Computer Applications to Power System	
Subject Code: UEE751C	**Credits: 03**
Contact Hours: 03 (3L - 0T - 0P)	**Assessment: CIE 50 and SEE 50**

Unit-I

01 Network Topology: **04 Hours**

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.

02 Primitive Network: **02 Hours**

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

03 Network Matrices: **04 Hours**

Introduction, Derivation of Ybus = [A][y][A]T, Formation of Ybus by inspection method. Modeling: Transmission lines, Transformers, Loads and generator internal impedance. Examples.

Unit-II

04 Load Flow Studies: **01 Hours**

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

06 Gauss-Seidal Method: **04 Hours**

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

07 Newton – Raphson Method: **05 Hours**

Introduction, Algorithm for NR method in polar coordinates and rectangular coordinates. Fast Decoupled Load Flow and examples.

Unit-III

08 Economic Operations of Power System: **09 Hours**

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

09 Transient Stability Studies: **05 Hours**

Introduction, swing equation, machine equations. Power system equations.

10 Modeling : **05 Hours**

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.

References:

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. Uma Rao, “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.
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.

Course outcomes:

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

1. State the concepts of power system analysis
2. Illustrate the development of mathematical skills and writing algorithm for various problems involved in power system
3. Apply optimization techniques in scheduling of thermal generators
4. Analyse the different types of algorithm in load flow analysis
5. Compare and contrast types of excitation and load Models
6. Construct the problem formulation in economic dispatch and in transmission losses.

HIGH VOLTAGE, SWITCHGEAR AND PROTECTION	
Subject Code: UEE752C	**Credits: 03**
Contact Hours: 03 (3L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Unit-I

Generation of HVAC 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

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

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

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.

References

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:

At the end of the course:

- Students should be able to define HV voltage generation, measurement and their protection schemes with different circuit configuration.
- Students should be able to illustrate high voltage HV generation, breakdown phenomena in insulating materials and various protective methods.
- Students should be able to solve numerical problems on HV and protection circuit by considering given system parameters.
- Students should be able to analyze the properties/characteristics of HV equipments and protection devices.
- Students should be able to compare & contrast multiple methods to implement protective schemes against different faults in electrical systems.
- Students should be able to develop the expression of fault current in HVAC & DC protective devices.

UHS753C : Intellectual Property Rights
(Credit Structure: 3-0-0)

Faculty In-Charge: Dr. B. G. Hokarani

About the course:

This is a substantive course on Intellectual Property. The course shall give a brief overview of the IP landscape in India. It shall also dwell into the role of IP in the modern intangible economy. The course curriculum covers a wide but definitive areas of study that involve fundamentals of IP and international obligations, economics of IP, justifications, nature of subject-matter, criteria for protection, term, rights, assignment and licensing, defences, limitations, exceptions, public interest considerations, remedies and enforcements. The course will also contain topics that involve the interface of IP with areas such as human rights and competition law and policy.

Course Learning Objectives:

1. **To recognize the importance of IP and to educate the students on basic concepts of Intellectual Property Rights.**
2. **To identify the significance of practice and procedure of Patents.**
3. **To make the students to understand the statutory provisions of different forms of IPRs in simple forms.**
4. **To learn the procedure of obtaining Patents, Copyrights, Trade Marks &Industrial Design.**
5. **To enable the students to keep their IP rights alive.**

The Syllabus

UNIT-I

Introduction to IPRS: **L- 10 Hours**

Importance of human creativity and its recognition and protection. Concepts of Property and Rights. History of IPRs. Different forms of IPRs. Role of IPRs in R and D.

P**atents** :

Meaning of Patent, Object and Value of Patent law. Advantages of Patent to the invertors. Criteria for Patentability. Software and Business Methods Patents. Govt.use of inventions, infringement of Patent and remedies for infringement. Compulsory license.

UNIT- II

Patent Drafting: L-**10 Hours**

Scope of invention, definitions, types of specification, descriptions, drawing, claim drafting and improvement.

Filing Requirement of patent:

Work flow chart in obtaining Patents, Forms to be submitted, assignment requirements, filing mechanism through Individual patent office and PCT route. Importance of PTC, claiming priority from either route. Request for re -examination and revocation. Term of Patent and Patent renewal.

Searching of Prior art:

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

UNIT- III

Trade-Marks: L - **10 Hours**

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 disputes and Well-Known Marks, Distinction between Trade names &Trade marks.

Industrial Design:

Definition of a design. Concept of Novelty and Originality; Inclusive and Exclusive Designs; Functions of Designs. Industrial Design registration in India. Duplicity of registration, Infringement of Design and remedies for infringement.

