Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electrical and Electronics Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24(For batches 2022 - 2024)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22EEU601	High Voltage Engineering	EEE	3	0	2		03	50	50	100	4
2	PCC	22EET602	Digital Signal Processing	EEE	4	0	0		03	50	50	100	4
3	PEC	22EET603x	Professional Elective Course	EEE	3	0	0		03	50	50	100	3
4	OEC	22XXT604x	Open Elective Course		3	0	0		03	50	50	100	3
5	PROJ	22EEP605	Major Project Phase I	EEE	0	0	4		03	100	--	100	2
6	PCCL	22EEL606	Digital Signal Processing Lab	EEE	0	0	2		03	50	50	100	1
7	AEC/SDC	22EET607x OR 22EEL608x	Ability Enhancement Course/Skill Development Course V	EEE	If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
8	HS	22CDN609	Analytical and Reasoning Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
9	MC	22NSN610	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		22PEN610	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON610	Yoga	Yoga Teacher									
									Total	500	300	800	18

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, **S**= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to all the stream of Engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course.

Professional Elective Course 22XXT603x			
22EET603A	**Modern Control Theory**	**22EET603E**	**Computer Control of Electrical Drives**
22EET603B	**Power System Planning**	**22EET603F**	**Introduction to Quantum Computing**
22EET603C	**Energy Auditing and DSM**		
22EET603D	**Special Electrical Machines**		
Open Elective Course 22XXT604x			
22EET604A	**Green Technology and Sustainability Engineering**		

Ability Enhancement Course / Skill Enhancement Course-V 22XXT607x OR 22XXL607x			
22EEL607A	**Scilab for Power Electronics**	**22EEL607C**	**Arduino and Raspberry PI based project**
22EEL607B	**Basics of VHDL lab**		

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals 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 only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

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 number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they canopt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under theguidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

Course Title	**HIGH VOLTAGE ENGINEERING**						
Course Code	**22EEU601**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours + Lab hours	Credits
	L	T	P	SS	Total		
	03	**00**	**02**	**00**	**05**	**40+20**	**04**
CIE Marks: **30T+20L**	SEE Marks: **50**		Total Max. marks:**100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. To introduce the need and basics and Applications of high voltage engineering.
2. Students will learn the break down mechanisms of insulating media.
3. Students will learn the concepts on generation of High AC. DC and impulse voltages and currents.
4. To learn techniques of measurement of High AC, DC and impulse voltages and currents
5. To gain knowledge in testing of high voltage equipment.

COURSE CONTENT:

UNIT I **08 hours**

Introduction: Introduction to HV technology, role of insulation in electrical apparatus, types and applications of insulating materials used in transformers and Bushings and Rotating electrical machines. Need for generating high voltages in laboratory. Industrial applications of high voltages.

Conduction and breakdown in gases: Gas as insulating media, Primary Ionization, Ionization by collision Photo ionization and secondary ionization processes Electron emission due to positive ion impact, electron emission due to Photons electron emission, due to meta stable and neutral atoms. Criteria for gaseous insulation breakdown based on Townsend's theory. Limitations of Townsend's theory. Streamer's theory of breakdown in non-uniform fields. Corona discharges. Breakdown in electro negative gases. Paschen's law and its significance. Time lags of breakdown.

Solid dielectrics: Breakdown in solid dielectrics: intrinsic breakdown, avalanche breakdown, thermal breakdown, and electro mechanical breakdown.

Liquid dielectrics: Breakdown of liquid dielectrics: Liquid as insulation, Suspended particle Theory, Cavity breakdown (Bubble's theory), and Stressed Oil Volume theory. Eco-friendly liquid dielectrics: introduction, Characteristic properties, advantages and disadvantages

UNIT II **08 hours**

Generation of HVAC voltages: HV- transformer, need for cascade connection and working of transformers units connected in cascade. Series resonant circuit- principle of operation and advantages.

Generation of HVDC voltages: Half and full wave rectifier circuits, voltage doubler circuit, Cockroft-Walton type high voltage generator set. Determination of voltage regulation, ripple and optimum number of stages for minimum voltage drop.

UNIT III **08 hours**

Generation of impulse voltage and current: Introduction to standard lightning and switching impulse voltages. Analysis of single stage impulse generator-expression for output impulse voltage. Multistage impulse generator, working of modified Marx multi stage impulse generator circuit. Rating of impulse generator. Components of multistage impulse generator. Triggering of impulse generator by three electrode gap arrangement. Trigatron gap and oscillograph time sweep circuits. Generation of switching impulse voltage generation of high impulse current.

UNIT IV **08 hours**

Measurement of high voltages: Measurement of high dc voltages using High ohmic resistance in series with micro-ohm meter, generating voltmeter- principle, construction, Standard sphere gap-measurement of HVAC, HVDC, and impulse voltages; factors affecting the measurements. Potential Dividers-Resistance dividers, Capacitance dividers and mixed RC potential dividers.

UNIT V **08 hours**

High voltage tests on electrical apparatus: Definitions of terminologies, tests on Insulators, Bushings and Transformers.

Non-destructive testing of equipments: Introduction, Measurement of capacitance and of an insulation sample using high voltage Schering Bridge, Partial discharges, methods of discharge

detection- Straight discharge detection method and Balanced detection method.

