Basaveshwar Engineering College (Autonomous), Bagalkot
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Scheme of Teaching and Evaluation for B.E Electrical and Electronics Engineering based on Joint Board Meeting held on 04-06-2018

2019-20 (admitted batch), 2020-21 (sem 3&4), 2021-22 (sem 5&6), 2022-23 (sem 7&8)

Total Credits for BE =175 (as per VTU/AICTE); Min Credits/sem= 16; Max Credits=28; Average=22

Breakdown of Credits suggested by the VTU Belagavi/ AICTE New Delhi

Sl.	Undergraduate Programme		Current Credits	% allotted by EE	% range as per VTU
1	HSS + Soft skills + Kannada [6+3+1]		10	05.7	5-10
2	Basic Sciences		25	14.3	10-20
3	Engg. Sciences		21	12.0	10-20
4	Professional Core Courses Advanced C Programming Lab – 2 credits (Mandatory at VI sem, common for circuit branches)		71	40.6	30-40
5	Dept. Electives		21	12.0	10-15
6	Open Elective (VI to VII) 3+3		6	03.4	5-10
7	Mini project (VI) Internship (Min 6 weeks from IV-VI), Registration & Evaluation in VII sem) Project phase-I (VII) Technical Seminar (VIII) Project phase-II (VIII)	2 2 4 1 12	21	12.0	10-15
Total			175	100	100

First Year Course

Subject	Credits	Contact hours
Basic Electrical Engineering	2 (L)+1 (T)	Lectures 2 Hours/week + Tutorial 2 Hours/week

Semester Wise Credit Distribution for Semester-III to VIII

Particulars	Semesters						Total		% of total credits	% range as per VTU
	III	IV	V	VI	VII	VIII				
Core + Lab	16+3	16+3	12+3	6+2+2	6+2	--		71	40.5	30-40
Dept. Elective	--	--	3+3	3	3	3+3+3		21	12.0	10-15
Open Elective	--	--	--	3	3	--		6	03.4	05-10
Mini Project	--	--	--	2	--	--	2	21	12.0	10-15
Internship	--	--	--	--	2	--	2			
Project phase-I	--	--	--	--	4	--	4			
Technical Seminar	--	--	--	--	--	1	1			
Project phase-II	--	--	--	--	--	12	12			
HSS + Soft Skills	--	1	1	3+1	3	--		9	05.1	5-10
Maths	3	3	--	--	--	--		6		
Kannada	--	1	--	--	--	--		1		
Total	22	24	22	22	23	22		135		

Semester-7 CAY 2022-23 [175 credits. 2019-20 admitted batch]

Sl.	Sub Code	Subject	C	Hrs/ Week			Exam Marks		
				L	T	P	CIE	SEE	Total
01	UEE751C	Computer Applications to Power System	3	3	0	0	50	50	100
02	UEE752C	High Voltage, Switchgear and Protection	3	3	0	0	50	50	100
03	UEE753C	Intellectual Property Rights	3	3	0	0	50	50	100
04	UEE7XXE	Dept. Elective – 4	3	3	0	0	50	50	100
05	UEE7XXN	Open. Elective – 2	3	3	0	0	50	50	100
06	UEE761L	Power System Simulation Laboratory	1	0	0	2	50	50	100
07	UEE762L	High Voltage and Relay Laboratory	1	0	0	2	50	50	100
08	UEE764I	Internship*	2	0	0	*	70	30	100
09	UEE766P	Project Phase – I	4	0	0	8	50	50	100
Total			23	15	0	12	450	450	900

* Working hours will be as per scheduled working hours prescribed by the industry.

List of Elective Subjects

Electrical Machine Drives	Operation Research
Solar Photovoltaic System Design	Standards and Indian Electricity Act
Professional Communication and Technical Writing	Autotronics (Automotive Electronics)
AI Applications to Power Systems	Embedded System and PLC

List of Open Electives Subjects @ 7th Sem	
Energy conservation in Industrial Systems	Electrical Safety for Engineers

Semester-8 CAY 2022-23 [175 credits. 2019-20 admitted batch]

Sl.	Sub Code	Subject	C	Hrs/ Week			Exam Marks		
				L	T	P	CIE	SEE	Total
01	UEE8XXE	Dept. Elective – 5	3	3	0	0	50	50	100
02	UEE8XXE	Dept. Elective – 6	3	3	0	0	50	50	100
03	UEE8XXE	Dept. Elective – 7	3	3	0	0	50	50	100
04	UEE860S	Technical Seminar	1	0	0	2	50	50	100
05	UEE865P	Project Work Phase – II	12	0	0	24	50	50	100
Total			22	9	0	26	250	250	500

List of Elective Subjects

Power System Operation and Control	Speech Signal processing
Power System Dynamics and Stability	Over Voltages in Power Systems
Data Base management Systems	HVDC Transmission
Energy Conservation, Audit and DSM	Advances in Instrumentation
Flexible AC Transmission Systems	Power System Planning
Digital Control Systems	Smart Grids

