistor as an amplifier, BJT h-parameter model, analysis of transistor amplifier using h- parameter model, CE, CB and CC amplifiers, comparison of CB, CE and CC configurations, Simplified h parameter model.

Feedback Amplifiers Concept of feedback, classification of feedback amplifiers, general Characteristics of negative feedback amplifiers, effect of negative feedback on input and output resistances.

Oscillators: Condition for oscillations, RC Phase shift oscillator with transistor, Wein bridge oscillator, Hartley and Colpitts oscillator.

4. Books and Materials

Text Books:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, PHI, 2013.
2. Jacob Milliman, Christos C .Halkias, Satyabrata Jit (2011), Electronic Devices and Circuits, 3rd edition, Tata McGraw Hill, New Delhi

Reference Books:

1. G.K.Mittal (1999), Electronic Devices and Circuits, 22nd edition, Khanna Publications, New Delhi
2. S. Shalivahanan, N. Suresh Kumar, A. Vallavaraj (2007), Electronic Devices and Circuits, 3rd edition, McGraw Hill, New Delhi, India.

Course Structure

A8482 - Principles of Communication Engineering

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a foundation in the theoretical aspects of Electronic Communication Systems. This course focuses on Analog and Digital Communications, Pulse and Data Communications. This course forms the basis for the study of advanced communication systems like Telephone Switching networks, Computer Communications, Radar Communications, Cellular and Mobile Communications, Optical Communications and Satellite Communications.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8482.1 Summarize the fundamental concepts and acquire competencies for each topic of analog and digital modulation techniques.

A8482.2 Illustrate elements of analog, digital and data communications systems and identify their real-time applications.

A8482.3 Compare analog and digital communication systems with respect to performance parameters and applications.

A8482.4 Analyze the error control and coding techniques including Source Coding Technique, Huffman Source Coding, Error Control, and Coding.

A8482.5 Distinguish the features of advanced communication systems.

3. Course Syllabus

Introduction to Electronic Communications: Historical Perspective, Electromagnetic Frequency Spectrum, Signal and its Representation, Elements of Electronic Communications System, Primary Communication Resources, Signal Transmission Concepts, Analog and Digital Transmission, Modulation, Concept of Frequency Translation, Signal Radiation and Propagation, Classification and Sources of Noise, Signal-to-Noise Ratio (SNR), Noise Figure.

Principles of Analog Communication: Types of Analog Modulation, Principles of Amplitude Modulation, AM Power Distribution, Limitations of AM, DSBSC Modulation, SSB Modulation, Vestigial-Sideband Modulation, Comparison of Analog Modulations, Applications, Principles of Angle Modulation, Theory of FM—Basic Concepts, Spectrum Analysis, Narrowband and Wideband FM, Theory of Phase Modulation, Relationship between FM and PM, Comparisons and Applications of FM and PM.

Sampling Theorem and Pulse Modulation Techniques: Digital Versus Analog Transmissions, Sampling Theorem, Classification of Pulse-Modulation Techniques: Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), Pulse-Code Modulation (PCM), Quantization of Signals, Delta Modulation, Comparison of PCM Techniques, Vocoders.

Digital Modulation Techniques and Information Theory: Types of Digital Modulation, Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Quadrature Phase Shift Keying, M-Ary PSK, Quadrature Amplitude Modulation, Minimum Shift Keying, Information, Entropy and Its Properties, Channel Capacity Theorem, Objectives of Source Coding, Source Coding Technique, Huffman Source Coding, Error Control and Coding.

Advanced Communication Systems: Spread Spectrum Communication: General Model, Features, Multiple Access techniques, Telephone Switching, Computer Communications, Optical Communications, Mobile Communications-the Cellular Concept, Satellite Communications, RADAR systems.

4. Books and Materials

Text Books:

1. T L Singal, “Analog and Digital Communications”, 1st edition, Tata McGraw-Hill, 2012
2. H. Taub, D L Schilling and G Saha, “Principles of Communication Systems”, 3rd Edition, Tata McGraw-Hill, 2008.

Reference Books:

1. George Kennedy, Electronic Communication Systems, Tata McGraw-Hill.
2. B. P.Lathi, “Modern Analog and Digital Communication Systems”, 3rd Edition, Oxford University Press, 2007.

Course Structure

A8483 - Fundamentals of IoT

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces you to Advance concepts and design techniques for creating Internet of Things systems and applications, as well as programming languages and tools optimized for the IoT industry. Participants are also exposed to new IoT-specific applications, physical layer protocols, communication technologies, and legacy protocols. This course will primarily present the fundamental IOT architecture building blocks and its theoretical components, such as Raspberry Pi programming using the Python Language Interface and other IOT peripherals.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8483.1 Identify the basic building blocks and its characteristics.
A8483.2 Determine the most appropriate IoT Devices and Sensors based on Application.
A8483.3 Make use of Python standard libraries for implementing various IoT Applications.
A8483.4 Analyze the appropriate protocol for establishing communication between various IoT Devices.
A8483.5 Interpret cloud infrastructure, services, APIs and architectures of commercial and industrial cloud platforms.

3. Course Syllabus

Introduction to Internet of Things: Introduction, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies, IoT Levels and Templates, IoT Platforms Design Methodology.

Introduction to Python: Language features of Python, Data types & data structures, Control of flow, Functions, Modules, Packages, File Handling, Data/Time operations, Classes, Python packages of interest for IoT(JSON,XML).

IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, IoT System Management with NETCONF- YANG-Need for IoT Systems Management, SNMP, Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG.

IoT Physical Devices and Endpoints: Introduction to IoT Device, Exemplary Device: Raspberry Pi, Components of Raspberry Pi Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming – Raspberry Pi with Python.

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs,WAMP – AutoBahn for IoT, Xively Cloud for IoT, ThingSpeak IoT Python web application framework-Django, Designing a RESTful web API.

4. Books and Materials

Text Books:

1. ArshdeepBahga and Vijay Madisetti: Internet of Things,A Hands-on Approach; University Press, 2016
2. Mark Lutz, "Learning Python", 4th edition, OREILLY, 2009.

Reference Books:

1. Getting Started with Raspberry Pi:Matt Richardson & Shawn Wallace,O'Reilly (SPD), 2014.

Course Structure

A8484 - Introduction to Embedded Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	**T**	**P**	**L**	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Introduction to Embedded systems course introduces the basic concepts like purpose and quality attributes of embedded systems. It covers the differences between the general purpose computers and specific purpose computers and selection of memory according to the requirement for a system. This course presents ASICs, PLDs, COTS, Memory Interface, and communication interface. This course provides a comprehensive introduction to microcontroller (8051) and their architecture with an emphasis on its interfacing with external devices. Focus is on 8051 microcontroller family which includes internal architecture, pin diagram, instruction set, register organization, addressing modes, operating modes, interrupt structure, assembly language programming and etc. Various aspects of hardware design, such as interfacing of memory and different types of I/O devices will be covered in detailed.

Course Pre/co-requisites

A8401 - Digital Logic Design.
A8416 - Computer Organization and Microprocessors.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

- A8484.1 Classify the embedded systems based on the performance, complexity and the era in which they evolved.
- A8484.2 Understand different factors to be considered for the selection of memory, sensors, actuators and their interfacing.
- A8484.3 Apply the fundamentals of microcontroller to investigate existing designs.
- A8484.4 Demonstrate assembly language programming to assemble and driver circuitry to microcontroller I/O ports to interface external devices.
- A8484.5 Develop a product with functional requirements using optimal hardware and software components.

3. Course Syllabus

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing,

Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

The 8051 Architecture: Introduction, 8051 micro controller hardware, external memory interfacing, Data transfer and logical instructions, arithmetic operations, decimal arithmetic, jump and call instructions and simple programs. The Assembly Language Programming: Programming tools and techniques, counter and timers programming, interrupts, interrupt programming.

I/O Interfaces: 8051 interfacing with seven segment LED displays, stepper motor, D/A converter interfacing, Interfacing DC motor, Interfacing 4*4 Matrix Keypad, Interfacing to Alphanumeric Displays (LCD) interfacing.

Basic Design Using a Real-Time Operating System: Tasks and Task states, Tasks and Data, Semaphores and Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment, Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System.

4. Books and Materials

Text Books:

1. Introduction to embedded systems Shibu K V Tata Mcgraw-Hill First Edition 2012
2. Kenneth J. Ayala (2008), The 8051 Microcontroller, 3rd edition, Cengage Learning, India.
3. David E. Simon (1999), An Embedded Software Primer, Pearson Education, India

Reference Books:

1. M. A. Mazidi J. G. Mazidi, Rolin D. McKinlay (2000), The 8051 Microcontroller and Embedded System, Prentice Hall of India, New Delhi.
2. Ajay V. Deshmukh (2004), Microcontrollers Theory and applications, Tata McGraw Hill Edition, New Delhi
3. Embedded Systems Rajkamal Tata Mcgraw-Hill Second Edition 2012

Course Structure

A8510 - Operating Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Operating Systems is a graduate-level introductory course that teaches the concepts in operating systems like abstractions, mechanisms, and various services provided. This course deals with Process Management & Synchronization, Inter process communication, Memory Management, Virtual Memory, File & Disk Management and Deadlock handling methods. Using these concepts, the student will be able to understand the internal working of various operating systems. The course provides the concepts and terminology required for advanced courses.