S.No	Laboratory Component	No. of Hours	BTL
1.	Motor protection scheme-fault studies.	2	1-4
2.	Spark over characteristics of air insulation subjected to high voltage AC/DC with spark over voltage corrected to STP for uniform and non-uniform field configuration.	2	1-4
3.	Measurement of HVAC and HVDC using standard sphere gap models.	2	1-4
4.	Breakdown strength of transformer oil using oil-testing unit.	2	1-4
5.	Measurement of capacitance and Tanδ of solid insulating samples.	2	1-4
6.	To determine the operating characteristics of Fuse/Numerical - OV/UV an OC relay.	2	1-4
	Beyond Syllabus		
1.	Demonstration of: (i)Cascade connection of transformers. (ii) Demonstration of partial discharge measurement in insulating materia	2	1-4
2.	Generation of standard lightning impulse voltage and to determine efficiency and energy of impulse generator. (b) To determine 50% probability flashover voltage for air insulation subjec to impulse voltage	2	1-4

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

COURSE OUTCOMES: On completion of the course, student should be able to:
CO1: explain the need for high voltages and currents.
CO2: explain the physics of break down mechanisms of insulating media.
CO3: compare the merits and demerits of generation of high voltage and currents.
CO4: select suitable method for measurement of high voltages.
CO5: explain the method of conducting the high voltage tests on different electrical equipment.

TEXT BOOKS

1. High Voltage Engineering, M.S.Naidu and Kamaraju, 4th edition, TMH, 2008
2. High Voltage Engineering Fundamentals, E.Kuffel and W.S. Zaengl, 2nd edition, Elsevier Press, 2005

REFERENCE BOOKS

1. High Voltage Engineering, R.S. Jha, 2nd edition, Dhanpat Rai & Sons, New Delhi .
2. High Voltage Engineering Theory and Practice, Mazen Abdel-Salam, Hussein Anis, Ahdab El- Morshedy, RoshdyRadwan, 2nd Edition,, 2003

ONLINE RESOURCES

1. https://www.academia.edu/12268238/High_Voltage_Engineering_CL_Wadhwa_PDF_BOok_Download
2. https://www.mv.helsinki.fi/home/tpaulin/Text/hveng.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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO2	PSO3
CO1	3	2	1				1			1		1	3	2	1
CO2	3	2	1				1			1		1	2	2	1
CO3	2	3	1			1	1			1		1	3	1	1
CO4	2	1	3			1	1			1		1	2	1	1
CO5	3	2	1				1			1		1	3	1	1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**DIGITAL SIGNAL PROCESSING**						
Course Code	**22EET602**						
Category	**PCC**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	04	00	00	00	04	52	04
CIE Marks: 50	**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.

COURSE CONTENT:

UNIT I **8+5 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+5 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 **7+5 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 **5+5 hours** **Design of IIR Digital Filters:** Introduction, impulse invariant & bilinear transformations, all pole analog filters- Butterworth & Chebyshev, design of digital Butterworth & chebyshev.
UNIT V **5+5 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	**MODERN CONTROL THEORY**						
Course Code	**22EET603A**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours + Lab 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. Students would be able to design and analyze the system in industrial control.
2. Student will get familiar with advanced applications of control system.

COURSE CONTENT:

UNIT I	**08 hours**
State Variable Analysis and Design: Introduction, concept of state, state variables and state model, state modelling of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables.	
UNIT II	**08 hours**
Derivation of transfer function from state model, Diagonalization, Eigen values, Eigen vectors, generalized Eigenvectors. Solution of state equation, state transition matrix, and its properties, computation using Laplace transformation.	
UNIT III	**08 hours**
Concept of controllability &observability, methods of determining the same, effect of pole-zero cancellation, duality.	
UNIT IV	**08 hours**
Pole Placement Techniques: stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, and state regulator design.	
UNIT V	**08 hours**
Non-linear systems: Introduction, the behaviour of non-linear systems, common physical non-linearity-saturation, friction, backlash, dead zone, relay, multivariable non-linearity. Phase plane method, singular points, stability of the nonlinear system, limit cycles, construction of phase trajectories	

TEACHING LEARNING PROCESS: Chalk and Talk, PowerPoint presentation, animations, videos

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

CO1: Understand the fundamentals of state variables for linear and nonlinear systems.
CO2: Construct state space models of SISO and MIMO systems.
CO3: Application of Eigenvalues for derivation of transfer functions and solutions of state equations.
CO4: Perform analysis on Controllability and Observability.
CO5: Improve stability of a given system by state feedback pole placement techniques

TEXTBOOKS

1. Digital control & state variable methods. M. Gopal , 3rd Edition, TMH ,2008
2. Control system Engineering. I. J. Nagarath& M. Gopal, New Age International (P) Ltd, 3rd edition.

