Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from the AY 2021

B.E in Electrical and Electronics Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS**) (Applicable to Batch 2021-2024(NEP))**

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week					Examination				Credits
					L	T	P	S	Total	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	HSSC	21EET601	Management and Entrepreneurship	HSME	3	0	0	0	3	03	50	50	100	3
2	IPCC	21EET602	Power System Analysis - 2	EE	3	0	2	0	5	03	50	50	100	4
3	PCC	21EET603	Digital Signal Processing	EE	3	0	0	0	3	03	50	50	100	3
4	PEC	21EET604X	Professional Elective Course-I	EE	3	0	0	0	3	03	50	50	100	3
5	OEC	21EET605X	Open Elective Course-I	Concerned Department	3	0	0	0	3	03	50	50	100	3
6	PCL	21EEL606	Digital Signal Processing Laboratory	EE	0	0	2	0	2	03	50	50	100	1
7	MP	21EEM607	Mini Project	EE	Two contact hours /week for interaction between the faculty and students.					-	100	-	100	2
8	INT	21EEI608	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.						-	100	-	100	3
9	HSSC	21HSN609	Analytical and Reasoning Skills	Placement Cell	2	0	0	0	2	-	50	-	50	NP/PP
										Total	**550**	**300**	**850**	**22**

Professional Elective - I			
21EET6041	Sensors and Transducers	21EET6043	OOPS with C++
21EET6042	Field Theory	21EET6044	Programmable Logic Controller
Open Electives – I offered by the Department of Electrical and Electronics Engineering to other Department students			
21EET6051	Renewable Energy Resources		

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. Selection of an open elective shall not be allowed if, **(i)** The candidate has studied the same course during the previous semesters of the program.
(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives. **(iii)** A similar course, under any category, is prescribed in the higher semesters of the program. In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college. The minimum students' strength for offering open electives is 10.
However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or to a group having not more than 4 students.
CIE procedure for Mini-project: (i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. No SEE component for Mini-Project.

VII semester Classwork and Research Internship /Industry Internship (21INT82): Swapping Facility
Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.
Elucidation:
At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.
Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The intership can also be rural internship.
The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after satisfying the internship requirements.

INT21INT82 Research Internship/ Industry Internship/Rural Internship

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural internship: A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.

The student can take up Interdisciplinary Research Internship or Industry Internship.

The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

Course Title	**POWER SYSTEM ANALYSIS - II**						
Course Code	**21EET602**						
Category	**IPCC**						
Scheme and Credits	No. of Hours/Week					Total teaching + Lab hours	Credits
	L	T	P	SS	Total		
	03	**00**	**02**	**00**	**05**	**40+12**	**04**
CIE Marks: **30T+20L**	SEE Marks: **50**		**Total Max. marks:100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. Describe network topology and form incidence matrices
2. Formulate Ybus and Zbus matrices for the power system network
3. Analyze the system power flow using numerical techniques.
4. Evaluate economic operation of power system
5. Estimate the stability of power system

UNIT I **8 hours**

Network Matrices: Introduction, elementary graph theory – oriented graph, tree, co-tree, cut set, loop. Incidence matrices: element-node, bus. Primitive networks – impedance form and admittance form. Formation of Y_{BUS} by method of inspection (including off-nominal tap setting transformer) and by method of singular transformation Bus voltage equations in terms network impedance and current injection. Modification of Z_{BUS} for branch and links addition. Impedance matrix by step by step building algorithm (numerical problems without mutual coupling elements)

UNIT II **8 hours**

Load Flow Studies 1: Introduction, power flow equations, classification of buses, operating constraints and data for load flow. Gauss-Seidal method – formulation of voltage equation, algorithm and flow chart for PQ and PV buses (numerical problems for one iteration only).

UNIT III **8 hours**

Load Flow Studies 2: Newton-Raphson's method – formulation of power residue equations, evaluation of Jacobian elements. Algorithm and flow chart in polar coordinates (numerical problems for one iteration only). Fast decoupled load flow. Comparison of load flow methods.

