
# SHIVAJI UNIVERSITY KOLHAPUR

## REVISED STRUCTURE AND SYLLABUS

FINAL YEAR (B. Tech) CBCS

# ELECTRICAL ENGINEERING

To be introduced from the academic year 2021-

22 (i.e. from June 2021) onwards

## SHIVAJI UNIVERSITY, KOLHAPUR

## CBCS STRUCTURE FOR FINAL YEAR B.TECH. ELECTRICAL ENGINEERING

## (Semester VII and Semester VIII)

**SEMESTER – VII (Duration – 6 Months)**

| Sr. No. | Course (Subject Title) | TEACHING SCHEME | | | | | | | | | EXAMINATION SCHEME | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | THEORY | | | TUTORIAL | | | PRACTICAL | | | THEORY | | | | | PRACTICAL | | | |
| | | | | | | | | | | | | | | | | TW | | POE | |
| | | Credits | No. of lectures | Hours | Credits | Conduction Hours | Hours | Credits | Conduction Hours | Hours | Hours | Mode | Marks | Total Marks | Min | Max | Min | Max | Min |
| 1 | PCC-EE401/ FACTS | 03 | 03 | 03 | -- | -- | -- | -- | -- | -- | | CIE | 30 | 100 | 40 | -- | -- | -- | -- |
| | | | | | | | | | | | | ESE | 70 | | | | | | |
| 2 | OCE-EE401/ OE-I | 03 | 03 | 03 | 01 | 01 | 01 | -- | -- | -- | | CIE | 30 | 100 | 40 | 25 | 10 | -- | -- |
| | | | | | | | | | | | | ESE | 70 | | | | | | |
| 3 | PCC-EE402/PQH | 03 | 03 | 03 | 01 | 01 | 01 | -- | -- | -- | | CIE | 30 | 100 | 40 | 25 | 10 | -- | -- |
| | | | | | | | | | | | | ESE | 70 | | | | | | |
| 4 | PCC-EE403/CMPS | 03 | 03 | 03 | -- | -- | -- | 01 | -- | 02 | | CIE | 30 | 100 | 40 | 25 | 10 | 50 | 20 |
| | | | | | | | | | | | | ESE | 70 | | | | | | |
| 5 | PCC-EE404/ SAP | 03 | 03 | 03 | -- | -- | -- | 01 | -- | 02 | | CIE | 30 | 100 | 40 | 25 | 10 | 50 | 20 |
| | | | | | | | | | | | | ESE | 70 | | | | | | |
| 6 | PCC-EE405/ ITP | 01 | 01 | 01 | 01 | 01 | 01 | | | | | CIE | 30 | 100 | 40 | 50 | 20 | -- | -- |
| | | | | | | | | | | | | ESE | 70 | | | | | | |
| 7 | PCC-EE406/PP-I | -- | -- | -- | -- | -- | -- | 04 | 04 | 04 | - | - | - | - | - | 50 | 20 | 50 | 20 |
| **TOTAL** | | **16** | | | **03** | | | **06** | | | | | | **600** | | **200** | | **150** | |
| **TOTAL CREDIT** | | | | | | | | | | **25** | | | **TOTAL MARKS** | | | | | | **950** |

## SHIVAJI UNIVERSITY, KOLHAPUR

## CBCS STRUCTURE FOR FINAL YEAR B.TECH. ELECTRICAL ENGINEERING

| SEMESTER – VIII (Duration – 6 Months) | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sr. | Course (SubjectTitle) | TEACHING SCHEME | | | | | | | | | EXAMINATION SCHEME | | | | | | | | | |
| | | THEORY | | | TUTORIAL | | | PRACTICAL | | | THEORY | | | | | PRACTICAL | | | | |
| | | | | | | | | | | | | | | | | TW | | POE | | |
| | | Credits | No. of lectures | Hours | Credits | Conduction Hours | Hours | Credits | Conduction Hours | Hours | Hours | Mode | Marks | Total Marks | Min | Max | Min | Max | Min | |
| 1 | PCC-EE407/ MED | 03 | 03 | 03 | -- | -- | -- | -- | -- | -- | | CIE | 30 | 100 | 40 | 50 | 20 | -- | -- | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | |
| 2 | OCE-EE402/ OE-II | 03 | 03 | 03 | 01 | 01 | 01 | -- | -- | -- | | CIE | 30 | 100 | 40 | 50 | 20 | -- | -- | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | |
| 3 | PCC-EE408/HVDC | 03 | 03 | 03 | -- | -- | -- | 01 | 02 | 02 | | CIE | 30 | 100 | 40 | 25 | 10 | 50 | 20 | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | |
| 4 | PCC-EE409/EHVAC | 03 | 03 | 03 | 01 | 01 | 01 | -- | -- | -- | | CIE | 30 | 100 | 40 | -- | -- | -- | -- | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | |
| 5 | PCC-EE410/ EGUT | 03 | 03 | 03 | 01 | 01 | 01 | -- | -- | -- | | CIE | 30 | 100 | 40 | 25 | 10 | -- | -- | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | |
| 6 | PCC-EE411/ Seminar | -- | -- | -- | 02 | 02 | 02 | -- | -- | -- | | CIE | 30 | -- | -- | 50 | 20 | -- | -- | |
| | | | | | | | | | | | | ESE | 70 | | | | | | | |
| 7 | PCC-EE412/PP-II | -- | -- | -- | | -- | -- | 04 | 04 | 04 | - | - | - | - | - | 100 | 40 | 100 | 40 | |
| **TOTAL** | | **15** | | | **05** | | | **05** | | | | | | **500** | | **300** | | **150** | | |
| **TOTAL CREDIT** | | | | | | | | | | **25** | | | **TOTAL MARKS** | | | | | | | **950** |