Syllabus for

B.E. VII - Semester

for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE751C	Computer Application to Power System	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Network Topology: Introduction, Elementary Graph Theory, connected graph, sub graph Loop, Cut-set, Tree, Co- tree, Basic loops, Basic cut-set. Incidence Matrices: Element-node incidence matrix A (Bus-incidence matrix), Branch path incidence matrix K, Basic (Fundamental) cut-set incidence matrix B, Augmented cut-set matrix, Basic loop incidence matrix C, Augmented loop incidence matrix

Primitive Network: General primitive element, Impedance and Admittance form of the primitive element, Primitive network matrices

Network Matrices: Introduction, Derivation of Y_{bus} = $[A][y][A]^T$, Formation of Y_{bus} by inspection method. Modeling: Transmission lines, Transformers, Loads and generator internal impedance. Examples

UNIT – II	(10 Hours)

Load Flow Studies: Introduction, Power Flow Equation, Classification of Buses, Operating Constraints, Data for Load Flow: System data, Generator bus data, Load Data.

Gauss-SeidalMethod: Algorithm for GS method, Modification of algorithm to include PV buses, Q- limit violations, Acceleration of convergence and examples.

Newton-Raphson Method: Introduction, Algorithm for NR method in polar coordinates and rectangular coordinates. Fast Decoupled Load Flow and examples.

UNIT – III	(10 Hours)

Economic Operations of Power System: Introduction, Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation including generator limits and neglecting losses, Iterative technique, Economic Dispatch Including Transmission Losses: Approximation penalty factor, Derivation of transmission loss formula. Introduction to optimal scheduling for hydrothermal plants. Problem formulation, solution procedure and algorithm

UNIT – IV	(10 Hours)

Transient Stability Studies: Introduction, swing equation, machine equations. Power system equations

Modeling: Modeling of excitation systems: Introduction, DC Excitation system, AC Excitation system. Type 1, Type 2 and Type 3 excitation. Load Model: Static, Dynamic load models

Reference Books:

1. Stag.G.W.,andEI-Abaid,A.H.,"Computer Methodsin Power System Analysis", (2019Edition), MEDTECH, A Division of Scientific International 2019.
2. K.UmaRao, "Computer Techniques and Model in Power Systems", 2nd edition, I.K.International,2014.
3. Singh,L.P., "Advanced Power System Analysis and Dynamics", 6th edition, New Age International(P) Ltd, NewDelhi, 2014.
4. Nagrath,I.J., and Kothari, D.P., "Modern Power System Analysis", 4th edition, TMH, 2011.
5. Pai.,M.A., "Computer Techniques in Power System Analysis", 2nd edition, TMH, 2006.

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

Course Outcomes:

After completion of the course the students shall be able to,

1. Recall/define network topology concepts, primitive network, types of buses, load flow studies, economic scheduling and transient studies in power systems.
2. Illustrate/describe need for network topology, primitive network, Y_{bus}, types of buses, load flow studies, optimal scheduling of thermal power plants, transient stability of power systems and computer model of DC excitation systems.
3. Derive Y_{bus}, Z_{bus}, load flow algorithms by different methods, necessary condition of economic scheduling of thermal generators and swing equations for transient stability of power systems.
4. Determine power system parameters using network topology, real and reactive power flow, optimal scheduling of thermal generators, solve swing equations and decide the suitable methods for economic scheduling for thermal generators.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE751C.1	3							1		1		1	2	1	
2	UEE751C.2	3	1						1		1		1	1	2	1
3	UEE751C.3	3	3	2	2	1			1		1		1	3	1	1
4	UEE751C.4	3	3	3	3	1			1	1	1		2		1	

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE752C	High Voltage, Switchgear & Protection	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Generation of HV AC and DC Voltage: L-06 Hours

Classification of high voltages, HVAC-transformer, Need for cascade connection, working of transformer units connected in cascade, Series resonant circuit – principle of operation and advantages, Tesla coil. HV – DC voltage doublers circuit, Cock croft – Walton type high voltage DC set. Calculation of high voltage regulation, ripple and optimum number of stages for minimum voltage drop, Important applications of high voltages.

Generation of Impulse Voltage and Current: L-04 Hours

Introduction to standard lightning and switching impulse voltages. Analysis of single -stage impulse generator, expression for output impulse voltage. Multistage impulse generator, working of Mark impulse generator, Rating of impulse generator, Components of multistage impulse generator.

UNIT – II	(10 Hours)

Measurement of High Voltages: L-05Hours

Electrostatic voltmeter – principle, construction and limitation. Chubb and Fortessue method for HVDC measurements. Series resistance micro ammeter, Standard Sphere gap measurements for HVAC, HVDC and factors affecting the measurements.

Insulation Testing Techniques: L-05Hours

Dielectric loss and loss angle measurement using Schering Bridge, Transformer ratios arm bridge, Breakdown in solid dielectrics: Intrinsic breakdown, Breakdown of liquid dielectrics: Suspended particle theory, electronic Breakdown, cavity breakdown(bubble's theory)

UNIT – III	(10 Hours)

Protective Relaying: L-05 Hours

Relay definition, Required qualities of Protective Relaying, Primary and Back up protection, Classification of protective Relaying, Induction type Non-directional over current relay, Directional relay. Differential relay- Principle of operation, Percentage Differential relay, Distance relays: Impedance Relay, Reactance Relay, Mho Relay, R-X diagram and Buchholz Relay.