UNIT IV **8 hours**

Economic Operation Of Power System: Introduction, performance curves, economic generation scheduling neglecting losses and generator limits. Economic generation scheduling including generator limits and neglecting losses, iterative techniques. Economic dispatch including transmission losses – approximate penalty factor, iterative technique for solution of economic dispatch with losses. Derivation of transmission loss formula

UNIT V **8 hours**

Transient Stability Studies: Introduction to transient stability. Numerical solution of swing equation by Point-by-point method, modified Euler's method, Milne's Method, Runge-Kutta method.

S.	**Laboratory Component:-** Using MATLAB & Mi-Power simulation package	**No. of hours**
1	Y-bus formation for power system without mutual coupling by inspection singular method.	2
2	Formation of Z bus formation by Z bus building algorithm(without mutual coupling)	2
3	Determination of bus currents, bus power, line flows and bus voltages for a specified system.	2
4	Optimal generator scheduling for thermal power plants.	2
5	Optimal generator scheduling for thermal power plants. (2-3 bus system)	2
6	Load flow analysis of power system using Gauss Seidal & Newton Raphson method	2
	Other Practices	
7	Drawing power angle diagrams for salient Pole & non-salient pole synchronous Machines and determination of excitation emf and regulation	2
8	Load flow analysis for system using Newton Raphson & Fast Decoupled methods	2
9	Determine sequence and fault currents and voltages of transmission system under fault.	2
10	Determine i) Swing curve ii) critical clearing time for a single machine connected to infinite bus under 3-phase Fault	2

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

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

CO1: Describe the graph theory applied to Power System and construct the fundamental matrices and built the Ybus and Zbus matrices.

CO2: Categorize the buses and formulate the power flow problems of power system network.

CO3: Analyze and solve the power flow problems through different iterative techniques.

CO4: Evaluate the economic operation of power system under various operating conditions..

CO5: Estimate the transient stability of the power system through different numerical methods

TEXT BOOKS

1. Stag G. W. and EI-Abiad A. H., **Computer Methods in Power System Analysis,** McGraw Hill International Student Edition. 1968

2. I.J.Nagrath and D.P.Kothari, "Modern Power System Analysis", 3rd Edition TMH, 2003

3. Uma Rao, Computer Techniques in Power System, IK International Publishing House pvt. Ltd., Bangalore

4. Lab manual for practical's

REFERENCE BOOKS

1. Haadi Sadat**, Power System Analysis,** TMH, 2nd Edition, 12th reprint, 2007

2. Pai M. A, **Computer Techniques in Power System Analysis**, TMH, 2nd edition, 2006.

3. Singh L.P **Advanced Power System Analysis and Dynamics**, New Age International (P) Ltd, New Delhi, 2001.

4. Naser A and Boldea I, "Linear Electric Motors: Theory", First Edition,Prentice, 2003

5 Dhar R.N, **Computer Aided Power System Operations and Analysis**"- TMH, 1984.

6. Nagrath I. J., and Kothari D. P, **Modern Power System Analysis,** TMH, 3rd Edition, 2003.

ONLINE RESOURCES

1. http://www.digimat.in/nptel/courses/video/108107127/L02.html
2 https://newhorizonindia.edu/nhengineering/computer_aided_power_system_analysis/
3 https://www.youtube.com/watch?v=7voNa0tMb1k&list=PLcwp2fRcIXJWFKh_LrhY2Uu07DqDWPPId

SCHEME FOR EXAMINATIONS

(i) The question paper will have ten full questions carrying equal marks.
(ii) Each full question will be for 20 marks.
(iii) There will be two full questions from each module.
(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(v) The students have to answer five full questions, selecting one full question from each module.
(vi) Only CIE evaluation for lab component no SEE for lab.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO2	PSO3
CO1	3	3						1		1		1	3		1
CO2	3	3						1		1		1	3		1
CO3	3	3						1		1		1	3		1
CO4	3	3						1		1		1	3		1
CO5	3	3						1		1		1	3		1