REFERENCE BOOKS

1. State Space Analysis of Control Systems**.** Katsuhiko Ogata -PHI
2. Automatic Control Systems**.** Benjamin C. Kuo&FaridGolnaraghi, 8th edition, John Wiley & Sons 2009.
3. Modern Control Engineering. Katsuhiko Ogata, PHI,5th Edition, 2010.
4. Modern Control Engineering. D. Roy Choudary, PHI, 4th Reprint, 2009.
5. Modern control systems. Dorf& Bishop- Pearson education, 11th Edition 2008

ONLINE RESOURCES

1. https://www.youtube.com/watch?v=4Yx0P5qNP6M&list=PLhtuA4lvZfQ0zKjxySnARYdKmOE2KVwAw
2. https://www.youtube.com/watch?v=590Vx7x0lYg&list=PL9ulM52OdvODt_bA3_sIQiAqExkmmwQYE

3. http://docs.znu.ac.ir/members/pirmohamadi_ali/Control/Brogan(BookZZ.org).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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO2	PSO3
CO1	3	3			1					1			3		1
CO2	3	3			1					1			3		1
CO3	3	3			1					1			3		1
CO4	3	3			1					1			3		1
CO5	3	3			1					1			3		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**POWER SYSTEM PLANNING**						
Course Code	**22EET603B**						
Category	**Core Elective Course (CEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**03**	**40**	**03**
CIE Marks**: 50 (TAA: 40+5+5)**	SEE Marks**: 50**		Total Max. marks = **100**		Duration of SEE**: 03** Hours		

COURSE OBJECTIVE:

At the end of the course the students will be able to analyze,

1. Structure of power system, grid system, Load fore casting and modeling.
2. Integrated and co-generation, power pooling trading, financial planning and tariffs.
3. Computer aided planning, greenhouse effect, insulation coordination and reactive power compensation.
4. Reliability of power supply, load prediction, power system expansion and management.
5. Optimization and expansion of power system

UNIT I **8 hours** **Introduction of Power Planning**: National and regional planning, structure of power system, planning tools, electricity regulation, Load forecasting, forecasting techniques, modeling. Text book
UNIT II **8 hours** **Generation Planning**: Integrated power generation, co-generation / captive power, power pooling and power trading, transmission & distribution planning, power system economics, power sector finance, financial planning, private participation, rural electrification investment, concept of rational tariffs. Text book
UNIT III **8 hours** **Computer Aided Planning:** Wheeling, environmental effects, greenhouse effect, technological impacts, insulation co-ordination, reactive compensation. Text book & Reference book
UNIT IV **8 hours** **Power Supply Reliability**: Reliability planning, system operation planning, load management, load prediction, reactive power balance, online power flow studies, test estimation, computerized management. Power system simulator**.** Text book & Reference book
UNIT V **8 hours** **Optimal Power System Expansion Planning**: Formulation of least cost optimization problem incorporating the capital, operating and maintenance cost of candidate plants of different types (thermal, hydro, nuclear, non-conventional).. Text book & Reference book
TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

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

At the end of the course students will be able to –

CO1: Plan & model the structure of power system and to know the regulations grid in India

CO2: Explain finance, tariff, private sector participation and rural electrification.

CO3: Analyze the environmental effects, greenhouse effect, technological impacts, insulation co-ordination, in power system planning.

CO4: Evaluate the reliability, planning, load management, load reactive power balances.

CO5: Formulate the least cost optimization problem, operating and maintenance cost of candidate plants.

TEXT BOOKS:

A.S.Pabla, Electrical Power System Planning. Macmillan India Ltd, 1998

REFERENCE BOOK/WEBSITE LINKS:

S.S. Murthy, Power System Planning and Control **ONLINE RESOURCES**

ONLINE RESOURCES

1. https://www.sciencedirect.com/topics/engineering/power-system-planning
2. https://www.scribd.com/document/394022071/Power-System-Planning-Notes

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
CO 1	2	2	1	2	1		2	2	1				3		1
CO 2	2	2			1			2	1		1	1	3		1
CO 3	3	2	1		1		2	2	1				3		1
CO 4	2	2			1			2	1		2	1	2		1
CO 5	2	2	1		1			2	1		2	1	3		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**ENERGY AUDITING AND DEMAND SIDE MANAGEMENT**						
Course Code	**22EET603C**						
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: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

COURSE OBJECTIVE:

1. To enable the students to develop managerial skills regarding energy conservation and energy auditing
2. To facilitate the students to achieve a clear conceptual understanding of energy economic analysis
3. To recognize opportunities for increasing rational use of energy and basics of energy auditing with application on different sectors
4. To explain electrical load management techniques, harmonics and their effects, electricity tariffs and power factor improvement.
5. To understand the basics of demand side management.

UNIT I **06 hours**

Introduction: Energy Situation – World and India, Energy Consumption, Conservation, Codes, Standards and Legislation.

UNIT II **08 hours**

Energy Economic Analysis: The Time Value of Money Concept, Developing Cash Flow Models, Payback Analysis, Depreciation, Taxes and Tax Credit – Numerical Problems

UNIT III **08 hours**

Energy Management and Auditing: Introduction, Definition, Principles of Energy Management, Energy Management Strategy, Elements of Energy Audits, Energy Use Profiles, Measurements in Energy Audits, Presentation of Energy Audit Results.

UNIT IV **09 hours**

Electrical Equipment and power factor: The Power Triangle, Power Factor, Causes and disadvantages of Low power factor, advantages of High power factor, power factor improvement equipments, importance of power factor, most economical power factor, calculation of power factor Correction & Location of Capacitors, Energy Efficient Motors, Electrical Tariff, Concept of ABT

UNIT V **08 hours**

Demand Side Management: Introduction to DSM, Concept of DSM, Benefits of DSM, Different Techniques of DSM – Time of Day Pricing, Multi-Utility Power Exchange Model, Time of Day Models for Planning, Load Management, Load Priority Technique, Peak Clipping, Peak Shifting, Valley Filling, Strategic Conservation. Management and Organization of Energy Conservation Awareness Programs.