CIE- Continuous Internal Evaluation ESE – End Semester Examination

| | |
|---|---|
| • Candidate contact hours per week : 30 Hours(Minimum) | • Total Marks for T.E. Sem V & VI:**1725** |
| • Theory and Practical Lectures : 60 Minutes Each | • Total Credits for T.E. Sem V & VI:**50** |
| • In theory examination there will be a passing based on separate head of passing for examination of CIEand ESE. | |
| • There shall be separate passing for theory and practical (termwork)courses. | |

Note:

1. **PCC-EE:** Professional Core course –Electrical Engineeringare compulsory.
2. **OCE-EE:** Open Course Elective for the students from otherdiscipline

**Semester VII**

| Sr. No | Code No. | Subject | Credits |
|---|---|---|---|
| 1. | PCC-EE401 | FACTS | 03 |
| 2. | OCE-EE401 | Open Elective-I | 04 |
| 3. | PCC-EE402 | Power Quality and Harmonics | 04 |
| 4. | PCC-EE403 | Computer Methods in Power Systems | 04 |
| 5. | PCC-EE404 | Advanced Switchgear and Protection | 04 |
| 6. | PCC-EE405 | Industrial Training & Presentation | 02 |
| 7. | PCC-EE406 | Project Phase-I | 04 |
| | | **Total** | 25 |

**Semester VIII**

| Sr. No | Code No. | Subject | Credits |
|---|---|---|---|
| 1. | PCC-EE407 | Management & Entrepreneurship Development | 03 |
| 2. | OCE-EE402 | Elective II | 04 |
| 3. | PCC-EE408 | HVDC Systems | 04 |
| 4. | PCC-EE409 | EHVAC | 04 |
| 5. | PCC-EE410 | Electrical Generation, Utilization & Traction | 04 |
| 6. | PCC-EE411 | Seminar | 02 |
| 7. | PCC-EE412 | Project Phase-II | 04 |
| | | **Total** | 25 |

| **Open Elective – I ( Any One)** | |
|---|---|
| 1 | Smart Grid |
| 2 | Electric Vehicle |
| 3 | Integrated Resource planning |
| 4 | Restructured Power System |

| **Open Elective – II ( Any One)** | |
|---|---|
| 1 | PLC and SCADA Application |
| 2 | VLSI Design & Embedded System |
| 3 | Electrical Maintenance and Electrical Energy Audit |
| 4 | Advanced Microcontrollers & Its applications |

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

# FLEXIBLE AC TRANSMISSION SYSTEM

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE-401 **FACTS** | 03 | -- | -- | 03 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | - | - | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objectives:**

The objectives of the course are to make the students,

1. To know the importance of compensation in transmission lines and the concepts of FACTS devices.
2. To illustrate the design, modeling and applications of SVC
3. To learn the operation, modes, modeling and applications of TCSC.
4. To study the principle, characteristics, modeling and applications of STATCOM and SSSC.
5. To summarize about the importance in coordination of FACTS controllers.

**Course Outcomes:**

After completion of this course students will be able to:

1) understand the interconnection system, Power flow systems, loading effects and important of FACTS and basics of types of FACTS controller
2) understand the Statics shunt compensators
3) understand the Static Synchronous compensator STATCOM
4) understand the Static Series compensators
5) understand the Static voltage and phase angle regulation TCVR and TCPAR
6) understand the combined compensator: UPFC and IPFC.

**SECTION-I**

**Unit No I:** **(7 Hrs)**

**Introduction to FACTS:** Need of transmission interconnection, power flow in ac system, loading limit, importance of FACTS, transmission network, introduction to basic types of FACTS controller, comparison of HVDC and FACTS.

**Unit No II:** **(8 Hrs)**

**Statics shunt compensators, SVC:** Objectives of the shunt Compensation, Static VAR compensators (TSC, TCR, FC-TCR, TSC, TCR), switching transient in TSC, functional control Scheme for FC-TCR and TSC-TCR.

**Unit No III:** **(10 Hrs)**

**Static Synchronous compensator STATCOM:** basic principal and control scheme for STATCOM, hybrid VAR generation, comparison between STATCOM and SVC.

## Section –II

**Unit No IV:** **(8 Hrs)**

**Static Series compensators:** objectives of the Series compensation ,variable impedance type series compensator GCSC and TSSC, operating control schemes for GCSC and TSSC , SSR (sub synchronous resonance) , switching converter type series compensators SSSC , internal schemes for SSSC, external control schemes for series reactive compensators , characteristics of series compensator .

**Unit No V:** **(8 Hrs)**

**Static voltage and phase angle regulation TCVR and TCPAR**: Objective of voltage and phase angle regulators, thyristors controlled voltage and phase angle Regulator, switching converter based voltage and phase angle regulators.

**Unit No VI:** **(7 Hrs)**

**Combined compensator: UPFC and IPFC.** UPFC – basic principle and reactive Power control scheme for UPFC, comparison of UPFC to Series compensator and phase angle regulations. IPFC-basic operating principle, control structure and its applications.