Strength of correlation: Low-1, Medium- 2, High-3

Course Title	**DIGITAL SIGNAL PROCESSING**

Course Code	**21EET603**						
Category	**PCC**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: **40+5(A)+5(GA)**	SEE Marks: **50**		Total Max. marks:**100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. To understand DFT and its properties,
2. To learn FFT algorithm to find DFT.
3. To understand the structure of IIR & FIR system
4. To learn Analog and Digital IIR filter design.
5. To learn digital FIR design.

UNIT I **8 hours**
Discrete Fourier Transforms: Definitions, properties-linearity, shift, symmetry etc, circular convolution – periodic convolution, use of tabular arrays, circular arrays, stock hams's method, linear convolution – two finite duration sequence, one finite & one infinite duration, overlap add and save methods**.**
UNIT II **8 hours**
Fast Fourier Transforms Algorithms: Introduction, decimation in time algorithm, number of computations, number of multiplications, computational efficiency and decimation in frequency algorithms, inverse decimation in time and inverse decimation in frequency algorithms.
UNIT III **8 hours**
. **Realization of Digital Systems:** Introduction, block diagrams and SFGs, realization of IIR systems- direct form, cascaded, parallel form, realization of FIR systems – direct form, cascade form, linear phase realization.
UNIT IV **8 hours**
Design of IIR Digital Filters: Introduction, impulse invariant & bilinear transformations, all pole analog filters- Butterworth & Chebyshev, design of digital Butterworth & chebyshev.
UNIT V **8 hours**
Design of FIR Digital Filters: Introduction, windowing, rectangular, modified rectangular, Hamming, Hanning, blackman window.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

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

CO1: Determine the Discrete Fourier transforms of a discrete signals.
CO2: Solve DFT using FFT algorithm.
CO3: Determine the structure of FIR & IIR filters.
CO4: Design analog and digital IIR filters.
CO5: Design digital FIR filters.

TEXT BOOKS

1. **Digital Signal Processing Principle, Algorithm & application**. Proakis, Pearson, 4th education, 2009.
2. **Digital Signal Processing.** Sanjeet. K. Mitra, TMH, 3rd Edition, 2009.

REFERENCE BOOKS

1. **Introduction to Digital Signal Processing**. Johnny R. Johnson, PHI, 2009
2. **Discrete Time Signal Processing**. Openheim, pearson 2nd Edition 2009
3. **Digital Signal Processing.**S.Salivahanan, A.Vallaraj, C.Gnanapriya, TMH, 2nd Edition, 2010.

4. **Digital Signal Processing**. IfeachorEmmauel- Pearson education, 2nd Edition, 2006.
5. **Fundamentals of Digital Signal Processing.** Ludeman, John Wiley, 3rd Edition, 2008

ONLINE RESOURCES

1. http://www.nptel.ac.in

2.https://mrcet.com/downloads/digital_notes/ECE/III%20Year/DIGITAL%20SIGNAL%20PROCESSING.pdf

SCHEME FOR EXAMINATIONS

(i) The question paper will have ten full questions carrying equal marks.
(ii) Each full question will be for 20 marks.
(iii) There will be two full questions from each module.
(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(v) The students have to answer five full questions, selecting one full question from each module.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO	P	PO	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3						1		1		1	3		1
CO2	3	3						1		1		1	3		1
CO3	3	3						1		1		1	3		1
CO4	3	3	2			1	1	1		1		1	2		1
CO5	3	3	2			1	1	1		1		1	3		1

Strength of correlation: Low-1, Medium- 2, High-3

Course Title	**SENSORS AND TRANSDUCERS**						
Course Code	**22EET6041**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**40**	**03**
CIE Marks: **40+5(A)+5(GA)**	SEE Marks: **50**		Total Max. marks:**100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. Understand the use of gauges and transducers to measure pressure, direction.
2. Understand distance and electromagnetic radiation transducers.
3. Identify the transducers used for temperature sensing.
4. Understand different transducers for the measurement of sound.
5. Understand the sensors and transducers used for the measurement of mass, volume and environmental quantities.