Protection Schemes: L-05 Hours

Merz-Price protection for generator, Merz -Price protection of Transformer. Inter turn fault, Induction motor protection-Protection against phase fault, ground fault and single phasing.

UNIT – IV	(10 Hours)

Static Relays :L-05 Hours

Introduction, Basic construction and classification. Definite time lag static over current relay, Inverse time static over current relay, Static over voltage and under voltage relay, Microprocessor based over current relay-block diagram approach.

Principles of Circuit Breakers : L-05 Hours

Principles of AC circuit breaking, Principles of DC circuit breaking, Initiation of arc, maintenance of arc, Arc interruption- High resistance and Low resistance interruption. Re striking voltage, Recovery voltage and resistance switching. Types of circuit breakers- Air break and air blast circuit breakers, SF6 circuit breakers- Puffer type and Non Puffer type.

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

Reference Books:

1. Sunil S. Rao "Switchgear and Protection and Power Systems", (13th edition),Khanna Publishers,2008
2. J. B. Gupta "Switchgear and Protection", (2nd edition), Katson Publisher, 2013
3. Ravindarnath B. "Power System Protection and Switchgear", 2nd edition, New age International, 2008.

Course Outcomes:

After completion of the course the students will be able to,

1. Select suitable generating and measuring instrument for testing high voltage equipment's.
2. Estimate the ripple factor, maximum voltage and relay timing for different high voltage instruments.
3. Compare the different insulating material, protection equipment's for high voltage applications
4. Apply the suitable protection equipments for selected rating of current and voltage ratings

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE752C.1	3	1		1	3	1		1		1		1	1	2	1
2	UEE752C.2	3	2	1	1				1		1		1	1	2	1
3	UEE752C.3	3	3	2	2	1			1		1		1	1	2	2
4	UEE752C.4	3	3	3	2	1			1	1	1	1	2	1	1	3

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UHS753C	Intellectual Property Rights	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Introduction to IPRS: Importance of human creativity and its recognition and protection. Concepts of Property and Rights. Different forms of IPRs. Role of IPRs in R&D.

Patents: Meaning of Patent, Objectives and Value of Patent. Criteria for Patentability. Software and Business Methods Patents. Govt. use of inventions, infringement of Patent and remedies for infringement. Compulsory license.

UNIT – II	(10 Hours)

Prior art Searching: Prior art- Tangible versus Intangible prior art. Search strategy: key words, structures, sequences, use of operators, database for searching- free and paid, disclosed versus claimed matters.

Patent Drafting: Types of specification, descriptions, drawing, claim drafting.

Filing Requirement of patent: Work flow chart in obtaining Patents, Forms to be submitted, filing mechanism through Individual patent office and PCT route. Request for re - examination and revocation. Term of Patent and Patent renewal.

UNIT – III	(10 Hours)

Trade-Marks: Meaning and functions of Trade Marks. Concept of Distinctiveness and Trade Marks registration. Trade Marks- Challenges in Non- Conventional Marks. Infringement of Trade Marks and remedies for infringement. Domain names and Trade Names.

Industrial Design: Definition of a design. Inclusive and Exclusive Designs; Industrial Design registration in India. Infringement of Design and remedies for infringement.

UNIT – IV	(10 Hours)

Copyright: Nature of Copyright, Subject-matter, Requirements to protect Copyright under the Law, Neighboring/Related Rights. Authorship rights. Copyright in the Digital Context. Transfer of Copyright and Infringement and remedies. Fair dealing and online streaming.

Confidential Information and Trade Secrets: Introduction, Conditions of protection. Essentials for an action for breach of confidence.

Reference Books:

1. P. Naryan, "Intellectual Property Law", 3rd Ed, Eastern Law House, 2007.
2. Dr. S. R. Myneni, "Law of Intellectual Property", 9th edition, Asia law House, 2019.
3. Dr. G. B Reddy, "Intellectual Property Rights and Law", Gogia Law Agency. Hydrabad, Reprint edition 2020.
4. N.R. Subbaram., S.Viswanathan, "Hand book Indian Patent Law and, Practice" Printers and publishers Pvt., Ltd, 2008.
5. Cornish, "Intellectual Property Rights", Universal publications.
6. Dr. B. L. Wadehra, "Law Relating to Intellectual Property" 5th edition, Universal Law publishing Co, Dehli.
7. SWAYAM / NPTL/ MOOCS/ We blinks/ Internet sources/ YouTube videos and other materials / notes

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

Course Outcomes:

After successful completion of this course the student should be able to:

1. Identify criteria to fit one's own intellectual work in particular form of IPRs.
2. Apply statutory provisions and procedure to protect different forms of IPRs at national and international level.
3. Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial designetc.
4. Develop skill of making search using modern tools and techniques.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UHS753C.1						3									1
2	UHS753C.2			2		1	2	2	2		2		2			1
3	UHS753C.3						3	2	2		2		1	1	1	1
4	UHS753C.4					2				1	1		2	1	1	2

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE754E	Solar Photovoltaic System Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Chapter-01: Solar Energy – Introduction and its scenario of India and global; Solar Radiation – solar radiation spectrum, diffuse & beam radiation and solar radiation measurement.