**Text Books/Reference Books:**

1. Understanding FACTS - Concept and Technology of flexible AC Transmission systems. N.G. Hingorani& L. Gywgyi IEE Press.
2. Static Reactive power compensation : T.J.E. Miller, John Wiley and sons New
3. FACTS : Yong Huasoug, Allan Johns
4. Flexible AC Transmission System: Modeling and Control -2nd Edition Springer by Xiao-ping Zhang.
5. Facts Controller In Power Transmission And Distribution by K.R.Padiyar Edited by New Age International Publishers
6. Flexible AC Transmission System By Sushmita Panda

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

## POWER QUALITY AND HARMONICS

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE-402 **PQH** | 03 | 01 | -- | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | 25 | 10 | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Objectives:**

1) To understand the necessity of power quality and its importance in the power system.
2) Effects of harmonics, sag/swell and interruptions in the power system and its elimination

**Course Outcomes:**

1) After completion of this course students will be able to:
2) To study various methods of power quality monitoring.
3) To Study the production of voltages sags.
4) To Study the interruptions types and its influence in various components
5) To Study the Effects of harmonics on various equipment's
6) Understand power quality monitoring and classification techniques

## Section –I

**Unit I** **08 hours**

**Introduction to Power Quality:** Desired feature of Electrical Power Supply, Power Quality related issues in distribution systems, loads and theirs characteristics, electromagnetic phenomena,voltage sags/swells, waveform distortions, unbalance, flicker, notches, unbalance and load balancing.

**Unit II** **08 hours**

**Fundamental of Harmonics:** causes for generation of harmonics, effect of harmonic on systems, types and characterization of Harmonics, THDs, influence on power factor, interference with communication network and harmonic indices.

**Unit III** **09 hours**

**Harmonics Suppression Filters:** Shunt Passive Filters, Design Considerations and case studies, Voltage / Current Source active filters, types: shunt, series and Hybrid Filter, their characteristics and comparison.

## Section –II

**UNIT IV** **08 hours**

**Mitigation of Voltage Sag and interruptions:** End user issues, UPS systems, Ferro resonant Transformers, Super Conducting Storage Devices, Dynamic Voltage Restorer and Application of D-STATCOM.

**UNIT V** **07 hours**

**Harmonic Measurement:** Instrumentation techniques, Analog and Digital Methods, presentation of harmonic data and Interruption, case studies, Harmonic Standard and future trends.

**UNIT VI** **08 hours**

**Power Quality Monitoring:** Power Quality Analyzer, Acceptability of Power Supply- tolerance envelops of CBEMA and ITIC, reliability indices, typical wiring and grounding problems, grounding practices and use of signal reference grid.

**General Instructions:**

1. The number of students per batch should be as per the university pattern for practical batches.
2. Minimum number of assignments should be 8 covering all topics.

**List of Experiments:**

Minimum five experiments based on Hardware and five experiments based on Simulations and at least three experiments based on Interfacing.

**Textbook**


1) Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.WayneBeaty, 'Electrical Power Systems Quality' McGraw Hill, 2003.
2) Dr. Mahesh Kumar, IIT Chennai, Power Quality in Distribution Systems.
3) A. Ghosh and G. Ledwich, Power Quality Enhancement using Custom Power Devices. Boston, MA: Kluwer, 2002.

**References:**


1) J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', (New York: Wiley, 1999).
2) G.T. Heydt, 'Electric Power Quality', 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications,1994).
3) George J. Wakileh, "Power System Harmonics - Fundamentals, Analysis & filter Design" Springer.
4) M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', (New York: IEEE Press, 1999).
5) Angelo Baggini, Handbook on Power Quality, John Wiley & Sons, New Jersey,USA, 2008.

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

## Computer Methods in Power System

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE-403 CMPS | 03 | -- | 02 | 05 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | 25 | 10 | 50 | 20 |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

Objectives**:**

1. To learn calculation of Impedance and admittance matrix
2. To learn load flow studies
3. To learn fault analysis

Course Outcomes**:**

After completion of this course students will be able to:

1) Calculate impedance and admittance matrices
2) Study load flow studies
3) Find fault current using 2 component theory

### SECTION-I

***Unit 1:-Network Formulation and Graph Theory*** **7Hrs**

Introduction, Elementary graph theory – oriented graph, tree, co-tree, basic cut-sets, basic loops; Incidence matrices – Element-node, Bus incidence, Tree-branch path, Basic cut-set, Augmented cut-set, Basic loop and Augmented loop, Numerical Treatment Expected.

***Unit 2:- Computer Solution Methods Using the Admittance Matrix*** **5Hrs**

Introduction, $Y_{BUS}$ formation by Direct and Singular Transformation Methods, Primitive network – impedance form and admittance form, Numerical treatment expected.

***Unit 3:- Computer Solution Methods Using the Impedance Matrix*** **6Hrs**

Introduction $Z_{BUS}$ formation by Step by step algorithm Methods, impedance matrix algorithm, adding a radial impedance to the reference node, adding a radial branch to a new node, closing a loop to the reference, closing a loop not involving the reference, Formation of $Z_{LOOP}$ Matrix & $Z_{BR}$ Matrix Numerical treatment expected.

**SECTION-II**

***Unit 4:- Load flow Studies*** **6Hrs**

Introduction, Bus and Types of buses, Impact of computers, orientation of engineering problems to computers, Power Flow equation, Classification of buses, Operating constraints, Data for load flow, Gauss-Siedal Method – Algorithm and flow chart, Newton Raphson's Method– Algorithm and flow chart, Fast Decoupled Method – Algorithm and flow chart.

***Unit 5:-Simultaneous Faults*** ***7*Hrs**

Simultaneous Faults by Two-Port Network Theory- Two port networks, interconnection of two port networks, simultaneous fault connection of sequence networks, series-series connection (Z-type faults), Parallel -parallel connection (Y-type faults), series-parallel connection (H-type faults).