COURSE CONTENT:

UNIT I **8 hours**

Strain and Pressure: Mechanical strain, Interferometry, Fibre optic methods, pressure gauges, low gas pressures, Ionization gauges, Transducer use.

Position, direction, distance, and motion: Position, Direction, Distance measurement, Distance travelled, Accelerometer systems, Rotation.

UNIT II **8 hours**

Light and associated radiation: Nature of light, Colour temperature, Light flux, Photosensors, Photoresistors and photoconductors, Photodiodes, Phototransistors, Photovoltaic devices, Fibre – optic applications, Light transducers, Solid-state transducers, Liquid crystal displays (LCD), Light valves, Image transducers, Radio waves.

UNIT III **8 hours**

Temperature sensors and thermal transducers: Heat and temperature, The bimetallic strip, Liquid and gas expansion, Thermocouples, Metal – resistance sensors, Thermistors, Radiant heat energy sensing, Pyroelectric detectors, Thermal transducers, Thermal to electrical transducers. .

UNIT IV **8 hours**

Sound, infrasound and ultrasound: Principles, Audio electrical sensors and transducers, Electrical to audio transducers.

UNIT V **8 hours**

Solids, liquids and gases: Mass and volume, Electronic sensors, Proximity detectors, Liquid levels, Liquid flow sensors, Timing, Gases, Viscosity.

Environmental Sensors: Environmental quantities, Time, Moisture, Acidity/alkalinity, Wind chill, Radioactive count rate, Surveying and security, Animal fat thickness, Water purity, Air purity, Smoke and fire detectors, Building acoustics.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

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

CO1: Understand the use of gauges and transducers to measure pressure, direction, position, motion and distance.
CO2: Discuss the use of light transducers and other devices used for the measurement of electromagnetic radiations.
CO3: Understand the working of different temperature sensing devices.
CO4: Summarize the principles and applications of audio electrical sensors and transducers used for the measurement of sound.
CO5: Predict the performance of sensors for the measurement of mass, volume and environmental quantities.

Course Title	**FIELD THEORY**

TEXT BOOKS

1. Sensors and Transducers, Ian R. Sinclair, 3rd Edition, Newnes. 2001.

REFERENCE BOOKS

1., Sensor & transducers, D. Patranabis, 2nd Edition., PHI.

2. Instrument transducers, H.K.P. Neubert, Oxford University press.

ONLINE RESOURCES

1. https://drive.google.com/drive/folders/1qszwDQy_-SOgttLzuvpP5Dy7HrSW3xJT?usp=sharing
2. https://www.electronicshub.org/sensors-and-transducers-introduction/

SCHEME FOR EXAMINATIONS

(i) The question paper will have ten full questions carrying equal marks.
(ii) Each full question will be for 20 marks.
(iii) There will be two full questions from each module.
(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(v) The students have to answer five full questions, selecting one full question from each module.

MAPPING of COs with POs and PSOs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2						1		1			3		1
CO2	3	2						1		1			3		1
CO3	3	2						1		1			3		1
CO4	3	2						1		1			3		1
CO5	3	2						1		1			3		1

Strength of correlation: Low-1, Medium- 2, High-3

Course Code	**21EET6042**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**40**	**03**
CIE Marks: **40+5(A)+5(GA)**	SEE Marks: **50**		Total Max. marks:**100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. Understand the concept of Coulomb's law, Gauss' law and divergence and its applications
2. Understand the concept of energy, density, conductor and dielectrics and the boundary conditions for an electric field.
3. Understand the concept of Poisson's, Laplace law and magnetic field and its applications.
4. Understand the concept of magnetic forces and magnetic materials.
5. Understand the applications of Maxwell's equations and time varying fields.