UNIT- IV

Copyright: **L- 10 Hours**

Introduction. Nature of Copyright, Subject-matter, protection requirement in Copyright Law, Neighboring/Related Rights. Economic and Moral Rights of Authors. Copyright in the Digital Context. An overview of Copyright protection in India. Transfer of Copyright. Infringement of Copyright, Copyright- fair dealing and remedies. Comparison with Patent and Copyright.

Emerging Copyright works in which copy subsists: Snippet tax and Online Streaming Platforms, Sound related technology, Blockchain technology

Confidential Information and Trade Secrets:

Introduction, Conditions of protection. Essentials for an action for breach of confidence, distinction between Confidential Information and General Information. Data protection laws in India: Cyber-Crimes under the IT Act.2000 **Total: L- 40 Hours**

TextBooks:

1. P.Naryan, "Intellectual Property Law", 3rd Ed,Easern Law House, 2007.
2. Dr. S.R.Myneni, "Law of Intellectual Property", 9th Ed, Asia law House, 2019.

Reference Books:

1.Dr.G.BReddy,"Intellectual Property Rights and Law", Gogia Law Agency.Hydrabad,Reprint edition2020.
2.N.R. Subbaram.S.Viswanathan,"Hand book Indian Patent Law and, Practice"Printers and publishers Pvt,Ltd,2008.
3. Cornish,"Intellectual Property Rights", Universal publications.
4. Dr.B.L.Wadehra,"Law Relating to Intellectual Property" 5thedition,Universal Law publishing Co, Dehli
5. Lionel Bently & Brad Sherman, Intellectual Property Law OUP UK; 4th edition (3 November 2014)

Course Outcomes(COs):

Students will:

CO1:	Distinguish and explain various forms of IPRs.
CO2:	Identify criteria to fit one's own intellectual work in particular form of IPRs.
CO3:	Apply statutory provisions to protect particular form of IPRs.
CO4:	Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Design etc.
CO5:	Identify procedure to protect different forms of IPRs national and international level.
CO6:	Develop skill of making search using modern tools and technics.

Solar Photovoltaic System Design

Syllabus

Subject Code	**UEE754E**	Session	**Sep 2020 – Jan 2021**	SEE Marks	**100**
Credits	**03**	Staff	**Dr. Suresh H. Jangamshetti**	Exam Duration	**03 Hrs**

Unit-I

Chapter-01: Solar Energy – Introduction and its scenario of India and global; Solar Radiation – solar radiation spectrum, diffuse & beam radiation and solar radiation measurement. **[03 Hrs]**

Chapter-02: Solar Cells – I-V & P-V characteristics; Technologies; Parameters; Factors affecting electricity generated; series, parallel and series & parallel connections; Numerical problems. **[07 Hrs]**

Unit-II

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. **[05 Hrs]**

Chapter-04: Balance of System (BoS) - Batteries; Charge Controllers; MPPT; Inverters. (BoS to cover functions, working, types, features, typical specifications and cost). Numerical problems. **[05 Hrs]**

Unit-III

Chapter-07: Wires – Introduction, basics of current conduction, types of wires, measurement of wire dimensions, wire sizing; junction box; **[03 Hrs]**

Chapter-08: Installation, troubleshooting of stand-alone and grid connected solar PV power systems; Safety of SPV power plants; Solar PV plant installation check list – Electrical testing of PV array, inverter; islanding protection; commissioning and system functioning. Field visits within campus to study installations.**[07 Hrs]**

Unit-IV

Chapter-05: SPV system design and integration – Types of SPV systems; Design Methodology for Stand-alone SPV systems. **[04 Hrs]**

Chapter-06: Grid connected Solar PV Power Systems (GCSPVPS) – Introduction, Configurations & Components of GCSPVPS, GCSPVPS Design for small applications and for power plants. **[06 Hrs]**

References

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.

Solar Photovoltaic System Design

Subject Code	**UEE754E**	Session	**Sep 2020 – Jan 2021**	SEE Marks	**100**
Credits	**04**	Staff	**Dr. Suresh H. Jangamshetti**	Exam Duration	**03 Hrs**

Pre-requisites

1. Knowledge about conductor and semiconductor electronics.
2. Knowledge about basic electrical and electronics engineering.
3. Computational techniques and design concepts.
4. Knowledge about basics of power generation, transmission and distribution.
5. Knowledge about renewable energy sources.

Course Outcomes

1. **CO1-R:** Students should be able to define various parameters & features of solar cell, module, panel, array and SPV systems
2. **CO2-U:** Students should be able to describe working of SPV systems and their components
3. **CO3-A:** Students should be able to compute performance of SPV systems for different loads and applications based on numerical problems
4. **CO4-AN:** Students should be able to compare and analyze different SPV systems for specific applications based on performance
5. **CO5-E:** Students **should be** able to operate and test working of SPV systems and their components
6. **CO6-C:** Students should be able to design & discuss a solar PV system – stand alone or grid connected – based on typical loads.