***Unit 6:-Analytical Simplification*** **5Hrs**

Two component method, Shunt Faults- SLG Fault, LL Fault, DLG Fault, Three phase fault, Series Faults- 2LO Fault, 1LO Fault.

**Term-work:**

Minimum 8 to 10 experiments based on analysis using Computer Software such as MATLAB/SCILAB.

**Reference Book**

| Sr No | Title | Author | Publications |
|---|---|---|---|
| 1 | Analysis of Faulted Power Systems | Paul.M. Anderson | IEEE Press |
| 2 | Power System Analysis | Grainger & Stevenson | Tata McGraw-Hill |
| 3 | Computer Techniques and Models in Power Systems | K. Uma Rao | I.K. International Publishing House |
| 4 | Power System Analysis | HadiSaadat | Tata McGraw-Hill |

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

# SWITCHGEAR AND PROTECTION

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE-404 SAP | 03 | -- | 02 | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | 25 | 10 | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

## Course Objectives:

1) To understand the types of Circuit breakers and relays for protection of Generators, Transformers and feeder bus bar from Over voltages.
2) To describe the important of neutral grounding for overall protection.
3) To analyses the phenomenon of over Voltage and its classification.

## Course Outcomes:

After completion of this course students will be able to:

1) Understand the types of Circuit breakers and choice of Relays for appropriate protection of power system equipment
2) Understand various types of Protective devices in Electrical Power Systems.
3) Interpret the existing transmission voltage levels and various means to protect the system against over voltages.
4) Understand the importance of Neutral Grounding, Effects of Ungrounded Neutral grounding on system performance, Methods and Practices.

## Section –I

**Unit No. 01 Circuit Breakers:**(08 Hrs)

Voltage-current characteristics of arc, Principles of DC and AC arc interruption, high resistance and current zero interruption, arc voltage, Transient Restriking Voltage (TRV), Recovery voltage, RRRV, current chopping, resistances witching, capacitive current interruption. Classification of circuit breakers, brief study of construction and working of bulk oil and minimum oil CB, Air break and Air Blast CB, SF6 and Vacuum CB, HVDC breakers, ratings of CB and testing of CB Fuse: Rewirable and HRSC fuse, fuse characteristics, application and selection of fuse.

**Unit No. 02 Relays:**(08 Hrs)

Selectivity, sensitivity, reliability and speed of operation of a relay, CT burden calculation, attracted armature, balanced beam, moving coil relays, theory and construction of induction disc and induction cup relays, numerical relays, microprocessor based relaying.

**Unit No. 03 over current Protection:** (06 Hrs)

Plug setting, time setting, radial feeder and ring mains protection, earth fault and phase fault, Directional relay, and microprocessor based over current relay.

## Section –II

**Unit No. 04 Differential Relays:** (06 Hrs)

Circulating current and opposed voltage principles, percentage differential relay, line protection, Carrier aided Protection scheme.

**Unit No. 05 Transformer protection:** (08 Hrs)

Problems associated with percentage differential protection, harmonic restraint and harmonic Blocking schemes, restricted earth fault protection, Buchholz relay for incipient faults.

**Unit No.06 Generator protection:** (12 Hrs)

Stator earth fault, phase fault, stator current unbalance (NPS) protection, Rotor overheating, earth fault protection, excitation failure and protection against motoring, generator-transformer unit protection.Distance protection: Impedance, reactance and admittance characteristics, relay

settings for 3-zone protection, out of step blocking scheme, blinder relay, numerical relays for transmission line protection, microprocessor based impedance, reactance and mho relays. Over voltage Protection: Causes of over voltages, surge arrestors and absorbers, metal oxide (ZnO) arrestors, insulation co-ordination in a power system.

**List of Experiments:**

1) Drawing sheet showing construction of MOCB, ABCB, SF6CB and Vacuum CB.
2) Drawing sheet or Generator and transformer protection schemes.
3) Study of construction and working of induction disc type relays.
4) Plotting of I αt characteristics of an IDMT over current or E/F relay.
5) Experimental study of working of electromechanical over voltage relay.
6) Experimental study of working of a Directional over current relay.
7) Experimental realization of microprocessor based over current relay.
8) Experimental realization of microprocessor based over-voltage/ Under Voltage relay.
9) Experimental realization of microprocessor based impedance relay.
10) Experimental realization of microprocessor based Directional over current relay.

**Text books and References:**


1) Power System Protection and Switchgear: B.RamandB.N.Vishwakarma
2) Fundamentals of Power System Protection: Y.G.Paithankar,S.R.Bhide
3) Switchgear and Protection: Sunil.S.Rao,KhannaPublications
4) Digital Protection: L.P.Singh
5) Switchgear and Protection: M.V.Deshpande

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

## INDUSTRIAL TRAINING & PRESENTATION

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE-405 **ITP** | 01 | 01 | -- | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | -- | -- | - | - | - | - |
| | | | | | ESE | -- | -- | 50 | 20 | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

### Course Objectives:

1. Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
2. Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
3. Exposure to the current technological developments relevant to the subject area of training.
4. Experience gained from the 'Industrial Training' in classroom will be used in classroom discussions.
5. Create conditions conducive to quest for knowledge and its applicability on the job.
6. Learn to apply the Technical knowledge in real industrial situations.
7. Gain experience in writing Technical reports/projects.
8. Expose students to the engineer's responsibilities and ethics.
9. Expose the students to future employers.

### Course Outcomes:

After completion of this course students will be able to:

1. Exhibit the corporate culture/ethics in their work-space/career.
2. Identify the size and scale of operations in Industry.
3. Accomplish allotted tasks within deadlines.
4. Demonstrate an understanding of various constraints in industry.
5. Learn problem solving techniques and also work as a team.