UNIT I **8 hours**

Introduction to Electrostatics

Coulomb's Law and electric field intensity: Experimental law of Coulomb, Electric field intensity, Types of charge distributions. Field due to various charge distributions-Line charges, Surface charge, Volume charge. Fields due to infinite line charge, charged circular ring, infinite sheet charge

Electric flux density, Gauss' law and divergence: Electric flux and flux density, Flux density for various charge distributions-Line charge, surface charge, volume charge. Gauss' law, Divergence, Maxwell's First equation (Electrostatics), vector operator and divergence theorem.

UNIT II **8 hours**

Energy and potential : Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge and system of charges, Potential gradient, Energy density in an electrostatic field.

Conductors and dielectrics: Current and current density, Continuity of current, metallic conductors, Conductor properties and boundary conditions, boundary conditions for perfect Dielectrics.

UNIT III **8 hours**

Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations. Examples of the solutions of Laplace's and Poisson's equations

The steady magnetic field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials.

UNIT IV **8 hours**

Magnetic forces and materials: Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit.

Magnetic materials: Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials.

UNIT V **8 hours**

Time varying fields and Maxwell's equations: Faraday's law, displacement current, General field relations for time varying Electric and Magnetic fields. Maxwell's equation in point and Integral form.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

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

CO1: Analyse the behaviour of static electric fields in standard configurations

Course Title	**OOPS with C++**

CO2: Explain the concepts of Energy and Potential to solve numerical problems
CO3: Solve problems on Poisons and Laplace's equations, Biot-savarts law and Circuital laws.
CO4: Distinguish the behaviour of Electrostatic and electromagnetic fields between two dielectrics/conductor-dielectric boundaries.
CO5: Apply Maxwell's equations for real time problems.

TEXT BOOKS

1. Field Theory, S. P. Basavaraju, First Edition, Sunstar Publisher, 2014
2. Engineering Electromagnetics, William H Hayt Jr. and John A Buck, 7th edition, Tata McGraw-Hill, 2006
3. Electromagnetics, J A Edminister 2nd edition, Tata McGraw-Hill, 2006

REFERENCE BOOKS

1. Electromagnetics with Applications, John Krauss and Daniel A Fleisch, 5th edition, Tata McGraw-Hill, 1999
2. Electromagnetic Waves and Radiating Systems, Edward C. Jordan and Keith G Balmain, Prentice, 2nd edition, Hall of India, 2008

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://www.youtube.com/watch?v=13hCkUiu_mI

SCHEME FOR EXAMINATIONS

(i) The question paper will have ten full questions carrying equal marks.
(ii) Each full question will be for 20 marks.
(iii) There will be two full questions from each module.
(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(v) The students have to answer five full questions, selecting one full question from each module.

MAPPING of COs with POs and PSOs

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1		1			1	1		1		2	2
CO2	3	3	1	1		1			1	1		1		2	2
CO3	3	3	1	1		1			1	1		1		2	2
CO4	3	3	1	1		1			1	1		1		2	2
CO5	3	3	1	1		1			1	1		1		2	2
Strength of correlation: Low-1, Medium- 2, High-3															

Course Code	**22EET6043**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**40**	**03**
CIE Marks: **40+5(A)+5(GA)**	SEE Marks: **50**		Total Max. marks:**100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. To understand Object Oriented Programming concepts using the C++ language.
2. Introduces the principles of function, classes and objects.
3. Introduces to Constructors, Destructors and Operator overloading.
4. Introduces the principles of inheritance, pointers, virtual functions and polymorphism.
5. Introduces the concept of streams and handling files.

UNIT I **8 hours**
Beginning with C++ and its features: What is C++? Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++
UNIT II **8 hours**
Functions, classes and Objects: Functions, Inline function, function overloading, friend and virtual functions, specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions.
UNIT III **8 hours**
Constructors, Destructors and Operator overloading: Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors, Defining operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators.
UNIT IV **8 hours**
Inheritance, Pointers, Virtual Functions, Polymorphism: Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions.
UNIT V **8 hours**
Streams and Working with files: C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

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

CO1: Understand the basics of Object Oriented Programming concepts using the C++ language.
CO2: Understand dynamic memory management techniques using pointers, constructors, destructors, etc.
CO3: Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.
CO4: Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.
CO5: Use I/O operations and file streams in programs.