Course Pre/co-requisites

A8506 - Computer Organization

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8510.1. Identify the services provided by the operating system for user and system.
A8510.2. Examine the concepts of IPC and Synchronization for process cooperation
A8510.3. Make use of Memory Management techniques for efficient use of main memory.
A8510.4. Select File and Disk Management methods for effective storage and access.
A8510.5. Identify a Deadlock Handling Method in allocating resources among processes.

3. Course Syllabus

Operating Systems Overview and Process Management: Definition, Operating System Types, Operating System operations, Operating system services, System calls and System Programs. Process concepts- Process, Process State Diagram, PCB and Operations on processes, Process Scheduling- Scheduling Criteria, Scheduler Types and Scheduling Algorithms.

Process Synchronization: Inter Procee Communication- Pipes, Message Passing and Shared Memory. Concept of Synchronization, Critical section problem, Peterson's solution,

Semaphores, Classic problems of Synchronization-The Bounded Buffer Problem, The Readers –Writers Problem, Dining - Philosophers Problem.

Memory Management: Introduction to Memory Management, Swapping, Contiguous Memory Allocation, paging, segmentation, virtual memory, demand paging, Page-replacement algorithms, allocation of frames, thrashing.

File and Disk Management: Concept of a file – File Attributes, File Types, Access Methods, Directory Structures, File System Implementation, Directory Implementation, File Allocation methods, and Free-Space management. Introduction to Magnetic Disks, Disk Structures, Disk Scheduling, Swap Space Management.

Deadlocks: System Model, Deadlock Characterization-Necessary Conditions, Resource Allocation Graph, Deadlock Prevention, Deadlock Avoidance - RAG Algorithm, Banker's Algorithm, Detection- Single Instance ofa Resource type, Multiple Instances of a resource type, recovery from deadlock.

4. Books and Materials

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne., Operating System Concepts, 8th Edition, Wiley India Private Limited, New Delhi,2009.

Reference Books:

1. William Stallings., Operating Systems, Internals and Design Principles, 5th Edition, Pearson Education, India, 2006.
2. Sumitabha Das., Your Unix the Ultimate Guide, Tata Mc Graw Hill, New Delhi, India, 2007.
3. T.Chan., Unix System Programming using C++, PHI, India,1996.

Course Structure

A8514 - Database Management Systems

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces the core principles and techniques required in the design and implementation of database systems. This course focus on relational database management systems, including database design theory: E-R modeling, query languages like relational algebra, relational calculus and SQL. It also covers essential DBMS concepts such as: Normalization, Transaction Processing, Concurrency Control, Recovery and tree based indexing techniques like ISAM, B+ trees etc which are required for designing an effective database. Students can undertake a semester project to design, build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Pre/co-requisites

A8608 - Java Programming

A8601 - Object Oriented Programming

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8514.1. Design a database for a given problem using E-R diagrams and Relational Model.
A8514.2. Construct Queries in Relational algebra and SQL for a case study.
A8514.3. Use Normalization techniques to reduce data redundancy in data base.
A8514.4. Select transaction control and recovery methods to keep data base consistent.
A8514.5. Compare various indexing techniques and NoSQL databases for efficient access.

3. Course Syllabus

Introduction and Data Base Design: Introduction to DBMS, applications of DBMS, database systems versus file systems, view of data, Database users and administrators, database system structure. Introduction to Relational database model, database schema, relations, columns and tuples. SQL data types, Database languages, DDL commands, DML commands, DCL commands, TCL commands. Database Design: Introduction to ER model, entities, attributes and entity sets, relationships and relationship sets, additional features of

the E-R model. logical database design: E-R to relational.

SQL Programming: SQL basic operators, SQL set operators-union, intersect and except operators, Integrity constraints in SQL. aggregate operators, GROUP BY, ORDER BY and HAVING Clause, null values, views in SQL, nested queries, SQL joins-inner join, outer join, left outer join, right outer join, storing and retrieving images, storing and retrieving files, Relational algebra operations and basic queries.

Schema Refinement and Normal Forms: Introduction to schema refinement & Normalization, Decomposition and properties of decompositions, functional dependencies, Closure of Attributes set. Normal forms: 1NF, 2NF, 3NF, BCNF, 4NF,5NF. Problems on normalization, Schema refinement in database design. PL/SQL basics for writing triggers, cursors.

Transaction Management: Transaction concept, transaction states, ACID properties, schedules, Serializability-Conflict serializability, View serializability, recoverability. Concurrency control: lock based protocols, timestamp based protocols, deadlocks handling. SQL stored procedures.

Indexing and NoSQL: :Recovery-ARIES recovery algorithm, Log based recovery. File organization techniques, Tree index structures: ISAM and B+ trees. SQL Vs NoSQL, basic CRUD operations using MongoDB.

4. Books and Materials

Text Books:

1. Raghurama Krishnan, Johannes Gehrke., Database Management Systems, 3rd Edition, Tata McGraw-Hill, New Delhi, India, 2014.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan., Database System Concepts, 7th Edition, McGraw- Hill, New Delhi, India, 2019.

Reference Books:

1. Elmasri Navate., Fundamentals of Database Systems, Database System Concepts, 7th Edition, Pearson Education, India,2016.
2. C. J. Date, A. Kannan and S. Swamynathan., An Introduction to Database Systems, 8th Edition, Pearson Education, India, 2015.

Course Structure

A8520 - Software Engineering

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course acts as a foundation in the field of software engineering and is aimed at helping students develop an understanding of how software systems are developed from basic, by guiding them through the development process, adopting the fundamental principles of system development. The course will orient the students to the different software process models, software requirements engineering process, systems analysis and design as a problem-solving activity, with focus on quality.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8520.1. Identify the design issues and process models to develop a software.
A8520.2. Determine the functional and non functional requirements with appropriate validation for a software product.
A8520.3. Develop software design documents for the given requirements.
A8520.4. Prepare test documents at various stages to validate project.
A8520.5. Illustrate the need of quality management and metrics for product standardization

3. Course Syllabus

Introduction to Software Engineering: The Evolving nature of software engineering, Changing nature of software engineering, Software engineering Layers, The Software Processes,Software Myths. Process Models: A Generic Process Model, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Spiral Model, the Unified Process.

Requirements Engineering: Functional and Non-Functional Requirements, The Software requirements Document, Requirements Specification, requirements Engineering, Requirements Elicitation and Analysis, Requirement Validation, Requirement Management.

Design and Implementation: System Modeling: Interaction Models, Structural Models, Behavioral Model, Model Driven Engineering. The Object Oriented Design with UML, Implementation Issues. User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

Software Testing Strategies: A Strategic approach to Software Testing, Strategic Issues and Test Strategies for Conventional Software, Validation Testing, Unit Testing , Integration Testing, Regression Testing , The Art of Debugging, White Box Testing - Basic Path Testing, Control Structure Testing. Black Box Testing - Equivalence partitioning, Boundary value analysis, Graph Based testing and state transition testing.

Quality Management: Quality Concepts, Software Quality, Software Quality Dilemma, Achieving Software Quality, Review Techniques, Reviews: A Formal spectrum, Informal Reviews, Formal Technical Reviews. Software Quality Assurance: Background Issues,Elements of Software Quality Assurance, Tasks, Goals and Metrics, Software Reliability,the ISO 9000 Quality Standards.

4. Books and Materials

Text Books:

1. Roger S. Pressman.,Software Engineering, A Practitioner's approach , 7th Edition, McGraw Hill International Edition, New Delhi,2011.
2. Sommerville., Software Engineering, 9th Edition,Pearson education, India.

Reference Books:

1. K. K. Agarval, Yogesh Singh., Software Engineering, 3rd Edition, New Age International Publishers, India,2007.
2. Lames F. Peters, Witold Pedrycz, Software Engineering an Engineering approach,John Wiely & Sons, New Delhi, India,2000.
3. Shely Cashman Rosenblatt., Systems Analysis and Design, 6th Edition, Thomson Publications, India.

Course Structure

A8607– Information Security

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Information security is the practice of protecting information by mitigating risks across computer systems. The course introduces the technical and policy foundations of information network security. This course explains the inner workings of cryptographic systems and how to correctly use them in real-world applications.

Course Pre/co-requisites

A8519 - Computer Networks.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8607.1 Recognize various security threats, services, mechanisms, and classical encryption techniques.

A8607.2 Apply classical encryption algorithms (Substitution and Transposition ciphers) and DES, AES algorithms to encrypt plain text.

A8607.3 Explain various key management techniques, exemplifying RSA and Diffie-Hellman.

A8607.4 Examine the problems of authentication techniques (SHA, Digital signature).

A8607.5 Analyze different symmetric key distribution and understanding of various authentication applications

3. Course Syllabus

Introduction to Information Security: Computer security concepts, OSI security architecture,security attacks, security services, security mechanisms, a model for network security.Classical Encryption Techniques: Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques.