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 energy economics, regulations associated with energy conservation, Management& audit.
CO2: Analyse the Energy Economic analysis and develop cash flow models.
CO3: Understand the energy management, auditing, tariff & power factor in energy sector.
CO4: Apply energy management strategies, Power factor Correction methods,
CO5: Familiarize with Demand side management and energy conservation in energy sector.

TEXT BOOKS

1. Arry C. White, Philip S. Schmidt, David R. Brown, "Industrial Energy Management Systems", First Edition, Hemisphere Publishing Corporation New York, 1994
2. N G Ajjanna, "Energy auditing and demand side management", First edition 2012, Gouthami publications,Shimaoga.
3. Wayne C.Turner, ―Energy management Hand book, 8th Edition. John Wiley and son

REFERENCE BOOKS

1. D.P.Sen, K.R.Padiyar, IndraneSen, M.A.Pai, "Recent Advances in Control and Management of Energy Systems", Edition, Interline Publisher Bengaluru, 1993
2. Ashok V. Desai, "Energy Demand – Analysis, Management and Conservation", Wiley Eastern, publisher, 2005
3. B R Gupta "Generation of Electrical Energy", S Chand Publishing, 14th Edition 2011
4. Umesh Rathore " Energy Management" , S K Kataria & Sons, 2nd edition 2014

ONLINE RESOURCES

1. https://www.youtube.com/watch?v=iMHAByuOz-E&t=2s
2. https://www.youtube.com/playlist?list=PLOzRYVm0a65eZkxiWk8aa-291VFTLKb-Y

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	2					1	1	1					2		1
CO2	2	2					1	1			1	1	2		1
CO3	1					1	2	2		1	2	2			2
CO4	2	2	1				1			1			1		1
CO5		1					2	1		1			1		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**SPECIAL ELECTRICAL MACHINES**
Course Code	**22EET603D**

Category	**Core Elective Course**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**03**	**40**	**03**
CIE Marks**: 40+5+5=50**	SEE Marks**: 50**		Total Max. marks **= 100**		Duration of SEE**: 03** Hours		

COURSE OBJECTIVE:

1. To understand the constructional aspects of Special electrical machines
2. To understand the speed-torque characteristics of Special electrical machines
3. To analyze the necessity of sensors used in Special electrical machines
4. To understand the concepts of converters and control schemes of Special electrical machines
5. To understand the merits, demerits, and applications of Special electrical machines

UNIT I **8 hours**

a. Stepper Motor: Types of motors, construction, working principle. Term & definitions- Step angle, resolution, slewing, etc. Excitation modes, switching circuits, open and closed loop control, torque equation, speed torque characteristic, digital control of motor, comparison and applications of stepper motors.

b. **Switched Reluctance Motor (SRM):** Construction, working principle, Inductance profile, pole arc and tooth arc constraints, torque equation, characteristics, power converter circuits, sensors- Hall and Optical, current regulators, sensor less and digital control, merits, demerits and applications.

UNIT II **8 hours**

a. DC Servo motor: Construction, working principle, Voltage Equation, characteristics transfer function control. Numeric and Applications

b. AC servo motor: Construction, working principle, analysis of two phase motor, torque – speed characteristics, transfer function , Numeric and Applications

UNIT III **8 hours**

Brushless Permanent Magnet DC (BLDC) Motor: Introduction to PMDC motors. BLDC motors: Classification, construction, principle of operation, types of motor, electronic commutation, emf equation and waveforms, Torque equation, sensors, sensor less and digital control, comparison of brushed and brushless dc motors, merits, demerits and applications.

UNIT IV **8 hours**

Permanent Magnet Synchronous Motor (PMSM): Construction, principle of operation, emf equation, torque equation, sensor less and digital control, phasor and circle diagrams, comparison with conventional motors, applications.

Linear Induction Motor and Axial Flux Machines:

LIM: Construction, types, Principle of operation, thrust equation, and applications.

AFM: Construction, types, Principle of operation, windings, torque and emf equations, applications.

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

COURSE OUTCOMES

CO1: Able to describe the construction and operation of different special electrical machine**s.**

CO2: Compare merits, demerits of different special electrical machines and their applications.

CO3: Analyse different power converter topologies for operation of special electrical machines.

CO4: Formulate the torque equation and analyze speed –torque characteristics of special electrical machines.

CO5: Develop digital control techniques for the operation and control of special electrical machines.

TEXT BOOKS

1. E.G. Janardhanan, "Special Electrical Machines", First Edition, PHI, 2009

REFERENCE TEXT BOOKS.

1. K. Venkataratnam "Special Electrical Machines", First, University Press, 2009
2. R.Krishnan, "Switched Reluctance motor Drives Modeling, Simulation" Analysis, Design, and Applications, CRC Press, 2015.
3. Miller, T.J.E. "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.
4. Kenjo, T, "Stepping Motors and their Microprocessor control", Clarendon Press, Oxford, 1989.
5. Naser A and Boldea I, "Linear Electric Motors: Theory, Design and Practical Application", Prentice Hall Inc., New Jersey,1987

ONLINE RESOURCES

1. https://onlinecourses.nptel.ac.in/
2. https://www.academia.edu/9885014/SPECIAL_ELECTRICAL_MACHINES_NPTEL_NOTES

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	3	2							**1**			3		1
CO2	3	3	2										3		1
CO3	3	3	2							**1**			3		1
CO4	3	3	2										3		1
CO5	3	3	2										3		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**COMPUTER CONTROL OF ELECTRIC DRIVES**						
Course Code	**22EET603E**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours + Lab 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. Introduction to modern digital control of drives, different types of sensors and to study the concept of ac machine drives in detail.
2. To learn phase controlled converters, principles of slip power recovery schemes and to know about principle of Vector Control of AC Drives.
3. To learn about Applications of expert system to Drives.