6. Apply the knowledge learnt in their own career.

## GUIDELINES FOR INDUSTRIAL TRAINING

1. Industrial Training should be minimum of 15-21 days or 500-600 hours of industrial training.

2. Industrial Training may be full-time or part-time.

3. They are full-time in the summer vacation and part-time during the academic session.

4. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

5. In case student want to pursue their family business and don't want to undergo training, a declaration by a parent may be submitted directly to the Principal/Head of the department

6. Prepare a file containing documentary proofs of the activities done by him.

7. Assessment of Industrial training report will be done by the faculty incharge by conducting presentations of the students and report and presentation should consists of

1. Brief overview of the industry
2. Product Details
3. Production Practices
4. Type of electric supply and its utilization
5. Details of Electric tariff.
6. Practices used for electric safety and maintenance
7. Energy audit

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

## PROJECT PHASE-I

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE-406 **PP-I** | -- | -- | 04 | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | -- | -- | - | - | - | - |
| | | | | | ESE | -- | -- | 50 | 20 | 50 | 20 |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objectives:**

1. To allow students to demonstrate a wide range of the skills learned at the College of Engineering during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation.
2. To encourage multidisciplinary research through the integration learned in a number of courses.
3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation

The project work should be based on hardware assembly. In first phase, the batch of maximum 5 students should finalize the theme of the project in consultation with guide. The circuit should be finalized and the results of simulation shall be presented in the report of project phase I.

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

# SMART GRID
## (Open Elective I)

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| OCE-EE-401 SG | 03 | 01 | -- | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | 25 | 10 | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objective:**

The course aims:-

1) To explain the concept of Smart Grid, compare with conventional grid, and identify its Opportunities and barriers. To describe the concept of Smart Meter, Smart Appliances, Automatic Meter Reading,
2) Outage Management System, Plug in Hybrid Electric Vehicles, Vehicle to Grid, Smart Sensors, Home and Building Automation, Phase Shifting Transformers. To elaborate the concept of Substation Automation, Feeder Automation. Intelligent
3) Electronic Devices, Smart storage like Battery, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System, phase Measurement Unit. To elaborate the concept of micro grid
4) To acquaint Power Quality issues of Grid connected Renewable Energy Sources, Web based Power Quality monitoring, Power Quality audit.

**Course Outcome:**

1) Apply the knowledge to differentiate between Conventional and Smart Grid.
2) Identify the need of Smart Grid, Smart metering, Smart storage, Hybrid Vehicles, Home Automation, Smart Communication, and GIS.
3) Comprehend the issues of micro grid.

4) Solve the Power Quality problems in smart grid.
5) Apply the communication technology in smart grid.

**SECTION-I**

**Unit 01 : Introduction to Smart Grid: ( 7 Hrs)**

Concept of Smart Grid, Need of Smart Grid, Functions of Smart Grid, Opportunities and Barriers of Smart Grid, Drivers of SG in India, Functionalities and key components of smart grid, Difference between conventional and smart grid, Smart Grid Vision and Roadmap for India, Concept of Resilient and Self-Healing Grid, Present development and International policies in Smart Grid, Smart Cities, Pilot projects in India.

**Unit 02 : Smart Grid Technologies (10 Hrs)**

Remote Terminal Unit (RTU):Block diagram and function of each block, Intelligent Electronic Devices (IED), Phase Measurement Unit (PMU). Smart Substations, Substation and Feeder Automation, application for monitoring, protection and control, Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid(V2G), Grid to vehicles(G2V), Smart storage technologies and applications – Battery(flow and advanced), SMES, Super Capacitors, Compressed Air Energy Storage(CAES) and its comparison, Optimal location of PMUs for complete Observability.

**Unit 03 : Smart Meters and Advance Metering Infrastructure: (7 Hrs)**

Introduction to Smart Meters, Advanced Metering Infrastructure (AMI), Real Time Prizing, Automatic Meter Reading (AMR), Outage Management System (OMS) Smart Sensors, Smart Appliances, Home and Building Automation, Geographic Information System (GIS).

**SECTION-II**

**Unit 04: Microgrid: (8 Hrs)**

Concept of Microgrid, need and applications of Microgrid, Microgrid Architecture, DC Microgrid, Formation of Microgrid, Issues of interconnection, protection and control of Microgrid, Integration of renewable energy sources, Smart Microgrid, Microgrid and Smart Grid Comparison, Smart Microgrid Renewable Green Energy System, Cyber Controlled Smart Grid.

**Unit 05 : Power Quality Management in Smart Grid ( 7 Hrs)**

Power Quality and EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality

monitoring, Power Quality Audit.

**Unit 06 : Communication Technology for Smart Grid (9 Hrs)**

Communication Architecture of SG, Wide Area Measurement System (WAMS), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN)., ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing and Cyber Security for Smart Grid, Broadband over Power line (BPL).

**Text Books:**


1) Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley
2) Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response",CRC Press
3) Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley Publications.
4) Stuart Borlase, "Smart Grids-Infrastructure, Technology and Solutions", CRC Press, Taylor and Francis group
5) James Momoh, "Smart Grid-Fundamentals of design and analysis", Wiley Publications.