Blooms Taxonomy: Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21st century

Level-1 (R): Knowledge or Remembering: * observation and recall of information; * knowledge of dates, events, places; * knowledge of major ideas; * mastery of subject matter; * Key words: list, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc. **Eg.** Write a list of vegetables

Level-2 (U): Comprehension or Understanding: * understanding information; * grasp meaning; * translate knowledge into new context; * interpret facts, compare, contrast; * order, group, infer causes; * predict consequences; * Key words: summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend, etc. **Eg.** Retell the story of the "Three Little Pigs" in your own words.

Level-3 (A): Application or Applying: * use information; * use methods, concepts, theories in new situations; * solve problems using required skills or knowledge; * Key words: apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover, etc. **Eg.** Make a model of a swing set with paper and explain how it works

Level-4 (AN): Analysis or Analyzing: * seeing patterns; * organization of parts; * recognition of hidden meanings; * identification of components; * **Key** words: analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, infer, etc. **Eg.** Make a family tree showing relationships

Level-5: Synthesis or Creating: * use old ideas to create new ones; * generalize from given facts; * relate knowledge from several areas; * predict, draw conclusions; * Key words: combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if?, compose, formulate, prepare, generalize, rewrite, etc. **Eg.** Design a magazine cover that would appeal to kids in your class

Level-6: Evaluation or Evaluating: * compare and discriminate between ideas; * assess value of theories, presentations; * make choices based on reasoned argument; * verify value of evidence; * recognize subjectivity; * Key words: assess, decide, rank, grade, test, measure, recommend, convince, select, judge, discriminate, support, conclude, summarize, etc. **Eg.** Make a booklet about 5 rules you see as important. Convince others

UEE755N: Energy Conservation in Industrial Systems

Subject Code: UEE755N	**SEE Marks: 100**
Credits: 03	**Exam Duration: 03 Hours**

Prelude: Electricity is used in different sectors, like industry, agriculture, commercial, domestic, transpiration, etc. Several devices that consume electricity are intensely employed in these sectors. Users or operators should know the energy consumed by such devices to save energy and thereby the cost of energy. The subject provides theoretical information of energy conservation opportunities in Industrial as well as other sectors.

Prerequisites: The students should have undergone the following courses.

1. UEE125C/UEE225C Basic Electrical Engineering
2. UPH122C/UPH222C Engineering Physics
3. UME124C/UME224C Elements of Mechanical Engineering
4. UBT133M/UBT233M Environmental Studies

Unit-I

Energy Management and Energy Planning : Definition & significance, Energy strategy, Energy policy and Energy planning, Two sides of energy management, Sectors of supply side energy management, Objectives of energy management, Hierarchical levels of supply side energy management, Energy and economy, Essential Imperatives and steps in supply side energy planning, Energy planning flow for supply side, Essential data for supply side energy planning, Per capita energy consumption, Essential Imperatives and steps in user side energy planning, Seven principles of energy management. [07hrs]

Concept and significance of energy conservation: Introduction, Listing of energy conservation opportunities (ECOs), Electrical ECOs, Thermodynamic ECOs, ECOs in Chemical process industry, ECOs in medium and small scale industry, ECOs in residential buildings, shopping complexes and in university campus, Human and animal bio muscle energy, Waste Management , Recycling of discarded materials and energy recycling, Waste Recycling Management. [03 hrs]

Unit-II

Heating and Power Ratings of Industrial Drive Motors: Load diagram, overload capacity, Insulating materials, Heating and cooling of motors, Service conditions of motor drives: Continuous, Intermittent and short time, Selection of motor power capacity : Continuous duty constant load motor application, Continuous duty variable load motor application, intermittent duty motor application and short time duty motor application. **[10 hrs]**

Unit-III

Industrial Heating: Methods of electrical heating: Resistance, Induction; Resistance heating: Heating methods, Resistance furnaces, Heating alloys, Causes for failure of heating elements, temperature control of Resistance furnaces, Arc furnaces, Basic mechanical requirements, Indirect arc furnace; Induction heating: Low frequency induction heating, Skin effect, Dielectric heating, Dipole formation, Generation of dielectric heat, Some applications of dielectric heating, Dielectric heating principle, Design of heating element, Efficiency and losses, Radiant heating, Depth of heat penetration. **[10 hrs]**

Unit-IV
Industrial Lighting: Basic principles of light control, Types of lighting schemes, Design of lighting schemes, Methods of lighting calculation, Factors controlling factory lighting, street lighting and flood lighting schemes, Factors affecting energy efficient lighting schemes. **[10 hrs]**