Chapter-02: Solar Cells – I-V & P-V characteristics; Technologies; Parameters; Factors affecting electricity generated; series, parallel and series & parallel connections; Numerical problems.

UNIT – II	(10 Hours)

Chapter-03: SPV module – Ratings, standard parameters; factors affecting electricity generated; I-V & P-V characteristics; connection of modules in series, parallel and series & parallel; Mismatch in series and parallel connections, Introduction to arrays.

Chapter-04: Balance of System (BoS) - Batteries; Charge Controllers; MPPT; Inverters. (BoS to cover functions, working, types, features, typical specifications and cost). Numerical problems.

UNIT – III	(10 Hours)

Chapter-05: Wires – Introduction, basics of current conduction, types of wires, measurement of wire dimensions, wire sizing; junction box;

Chapter-06: Introduction – stand-alone, grid connected & hybrid solar PV power systems; Installation, Maintenance, Troubleshooting and Safety of SPV power plants; Solar PV plant installation check list. Islanding – Definition, Causes. Types and Protection. Field visits within campus to study installations.

UNIT – IV	(10 Hours)

Chapter-07: Introduction – Configurations of SPV systems, SPV system design and integration – Design Methodology for Stand-alone SPV systems.

Chapter-08: Grid connected Solar PV Power Systems (GCSPVPS) – Introduction, Configurations & Components of GCSPVPS, GCSPVPS Design for small applications and for power plants.

Reference Books:

1. Chetan Singh Solanki, Solar Photovoltaics – Fundamentals, Technologies and Applications, PHI Learning Private Limited, New Delhi, 2009
2. Chetan Singh Solanki, Solar Photovoltaic Technology and Systems – A Manual for Technicians, Trainers and Engineers, PHI Learning Private Limited, New Delhi, 2014
3. M S Imamuaa and P. Helm Photovoltaic System Technology A European Hand book.
4. Tiwari, G. N and Ghosal, M. K., Fundamentals of Renewable Energy Sources, Narosa Publishing House, New Delhi, 2007

Course Outcomes:

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

1. Define parameters, components & features of solar cell, module, panel, array and SPV systems. They should be able to describe installation, O&M, troubleshooting and safety aspects of SPV systems,
2. Compute/estimate performance of SPV systems for different loads and applications

based on numerical problems.

3. Compare and analyze output of different solar PV systems.
4. Operate, test, design & discuss a solar PV system – stand alone or grid connected – based on typical loads

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE754E.1	3	1		1	3	1		1		1		1	1	2	1
2	UEE754E.2	3	2	1	1				1		1		1	1	1	3
3	UEE754E.3	3	3	2	2	1			1		1		1	1	1	1
4	UEE754E.4	3	3	3	2	1			1	1	1	1	2	1	3	1

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE732N	Electrical Safety for Engineers	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to Electrical Safety, Electric Shocks and their Prevention: OSHA standards on electrical safety, objectives of safety and security measures, hazards associated with electric current and voltage, principles of electrical safety, approaches to prevent accidents, review of IE rules & acts. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns	
UNIT – II	**(10 Hours)**
First Aid in Case of Electric Shock: First principles of actions after electric shock, first aid-artificial respiration methods, Cardiac Pulmonary Resuscitation, accident management and safety management. **Equipment Earthing and System Neutral Earthing:** Earthing, need for earthing, types of earthing, distinction between system grounding and equipment grounding, functional requirement of earthing system, technical consideration of station earthing system, step and touch potential, neutral grounding and its advantages	
UNIT – III	**(10 Hours)**
Safety in Residential, Commercial and Agricultural Installations: Domestic wiring methods and installations, safety requirements, shocks from domestic equipment-water taps- wet walls-agricultural pumps, types of cables and specifications, underground cables, best practices with use of electricity. **Accident Investigation:** Why and how to investigate, investigation report writing. Case studies of accidents in HESCOM/GESCOM region	
UNIT – IV	**(10 Hours)**
Electrical System Safety: Safety devices and their characteristics, safety clearances and creepage distances in electrical plants, line supports, insulators Circuit Breakers: Arc phenomenon, principles of arc extinction, oil & air blast breakers Protective Relays: Fundamental requirements of relaying, classification of relays Protection of Alternators, Transformers, Bus bars and Lines, protection against over voltages	

Reference Books:

1. S. Rao., R. K. Jain., H.L. Saluja., "Electrical safety, fire safety Engineering and safety management", Khanna Publishers New Delhi,2nd Edition, 2021
2. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.
3. V. K.Mehta, Rohit Mehta, "Principles of Power Systems", S Chand Publications, 4th Edition, 2008.
4. The Electricity Act, 2003, https://cercind.gov.in/Act-with-amendment.pdf

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

Course Outcomes:

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

1. List and explain the objectives and security measures in electrical safety systems
2. Illustrate approaches to prevent accidents in electrical systems and describe the operation of safety devices
3. Suggest the methods to rescue & first aid approaches in case of electrical accidents
4. Assess & provide solutions to a practical case study and write an investigation report with independent conclusions.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE732N.1	2	1		1		1		1		1		1			
2	UEE732N.2	2	2	1	1				1		1		1			
3	UEE732N.3	2	2	2	2				1		1		1			
4	UEE732N.4	2	2	2	2				1	1	1	1	2			