**Reference Books:**


1) [R1] Nikos Ziargyriour, "Micro grid, Architecture and Control", IEEE Press, Wiley Publications.
2) [R2] Yang Xiao, "Communication and Networking in Smart Grids", CRC Press, Taylor and Francis group [R3] Lars T. Berger and Krzysztof Iniewski, "Smart Grid-Applications, Communications and Security", Wiley Publications.
3) [R4] MladenKezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronics and Power Systems)", SpringerPublications.
4) [R5] Smart grid handbook for regulators and policy makers November 2017,ISGF

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER –VII**

# **ELECTRIC VEHICLE** (Open Elective I)

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| OCE-EE-401 **EV** | 03 | 01 | -- | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | 25 | 10 | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objectives:**

1) Identify how to define key vehicle system requirements and select and size system components that best meet those requirements.
2) Define and analyze fundamental electrochemistry of battery operation and performance requirements for HEV and full electric vehicle application.
3) Explain different approaches and application to electric and hybrid electric vehicles.
4) Compare various industry and regulatory standards for hybrid vehicle components, batteries, and charging systems.

**Course Outcomes:**

After completion of this course students will be able to:

1) Understand working of different configurations of electric vehicles
2) Understand hybrid vehicle configuration and its components, performance analysis
3) Understand of electric vehicle drive systems
4) Discuss about the different types of energy storage system.
5) Describe about the battery characteristic & parameters.
6) Explain about the battery testing, disposal and recycling.

## SECTION-I

**Unit I: Introduction to EV & HEV (6 Hours)**

Past, Present & Feature of EV, Current Major Issues, Recent Development Trends, EV Concept, Key EV Technology, State-of-the Art EVs & HEVs, Comparison of EV Vs IC Engine. EV System: EV Configuration: Fixed & variable gearing, single & multiple motor drives, In-wheel drives.

**Unit II: Electric Drive and Electric Propulsion System (10 Hours)**

Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

**Unit III: Energy Management Strategies (08 Hours)**

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

## SECTION-II

**Unit IV: Energy Storage System (06 Hours)**

Batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zine Chloride battery; Ultra capacitors; Flywheel Energy Storage System; Hydraulic Energy Storage System; Comparison of different Energy Storage System Suggested reading: Study of different types of batteries

**Unit V: Battery Characteristics & Parameters (08 Hours)**

Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics; Efficiency of batteries; Electrical parameters Heat

generation- Battery design Performance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries- Meeting battery performance criteria- setting new targets for battery performance.

**Unit VI: Battery Testing, Disposal & Recycling (08 Hours)**

Chemical & structure material properties for cell safety and battery design, battery testing, limitations for transport and storage of cells and batteries, Recycling, disposal and second use of batteries. Battery Leakage: gas generation in batteries, leakage path, leakage rates. Ruptures: Mechanical stress and pressure tolerance of cells, safety vents, Explosions: Causes of battery explosions, explosive process, Thermal Runway: High discharge rates, Short circuits, charging and discharging. Environment and Human Health impact assessments of batteries, General recycling issues and drivers, methods of recycling of EV batteries.

**Industry and regulatory standards for hybrid vehicle components, batteries, and charging systems.**

**One visit to commercialelectricvehicleshowroom in the local area**

**One industrial visit to battery manufacturing industry in the local area.**

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

# INTEGRATED RESOURCE PLANNING

(Open Elective I)

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| OCE-EE-401 **IRP** | 03 | 01 | -- | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | 25 | 10 | -- | -- |

ISE:In Semester Evaluation MSE:Mid Semester Evaluation ESE: End SemesterEvaluation

**Course Objectives:**

The objective of IRP is to determine the least-cost solution to a capacity shortage or reliability problem by evaluating the cost-effectiveness of distributed resources, such as small-scale distributed generation (DG) and demand-side management (DSM)

**Course Outcomes:**

After completion of this course students will be able to:

## SECTION-I

**Unit I Energy Services and Energy Efficiency: 08 hours**

Introduction: Energy Efficiency, Basics of the Energy System, Energy Services and Electricity Supply, Energy as a Commodity, Integrated Resource Planning, IRP and the Traditional Power-Planning Approach, Objectives of Bottom-Up Analysis.

**Unit II The Technological Structure of Energy Demand Projections and Scenarios: 08 hours**

Models to Analyze and Forecast Energy Demand, Econometric Models, Projections of End-Use Energy Demand, Baseline Framework, Costs of Energy Effectiveness. Projections of Energy Services, Scenario-Based Projections Scenarios, Screening of Demand Side Options: DSM Cost

**Unit III Renewables, Energy-Efficiency: 09 hours**

Barriers to Energy Efficiency and Renewables, Institutional and Legal Barriers, Financial Barriers, Energy Prices and Rate Making, Energy Pricing, Block Tariffs, Demand Charges, Time-of-Use, and Seasonal Pricing, Green Pricing and Tax Benefits to Renewables, Electricity Tariffs and Energy-Efficiency Program Costs, Recovering Program Costs: Rate basing vs. Expensing of DSM Costs

**SECTION-II**

**UNIT IVGovernment Programs and Demand-Side Management (DSM) 08 hours**

Information and Labeling, Standards and Regulation, The Effects of Standards Over Time, Technology Procurement Financial and Fiscal Mechanisms, Demand-Side Management (DSM): Load Management, Investments in Energy Efficiency, Evaluation of DSM Programs

**UNIT V Electric Power Planning: 07 hours**

Electricity Production Costs, Utility Revenue Requirements, Marginal Energy and Capacity Costs, Supply System Integration,Supply Resource Screening,Dispatch Strategies.