COURSE CONTENT:

UNIT I **08 hours**
Review of Micro Controllers in Industrial Drives System: Typical Micro controller's 8 bit 16 bit (only block diagram) Digital Data Acquisition system, voltage sensors, current sensors, frequency sensors and speed sensors.
UNIT II **08 hours**
AC Machine Drives: general classification and National Electrical Manufacturer Association (NEMA) classification, Speed control of Induction motors with variable voltage constant frequency, constant voltage variable frequency, (v/f) constant operation, drive operating regions. Variable stator current operation. Effect of Harmonics.
UNIT III **08 hours**
a) Phase Controlled Converters: Converter controls, Linear firing angle control, cosine wave crossing control, and phase locked Oscillator principle, Electromagnetic Interference (EMI) and line power quality problems, cyclo converters, voltage fed converters, Rectifiers, and Current fed converters. **b) Principles of Slip Power Recovery Schemes**: Static Kramer's drive system, block schematic diagram, phasor diagram and limitations, Static Scherbins scheme system using D.C link converters with cyclo converter modes of operation, modified Scherbins Drive for variable source, constant frequency (VSCF) generation.
UNIT IV **08 hours**
Principle of Vector Control of AC Drives: Phasor diagram, digital Implementation block diagram, Flux vector estimation, indirect vector control block diagram with open loop flux control, synchronous motor control with compensation.
UNIT V **08 hours**
Expert System Application to drives (Only Block Diagram): Expert system shell, Design methodology, ES based P-I tuning of vector controlled drives system, Fuzzy logic control for speed controller in vector control drives, structure of fuzzy control in feedback system.

TEACHING LEARNING PROCESS: Chalk and Talk, PowerPoint presentation, animations, videos

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

CO1: Learn about Digital Data Acquisition System and all types of sensors in detail.
CO2: Understand the concept of AC Machine Drives operation and characteristics.
CO3: Know about different types of phase controlled converters.
CO4: Learn about digital implementation and principle of vector control of AC drives.
CO5: Learn design methodology of drives and fuzzy logic control feedback system.

TEXTBOOKS

1. Power Electronics & Motor Drives. BimalK.Bose, Elsevier 2006
2. Modern Power Electronics & Drives. Bimal K. Bose, Pearson Education 2003.

REFERENCE BOOKS

1. Advanced Microprocessor and Interfacing. Badri Ram, TMH, 1st Edition.

ONLINE RESOURCES

1. https://www.electrical4u.com/control-of-electrical-drives/
2. https://www.slideshare.net/slideshow/electrical-drives-and-control/250364732

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	3			1					1			3		1
CO2	3	3			1					1			3		1
CO3	3	3			1					1			3		1
CO4	3	3			1					1			3		1
CO5	3	3			1					1			3		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**INTRODUCTION TO QUANTUM COMPUTING**						
Course Code	**22EET603F**						
Category	**PEC**						
Scheme and Credits	No. of Hours/Week					Total teaching + Lab hours	Credits
	L	T	P	SS	Total		

	03	**00**	**00**	**00**	**03**	**40**	**03**
CIE Marks: **50**	SEE Marks: **50**		**Total Max. marks:100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. Theoretical and practical aspects of LASERs and Optical Fibers, including their principles, properties, applications, and associated numerical problems.
2. Fundamental concepts of quantum mechanics, including de Broglie hypothesis, wave functions, Schrödinger equation, and applications of these principles.
3. Essential principles of quantum information and quantum computing, including the concepts of qubits,
   Quantum gates and matrix operations.
4. overview of key concepts in electrical conductivity, superconductivity, and their applications in quantum
   Computing.
5. Understanding of how physics principles are applied in animation and statistical physics for computing, along with key concepts, methods, and example numerical problems.

UNIT I **8 hours**

LASER: Characteristic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients and Expression for Energy Density (Derivation), Laser Action, Population Inversion, Metastable State, Requisites of a laser system, Semiconductor Diode Laser, Laser Printer, Laser Cooling(Qualitative), Optical Fiber : Principle and structure, Propagation of Light, Acceptance angle and Numerical Aperture (NA), Derivation of Expression for NA, Modes of Propagation, RI Profile, Classification of Optical Fibers, Attenuation and Fiber Losses, Applications: Fiber Optic networking, Fiber Optic Communication. Numerical Problems

UNIT II **8 hours**

Quantum Mechanics: de Broglie Hypothesis and Matter Waves, de Broglie wavelength and derivation of expression by analogy, Phase Velocity and Group Velocity, Heisenberg's Uncertainty Principle and its application (Non-existence of electron inside the nucleus - Non Relativistic), Principle of Complementarity, Wave Function, Physical Significance of a wave function and Born Interpretation, Expectation value, Eigen functions and Eigen Values, Particle inside one dimensional infinite potential well, Quantization of Energy States, Waveforms and Probabilities. Numerical Problems.