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE761L	Power System Simulation Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. ABCD parameters for short and medium network of transmission lines.
   a. Verification of Symmetry and Reciprocity of the network.
   b. Determination of regulation and efficiency.
2. To determine fault currents and voltages in a single line systems with star- delta transformers at a specified location for SLGF, DLGF, LL and check boundary conditions.
3. YBus formation of power systems with and without mutual coupling by singular transformation and inspection method.
4. Determination of power angle diagrams for salient and non-salient pole synchronous m/cs, reluctance power, excitation emf and regulation.
5. Determine stability of power system using Swing equation. To determine critical clearing time for SMIB system by varying inertia constant, line parameters/fault location.
6. Write a program to perform load flow study using Gauss-Seidel method (only pq Bus not exceeding 4-buses).
7. Formation of Jacobian matrix for a given power system not exceeding 4 buses in polar Coordinates (no PV buses).
8. Write a program to perform load flow study using Fast-Decouple Load Flow Method
9. Optimal Generator Scheduling for Thermal power plants connected to load dispatch center.

Reference Books:

1. Stag.G.W., and EI-Abaid,A.H., “Computer Methods in Power System Analysis”, (2019 Edition), MEDTECH, A Division of Scientific International 2019.
2. K.UmaRao, “Computer Techniques and Model in Power Systems”, 2nd edition, I.K.International, 2014.
3. Singh,L.P., “Advanced Power System Analysis and Dynamics”, 6th edition, New Age International(P) Ltd, New Delhi, 2014.

Course Outcomes:

After completion of the course the students shall be able to:

1. Identify and formulate the electrical network parameters for load flow analysis using electrical topology
2. Model and simulate the steady state analysis of power system network
3. Evaluate generator scheduling and economic load dispatch in power plant

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE761L.1	3	1	1		1	1					1	1	3		2
2	UEE761L.2	3	1	1	1							1	1	3		2
3	UEE761L.3	3	1	1	1							1	1	2		2

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE762L	High Voltage and Relay Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Operating characteristics of static Under/Over Voltage relay.
2. Operating characteristics of Microcontroller over voltage relay (DMT and IDMT)
3. Operating characteristics of Electro-Mechanical over current relay.
4. Operating characteristics of Electro-Mechanical Earth fault relay.
5. Operating characteristics of Microcontroller over current relay (DMT and IDMT).
6. Operating characteristics of Numerical Under / Over voltage relay (DMT and IDMT).
7. Operating characteristics of static Over Current relay (DMT).
8. Break down strength of transformer oil.
9. Experiment on field plotting using electrodes.
10. Measurement of high AC and DC voltage using Sphere-gap.
11. Flash-over characteristics of uniform and non-uniform Gaps for HVAC
    a. Plane-Plane Electrodes (Uniform field)
    b. Point-Plane Electrodes (Non-uniform field)
12. Flash-over characteristics of Uniform and non-uniform fields for Direct high voltage
    a. Plane-Plane Electrodes
    b. Point positive, Plane negative
    c. Point negative, Plane positive

Reference Books:

1. Sunil Rao "Switchgear and Protection and Power Systmes", (13th edition),Khanna Publishers,2008
2. J.B.Gupta "Switchgear and Protection", (2nd edition), Katson Publisher,2013.
3. Ravindarnath B. "Power System Protection and Switchgear", 2nd edition, New age International, 2008.

Course Outcomes:

After completion of the course the students shall be able to:

1. Test the breakdown strength of various insulating material by different methods.
2. Select the appropriate relays for different current ratings based on their characteristics.
3. Estimate the flash over characteristics for uniform and non-uniform fields for high voltage applications.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE762L.1	3	1	1		1	1					1	1	1	2	1
2	UEE762L.2	3	1	1	1							1	1	1	1	1
3	UEE762L.3	3	1	1	1							1	1	1	2	3

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE764I	Internship	02 - Credits (0 : 0 : 2)
Hours/Week :		CIE Marks : 70
Total Hours :		SEE Marks : 30

All the students have to undergo mandatory internship/training in any one of the reputed industry/ research institute. The training program has to be taken up during the vacation between 6th and 7thsemester. The duration of the training program should be for period of 4 weeks. A report on the training is to be submitted. The supervisor/ guide from industry shall allot 70 marks of the CIE and the other 30 by the internal evaluation committee. SEE evaluation will be made by a committee comprising of HoD as Chairman/his nominee, internship coordinator and a senior faculty. The SEE will be a Technical Seminar on the industrial training.