Course Outcomes	
	After completion of the course, 1. Students shall be able to list and define various parameters and features of Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting. 2. Students shall be able to explain various concepts and theory related to Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting. 3. Students shall be able to relate/articulate the concepts and theories related to Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting. 4. Students shall be able to compare and contrast the features of Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting. 5. Students shall be able to evaluate/calculate various parameters related to Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting. 6. Students shall be able to discuss/choose/test issues relating to Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting.
Text Books	
1.	S.Rao and B.B. Parulekar, *Energy technology*, 3rd edition, khanna publishers, 6th reprint, 2009.
2.	M.V. Deshpande, *Elements of electrical power station design*, 3rd edition, wheeler publishing, 2010.
3.	J.B. Gupta, *Generation, transmission and utilization of electric power*, Kataria publication, New Delhi 2015.
Reference Books	
1.	Dr. Lal Jayamaha, "Energy-Efficient Industrial Systems: Evaluation and Implementation", McGraw-Hill Education, 2016.
2.	Petrecca, Giovanni, "Industrial Energy Management: Principles And Applications", Springer US, 2018.
3.	Durmuş KAYA, Fatma Canka Kilic' Hasan Hüseyin ÖZTÜRK, "Energy Management and Energy Efficiency in Industry", Springer International Publishing, 2021

POWER SYSTEM SIMULATION LAB

Subject Code : UEE761L **SEE Marks : 100**

Credits : 1 **Exam Duration: 03 Hours**

1. ABCD parameters for short and medium network of transmission lines.
   - Verification of Symmetry and Reciprocity of the network.
   - 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. Y Bus 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/c s, 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 p q 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.

Course outcomes:

Students should be able to

1. Formulate and determine the electrical network parameters 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.

Note:

All experiments must be simulated using MATLAB and MiPower Software.

LABORATORY ASSESSMENTS FOR SEE:

1) Each Laboratory is evaluated for 100 marks (50CIE and 50SEE)
2) Allocation of 50 marks for CIE
   - Performance and journal write-up: Marks for each experiment =30 marks/No. of proposed experiments.
   - One Practical test, for 20 marks, (5 write up, 10 conduction, calculation, Results etc., 5 viva-voce).
3) Allocation of 50 marks for SEE.25% write up, 50% conduction, calculation, results etc., 25% viva-voce.

HIGH VOLTAGE AND RELAY LAB

Subject Code: UEE762L **Credits: 01**

Contact Hours: 02 (0L-0T-2P) **Assessment: CIE 50 and SEE 50**

Course Outcomes:

Students should be able

- To know the concept of relays and HV systems.
- To understand the operation and IDMT and DMT characteristic of relay.
- To understand concept of various types of relay and their characteristics.
- To study the application of different types of relays in the power system.
- To study the flash over characteristics of HVAC.
- To study breakdown strength of transformer (insulating) oil.

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

LABORATORY ASSESSMENTS FOR SEE:

1) Each Laboratory is evaluated for 100 marks (50CIE and 50SEE)
2) Allocation of 50 marks for CIE
   - Performance and journal write-up: Marks for each experiment =30 marks/No. of proposed experiments.
   - One Practical test, for 20 marks, (5 write up, 10 conduction, calculation, Results etc., 5 viva-voce).
3) Allocation of 50 marks for SEE. 25% write up, 50% conduction, calculation, results etc., 25% viva-voce.

Internship

Subject Code	**:UEE764I**	**CIE +SEE Marks**	**:50 + 50**
Credits	**:02**	**Exam Duration**	**:03 Hrs**

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 7th semester. The duration of the training program should be for period of 2 weeks. A report on the training is to be submitted. The supervisor/ guide from industry shall allot 50 marks of the CIE and the other 50% by the internal supervisor/guide. SEE evaluation will be made by a committee comprising of HoD as Chairman, UG coordinator and internal supervisor/guide. The SEE will be a Technical Seminar on the industrial training. Marks awarded shall be based on the evaluation of Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

PROJECT PHASE -I

Subject Code :UEE765P **CIE + SEE Marks :50 + 50**

Credits :05 **Exam Duration :03 Hrs**

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.

Rubrics for Project Phase-I (VII Semester)

Rubrics	Phase	Period (Duration)	Rubric #	Marks	Evaluation by
CIE	Evaluation-I	Before one month from the start of 7th semester of BE Program	R1	15	Committee consisting of HOD/Nominee + Project Coordinator + Guide(s)
	Evaluation-II	Before 15 days from the last working day of 7th semester of BE Program	R2	15	
	Evaluation by guide	In the last week of working days	R3	20	Guide(s)
SEE	Semester End Examination	During SEE of 7th semester of BE Program	R4	50	Committee consisting of HOD/Nominee + Project Coordinator + External Examiner