TEXT BOOKS

1. Object Oriented Programming with C++, E. Balaguruswamy,6th Edition, TMH, 2013.

REFERENCE BOOKS

1. Object Oriented Programming in C++, Robert Lafore, 4th edition, Pearson publication, 2008.

ONLINE RESOURCES

1. https://www.javatpoint.com/cpp-oops-concepts
2. https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/
3. https://www.programiz.com/cpp-programming/oop
4. https://www.w3schools.com/cpp/cpp_oop.asp

SCHEME FOR EXAMINATIONS

(vi) The question paper will have ten full questions carrying equal marks.
(vii) Each full question will be for 20 marks.
(viii) There will be two full questions from each module.
(ix) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(x) The students have to answer five full questions, selecting one full question from each module.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO2	PSO3
CO1	2	2	2		**1**					**1**			2	1	1
CO2	2	2	2		**1**					**1**			2	1	1
CO3	2	2	2		**1**					**1**			2	1	1
CO4	2	2	2		1					1			2	1	1
CO5	2	2	2		1					1			2	1	1

Strength of correlation: Low-1, Medium- 2, High-3

Course Title	**PROGRAMMABLE LOGIC CONTROLLERS**						
Course Code	**21EET6044**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**40**	**03**
CIE Marks: **40+5(A)+5(GA)**	SEE Marks: **50**		Total Max. marks:**100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. The need of automation in the industry with basic controller mechanisms involved.
2. The programming concepts to achieve the desired goal or to define the various steps involved in the automation and the programming languages involved with basic subroutine functions.
3. To make use of the internal hardware circuits of automation circuit to control the devices during various states with monitoring the timers and counters
4. To handle the data of the I/O devices to interface the data with the controller and auxiliary devices.

COURSE CONTENT:

UNIT I **8 hours**

Introduction: programmable logic controller (PLC). Role in automation (SCADA). Advantages and Disadvantages, Hardware of PLC, Internal Architecture, Sourcing and Sinking,

Input and Output Devices: Characteristics of I/O devices, List of input devices- mechanical switches, proximity switches, photoelectric sensor and switches, temperature sensor. Output devices- relay, directional control valve and motor. Examples of applications- conveyor belt, lift and Liquid level monitoring.

UNIT II **8 hours**

I/O Processing: Input unit / Output unit, Signal conditioning- changing voltage level, Remote connection- serial and parallel communication, serial standard. Networks and its types.

Programming: Ladder Diagrams- PLC ladder programming, Logic Functions, Latching, Multiple Outputs, Function Blocks- Logic gates, Boolean Algebra, Program Examples- Signal lamp task, Valve operation program.

UNIT III **8 hours**

Programming Methods: Instruction Lists- Ladder programs and Instruction lists, Branch codes, Programming Examples- Signal lamp task and Valve operation program. Sequential Function Charts- Branching and convergence. Structured Text- Conditional statement and iteration statements

i) Internal Relays: internal relay, ladder programs- programs with multiple input conditions and Latching programs, Battery-Backed relays.

UNIT IV **8 hours**

ii) Internal relays: One-Shot Operation, Set and Reset, Program Examples- Fire alarm system and Loading system, Master control relay.

Jump and Call: jump- jumps within jumps, Subroutines call.

Timers: Types of Timers, On-Delay Timers, Excluded- sequencing and cascaded timers. Off-Delay Timer, Pulse Timers, Programming Examples- Flashing light and Traffic light sequence. Counters: Forms of Counter, Programming, Counter Application- Counting task. Up and Down counting.