Course Outcomes

After undergoing the internship, students shall be able to:

1. Test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
2. Operate the systems/ devices independently and tabulate the experimental results in consultation with supervisor.
3. Apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
4. Analyze the real time functioning of internship organization.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE764I.1	1	1			2						2		2	1	2
2	UEE764I.2	1	1			2	1		1		2	2		3	1	2
3	UEE764I.3	1				1	1					2		2		1
4	UEE764I.4	1							1	3	3	2		2		1

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE766P	Project Work -I	04 - Credits (0 : 0 : 4)
Hours/Week : 08		CIE Marks : 50
Total Hours :80		SEE Marks : 50

Phase –I of the project is part of the final year UG Project. Students have to take up Literature survey, formulate the problem of the project, define the project objectives and prepare the project implementation schedule. A certified report and a seminar is to be presented by the students. The seminar should highlight – Broad project area, literature survey, problems definition, Project objectives, implementation schedule of the project and work carried out. Guide will allot CIE marks for 50. For SEE, student has to make a presentation of the work carried out to Project Evaluation Committee (PEC- guide, project coordinator, Hod/Nominee). PEC will allot SEE marks for 50

Course Outcomes

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

1. Apply their basic knowledge of mathematics, science and engineering to address the project topic.
2. Review the literature to identify and formulate problem for the project in contemporary issues.
3. Conduct detailed investigations of complex issues associated with project and develop the design procedures for the identified research topic and plan the schedule for the project work.
4. Prepare engineering documents and make effective presentation to communicate effectively and collaboratively.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE766P.1	3	3						3	3	3	1	3	1	2	1
2	UEE766P.2	3	3		2		2		3	3	3	2	2	1	1	
3	UEE766P.3	3	3	3	3	3	3	1	3	3	3	3	3	1	2	1
4	UEE766P.4	1	1	2					3	3	3	1	2	2	2	2

Syllabus for

B.E. VIII - Semester

for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

Syllabus for B.E VIII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE851E	Power System Operation and Control	03 - Credits (3 :0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Automatic Generation Control: Introduction, Control loops of power systems, Modeling of Automatic Voltage Regulator (AVR), performance AVR, modeling of Automatic Load Frequency Control (ALFC) of single area systems, performance of AVR, ALFC of two area systems, expression for tie-line flow and frequency deviation, tie-line bias-control, area control error and parallel operation of generators	
UNIT – II	**(10 Hours)**
Control of Voltage and Reactive Power: Introduction, generation and absorption of reactive power, relation between voltage, power and reactive power at nodes, methods of voltage control: Shunt reactor, shunt capacitor, series capacitor, tap changing transformer and booster transformer Compensating Devices-Characteristics of SVC, TCR, TSC and STATCOM. voltage stability, PV and QV curves, voltage collapse, prevention of voltage collapse	
UNIT – III	**(10 Hours)**
Unit Commitment: Statement of the problem, need and importance of unit, constraints in unit commitment, spinning reserve, Thermal Unit Constraints, Other constraints, Hydro constraints, Must Run, Fuel constraints, Unit commitment Solution methods: Priority-List methods, Dynamic Programming solution. Reliability Considerations, Patton's Security Function, Security constrained Optimal Unit Commitment, Start-up considerations, Optimal Generation Scheduling reliability in Unit commitment	
UNIT – IV	**(10 Hours)**
Power System Security: Introduction, factors affecting power system security, power system contingency analysis, detection of network problems, network sensitivity methods, calculation of network sensitivity factor, contingency ranking **Power System State Estimation:** Introduction, power system state estimation, maximum likeli-hood weighted least-square estimation, maximum likeli- hood concept with example, matrix formulations, Detection and Identification of bad measurements	
Reference Books: 1. Woodand BAJF Wallenberg, “Power Generation, Operation and Control”, 2nd Edition, John Wiley and Sons, 2007. 2. G.L. Kusic, “Computer Aided Power System Analysis”, 2nd edition, PHI,1992. 3. T.J.E Miler, “Reactive Power Control in Electric Power Systems”, John Wiely and Sons NY,1982. 4. Nagrath,I.J., and Kothari,D.P,“Modern Power System Analysis”, (4^{th} edition),TMH,2014. 5. Prabha Kundur, “Power System Stability and Control”, 9th reprint, TMH, 2009.	
Course Outcomes: After completion of the course the students will be able to, 1. Develop the model of AVR and ALFC applied to the thermal generators in-order to regulate the frequency and terminal voltage. 2. Asses the performance of compensating devices, AVR, ALFC and summarize in terms	

of stability issues.

3. Identify various compensating device and design the compensating devices applied to power systems.
4. Develop the unit commitment table and find the optimum combination of thermal generators for supplying the demand.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE851E.1	3							1		1		1	1	2	1
2	UEE851E.2	3	1						1		1		1	2	1	
3	UEE851E.3	3	3	2	2	1			1		1		1	1	3	1
4	UEE851E.4	3	3	3	3	1			1	1	1		2	1	1	