**UNIT VI Integrating The Options On The Supply And Demand Sides 08 hours**

Environmental and Social Cost Analysis, Environmental Impacts of Electricity Production, Emissions Accounting and Environmental Impacts, Integrating Energy Demand and Supply: Defining Scenarios and Baselines, Combining DSM and Supply Resource Options, Ranking the Resource Options by Marginal Cost, Ranking Emission Reduction Measures by Cost of Avoided Emissions, Including Emission Charges in Marginal Cost Estimates, Constructing Emission Reduction Cost Curves

**General Instructions:**

The number of students per batch should be as per the university pattern for practical batches.

Minimum number of assignments should be 8 coveringall topics.

**List of Experiments:**

Minimum five experiments based on Hardware and five experiments based on Simulations and at least three experiments based on Interfacing.

**Textbook**

1. Integrated Resource Planning and Management: The Ecosystem Approach In the Great Lakes Basin – June 1, 1996by Susan Hill Mac Kenzie
2. Integrated Resource Strategic Planning and Power Demand-Side Management Hu, Zhaoguang, Han, Xinyang, Wen, Quan

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

# RESTRUCTURED POWER SYSTEMS

(Open Elective I)

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| OCE-EE-401 **RPS** | 03 | 01 | -- | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | 25 | 10 | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objectives:**

1) Understand the need for restructuring of Power Systems
2) Understand and generalize the functioning and planning activities of ISO.
3) Understand transmission open access pricing issues and congestion management.
4) Understand transfer capability and estimate the transfer capability of a small power systems.
5) Understand reactive power as ancillary service and management through synchronous generator.

**Course Outcomes (COs):**

At the end of this course students will demonstrate the ability to:

1) Identify, formulate and solve electrical engineering problems in the broad area like power systems and its economics.
2) Understand market models and mechanisms for electricity as a commodity.
3) Appreciate legal, financial and economic issues related with transmission congestion management, locational marginal pricing and ancillary management.
4) Appreciate issues like fairness and social welfare with reference to transmission system usage and loss allocation.
5) Appreciate the need of reforms in power sector with focus on Indian power sector

## SECTION-I

**Unit 1** **(7 hrs)**

**Overview of Restructured Power System**

Regulation and Deregulation, Vertically Integrated and Deregulated power industry, Market models, Market Clearing Price(MCP), Independent System Operator(ISO), Role of ISO, Ancillary Service Management, Deregulation in Power Industry (Technical and Economic Issues)

**Unit 2** **(7 hrs)**

**Economic Considerations in Restructured Power System**

Introduction, Consumer and Supplier behavior, Demand elasticity, Supply elasticity, Short-run and Long-run costs, various costs of production. Electricity pricing: Electricity pricing in Generation, Transmission and Distribution, Introduction to Marginal cost, opportunity Costs, Dynamic pricing mechanism (ABT), Price elasticity of demand, Tariff setting principles, Distribution tariff for H. T. and L. T. consumers

**Unit 3** **(4 hrs)**

**Global Models of Restructured Power System**

Market Evolution and Deregulation in UK, USA, South America, Nordic pool, China, PJM ISO, and New York Market.

## SECTION-II

**Unit 4** **(6 hrs)**

**Indian Power Market Evolution**

Electricity Act 2003 and various national policies and guidelines, Ministry of Power, Role of CEA ,CERC, state ERC, Load Dispatch Centers etc., Implications of ABT tariff on Indian power sector, Introduction to Indian Power Exchange

**Unit 5** **(7 hrs)**

**Transmission Pricing and Congestion Management**

Transmission price components, various transmission pricing mechanisms, Tracing of power, Network usage and Loss Allocation. Introduction to Congestion in Transmission network, methods of Congestion Management

**Unit 6** **(5 hrs)**

**OASIS**

Introduction of OASIS, Structure of OASIS, Pooling of information, Transfer capability on OASIS and various concepts like ATC, TTC, TRM, and CBM

**Text Books:**

**1.** Mohammad Shahidehpour, Muwaffaq Alomoush, "Restructured electrical power systems: operation, trading and volatility", Marcel Dekker.

**2.** "Know Your Power" , A citizens Primer on the Electricity Sector, PRAYAS Energy Group, Pune.

**Reference Book:**

**1.** Daniel Kirschen, GoranStrbac, "Fundamentals of Power System Economics", John Wiely& Sons Ltd. 2004

**2.** Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, "Operation of restructured power systems", Kluwer Academic Pub., 2001.

**3.** Steven Stoft,"Power system economics: designing markets for electricity", John Wiley and Sons, 2002.

**4.** Sally Hunt, "Making competition work in electricity", John Wiely& Sons, Inc., 2002

**5.** Loi Lei Lai, "Power System Restructuring and Deregulation" John Wiley and Sons

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VIII**

## Management & Entrepreneurship Development

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | TW (Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE407 MED | 03 | -- | -- | 03 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | 50 | 20 | - | - |
| | | | | | ESE | 70 | 28 | - | - | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

### Course Objectives:

1) Apply Knowledge for handling and execution project work.
2) Build a good leader and managerial skills.

### Course Outcomes:

Students of this course will be able to:

1) Understand the concept and significance of project.
2) Understand management of functional dimensions of Project
3) Analyze risk and opportunities involved in project management.
4) Prepare feasibility report for a project.

### Section –I

**Unit-01** ***Management and Planning*** ***(6 hrs)***

Management: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession. Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning,Types and Steps in Decision Making.

***Unit-02 Organizing and Staffing ( 6 hrs)***

**Organizing and Staffing**: Organization-Meaning, Characteristics, Process of Organizing, Principles ofOrganizing, Span of Management (meaning and importance only), Departmentalization, Committees–Meaning, Types of Committees; Centralization V/S Decentralization of Authority and Responsibility; **Staffing**-Need and Importance, Recruitment and Selection Process.