Block Cipher and Data Encryption Standards: Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles, tools used for DES.Advanced Encryption Standards: Advanced Encryption Standard, Finite Field Arithmetic, AES Structure, AES Transformation Functions, AES Key Expansion, tools used for AES.Blowfish Algorithm,International Data Encryption Algorithm(IDEA).

Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, extended Euclid's algorithm. Public-Key Cryptography

and RSA: Principles of Public key crypto Systems, RSA algorithm, Diffie-Hellman Key Exchange.

Hash Functions: Cryptographic Hash Functions, Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA). Digital Signature: Digital Signature Requirements, Attacks and Forgeries, Properties.

Key Management and Distribution : Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security Email Security:Pretty Good Privacy (PGP).

4. Books and Materials

Text Books:

1. William Stallings, Cryptography and network security: principles and Practice Upper Saddle River: Pearson, 6th edition.

Reference Books:

1. Forouzan, Behrouz A., and Debdeep Mukhopadhyay. Cryptography and network security (Sie).McGraw-Hill Education, 2011.
2. AtulKahate., Cryptography and Network Security, 2nd edition, Tata Mc-Grawhill, India,2008.

Course Structure

A8608 - Java Programming

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides Object Oriented Programming concepts using Java. The course focuses on different aspect of core Java Environment suitable to write efficient, maintainable, and portable code. It also ignites Object Oriented thinking and explores with the evolution of Java and its basics. It provides strong foundation on Inheritance, Packages and Interfaces and also illustrates Exception Handling and Multithreaded mechanisms. It also provides Collection framework for manipulating data. This course also focuses on file handling using Java API.

Course Pre/co-requisites

A8505 - Data Structures

A8508 - Python Programming Laboratory

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8608.1 Make use of various constructs to write a console application.
A8608.2 Use principles of OOP to develop real time applications.
A8608.3 Identify the need of exception handling to deal with runtime errors.
A8608.4 Build applications for parallel processing using Multithreading.
A8608.5 Choose Collection framework and I/O to manipulate and store data.

3. Course Syllabus

Introduction to OOP : Evolution of Java, OOP principles, Java Buzzwords, Implementing Java program, JVM, Data Types, Variables, Type conversions and Casting, Operators, Control statements, Arrays. Classes, Objects, Methods, Constructors, this keyword, Overloading Methods and Constructors, Argument passing, Exploring String class.

Inheritance, Interfaces and Packages: Inheritance- Inheritance Basics, Using super, Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Abstract classes, final keyword. Packages and Interfaces: Defining a Package, Finding Packages and CLASSPATH,

Access Protection, Importing Packages, Defining and Implementing interfaces, Extending interfaces.

Exception Handling: Exception Handling Fundamentals, Exception Types, using try catch, throw throws and finally keywords, Built-in Exceptions, Creating own exception subclasses.

Multithreading: Multithreading: Multithreading- Life cycle of a thread, Thread class methods, creating threads, thread priorities, Synchronizing threads, Interthread Communication.

Collections and I/O : Collections - Introduction to Collection Framework, Collections Hierarchy, ArrayList, LinkedList, HashSet, TreeSet. The Date and StringTokenizer. I/O – Basics, reading and writing console input and output, PrintWriter class, operations of files – reading, writing and copying files.

4. Books and Materials

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 11th Edition, Tata McGraw-Hill Education, 2019.

Reference Books:

1. Y.Daniel Liang, Introduction to Java Programming-Comprehensive Version, 10th Edition,Pearson Education,2018.
2. Kathy Sierra, Bert Bates, OCA Java SE 8 Programmer, 1st Edition, McGraw-Hill Education, 2017.

Course Structure

A8651 - Ethical Hacking

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Ethical hacking strikes all of us as a subject that requires a great deal of prerequisite knowledge about things like heavy duty software, languages that includes hordes of syntaxes, algorithms that could be generated by maestros only. Well that's not the case, to some extent. This course introduces the steps required to complete a penetration test, or ethical hack. Requiring no prior hacking experience, the book explains how to utilize and interpret the results of modern day hacking tools that are required to complete a penetration test. Coverage includes GoogleHacking, Nmap, Nessus, Metasploit, and Hacker Defender rootkit. Simple explanations of how to use these tools and a fourstep methodology for conducting a penetration test provide readers with a better understanding of offensive security.

Course Pre/co-requisites

A8519-Computer Networks

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8651.1 Use the various security tools to assess the computing system.
A8651.2 Identify the vulnerabilities across any computing system using penetration testing.
A8651.3 Choose a prediction mechanism to prevent any kind of attacks.
A8651.4 Make use of metasploit tool to probe systematic vulnerabilities on networks and servers.
A8651.5 Identify the wireless network flaws and fill security patches in web access.

3. Course Syllabus

Introduction to Hacking: Important Terminologies, Penetration Test, Vulnerability Assessments versus Penetration Test, Pre-Engagement, Rules of Engagement, Penetration Testing Methodologies, OSSTMM, NIST, OWASP, Categories of Penetration Test, Types of Penetration Tests, Vulnerability Assessment Summary Reports.

Information Gathering Techniques: Information Gathering Techniques, Active Information Gathering, Passive Information Gathering, Sources of Information Gathering, Information Gathering with Whois, Tracing the Location, Traceroute, ICMP Traceroute, TCP Traceroute, Usage, UDP Traceroute, Enumerating and Fingerprinting the Webservers, Google Hacking.

Network Attacks: Vulnerability Data Resources, Exploit Databases, Network Sniffing, Types of Sniffing, Promiscuous versus Nonpromiscuous Mode, MITM Attacks, ARP Attacks, Denial of Service Attacks, Hijacking Session with MITM Attack, SSL Strip: Stripping HTTPS Traffic, DNS Spoofing, ARP Spoofing Attack Manipulating the DNS Records, DHCP Spoofing, Remote Exploitation, Attacking Network Remote Services, Overview of Brute Force Attacks, Traditional Brute Force, Attacking SMTP.

Exploitation: Introduction to Metasploit, Reconnaissance with Metasploit, Port Scanning with Metasploit, Compromising a Windows Host with Metasploit, Client Side Exploitation Methods, e- Mails with Malicious Attachments. .

Wireless and Web Hacking: Wireless Hacking, Introducing Aircrack, Cracking the WEP, cracking a WPA/WPA2 Wireless Network Using Aircrack-ng, Brute Force and Dictionary Attacks, Types of Authentication.

4. Books and Materials

Text Books:

1. Rafay Baloch., Ethical Hacking and Penetration Testing Guide, CRC Press, 2014.

Reference Books:

1. Kevin Beaver, Ethical Hacking for Dummies,6th Edition,Wiley, 2018.
2. Jon Erickson., Hacking: The Art of Exploitation, 2nd Edition, Rogunix, 2007.

Course Structure

A8652 - Cyber Security

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides a comprehensive overview of various cybercrimes, how they are planned, possible vulnerabilities and crimes that occur in mobile and wireless devices. It introduces tools and techniques that are used in cybercrime. It helps in analyzing and designing defensive security mechanisms for protecting information systems resources.

Course Pre/co-requisites

A8519- Computer Networks
A8607- Information Security

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8652.1 Identify the cybercrimes and offences in network accesses.
A8652.2 Interpret the criminal plans before going to attack.
A8652.3 Choose various security measures on mobile devices for a given scenario and make an effective report.
A8652.4 Identify the various methods and tools in Cyber Crime.
A8652.5 Examine various defense and analysis techniques to protect our information from attackers

3. Course Syllabus

Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, who are Cybercriminals, Classifications of Cybercrimes. Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes. Botnets: The Fuel for Cybercrime, Attack Vector, and Cloud Computing.

Cybercrime -Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

Defense and Analysis Techniques: Memory Forensics - Why Memory Forensics Is Important, Capabilities of Memory Forensics, Memory Analysis Frameworks, Dumping Physical Memory, Installing and Using Volatility, Finding Hidden Processes, Volatility Analyst Pack, Honey pots, Intrusion Detection Systems.

4. Books and Materials

Text Books:

1. Nina Godbole and Sunil Belapure., Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Prespectives,1st Edition,Wiley INDIA, 2011.
2. James Graham, Richard Howard and Ryan Otson., Cyber Security Essentials,1st Edition,CRC Press,2011.

Reference Books:

1. Chwan-Hwa(John), Wu,J.David Irwin., Introduction to Cyber Security,1st Edition, CRC Press T and F Group, 2013.
2. Richard A. Clarke, Robert Knake., Cyberwar: The Next Threat to National Security and What to Do About It,Ecco 2010.

Course Structure

A8656 - Blockchain Technology

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course introduces blockchain, a revolutionary technology that enables peer-to-peer transfer of digital assets without any intermediaries, and is predicted to be just as impactful as the Internet. A blockchain is a permanent, sequential list of transaction records distributed over a network. The course introduces consensus, proof of work, mining, in Bitcoin. The course introduces ethereum blockchain and smart contracts.