UNIT III **8 hours**

Principles of Quantum Information & Quantum Computing: Introduction to Quantum Computing, Moore's law & its end, Differences between Classical & Quantum computing. Concept of qubit and its properties. Extension to N qubits. Dirac representation and matrix operations: Matrix representation of 0 and 1 States, Identity Operator I, Applying I to|0 ⟩and |1⟩ states, Pauli Matrices and its operations on |0⟩and |1⟩states, Explanation of i) Conjugate of a matrix and ii) Transpose of a matrix. Unitary matrix U, Examples: Row and Column Matrices and their multiplication (Inner Product), Probability, and Quantum Superposition, normalization rule. Orthogonality, Orth normality. Numerical Problems

UNIT IV **8 hours**

Electrical Conductivity in metals Resistivity and Mobility, Concept of Phonon, Matheissen's rule, Failures of Classical Free Electron Theory, Assumptions of Quantum Free Electron Theory, Fermi Energy, Density of States, Fermi Factor, Variation of Fermi Factor With Temperature and Energy. Numerical Problems. Superconductivity Introduction to Super Conductors, Types of Super Conductors, BCS theory (Qualitative), Quantum Tunneling, High Temperature superconductivity, Josephson Junctions (Qualitative), DC and RF SQUIDs (Qualitative), Applications in Quantum Computing : Charge, Phase and Flux qubits . Numerical Problems.

UNIT V **8 hours**

Applications of Physics in computing: Physics of Animation : Taxonomy of physics based animation methods, Frames, Frames per Second, Size and Scale, Weight and Strength, Motion and Timing in Animations, Constant Force and Acceleration, The Odd rule, Odd rule Scenarios, Motion Graphs, Examples of Character Animation : Jumping, Parts of Jump, Jump Magnification, Stop Time, Walking: Strides and Steps, Walk Timing. Numerical Monte Carlo Method : Determination of Value of π. Numerical Problems

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

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

CO1: Theoretical and practical aspects of LASERs and Optical Fibers, including their principles,

Properties, applications, and associated numerical problems.

CO2: Fundamental concepts of quantum mechanics, including de Broglie hypothesis, wave functions, Schrödinger equation and applications of these principles.

CO3: Essential principles of quantum information and quantum computing, including the concepts of Qubits, Quantum gates and matrix operations.

CO4: overview of key concepts in electrical conductivity, superconductivity, and their applications in Quantum Computing.

CO5: Understanding of how physics principles are applied in animation and statistical physics for Computing, along with key concepts, methods, and example numerical problems

TEXT BOOKS

1. Michael A. Nielsen and Isaac L. Chuang . "Quantum Computation and Quantum Information" Cambridge University Press, 2000

2. Phillip Kaye, Raymond Laflamme, and Michele Mosca. "An Introduction to Quantum Computing" Oxford University Press 2007

REFERENCE BOOKS

1. Eleanor Rieffel and Wolfgang Polak, "Quantum Computing: A Gentle Introduction" MIT Press, 2011

2. Noson S. Yanofsky and Mirco A. Mannucci "Quantum Computing for Computer Scientists" Cambridge University Press 2008

ONLINE RESOURCES:

1. https://www.bietdvg.edu/media/department/PHY/data/learning-materials/Module_III__IV_Lasers__Optical_fibers-1.pdf
2. https://www.studocu.com/in/document/visvesvaraya-technological-university/bachelor-of-engineering/module-1/65136919
3. https://www.studocu.com/in/document/sg-balekundri-institute-of-technology/cse-sgbit/quantum-computing/78116645.

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

	P	P	P	P	P	P	P	P	P	PO	PO	PO	PS	PS	PS
C	2		2		2	3									
C	1				2	3									
C	2		2		2	3									
C	2		2		2	3									
C	2		2		2	2									

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

Course Title	**GREEN TECHNOLOGY AND SUSTAINABILITY ENGINEERING**						
Course Code	**22EET604A**						
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 enable the students to develop skills regarding Green technology and energy auditing
2. To facilitate the students to achieve a clear conceptual understanding of Green technology analysis
3. To recognize opportunities for improving Green technology and is sustainability.
4. To explain the necessity of Sustainable Development
5. To understand the concept of the subject.

UNIT I **08 hours** **Principles of Green Technology and Green Engineering**: To learn to modify the processes and products to make them green safe and economically acceptable to the society, Concepts of green chemistry and Process intensification.
UNIT II **08 hours** **Green Synthesis and Catalysis and Green Industrial Processes:** Green oxidation and photochemical reactions, Microwave and Ultrasound assisted reactions, Synthesis of Green Reagents, Green solvents, Green nanotechnology and Ionic liquids. Pollution statistics from various industries like polymer, textile, pharmaceutical, dyes, pesticides and wastewater treatment. A greener approach towards all these industries
UNIT III **08 hours** **Meaning of Sustainable Development**: Understand the Sustainable Development, three principal dimensions: the ecological, the economic and the social dimension, including intergenerational justice; use a systems perspective, to describe sustainability challenges and possibilities for major technical systems and for their transformation to meet sustainability requirements
UNIT IV **08 hours** **Concepts of Cleaner Technologies**: Cleaner Production (CP), Definition, methodology, Role of CP in Achieving Sustainability, Benefits, Role of Industry, Government and Institutions, Environmental Management Hierarchy, Relation of CP and EMS. CP case studies: Ammonical nitrogen recovery from wastewater, Fluoride removal from wastewater, Reuse of water from sewage treatment plant, Gas quenching process: replacement of oil with nitrogen and Reduction of hydrogen cyanide from process stack. Reuse of liquid industrial waste from several industries.
UNIT V **08 hours** **Challenges and Practical Implementation:** Responsibilities and potentials of companies for action. Green Productivity and emerging technologies. Implementation of the practical applications of Green emerging technologies and sustainable development. Case studies in Green Technology. Green laws compliance.