UNIT V **8 hours**

Shift Registers: Ladder Programs-4 bit shift register, Sequencing Application- sequencing cylinders and keeping track of faulty items.

Data Handling: Registers and Bits, Data Handling- Data movement, Data comparison, Data Selection.

Arithmetic Functions- Conversion BCD-to-binary and binary-to-BCD.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

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

CO1: Need of automation and its various control strategies with its auxiliary devices.

CO2: Programs for various functional block consisting of multiple inputs and outputs and to control

CO3: Programming issues with subroutines and debugged.

CO4: The use of auxiliary units of a controller with hardware exposure

CO5: The data handling with simple hardware

TEXT BOOKS

1. Programmable Logic Controllers, W Bolton, Elsevier- newness, 5th Edition, 2009.
2. Programmable Logic Controllers - Principles and Applications, John W Webb, Ronald A Reis, Pearson Education, 5th Edition, 2007

REFERENCE BOOKS

1. Programmable Controller Theory and Applications, L.A.Bryan, E. A Bryan, An Industrial Text Company Publication, 2nd Edition, 1997.
2. Programmable Logic Controllers, E. A Paar, An Engineers Guide. Newness, 3rd Edition, 2003.
3. Introduction to Programmable Logic Controller, Garry Dunning, Thomson Asia Pte Ltd. Publication , 3rd Edition , 2006
4. Programmable Logic Controllers and Industrial Automation, Madhuchhanda Mitra and Samarjt Semgupta,, Pri penram, 2nd Edition, 2017
5. PLCs & SCADA - Theory and Practice, Rajesh Mehra, Vikrant Vij, Laxmi Publisher, 2nd edition, 2016

ONLINE RESOURCES

1. news.mit.edu/topic
2. https://www.allaboutcircuits.com/textbook/digital/chpt-6/programmable-logic-controllers
3. https://onlinecourses.nptel.ac.in

SCHEME FOR EXAMINATIONS

(i) The question paper will have ten full questions carrying equal marks.
(ii) Each full question will be for 20 marks.
(iii) There will be two full questions from each module.
(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(v) The students have to answer five full questions, selecting one full question from each module.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO2	PSO3
CO1	3	2	2	1									2		2
CO2	3		1	2							1		2		2
CO3			1	2	2				2				3		2
CO4	3	3							2		2	2	3		2
CO5		2		2	2						2	2	3		2

Strength of correlation: Low-1, Medium- 2, High-3

Course Title	**DIGITAL SIGNAL PROCESSING LAB**						
Course Code	**21EEL606**						
Category	**PCL**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	**00**	**02**	**00**	**02**	**26**	**01**
CIE Marks: **50**	SEE Marks: **50**		Total Max. marks:**100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. To write program for computation of DFT, Circular Convolution & Linear convolution
2. To write program to find Impulse response of LTI system.
3. To write program for IIR filter design.
4. To write program for FIR filter design

Expt No	Syllabus Contents	No.of Hours	Blooms Taxonomy level.
1	Direct Computation of N-point DFT.	2	L1, L2
2	IIR filter realization using cascade form, Parallel form	2	L1,L2,L3.
3	IIR Filter Design using Butterworth method.	2	L1, L2, L3,L4,L5
4	IIR Filter Design using Chebyshev type 1 prototype.	2	L1, L2, L3, L4,L5
5	FIR Filter Design using rectangular, hamming, window.	2	L1, L2, L3, L4,L5
6	FIR Filter Design using Hanning, Blackman window.	2	L1, L2, L3, L4,L5
7	N-Point Circular Convolution and Proof in frequency domain.	2	L1, L2, L3
8	Circular Convolution, Linear Convolution and Linear Convolution using Circular Convolution.	2	L1, L2, L3
9	Sampling Theorem.	2	L1, L2, L3
10	Impulse response from X[n] and y[n].	2	L1, L2, L3
11	Impulse response from difference equation and response to x[n].	2	L1, L2, L3
12	N-point DFT using decimation in Time and Frequency FFT.	2	L1, L2, L3
	EXPERIMENTS BEYOND SYLLABUS		
1	Design and implementation of a digital IIR filter (Low pass and High pass) to meet given specifications and test with an audio file. Plot the spectrum of audio	2	L3

Expt No	Syllabus Contents	No.of Hours	Blooms Taxonomy level.
	signal before and after filtering. Following Experiments to be done using DSP kit.		