Syllabus for B.E VIII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE852E	Energy Conservation, Audit and Demand Side Management	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Energy Scenario: Introduction to Energy; Units and Conversions; GDP, GNP and Per Capita Energy Consumption; Renewable Energy Act, International Energy Agency, OECD and Kyoto Protocol (only overview) **Economic Analysis of Energy:**Economic analysis of investment, Cash Flows and CF diagrams, Economic analysis technique – Simple payback period method, Discounted cash flow method or Time adjustment technique, Net present value method, Present value index method or Profitability index method, Internal rate of return method, Accounting on average rate of return method; Interest Factors – Single Payment Compound Amount **(SPCA),** Single Payment Present Worth (**SPPW**), Uniform Series Compound Amount (**USCA**), Sinking Fund Payment (**SFP**), Uniform Series Present Worth (**USPW**), Capital Recovery (**CR).** **(**Simple Numericalproblems**).**	
UNIT – II	**(10 Hours)**
Motors: Introduction, Motor Characteristics - Speed, Slip & Efficiency, Motor Selection; Determination of energy saving, Energy saving options in oversized motors, Effect of variation of voltage on performance of motor, Effect on efficiency due to variation in load; Energy Efficient Motors, Choice of energy efficient motor, Factors Affecting Energy Efficiency, Rewinding Effects on Energy Efficiency, Standards and Star Labeling of Energy Efficient Induction Motors. **Lighting:**Introduction, Terms and definitions – Lumen, Lux, Load efficacy, Lamp circuit efficacy, Color rendering index (**CRI**); Characteristic of different types of lamps. Energy saving opportunities in lighting. Criteria for Energy Efficient Lighting. Designing Lighting system – Indoor and Outdoor. Effect of reduction in supply voltage on energy consumption. Timers and occupancy sensors.	
UNIT – III	**(10 Hours)**
Energy Management and Audit: Energy management; Developing energy use profiles; Sankey Diagram; Process flow diagrams; Material and energy balance; Energy auditing instruments. Energy audit – Need for energy audit, Scope of energy audit, Types of energy audit – Preliminary energy audit, Detailed energy audit;	
UNIT – IV	**(10 Hours)**
Energy Conservation: Introduction, Results of energy conservation, Principles of energy conservation, Energy conservation planning, Energy conservation Act,; Energy conservation in residential and commercial sectors, Energy conservation in transportation, considerations for Energy conservation in industry, Energy conservation in electricity generation, transmission and distribution, Energy conservation in agricultural sector. **Demand Side Management:** Introduction to DSM – Definition, Evolution, Benefits and Scope; Role of Energy Companies, Load Management, Application of Load Control, DSM Implementation Issues, Strategies to implement and Promote DSM, Customer acceptance of DSM, Environment & DSM, International experience with DSM, DSM in India.	

Syllabus for B.E VIII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

Reference Books:

1. Suresh Kumar Soni and Manoj Nair, Energy Conservation and Audit, Satya Prakashan, New Delhi, 2010
2. Rajiv Shankar, Energy Auditing in Electrical Utilities, Viva Books, New Delhi 2010
3. Larry C. White, Philip S. Schmidt, David R. Brown, "Industrial Energy Management Systems", Hemisphere Publishing Corp, New York.
4. Albert Thumann, "Fundamentals of Energy Engineering", Prentice Hall Inc, Englewood Cliffs, New Jersey.

Course Outcomes:

After completion of the course the students will be able to,

1. Define/list different energy resources, energy management/audits, energy efficient motors, lighting terminologies and demand side management terminologies.
2. Describe/explain energy economic methods, energy audit methods, lighting criteria and DSM techniques
3. Compute/determine numerical problems and compare & contrast on selection of energy economic techniques, lighting criterion, energy efficient motors and energy alternative from DSM techniques
4. Evaluate various methods of energy conservation & DSM in different sectors like agriculture, commercial, transpiration and domestic and design & develop methods/techniques for energy conservation, audit & management

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE852E.1	3							1		1		1	1	1	1
2	UEE852E.2	3	1						1		1		1	1	1	1
3	UEE852E.3	3	3	2	2	1			1		1		1	1	2	3
4	UEE852E.4	3	3	3	3	1			1	1	1		2	1	1	3

Syllabus for B.E VIII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE853E	Smart Grid	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10LHours)
Smart Grid Architectural Designs: Introduction, Today's Grid versus the Smart Grid, Energy Independence and Security Act of 2007: Rationale for the Smart Grid, Computational Intelligence, Power System Enhancement, Communication and Standards, Environment and Economics, General View of the Smart Grid Market Drivers, Stakeholder Roles and Function, Working Definition of the Smart Grid Based on Performance Measures, Representative Architecture, Functions of Smart Grid Components. **Smart Grid Communications and Measurement Technology:** Communication and Measurement, Monitoring, PMU, Smart Meters, and Measurements Technologies, GIS and Google Mapping Tools, Multiagent Systems (MAS) Technology, Microgrid and Smart Grid Comparison. **Performance Analysis Tools for Smart Grid Design:** Introduction to Load Flow Studies, Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods, Load, Flow State of the Art: Classical, Extended Formulations, and Algorithms, Congestion Management, Effect, Load Flow for Smart Grid Design, DSOPF Application to the Smart Grid.	
UNIT – II	**(10L Hours)**
Network Theorems: Introduction to Stability, Strengths and Weaknesses of Existing Voltage Stability Analysis Tools, Voltage Stability Assessment, Voltage Stability Assessment Techniques, Voltage Stability Indexing, Analysis Techniques for Steady-State Voltage Stability Studies, Application and Implementation Plan of Voltage Stability, Optimizing Stability Constraint through Preventive Control of Voltage Stability, Angle Stability Assessment. **Computation Tools for Smart Grid:** Introduction to Computational Tools, Decision Support Tools, Optimization Techniques, Classical Optimization Method, Heuristic Optimization, Evolutionary Computational Techniques, Pareto Method.	
UNIT – III	**(10L Hours)**
Pathway for Designing Smart Grid:: Introduction to Smart Grid Pathway Design, Barriers and Solutions to Smart Grid Development, Solution Pathways for Designing Smart Grid Using Advanced Optimization and Control Techniques for Selection Functions, General Level Automation, Bulk Power Systems Automation of the Smart Grid at Transmission Level, Distribution System, Automation Requirement of the Power Grid, End User/Appliance Level of the Smart Grid, Applications for Adaptive Control and Optimization. **Renewable Energy and Storage:** Renewable Energy Resources, Sustainable Energy Options for the Smart Grid, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, PHEV Technology, Environmental Implications, Storage Technologies, Tax Credits.	
UNIT – IV	**(10L Hours)**
Interoperability, Standards, and Cyber Security: Introduction, Interoperability, Standards, Smart Grid Cyber Security, Cyber Security and Possible Operation for Improving Methodology for Other Users.	