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 technology of maintaining audit.
CO2: Analyse the Green technology and Sustainable Engineering.
CO3: Understand the Challenges and Practical Implementation
CO4: Understand the necessity and application of Green technology.
CO5: Familiarize with Demand side management of Green technology.

TEXT BOOKS

1. Introduction to Green Chemistry, Matlack A.S. Publisher: Marcel Dekker, Newyork, 2001.
2. Green Chemistry: Theory and Practice, Anastas P.T. and Warner J.C. Oxford University Press, 1998.
3. Pollution Prevention: Fundamentals and Practice, Bishop P. L. McGraw-Hill, Boston, 2000.
4. Cleaner Production Audit Environmental System Reviews, Modak P., Visvanathan C. and Parasnis M. Asian Institute of Technology, Bangkok, 1995.

ONLINE RESOURCES

1. https://www.youtube.com/watch?v=iMHAByuOz-E&t=2s
2. https://www.youtube.com/playlist?list=PLOzRYVm0a65eZkxiWk8aa-291VFTLKb-Y

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	2					1	1	1					2		1
CO2	2	2					1	1			1	1	2		1
CO3	1					1	2	2		1	2	2			2
CO4	2	2	1				1			1			1		1
CO5		1					2	1		1			1		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**DIGITAL SIGNAL PROCESSING LAB**						
Course Code	**22EEL606**						
Category	**PCCL**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	24	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	L2
2	IIR filter realization using cascade form, Parallel form	2	L3.
3	IIR Filter Design using Butterworth method.	2	L5
4	IIR Filter Design using Chebyshev type 1 prototype.	2	L5
5	FIR Filter Design using rectangular, hamming, window.	2	L5
6	FIR Filter Design using Hanning, Blackman window.	2	L5
7	N-Point Circular Convolution and Proof in frequency domain.	2	L3
8	Circular Convolution, Linear Convolution and Linear Convolution using Circular Convolution.	2	L3
9	Sampling Theorem.	2	L3
10	Impulse response from X[n] and y[n].	2	L3
11	Impulse response from difference equation and response to x[n].	2	L3
12	N-point DFT using decimation in Time and Frequency FFT.	2	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 signal before and after filtering. Following Experiments to be done using DSP kit.	2	L3

Course Outcomes:

CO1: Write & execute the program to find DFT, Circular Convolution & Linear convolution
CO2: Write & execute program to find Impulse response of LTI system
CO3: Differentiate & Write program for FIR & IIR Filter Structures
CO4: Design & Write program for IIR filters.
CO5: Design & Write 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
CO1	3	3		1	2			1	1	1		1	3		1

CO2	3	3		1	2			1	1	1		1	3		1
CO3	3	3		1	2			1	1	1		1	3		1
CO4	3	3	3	2	2			1	1	1		1	3		1
CO5	3	3	1	2	2			1	1	1		1	3		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**SCILAB FOR POWER ELECTRONICS**						
Course Code	**22EEL607A**						
Category	Ability Enhancement Course						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	01	00	02	24	01

CIE Marks: 50	SEE Marks: 50	Total Max. marks=100	Duration of SEE: 03 Hours

COURSE OBJECTIVE:

1. Understand the main features and importance of the SCILAB mathematical programming environment.
2. Understand the simulation of various power electronic devices.
3. Understand the simulation of various power electronic converters.
4. Understand the Simulation of various power control circuits.
5. Analyse the characteristic behavior of power electronic circuits.

S.No	Laboratory Component	No. of hours	BTL
1.	Power Diodes and Switched RLC Circuits	2	L3
2.	Diode Rectifiers	2	L3
3.	Power Transistors	2	L4
4.	DC to DC Converters	2	L4
5.	DC AC Converters	2	L3
6.	Resonant Pulse Inverters	2	L3
7.	Thyristors	2	L3
8.	Controlled Rectifiiers	2	L3
9.	AC Voltage Controllers	2	L4
10.	Power Supplies	2	L4
	Experiments beyond the Syllabus		L4
1.	AC and DC Drives	2	L4
2.	Protections of Devices and Circuits	2	L4

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

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

CO1: Apply the main features and importance of the MATLAB/ SCILAB mathematical programming environment.
CO2: Simulate various power electronic devices
CO3:. Simulate various power electronic converters
CO4: Simulate various power control circuits
CO5: Analyse the characteristic behavior of power electronic circuits..