Course Pre/co-requisites

A8607 - Information Security

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8656.1 Identify the basic concepts of block chain to process data
A8656.2 Make use of Bitcoin as cryptocurrency
A8656.3 Choose Ethereum block chain for security
A8656.4 Design smart contracts as per the requirements and deploy on Testnet works.

3. Course Syllabus

Introduction to Cryptocurrencies: Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency. How Bitcoin Achieves Decentralization: Centralization vs. Decentralization, Distributed Consensus, Consensus without Identity: the Block Chain, Incentives and Proof of Work, Putting It All Together.

Mechanics of Bitcoin: Bitcoin Transactions, Bitcoin Scripts, Applications of Bitcoin Scripts, Bitcoin Blocks, The Bitcoin Network, Limitations Improvements. Store Usage: How to Store and Use Bitcoins, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

Bitcoin Mining: The Task of Bitcoin Miners, Mining Hardware, Energy Consumption Ecology, Mining Pools, Mining Incentives and Strategies. Bitcoin and Anonymity: Anonymity Basics, How to de-anonymizeBitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash, Tor and the Silk Road.

Ethereum: What is Ethereum, smart contracts, Solidity Ethereum Virturalmachine. Installing solidity ethereum wallet, basics of solidity by example, Layout of a solidity source file

structure of smart contracts, General value types, ether units, Time units, Globally available variables and functions.

Operators: Arithmetic, Logical Bitwise operators, Control structure (if-else, for, while, do-while), Scoping and declarations, Input parameters and output parameters, Function calls return types, Function Modifiers, Fallback functions, Abstract contract, Creating contracts via new operator, Inheriting smart contracts, Importing smart contracts compiling contracts, Events logging, exceptions, Examples of smart contract : crowd funding, voting ballot.

4. Books and Materials

Text Books:

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A., Goldfeder, S.,Bitcoin and cryptocurrency technologies: a comprehensive introduction, Princeton University Press, 2016.
2. Dave Hoover, Kevin Solorio, and Randall Kanna., Hands–On Smart Contract Development with Solidity and Ethereum, O'Reilly Media, Inc., 2019.

Reference Books:

1. Andreas M. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, 1st Edition, O'Reilly Media, Inc., 2019.

Course Structure

A8658 - Robotic Process Automation

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

RPA is an advanced form of business process automation that can provide a path for businesses to automate human actions. RPA is ultimately about automating some of the most mundane and repetitive computer-based tasks and processes in the workplace like text, image automation with sequence of actions, keyboard-based automation, and E-mail automation etc. Process automation is able to record tasks performed by a human on their computer, then perform those same tasks without human intervention.This course will help Students to learn how to Automate the Tasks in real time.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8658.1. Discuss use of RPA platform and its components.
A8658.2. Apply sequence and control flows as per the requirements.
A8658.3. Analyse data manipulation concepts to solve real time problems.
A8658.4. Illustrate user interface explorer and handle events.
A8658.5. Demonstrate scenario of handling the errors and exceptions and benefits of RPA.

3. Course Syllabus

Introduction to Robotic Process Automation: Scope and techniques of automation, Benefits of RPA, Components of RPA, RPA platforms, About UiPath. Record and Play: UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio,Task recorder, Step-by-step examples using the recorder.

Sequence & Control Flow: Sequence, Flowchart, and Control Flow, Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-Step example using Sequence and Flowchart, Step-by step example using Sequence and Control flow.

Data Manipulation: Variables and scope, Collections, Arguments-purpose and use,Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step-by-step example).

Handling events: Element triggering events, image triggering events, system triggering events, PDF Extraction, Revisit Recorder: Basic recording, Desktop recording, web recording, Screen Scraping, Automation Techniques: Incoming Email automation, Sending Email automation, Workbook and Excel automation (read/write).

Error and Exception Handling: Exception handling, Common exceptions and ways to handle them,debugging techniques, Collecting crash dumps, Error reporting. Future of RPA,RPA Compared to BPO, BPM and BPA

4. Books and Materials

Text Books:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940.
2. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA System, Publisher: A press,2020.

Reference Books:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant.
3. SrikanthMerianda,Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation.

Web Resources:

1. https://www.uipath.com/rpa/robotic-process-automation

Course Structure

A8681 - E-Commerce

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The tremendous growth of the Internet and World Wide Web is making a great impact on businesses, governments and individuals throughout the world. In this course, students will understand the phenomena, technological, economic and social, behind these rapid changes, and how organizations successfully conduct Internet-based activities. This course discusses some of the technology of the Internet. This course provides an overview of e-commerce from both technological and managerial perspectives. It introduces e-commerce frameworks and technological foundations; and examines basic concepts such as strategic formulation for e-commerce enterprises, management of their capital structures and public policy. It is particularly important that the students emphasis on understanding the different E-Commerce system design principles.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8681.1. Elaborate the components and roles of the E-Commerce environment.
A8681.2. Estimate how to sell products and services on the web as well as to meet the needs of website visitors.
A8681.3. Analyze the impact of E-commerce on business models and strategy.
A8681.4. Create a portfolio of the steps required to start-up an on-line business.
A8681.5. Interpret legal and ethical issues related to E-Commerce and web marketing approaches.

3. Course Syllabus

Introduction to E-Business and E-Commerce: What is the difference between e-commerce and e-business, Anatomy of E-Commerce applications, E-Business risks and barriers to business adoption, Management responses to E-Commerce and E-Business, Electronic Commerce-Frame work.

E-Commerce Fundamentals: Location of trading in the marketplace, Business models for ecommerce, Focus on auction business models, Focus on Internet start-up companies. E-Business Infrastructure - Introduction, Internet technology, Web technology, Internet-access software applications, Managing e-business infrastructure, Focus on web services, SaaS and service oriented Architecture (SOA), Focus on mobile commerce.

E-Environment: Social and legal factors, Environmental and green issues related to Internet Usage, Focus on e-commerce and globalization, Political factors.
E-Business Strategy - What is e-business strategy, Strategic analysis, Strategic objectives, Strategy definition, Strategy implementation, Focus on information systems strategy and e-business strategy.

E-Security: Securing the Business on Internet- Security Policy, Procedures and Practices, Transaction Security, Cryptology, Digital Signatures, Security Protocols for Web Commerce. Supply Chain Management- What is supply chain management?,Focus on the value chain, Using e- business to restructure the supply chain, Supply chain management implementation

E-Procurement: What is e-procurement, Drivers of e-procurement, Focus on estimating eprocurement cost, implementing e-procurement.

4. Books and Materials

Text Books:

1. Dave Chaffey., E-Business and E-Commerce Management , strategy, Implementation and practice, 5th Edition, Prentice Hall,2011.

Reference Books:

1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth - 215 - Chang, JohnWiley.
2. Whinston,Pearson., Frontiers of electronic commerce –Pearson Education, Kalakata,2015.
3. Bharat Bhaskar: Electronic Commerce,TataMc-Graw-Hill, New Delhi, 2003
4. E-Commerce — Business, Technology, Society, Kenneth C.Taudon, Carol Guyerico-Traver.

Course Structure

A8682 - Full Stack Development

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The popularity of JavaScript has brought many advancements and changed the face of web development. Real-world applications are looking at the web design with push capabilities. The purpose of this course is to study the concepts of JAVASCRIPT, React JS and Node JS to build user interface web-based applications to meet real-world needs.

Course Pre/co-requisites

A8604 - Web Technologies

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8682.1 Demonstrate the fundamentals of scripting languages & non - scripting languages and its differences.
A8682.2 Use react concepts to design forms.
A8682.3 Use different node.js modules to connect with database.
A8682.4 Build web application using Node.js.

3. Course Syllabus

Introduction: Introduction to scripting language, motivation , applications; scripting languages vs non-scripting languages; overview of popular scripting languages-JavaScript, Perl, Python; environments - Node.js and react.js, java scripting language constructs.

React JS: JSX and its use case, DOM, Virtual DOM and its working, ES6, Difference between ES5 and ES6, NPM Modules, React Elements, Render Function, Redux ,ReactJS with Redux.

React JS: Components, Class Component, Props, Events, Forms, CSS, Hooks & Context API, Material UI.

Node.JS: Concepts-modules, packages, working with HTTP, streams and file systems,

events, REST API, ExpressJS.

Node.JS: Database connectivity-Mysql, create connection, create database, working with Database operations-create table, insert, select, update, delete, etc.s

4. Books and Materials

Text Books:

1. Learning Node.js A Hands on Guide to Building Web Applications in JavaScript, Marc Wandschneider, Second Edition, Addinson-Wesley.
2. React.js Book: Learning React JavaScript Library From Scratch, Greg Sidelnikov, Learning Curve, 2017.

Reference Books:

1. Beginning Node.js, Basarat Ali Syed, Apress, 2004.
2. The Node Beginner Book: A Comprehensive Node.js Tutorial, Manuel Kiessling, Leanpub, 2011.
3. FullStack React: The Complete Guide to ReactJS and Friends, Anthony Accomazzo, Anthony Accomazzo, Nate Murray, Ari Lerner, Clay Allsopp, David Guttman, and Tyler McGinnis.
4. Learning React: Functional Web Development with React and Redux, Alex Banks & Eve Porcello, O'Reily.