Syllabus for B.E VIII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

Research, Education, and Training for the Smart Grid: Introduction, Research Areas for Smart Grid Development, Research Activities in the Smart Grid, Multidisciplinary Research Activities, Smart Grid Education, Training and Professional Development.

Case Studies and Test beds for the Smart Grid:

Introduction, Demonstration Projects, Advanced Metering, Microgrid with Renewable Energy, Power System Unit Commitment (UC) Problem, ADP for Optimal Network Reconfiguration in Distribution Automation, Case Study of RER Integration, Testbeds and Benchmark Systems, Challenges of Smart Transmission, Benefits of Smart Transmission.

Reference Books:

1. James Momoh., "Smart Grid, Fundamentals of Design and Analysis", (1st Edition), Wiley, 2012.
2. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
3. Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify the smart measuring instruments for two way communication of each components in grid.
2. Apply the suitable load flow analysis technique for exiting distribution system.
3. Evaluate the optimal value for distribution system including renewable energy and storage systems.
4. Formulate the existing distribution for the conversion to smartgrid using standards as for the case studies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE853E.1	3	1		1	3	1		1		2		1	1	3	1
2	UEE853E.2	3	2	1	1				1		1		1	1	2	3
3	UEE853E.3	3	3	2	2	1			1		1		1	1	2	1
4	UEE853E.4	3	2	3	2	1			1	1	1	1	2	1	3	2

Syllabus for B.E VIII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE860S	Technical Seminar	1 - Credits (0 : 0 : 2)
Hours/Week : 2		CIE Marks : 50
Total Hours :26		SEE Marks : 50

	(0L-0T-2P Hours)

Technical seminar is an important integral part of BE (E&EE) program. Seminaris outcome of 4 years of engineering program and is expected to test the learning skills of a student. It reflects quality of teaching-learning process in the department. Seminar work will remain as an epitome of your entire professional career.

Seminar should be based on thrust areas in state of arttechnologies. Students should identify the topic of seminar and finalize in consultation with coordinator. Students should understand the topic and compile the report in standard format and present in front of Panel of Examiners respective Programme.

Course Outcomes

At the end of this course,students will be able to:

1. Enhance the knowledge on engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Data analysis and interpretation of contemporary tools & resources to analyze / validate the solutions of engineering problems
3. Communicate effectively to meet the technical seminar requirements and present the work to technical audience.
4. Prepare quality technical report with detailed analysis and representation of selected topic.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE860S.1	3	3						3	3	3	1	3	1	1	1
2	UEE860S.2	3	3		2		2		3	3	3	2	2	1	1	2
3	UEE860S.3	3	3	3	3	3	3	1	3	3	3	3	3	2	1	1
4	UEE860S.4	1	1	2					3	3	3	1	2	2	2	3

Syllabus for B.E VIII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UEE865P	Project Work -II	12 - Credits (0 : 0 : 24)
Hours/Week : 24		CIE Marks : 50
Total Hours :240		SEE Marks : 50

	(0L-0T-12P Hours)
Phase –II of the project is part of the final year UG Project. Students have to take up Design methodology and planning of project work, Description of Concepts and Technical Details, Incorporation of Suggestions made by examiners during CIE and prepare the project implementation schedule. A certified report with project demonstration and a seminar is to be presented by the students. The seminar should highlight – Broad project area of their project work carried out. CIE of 50 marks will be allotted by the examiners as per the rubrics. For SEE, student has to make a presentation of the work carried out to Project Evaluation Committee (PEC- Project coordinator, Internal Examiner, External Examiner). PEC will allot SEE marks for 50.	

Course Outcomes

At the end of this course, students will be able to:

1. Identify, formulate & analyze the engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Design & implement proposed solutions for complex engineering problems to meet specified objectives by analyzing / validating the design / solutions of engineering problems using contemporary tools & resources.
3. Prepare engineering documents and make effective presentation to communicate effectively and collaboratively with detailed analysis and interpretation of results to yield valid conclusions.
4. Demonstrate social, ethical cultural & engineering professional responsibilities.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE865P.1	3	3						3	3	3	1	3	1	2	2
2	UEE865P.2	3	3		2		2		3	3	3	2	2	2	2	2
3	UEE865P.3	3	3	3	3	3	3	1	3	3	3	3	3	2	2	2
4	UEE865P.4	1	1	2					3	3	3	1	2	2	2	2