TEXT BOOKS

1. Scilab Textbook Companion for Power Electronics Devices,circuits And Applicationby Muhammad. H. Rashid

REFERENCE BOOKS

1. Scilab Manual for Power Electronics Lab
2. SCILAB(a Free Software to Matlab),Er. Hema Ramachandran and Dr. Achutsankar Nair, S. Chand Publishers, ISBN-10: 8121939704, 201

ONLINE RESOURCES

1. https://www.youtube.com/watch?v=czoZA3raJik&list=PLRN3HroZGu2n0AVwOYb-t5L-mkxZe03Gr
2. https://www.youtube.com/watch?v=d2FLcBLUub4&pp=ygUbc2NpbGFiIHRvIHBvd2VyIGVsZWN0cm9uaWNz

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1			2								1	1	

CO2	2	1			2								1	1	
CO3	2	2			2								2	2	
CO4	2	2			2								2	2	
CO5	2	3			2								2	2	
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**BASICS OF VHDL LAB**						
Course Code	**22EEL607B**						
Category	**Ability Enhancement Course**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	24	01

CIE Marks: 50	SEE Marks: 50	Total Max. marks=100	Duration of SEE: 03 Hours

COURSE OBJECTIVE:

1. To learn the concepts of simplifying Boolean expression
2. To understand the concepts of designing and analyzing combinational logic circuits.
3. To apply design methods and analysis of sequential logic circuits.
4. To understand the concepts of HDL-Verilog data flow and behavioral models for the design of digital systems.

Expt No	Syllabus Contents	No. of Hours	Blooms Taxonomy level.
	Introduction to Verilog: Structure of Verilog module, Operators, Data Types, Styles of Description- Data flow description, Behavioral description. Verilog Behavioural description: Structure, Sequential Statements, Case statement, Loop Statements.	02	L1-L2
1	Simplification, realization of Boolean expressions using logic gates/Universal Gates	02	L1-L4
2	To design and implement (a) Adder/Subtractor – Full/half using logic gates. (b) 4-bit Parallel Adder/ subtractor using IC 7483.	02	L1-L4
3	To realize (a)Binary to Gray code conversion and vice versa (b)Priority encoder and 3:8 Decoder using IC74138 (c)One / Two bit comparator	02	L1-L4
4	To realize the following flip-flops using NAND Gates: (a) T type (b) JK Master slave (c) D type	02	L1-L4
5	To design and implement the 3-bit Mod-N synchronous counters using 7476.	02	L1-L4
6	Adder/Subtractor – Full/half using Verilog data flow description	02	L1-L4
7	Flip-flops using Verilog Behavioral description (a) JK type b) SR type c) T type and d) D type	02	L1-L4
8	Counter Up/ Down (Binary), sequential counters using Verilog.	02	L1-L4
Interfacing Experiments **Use FPGA/CPLD kits for downloading Verilog codes and check the output for interfacing experiments.**			
1	Verilog program to interface a stepper motor to rotate the motor in specified direction	02	L1-L4
2	Verilog program to interface a Relay	02	L1-L4
3	Verilog program to interface a Waveform generation using DAC	02	L1-L4
4	Verilog program to interface switches and LEDs	02	L1-L4

Course Outcomes:

CO1: Simplify Boolean functions using K-map and Quine-McCluskey minimization technique
CO2: Analyze combinational logic circuits
CO3: Analyze the concepts of Latches and Flip Flops. (SR, D, T and JK).
CO4: Analyze and design the synchronous sequential circuits.
CO5: Implement Combinational circuits & sequential circuits using Verilog descriptions.

References.

1. Fundamentals of logic design, by Charles H Roth Jr., Cengage Learning
2. Digital Principles and Design – Donald D Givone,12threprint, TMH,2008

3. Logic Design, Sudhakar Samuel, Pearson/ Saguine, 2007

Web Links.

1. https://nptel.ac.in/courses/108105132
2. https://nptel.ac.in/courses/117105080
3. https://nptel.ac.in/courses/108103179

MAPPING of COs with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	2	1	-	-	-	-	1	1	2	2	2
CO 2	3	3	2	2	2	1	-	-	-	-	1	1	2	2	2
CO 3	3	3	2	2	2	1	-	-	-	-	1	1	2	2	2
CO 4	3	3	2	2	2	1	-	-	-	-	1	1	2	2	2
CO 5	3	3	2	2	2	1	-	-	-	-	1	1	2	2	2
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**ARDUINO AND RASPBERRY PI BASED PROJECT**						
Course Code	**22EEL607C**						
Category	**Ability Enhancement Course**						
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 impart necessary and practical knowledge of components of Internet of Things.
2. To develop skills required to build real-time based projects.

Expt No	Syllabus Contents	No.of Hours	Blooms Taxonomy level.
1	i) To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to 'turn ON' LED for 1 sec after every 2 seconds. ii) To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to 'turn ON' LED when push button is pressed or at sensor detection.	02	L4
2	i) To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings. ii) To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it	02	L4
3	To interface motor using relay with Arduino/Raspberry Pi and write a program to 'turn ON' motor when push button is pressed.	02	L4
4	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.	02	L4
5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.	02	L4
6	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thing speak cloud.	02	L4
7	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thing speak cloud.	02	L4
8	To install MySQL database on Raspberry Pi and perform basic SQL queries.	02	L4
9	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	02	L4
10	Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.	02	L4
	EXPERIMENTS BEYOND SYLLABUS		
1	Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.	02	L4
2	Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it	02	L4

Course Outcomes:

CO1: Understand internet of Things and its hardware and software components
CO2: Interface I/O devices, sensors & communication modules
CO3: Distantly monitor data and control devices.
CO4: Develop real time IoT based projects

References.

1. Vijay Madisetti, Arshdeep Bahga, Internet of Things. "A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs.
3. Pethuru Raj and Anupama C Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

Web Links.

1. https://www.basedash.com/blog/how-to-install-mysql-on-a-raspberry-pi.

2. https://projecthub.arduino.cc/

MAPPING of COs with POs and PSOs

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