Course Structure

A8702 – Artificial Intelligence

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This is an undergraduate course to acquire the ability to design intelligent solutions to problems in a variety of domains and business applications such as natural language Processing, text mining, and robotics, reasoning and problem-solving. AI will focus on problem solving, reasoning, planning and gaming. Through learning problem solving skills can be acquired. The course enables to choose data science domain to implement machine learning and deep learning applications.

Course Pre/co-requisites

A8508-Python Programming Laboratory
A8509-Discrete Mathematical Structures

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8702.1. Apply AI techniques to solve game playing theorem proving and machine learning.
A8702.2. Apply the propositional logic to AI designs .
A8702.3. Learn different playing and reinforcement learning techniques .
A8702.4. Examine the role of searching strategies in AI environment.
A8702.5. Analyse the constraint satisfaction problems for problem solving.

3. Course Syllabus

Introduction: Introduction to AI - Intelligent Agents, Problem-Solving Agents, Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

Adversarial Search : Games, Optimal decisions in games, The minimax algorithm, Alpha–Beta pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking search for CSPs, Knowledge-Based Agents, The wumpus world.

Propositional Logic: Inference and proofs, Proof by resolution, Horn clauses and definite clauses. First-Order Logic : Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.

Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning ,Graphs, Analysis of Planning approaches, Hierarchical Planning.

Reinforcement learning: Introduction, passive Reinforcement learning, active Reinforcement learning, Generalization in reinforcement learning. Robotics: Introduction, Robot Hardware, Robot Perception, planning to move, moving Robotic Software Architectures.

4. Books and Materials

Text Books:

1. Stuart J.Russel, Peter Norvig, Artificial Intelligence – A Modern Approach, 3rd Edition, Pearson Education, 2009.

Reference Books:

1. E.Rich and K.Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2008.
2. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, Pearson Education Private Limited, India, 2001.
3. George F. Luger , Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 6th Edition, Pearson, 2008.
4. Shivani Goel, Artificial Intelligence, 4th Edition, Pearson Education Private Limited, India, 2009.

Course Structure

A8781- Computer Organization and Architecture

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	30	0	0	3	40	60	100

1. Course Description

Course Overview

This course is designed to understand the concepts and functionalities of computer system among the various components such as registers, control unit and memory units. The course provides in-depth knowledge of internal working, structuring, and implementation of a computer system, the way the system is structured so that all those catalogued tools can be used properly. In addition, this course helps to construct the circuits to the corresponding operations and also discusses the multiprocessing. It is a fundamental course and provides the concepts and terminology required for advanced courses.

Course Pre/co-requisites

A8402 - Digital Electronics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8781.1. Identify various functional aspects of computer hardware.
A8781.2. Choose various instructions and addressing modes to execute an instruction.
A8781.3. Make use of integer and floating point algorithms to perform arithmetic operations on data.
A8781.4. Design control unit and memory for a computer system.
A8781.5. Examine the performance of a system using pipelining and multiprocessors.

3. Course Syllabus

Introduction and Micro operations: Computer functional units, Von – Neumann Architecture, Harvard architecture. Register transfer, Bus and memory transfer, arithmetic micro operations, logic micro operations, shift micro operations, arithmetic logic and shift unit. Data Representation – Fixed point and Floating point.

Instructions and Addressing Modes: Computer Instructions, Instruction Cycle, Register reference instructions, Memory reference instructions, Input-output and Interrupt. Stack organization, instruction formats, addressing modes, data transfer and manipulation, Inter-

rupt Handling and types.

Computer Arithmetic: Introduction, Addition, Subtraction and Multiplication algorithms on signed magnitude and two's complement data, Division Algorithms, Floating point arithmetic operations.

Control Unit and Memory Organization: Control memory, address sequencing, micro program example and design of control unit. Memory Hierarchy, Main Memory – RAM and ROM chips, Cache Memory – Introduction, Cache Mapping Techniques.

Pipelining and Multiprocessors: Parallel processing, Arithmetic Pipeline, Instruction pipeline and RISC pipeline. Multiprocessors- characteristics of multiprocessors, Interconnection structures, Interprocessor arbitration.

4. Books and Materials

Text Books:

1. M. Moris Mano., Computer System Architecture,3rd Edition, Pearson Publication, India, 2006.
2. Stallings William., Computer Organization and Architecture,9th Edition, Pearson Education India, 2012.

Reference Books:

1. Carl Hamacher, ZvonksVranesic, SafeaZaky., Computer Organization,5th Edition, McGraw-Hill, New Delhi, India, 2002.

Course Structure

A8851 - Data Science for Engineers

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

Data Science for Engineers course aims to equip engineering students with the essential knowledge and practical skills required to excel in the dynamic field of data science, emphasizing their ability to proficiently query and analyze diverse datasets. Through this course, students will gain a comprehensive understanding of the intricacies involved in handling heterogeneous data, learning how to effectively preprocess and visualize it. By exploring the methodologies and tools employed in data science, students will not only grasp the theoretical foundations but also engage in hands-on applications. Ultimately, upon completing this course, students will emerge with a well-rounded skill set that encompasses data querying and analytics, data preprocessing and visualization, and a solid foundation in data science methodologies and tools. This comprehensive preparation equips them to navigate the complex landscape of data science effectively and contribute meaningfully to data-driven decision-making processes.

Course Pre/co-requisites

A8005- Computer Oriented Statistical Methods
A8514- Database Management Systems
A8804- Data Analytics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8851.1 Identify the various requirements for data science process.
A8851.2 Choose an appropriate database required for processing data.
A8851.3 Demonstrate the data science methodology and text mining approaches.
A8851.4 Make use of data science tools to visualize the insights of data.
A8851.5 Apply various data visualization techniques using Tableau over Google Sheets.

3. Course Syllabus

Importance of Data Science: Need for Data Science, what is Data Science? Data Science Process, Business Intelligence and Data Science, Prerequisites for a Data Scientist, Components of Data Science, Tools and Skills needed. Statistics and Probability- Data Types, Variable Types, Statistics, Sampling Techniques and Probability, Information Gain and Entropy, Probability Theory, Probability Types, Probability Distribution Functions, Bayes' Theorem, Inferential Statistics.

Databases for Data Science: SQL – Tool for Data Science, Basic Statistics with SQL, Data Munging with SQL, Filtering, Joins, and Aggregation, Window Functions and Ordered Data, Preparing Data for Analytics Tool, Advanced NoSQL for Data Science- Why NoSQL, Document Databases for Data Science, Wide-Column Databases for Data Science, Graph Databases for Data Science.

Data Science Methodology: Analytics for Data Science, Examples of Data Analytics, Data Analytics Life Cycle- Data Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalization. Data Analytics and Text Mining- Text Mining, Major Text Mining Areas, Text Analytics, Major Components of NLP, Stages of NLP, Statistical Processing of Natural Language, Applications of NLP.

Data Science Tools-I: Python Libraries: DataFrame Manipulation with pandas and NumPy, Data Wrangling: Clean, Transform, Merge, Reshape, Exploration Data Analysis with Python, Time Series Data, clustering with Python, Plotting and Visualization, ARCH and GARCH, Dimensionality Reduction.

Data Science Tools-II: Tableau- Introduction to Data Visualization and Tableau, Dimensions and Measures, Cleaning and Structuring Messy Data Descriptive Statistics, Basic Charts, Joins and blends, Filtering data, Row-level calculations, Aggregate-level calculations, Level of detail calculations, Custom Table Calculations, Dashboard Design & Principles, Special Chart Types, Integrate Tableau with Google Sheets.

4. Books and Materials

Text Books:

1. Sanjeev Wagh, Manisha Bhende, Anuradha Thakare, Fundamentals of Data Science, 1st Edition,CRC Press, India,2022.
2. Wes McKinney., Python for Data Analysis, 1st Edition,O'Reilly Publications, 2015.
3. Joshua N. Milligan, Learning Tableau 2019, Packt Publications,2019.

Reference Books:

1. Avrim Blum, John Hopcroft, Ravindran Kannan., Foundations of Data Science, 1st Edition, Cambridge University Press, 2020.
2. Ani Adhikari and John DeNero,Computational and Inferential Thinking: The Foundations of Data Science,GitBook, 2019.

Course Structure

A8081 - Mathematical Programming

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with the Linear programming problem, Formulation and Graphical solution of Linear programming problem, Simplex method, Big -M method, Two-phase simplex method, Dual simplex method, Degeneracy in simplex and unbounded solutions, Transportation problem, Assignment model, Replacement models and Sequencing models. In addition, this course can be applied in many areas of engineering such as computer graphics, cryptography.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8081.1. Identify LPP and express in mathematical form to solve by graphical or simplex method.
A8081.2. Apply artificial variable techniques to obtain the optimal solution of an LPP.
A8081.3. Interpret various methods under transportation model to get optimal results.
A8081.4. Solve travelling salesmen problem using Hungarian method.
A8081.5. Develop various replacement and sequencing models to arrive at an optimal decision.