Course Outcomes:

CO1: Execute the program to find DFT, Circular Convolution & Linear convolution

CO2: Execute program to find Impulse response of LTI system

CO3: Differentiate by writing a program for FIR & IIR Filter Structures

CO4: Design a program for IIR filters.

CO5: Design a program for FIR filters

References.

1. DSP lab manual.

Web Links.

https://www.azdocuments.in/2020/09/digital-signal-processing.html

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO	3	3		1	2			1	1	1		1	3		1
CO	3	3		1	2			1	1	1		1	3		1
CO	3	3		1	2			1	1	1		1	3		1
CO	3	3	3	2	2			1	1	1		1	3		1
CO	3	3	1	2	2			1	1	1		1	3		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**RENEWABLE ENERGY SOURCES**						
Course Code	**21EET6051**						
Category	**Open Elective Course (OEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**40**	**03**
CIE Marks: **40+5(A)+5(GA)**	SEE Marks: **50**		Total Max. marks:**100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. To create awareness among the students about the different types of non-conventional energy resources and emphasize its importance
2. Learn the fundamental concepts about solar energy systems and devices.
3. Analyse the environmental aspects of renewable energy resources.
4. Understand the working of OTEC system and different possible ways of extracting energy from ocean and know about Biomass energy.

UNIT I **8 hours**

Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India. Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships with numerical, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications.

UNIT II **4+4 hours**

Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish. Solar Air Heating, Solar Dryers, Crop Drying, Space Cooling, Solar Cookers, Solar pond

UNIT III **4+4 hours**

Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.

Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection, Wind power calculation.

UNIT IV **4+4 hours**

Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers and applications.

Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant-KVIC and Janatha models

UNIT V **7 hours**

Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy

Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Closed Cycle, Open Cycle, Advantages, Disadvantages and Benefits of OTEC.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

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

CO1: Understand and Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy
CO2: Analyze and evaluate the implication of renewable energy. Concepts in solving numerical problems pertaining to solar radiation geometry
CO3: Identify hydrogen and wind energy as alternate form of energy and to know how it can be tapped.
CO4: Apply engineering techniques and Gain knowledge, discuss various generation schemes of energy Biomass, Biogas, Ocean thermal and Tidal systems
CO5: Demonstrate self -learning capability to discuss production of energy from solar, Biomass and Biogas energy, Wind, Hydrogen, Tidal, Ocean thermal, world and Indian scenarios resources.

TEXT BOOKS

1. Non- Conventional Energy Sources, G D Rai, Fourth Edition, Khanna Publisher, 1997
2. Non- Conventional Energy Sources, B H Khan, Second edition, TMH
3. Solar Energy for Thermal applications, S P Sukhatme, Second edition, TMH, 2009

REFERENCE BOOKS

1. Non- Conventional and Renewable energy Sources, S S Thipse, Fourth edition, Narosa publishers, 2014

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https:// www.mnre.org
3. www.renewableenergyworld.com

SCHEME FOR EXAMINATIONS

(i) The question paper will have ten full questions carrying equal marks.
(ii) Each full question will be for 20 marks.
(iii) There will be two full questions from each module.
(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(v) The students have to answer five full questions, selecting one full question from each module.

MAPPING of COs with POs and PSOs

	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3					3	3	2				1		2	3
CO2	3	2	1			3	3	2	2			1		2	3
CO3	3	2	1			3	3	2	2			1		2	3
CO4	3					3	3	2				1		2	3
CO5	3					3	3	2				1		2	3
Strength of correlation: Low-1, Medium- 2, High-3															