3. Course Syllabus

Introduction to Operations Research: Basic definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem, Formulation and Graphical solution of Linear Programming Problem, Simplex method.

Artificial Variables Techniques: Big -M method, Two-phase simplex method, Duality in simplex method, Dual simplex method, degeneracy in simplex and unbound solutions.

Transportation problem: Formulation, solution, unbalanced Transportation problem. Finding initial basic feasible solutions, North-West corner rule, lowest cost entry method and Vogel's approximation method. Optimality test- MODI method, degeneracy in transportation, restricted transportation problem, conditional transportation problem.

Assignment Model: Formulation, Hungarian method for optimal solution, solving unbalanced problem, restricted assignment, conditional assignment problems, crew assignment problems, Travelling salesman problem, Transportation problem as assignment problem.

Replacement Models and Sequencing Models: Replacement Models: Replacement of Items that Deteriorate whose maintenance costs increase with time without change in the money value, Replacement of items that fail suddenly, individual replacement policy, group replacement policy. Sequencing Models: Solution of Sequencing Problem, Processing n Jobs through two machines, Processing n Jobs through three machines, Processing two Jobs through m machines, Processing n Jobs through m Machines.

4. Books and Materials

Text Books:

1. Sharma S. D. Operation Research, Tata McGraw Hill, New Delhi, 2009.
2. Panneerselvam R. Operations Research, 2nd Edition, Prentice Hall of India, India, 2008.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006
2. Sharma J. K. Operations Research – Theory and Applications, 5th Edition, Macmillan India Ltd, India, 2007.

Course Structure

A8082 - Transform Calculus

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with the Series Solutions of Second Order Ordinary Differential Equations, Fourier Series, Fourier Transforms, Z-Transforms and Applications of Transforms to Integral equations. In addition, this course can be applied in many areas of engineering such as computer graphics, cryptography, wireless communication, signal processing, robotics and animation.

Course Pre/co-requisites

A8002 - Ordinary Differential Equations and Vector Calculus.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8082.1. Formulate series solutions of ordinary differential equations.
A8082.2. Develop Fourier series for different types of functions.
A8082.3. Apply Fourier Transform to connect the time and frequency domain.
A8082.4. Analyze Z-transform and discrete signals to solve equations.
A8082.5. Apply Laplace transforms to solve integral equations.

3. Course Syllabus

Series Solutions of Second Order Ordinary Differential Equations: Classification of Singularities, Series Solutions to Differential Equations around zero, Frobenius Method around zero.

Fourier Series: Euler's formulae, Dirichlet's conditions, Fourier series for functions having period , Fourier series for even and odd functions, Half range Fourier sine and cosine series.

Fourier Transforms: Fourier integrals, Fourier sine and cosine integrals, Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms, Finite Fourier transforms.

Z-Transforms: Definition, Some standard Z-transforms, Damping rule, Shifting rule, Multiplication by n , Initial and final value theorems. Inverse Z-transforms using partial fractions, Convolution theorem, Solution of difference equations by Z - transforms.

Applications of Transforms to Integral equations: Integral equations, Abel's Integral equations, Integral equation of convolution type, Integro differential equations, Applications

of Transforms to Integral equations.

4. Books and Materials

Text Books:

1. Grewal,B.S. Higher Engineering Mathematics, 43rd Edition, Khanna Publications, 2015.
2. Jain, R.K. and Iyengar, S.R.K. Advanced Engineering Mathematics, Narosa Publishing House, 2015.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006
2. Ramana, B.V. Higher Engineering Mathematics, 23rd Reprint,Tata Mc-GrawHill Education Private Limited, New Delhi, 2015.

Course Structure

A8083 - Numerical Techniques

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course offers more advanced topics of mathematics required to analyze the problems in engineering. Topics to be covered in this course include: Solution of algebraic and transcendental equations, system of linear equations, Interpolation, Numerical differentiation and integration, curve fitting, Numerical solutions of ordinary and partial differential equations. The mathematical skills derived from this course provides necessary base to analytical and theoretical concepts occurring in the program.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8083.1	Apply numerical methods to obtain approximate solutions of algebraic and transcendental equations
A8083.2	Make use of interpolation techniques to find approximate values and derivatives of the function at intermediate points
A8083.3	Compute an approximate value of a definite integral using numerical integration
A8083.4.	Construct curve of best fit for the experimental data using method of least squares
A8083.5.	Select an appropriate numerical method to solve ordinary and partial differential equations.

3. Course Syllabus

Solution of Algebraic, Transcendental Equations and System of Linear Equations: Bisection method, Regula-falsi method, Iteration method, Newton - Raphson method. Iterative methods of solution of system of equations: Jacobi's iteration method, Gauss-Seidel iteration method.

Interpolation: Finite differences: Forward, Backward and Central differences, Other difference operators and relations between them, Differences of a polynomial, Missing terms, Newton's interpolation formulae, Interpolation with unequal intervals: Lagrange's interpolation formula.

Numerical Differentiation, Integration and Curve fitting: Numerical differentiation: Derivatives using Newton's interpolation formulae. Numerical integration: Newton-Cote quadrature formula, Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth

rule. Curve Fitting: Method of least squares, Fitting a straight line, Second degree parabola and Non-linear curves of the form $y = ae^{bx}, y = ab^x, y = ax^b$ by the method of least squares

Numerical Solution of Ordinary Differential Equations of First Order: Taylor's series method, Picard's method, Euler's and modified Euler's Method, Runge-Kutta method of fourth order, Predictor and Corrector methods: Milne's method, Adams-Bashforth-Moulton method.

Numerical Solution of Partial Differential Equations: Finite difference approximations to partial derivatives, Elliptic equations: Solution of Laplace equation by Liebmann's iteration process, Parabolic equations: Solution of one dimensional Heat equation by Schmidt explicit method and Crank-Nicolson implicit method.

4. Books and Materials

Text Books:

1. S.S. Sastry, Introductory Methods of Numerical Analysis, 5th Edition, PHI Learning Pvt. Ltd, New Delhi, 2012.
2. M.K. Jain, S.R.K Iyengar and R.K.Jain, Numerical Methods for Scientific and Engineering Computation, 5rd Edition, New Age International Publishers, New Delhi, 2007.

Reference Books:

1. Grewal, B.S., Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Ramana, B.V. Higher Engineering Mathematics, 23nd Reprint, Tata McGraw Hill Education (India) Pvt Ltd, New Delhi, 2015.
3. T.K.V. Iyengar, B. Krishna Gandhi & Others, Numerical Methods, 2nd Revised Edition, S Chand & Company Ltd, New Delhi, 2013.

Course Structure

A8084 - Entrepreneurship Development

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course aims to provide students with an understanding of the nature of enterprise and entrepreneurship and introduces the role of the entrepreneur, will inculcate the knowledge of government supporting programs like financial assistance by public sector banks. Apart from this, students learn about the women entrepreneurs and success stories of women entrepreneurs, gain the knowledge of project management and profitability appraisal, focus on importance of training the new entrepreneurs as well as existing entrepreneurs.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8084.1 Identify the role, characteristics, qualities and functions of entrepreneur.
A8084.2 Interpret various Institutional supports for setting up a business enterprise.
A8084.3 Illustrate role, importance and functions of women entrepreneur.
A8084.4 Infer the concept of Project Management and steps in Project development.
A8084.5 Indicate training programs and different training institutions to impart training.

3. Course Syllabus

Entrepreneurship: Importance and role of entrepreneurship, Qualities of an entrepreneur, Functions of entrepreneur, Theories of entrepreneurship, Stimulants of entrepreneurship and Barriers to entrepreneurship, Ethics and Social Responsibility, Role of entrepreneur in economic development.

Institutional Support: Role of Government: Role of IDBI, SIDBI, SIDO, NIESBUD, DIC, Entrepreneurship Development Institute, T-Hub (Telangana Hub).

Women Entrepreneurship: Role & Importance, Functions of women entrepreneur, Profile of Indian Women Entrepreneur, Problems of Women Entrepreneurs, Women Entrepreneurship Development in India and in Foreign Countries.

Project Management: Concept of project and classification of project, Project life cycle identification, Project formulation, Project report, Project evaluation- profitability appraisal, social cost benefit analysis, feasibility analysis, financial analysis and project financ-

ing, Project implementation, Project completion.

Entrepreneur Training: Designing appropriate training programmes to inculcate Entrepreneurial Spirit, significance of entrepreneurial training, Feedback and Performance of Trainees, NSIC, Pradhan Mantri Kaushal Vikas Yojana (PMKVY), Telangana Academy for Skill and Knowledge (TASK).

4. Books and Materials

Text Books:

1. Robert Hisrich, Michael P. Peter, Dean A. Shepherd (2010), Entrepreneurship, Tata Mc Graw Hill, New Delhi

Reference Books:

1. Bholanath Datta (2009), Entrepreneurship, Excel publications, India.
2. David H Holt (2010), Entrepreneurship, Prentice hall of India, New Delhi, India

Course Structure

A8085 - Logistics and Supply Chain Management

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

The LSCM deals with effective management, organizing and monitoring of storage and distribution of goods. It imparts knowledge on the various functions of logistics management. It educate on designing of the supply chain network. it gives clarify the significance of establishing global supply chain. Also it will highlight the role of information technology in supply chain. The aim is to manage the entire order cycle in the most efficient way so that it enhances business development and ensures sustainability and customer satisfaction.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8085.1. Understand the cyclical perspective of logistics and supply chain process.
A8085.2. Learn about the distribution, transportation, warehousing related issues and challenges in supply chain.
A8085.3. Appreciate the significance of network design in the supply chain.
A8085.4. Gain knowledge of various models/tools of measuring the Supply Chain Performance.
A8085.5. Appreciate the role of coordination and technology in supply chain management.

3. Course Syllabus

Understanding Supply Chain: Objectives of a Supply Chain, Importance, Stages of Supply Chain, Value Chain Process, Cycle View of Supply Chain Process, Key Issues in SCM, Logistics & SCM, Supply Chain Drivers and Obstacles, Supply Chain Strategies, Strategic Fit, Best Practices in SCM, Obstacles of Streamlined SCM, Green Supply Chain Management, Supply Chain Sustainability – case study.

Logistics: Evolution, Objectives, Components and Functions of Logistics Management, Difference between Logistics and Supply Chain, Distribution related Issues and Challenges. Gaining Competitive Advantage through Logistics Management. TRANSPORTATION: Functions, Costs, and Mode of Transportation Network and Decision, Models, Containerization, Cross Docking, Reverse Logistics. Outsourcing: Nature and Concept, Strategic Decision to Outsourcing, Third-party Logistics (3PL), Fourth-party Logistics (4PL) - case study.

Designing the Supply Chain Network: Designing the Distribution Network ,Role of Distribution, Factors Influencing Distribution, Design Options, e-Business and its Impact, Distribution Networks in Practice, Network Design in the Supply Chain, Role of Network, Factors Affecting the Network Design Decisions ,Modeling for Supply Chain - case study.

Supply Chain Performance: Bullwhip Effect and Reduction, Performance Measurement: Dimension, Tools of Performance Measurement, SCOR Model. Demand Chain Management, Global Supply Chain, Challenges in Establishing Global Supply Chain, Factors that influence Designing Global Supply Chain Network-case study.

Coordination in a Supply Chain: Importance of Coordination, Lack of Supply Chain Coordination and the Bull whip Effect, Obstacles to Coordination, Managerial Levels, Building Partnerships and Trust, Continuous Replenishment and Vendor Managed Inventories, Collaborative Planning, Forecasting and Replenishment. Role of Information Technology in Supply Chain, Supply Chain 4.0.-Case study.

4. Books and Materials

Text Books:

1. David B. Grant, Chee Yew Wong, Sustainable Logistics and Supply Chain Management: Principles and Practices for Sustainable Operations and Management, Kindle Edition
2. Fundamentals ofLogistics Management (The Irwin/Mcgraw-Hill Series in Marketing), Douglas Lambert, James R Stock, LisaM. Ellram, McGrawhill/Irwin, First Edition, 1998.
3. Vinod V. Sople (2009) Logistic Management (2nd Edn.), Pearson Limited.

Reference Books:

1. IMT Ghaziabad, Advanced Supply Chain Management Sage Publications, 2021.
2. Rajat K. Basiya, Integrated Supply Chain Management, Sage Publications, 2020.
3. K Sridhara Bhat, Logistics & Supply Chain Management, HPH,1e,2017.
4. Chopra, Sunil, Meindl, Peter and Kalra, D.V., Supply Chain Management: Strategy, Planning and Operation, Pearson Education,6e,2016.
5. Altekar, Rahul V, Supply Chain Management: Concepts and Cases, PHILearning,1e,2005.
6. Ballou, R.H. Business Logistics Management.Pearson Education,5e, 2014.
7. Coyle, Bardi, Langley, The Management of Business Logistics–A Supply Chain Perspective, Thomson Press,7e,2003.

Course Structure

A8086 - Management Science

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

In this course, students will learn the fundamental concepts and contributions of Management. It also explains Inventory control techniques, Human Resource Practices, Quality control techniques and Project Management which plays a vital role in the organization.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8086.1 Explain and infer the concepts and aspects of management.
A8086.2 Analyze the contributions of management, organizational structures, plant layouts, work study tools for enhancement of productivity in an organization
A8086.3 Apply the project management techniques to decide the optimum time and cost for completion of a project.
A8086.4 Apply statistical quality control & Inventory control techniques to manage and control products and materials.
A8086.5 Use Human resource management techniques for better people management.

3. Course Syllabus

Introduction: Management - Definition, Nature, Importance of management, Functions of Management- Taylor's scientific management theory, Fayol's principles of management, Contribution of Elton mayo, Maslow, Herzberg, Douglas MC Gregor. Basic concepts of Organisation Authority, Responsibility, Delegation of Authority, Span of control, Departmentation and Decentralization - Organisation structures (Line organization, Line and staff organization, Functional organization, Committee organization, Matrix organization).

Operations Management: Plant location, Factors influencing location, Principles and types of plant layouts - Methods of production (job, batch and mass production), Work study - Basic procedure involved in method study and Work measurement.

Quality Control and Materials Management: : Statistical quality control - Meaning-Variables and attributes - X chart, R Chart, C Chart, P Chart, (simple Problems) Acceptance sampling, Sampling plans, Deming's contribution to quality. Materials management - objectives, Need for inventory control, Purchase procedure, Store records, EOQ, ABC analysis, Stock levels.

Human Resource Management (HRM): Concepts of HRM, Basic functions of HR manager: Man power planning, Recruitment, Selection, Training and development, Placement, Wage and salary administration, Promotion, Transfers, Separation, performance appraisal, Job evaluation and Merit rating.

Project Management: Early techniques in project management - Network analysis: Programme evaluation and review technique (PERT), Critical path method (CPM), Identifying critical path, Probability of completing project within given time, Project cost analysis, project crashing (simple problems)..

4. Books and Materials

Text Books:

1. Koontz & weihrich - Essentials of management, TMH, 8th edition, 2010
2. O.P. Khana, Industrial engineering and Management, Dhanpat rai publication

Reference Books:

1. Dr.A.R.Aryasri, Management Science, TMH, 4th edition, 2009.
2. Stoner,Freeman, Gilbert, Management, 6th edition Pearson education, New Delhi, 2004
3. L.S.Srinath, PERT & CPM, 3rd edition East-West press pvt. ltd.-New Delhi.

Course Structure

A8087 - Human Resource Management

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course is intended to disseminate the concepts of Human resource management, functions of Human resource management from human resource planning to employee relations aspects that helps in effective functioning of an organization.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8087.1. Identify the functions of Human Resource Management.
A8087.2. Illustrate the process of Recruitment and selection.
A8087.3. Analyse the needs and methods of training.
A8087.4. Appraise the functional relationship with performance compensation and employee welfare.
A8087.5. Examine the significance of employee relations.

3. Course Syllabus

Introduction to HRM: Objectives and Functions of HRM, Challenges of HRM, Line Managers. HR Roles and responsibilities, Workforce and demographic trends, New Approaches to organizing HR, HR Scorecard - Human Resource Information System (HRIS).

Recruitment and Selection: Job Design, Job Analysis, Process and methods of data collection, Job descriptions and Job specification, Job enlargement, Job enrichment and Job rotation. Human Resource Planning, Recruitment, Sources of Recruitment, Recruitment on Diverse Work Force, e-Recruitment and Selection Process, Employee Testing and Selection, Basic Types of Interviews, Errors in Interviews.

Training and Development: Definition, Training vs. Development, Importance of Training and Development, Process of Training, Methods of Training and Management development programmes. PERFORMANCE APPRAISAL: Concepts of Performance Management, Process of Performance Management, Performance Appraisal, Techniques of Performance Appraisal, Errors in Performance Appraisal, Career Management.

Compensation: Objectives of compensation, Factors influencing on compensation, concept of job evaluation and techniques of job evaluation. EMPLOYEE WELFARE: Concept of employee welfare, performance-based pay benefits, provisions of employee's compensation

act and implications of employee welfare on productivity.

Employee Relations: Employee Associations, Grievances: Grievances Handling Procedure, Employee Separation, Downsizing, Work-Life Integration - Hybrid work culture, contemporary developments in HR practices. Stress Management, talent mobility, Prevention of sexual harassment (POSH) at workplace.

4. Books and Materials

Text Books:

1. Gary Dessler, BijuVarkkey, Human Resource Management, 4th edition, Pearson Publication, 2017.
2. P. Subba Rao, Essentials of Human Resource Management, Himalaya Publishing, 6e, 2021.

Reference Books:

1. Biswajeet Pattanayak, Human Resource Management, 6e, PHI Learning Pvt. Ltd, 2020.
2. Mamoria and Mamoria, Personnel Management, Himalaya Publications, 2006

Course Structure

A8088 – Organizational Behavior

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	45	0	3	40	60	100

1. Course Description

Course Overview

The course focuses upon translation of organizational behaviour theory to practices that result in organizational effectiveness, efficiency, and human resource development. The primary goal of this course is to prepare students for advanced leadership roles in modern organization.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8088.1. Analyse the Concepts and models of Orgnizational Behaviour and Contemporary challenges.
A8088.2. Analyse the relevance of planning and decision making process for the development of the organisation.
A8088.3. Identify various organisation design and control technique for better performance of the company.
A8088.4. Examine the relevance of Individual and group behaviour in an organization and the role of Culture and dynamics
A8088.5. Apply the theories of leadership and motivation to lead people to attain the organisation goals.

3. Course Syllabus

Behavioural Concepts: Nature and Concepts of Orgnizational Behaviour, Models of Organizational Behaviour, Relationship with Other Fields, Contemporary challenges. Learning: Nature and Significance of Learning, Process of Learning, Theories of Learning.

Planning and Decision Making: Planning and Goal Setting, Organizational Planning, Vision, Mission and Goals, Types of Plans, Steps in Planning Process, Approaches to Planning, Planning in Dynamic Environment. Decision-making Process, Types of Decisions, Decision Making Styles, Vroom's Participative Decision-making Model.

Organizing and Controlling: Organizational Structure, Principles of Organizing, Authority, Power and Influence, Designing Organizational Structure. Mechanistic and Organic Structures, Contemporary Organizational Design and its Challenges. Controlling: The Control Process, Controlling for Organizational Performance, Types of Control, Financial Controls, Balanced Scorecard, Bench Marking, Contemporary issues in Controlling.

Organizational Behavior: Individual and Group Behavior: Importance of Organizational Behavior, Culture and Dynamics of Diversity, Personality Theories, Perception, Formation of Group Behavior, Classification of Groups, Group Properties, Group Cohesiveness, Building Teams.

Leadership and Motivation: Leadership Traits, Leadership Styles, Leadership Theories, Power and Politics. Motivation: Approaches to Motivation, Maslow's Needs Hierarchy Theory, Two-factor Theory of Motivation, McGregor's Theory, ERG theory, McClelland's Needs Theory, Valance Theory.

4. Books and Materials

Text Books:

1. K. Aswathappa, Organisational Behaviour, Himalaya Publications, 8e, 2021
2. Harold Koontz, Heinz Weihrich, Mark V Cannice, Essentials of Management, Tata McGraw Hill Education, 11e, 2020.
3. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behaviour, Pearson Education, 18e, 2018.

Reference Books:

1. Luthans Fred, "Organizational Behaviour", Tata McGraw Hill.
2. Rao V S P., "Organizational Behaviour", Excel Books.
3. Chandrani Singh, Aditi Ktri, Principles and Practices of Management and Organizational Behaviour, Sage Publications, 1e,2016.
4. Afsaneh Nahavandi, Robert B. Denhardt, Janet V. Denhardt, Maris P. Aristigueta, Organizational Behaviour, Sage Publications, 1e, 2015.

Course Structure

A8089 – Intellectual Property Rights

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	45	0	3	40	60	100

1. Course Description

Course Overview

This Course deals with the types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights. It analyzes and evaluates the procedures involved in submission of application for the grant of intellectual property rights. It also deals with the significance of intellectual property of a business enterprise.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8089.1. Identify the different types of intellectual property, agencies and treaties that protect intellectual property rights
A8089.2. Classify the protectable matter of intellectual property rights.
A8089.3. Analyze and evaluate the procedures involved in submission of application for the grant of intellectual property rights
A8089.4. Interprete Trade secret law, liability for misappropriations of trade secrets, protection for submission, and trade secret litigation

3. Course Syllabus

Introduction to Intellectual Property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Trade Marks: Purpose and function of trademarks, Trade mark rights, protectable matter, selecting and evaluating trademarks, trade mark registration process.

Law of Copy Rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of Patents: Foundation of patent law, patent searching process, ownership rights and transfer.

Trade Secrets: Trade secret law, determination of trade secrets status, liability for misappropriations of trade secrets, protection for submission, and trade secret litigation.Unfair Competition: Misappropriation right of publicity, false advertising.

4. Books and Materials

Text Books:

1. R.S.Nagarajan, a Textbook on Professional Ethics and Human Values, New Age Publishers – 2006. Deborah.
2. Neeraj Pandey, Khushdeep Dharni- 2014, Intellectual property rights, PHI, India.

Reference Books:

1. Prabudda ganguli (2003), Intellectual property right, Tata McGraw Hill Publishing company ltd., India.
2. P.N. Cheremisinoff, R.P. Ouellette and R.M. Bartholomew, Biotechnology Applications and Research, Technomic Publishing Co., Inc. USA, 1985
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010

Course Structure

A8090 - Professional Practice, Law and Ethics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

This course makes students to understand the types of roles they are expected to play in the society as practitioners of an engineering profession. It develops ideas of the legal and practical aspects of their profession. Students will learn importance of professional practice, Law and Ethics in their personal lives and professional careers and the rights and responsibilities as an employee and team leader.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8090.1. Apply the concepts of professional practice, Law and Ethics in their personal lives and professional careers.
A8090.2. Analyze Arbitration, Conciliation and Alternative Dispute Resolution system
A8090.3. Interpret Law relating to Intellectual property
A8090.4. Apply the rights and responsibilities as an employee, team member in any organization as a global citizen.

3. Course Syllabus

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders.

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996;UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention;

International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other - Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970.

4. Books and Materials

Text Books:

1. R. Subramanian - Professional Ethics, Oxford University Press, 2015.
2. Ravinder Kaur - Legal Aspects of Business, 4th edition, Cengage Learning, 2016.

Reference Books:

1. RERA Act, 2017.
2. Wadhera - Intellectual Property Rights, Universal Law Publishing Co.,2004.
3. 3. T. Ramappa - Intellectual Property Rights Law in India, Asia Law House,2010.
4. 4. O.P. Malhotra - Law of Industrial Disputes, N.M. Tripathi Publishers.

Course Structure

A8091 - National Cadet Corps(NCC)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	45	0	0	3	40	60	100

1. Course Description

Course Overview

National Cadet Corps, is a unique course designed for youth in India that aims to develop character, discipline, leadership, secular outlook, spirit of adventure, and ideals of selfless service among young citizens. Through this course students learn about rhe national integration and its importance. They understand the concept of self-awareness and emotional intelligence, critical & creative thinking, decision making & problem solving and importance of Social service.This course also explores the security challenges & role of cadets in border areas. Students acquire the knowledge about various wars and their heroes.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A8091.1. Acquire knowledge of the history of NCC, its organization, and incentives of NCC for their career prospects and duties & conduct of ncc cadets.

A8091.2. Imbibe good leadership traits and apply them in practical life and appreciate the visible outcome of leadership and motivation.

A8091.3. Develop a sense of responsibility, smartness in appearance and improve self-confidence, inculcate importance of empathizing with others, improve their deep-thinking ability and apply ideas and be able to face problems in a constructive manner with solutions.

A8091.4. Learn about the various natural resources, their utilization and practice method of conservation of these resources in daily life.

A8091.5. Appreciate value of physical and mental health in daily life and spread awareness about treatment and care of wounds in their society.

A8091.6. Understand individaul responsibilities & role in meetings the security challenges on Border/Coastal areas.

3. Course Syllabus

Introduction to NCC and National Integration: Introduction of NCC, History, Aims, Objective of NCC & NCC as Organization, Duties of NCC Cadet. National Integration: Importance & Necessity, Factors Affecting National Integration, Unity in Diversity & Role of NCC in Nation Building.

Personality Development & Leadership: Intra & Interpersonal skills - Self-Awareness- & Analysis, Empathy, Critical & creative thinking, Decision making and problem solv-

ing. levels of Creativity, Characteristics of creative person. Leadership capsule., Important Leadership traits, Indicators of leadership and evaluation., Motivation- Meaning & concept, Types of motivation. Factors affecting motivation., Ethics and Honor codes.

Social Service & Community Development: Basics of social service and its need, Types of social service activities, Objectives of rural development programs and its importance, NGO's and their contribution in social welfare, contribution of youth and NCC in Social welfare. Protection of Children & Women Safety., Road/Rail Safety., New Government Initiatives., Cyber and mobile Security Awareness.

Environmental Awareness and Conservation: Natural Resources, Conservation and Management, Water Conservation, Waste Management, Energy Conservation. Adventure Environmental Awareness and Conservation. Health & Hygiene: Hygiene & Sanitation (Hygiene- Personal & Social Hygiene)., First Aid in common medical emergencies. Treatment & Care of Wounds.

Border & Coastal Areas: History, Geography & Topography of Border/ Coastal Areas. Security Setup and Border/Coastal management in the area., Security Challenges & Role of cadets in Border management.

4. Books and Materials

Text Books:

1. R. K. Gupta, "Hand book of NCC Cadets for A, B & C Certificate Examinations", R-1992, 23rd Edition. Ramesh Publishing House, New Delhi (2023).