***Unit-03 Directing and Controlling ( 6 hrs)***

**Directing and Controlling:** Meaning and Requirements of Effective Direction, Giving Orders; Motivation- Nature of Motivation, Motivation Theories (Maslow's Need- Hierarchy Theory and Herzberg's Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioral Approach of Leadership; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process.

**Section –II**

***Unit-04*** **Social Responsibilities of Business ( 06 hrs)**

Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship.

***Unit -05*** **Modern Small Business Enterprises (04 hrs)**

Modern Small Business Enterprises: Role of Small Scale Industries, Impact of Globalization and WTO on SSIs, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry (Definition only).

***Unit-06 Projects* Management** **( 08 hrs)**

Projects Management: A Project. Search for a Business idea: Introduction, Choosing an Idea, Selection of product, The Adoption process, Product Innovation, Product Planning and Development Strategy, Product Planning and Development Process. Concepts of Projects and Classification: Introduction, Meaning of Projects, Characteristics of a Project, Project Levels, Project Classification, Aspects of a Project, The project Cycle, Features and Phases of Project management, Project Management Processes. Project Identification: Feasibility Report, Project Feasibility Analysis. Project Formulation: Meaning, Steps in Project formulation, Sequential Stages of Project Formulation, Project Evaluation.

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER –VIII**

# H.V.D.C. SYSTEMS

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE408 HVDC | 3 | -- | 1 | 4 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | 25 | 10 | - | - |
| | | | | | ESE | 70 | 28 | -- | -- | 50 | 20 |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objectives:**

The objectives of the course are to make the students,

1) To understand the concept, planning of DC power transmission and comparison with AC power transmission.
2) To analyze HVDC converters.
3) To study about MTDC system.
4) To analyze harmonics and design of filters.
5) To learn about HVDC cables and reactive power control.

**Course Outcomes:**

Upon the successful completion of the course, students will be able to:

1) Explain about HVDC.
2) Explain the analysis of HVDC converters.
3) Explain The Multi Terminal HVDC Systems.
4) Apply the knowledge of reactive power and design the filters.
5) Explain HVDC Cables and simulation of systems.

## SECTION-I

**Unit-I General Background: (7 Hrs)**

Trends in transmission Voltages, Hierarchical Levels in transmission and distribution, Standard rated voltage of EHV-AC and HVDC, General aspects HVDC. Transmission: Constitution of EHVAC and DC links, Kinds of DC links, HVDC projects in India and abroad, limitations and advantages of HVDC transmission over EHVAC, Layout of HVDC station. Deep Hole Ground Electrode, Electrolytic Corrosion, factors for General Design of Electrodes.

**Unit-II Grid Control and Characteristics: (7 Hrs)**

Grid control of thyristor, valve-Analysis with grid control with no overlap, overlap less than 60 degrees and overlap greater than 60 degrees. Basic means of control, Power reversal, manual control and its limitations-constant current versus constant voltage Control, desired features of control, actual control characteristics-constant minimum ignition angle, current and extinction angle controls –power control and current limits. Voltage Dependent Current
Limiter (VDCOL), Comparison of Converters - CSC & VSC systems

**Unit-III Protection: (4Hrs)**

Disoperation of converters-short circuit on a rectifier – commutation failure, causes and remedies – Protection of HVDC system, DC rectors, damper circuits, Over current protection and over-voltage protection, clearing fault and reenergizing the line.

## SECTION-II

**Unit-IV Harmonics and Filters: (5Hrs)**

Characteristic and uncharacteristic harmonics-causes, consequences and suppression-Troubles caused by harmonics, Harmonic filters- Types, Location, series or shunt, sharpness of tuning, Quality Factor Q for L, C & RLC filter

**Unit-V Reactive Power Compensation: (6 Hrs)**

Reactive Power Requirement of HVDC Converter- reactive Power balance in HVDC substations-Effect of angle of advance and extinction angle on reactive power requirement of converters.

**Unit-VI Multi-terminal DC Systems: (7Hrs)**

Introduction, Configurations and Types of MTDC Systems, Control and Protection of MTDC Systems Configurations and Types of MTDC Systems, Reversal of Power in MTDC System, Comparison between MTDC and AC Interconnections, Philosophy and tools – HVDC system simulation – Modeling of HVDC systems for digital dynamic simulation.

**Term Work:**

Minimum 8 experiments to be performed based on simulation:

**A] MATLAB/SIMULINK/PSCAD/EMBTC or PSPICE may be used for simulation.**

**B] Compulsory One field visit to HVDC Station.**

**Text Books:**


1) Edward Wilson Kimbark "Direct Current Transmission" Wiley publication Inter science
2) K R Padiyar "HVDC power transmission systems" second edition, New Age International(p)Ltd
3) S. Kamkshaiah and V Kamraju "HVDC transmission" Tata Mc Graw Hill Education Pvt. Ltd,New Delhi.


**Reference Books:**


**1)** S. Rao" EHVAC and HVDC Transmission Engineering and Practice" –Khanna publication,

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VIII**

## Extra High Voltage AC Transmission

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE-409 **EHVAC** | 03 | 01 | -- | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | -- | -- | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

### Course Objectives:

1) To learn calculation of EHVAC line parameters
2) To learn voltage gradients and corona effects
3) To learn over-voltages and protection

### Course Outcomes:

After completion of this course students will be able to:

1) Calculate EHVAC line parameters
2) Study voltage gradients and corona effects
3) Find over-voltages and methods of protection

### Section I

**Unit I - Introduction to EHVAC Transmission**: **(7 Hrs)**

Standard transmission voltages, Engineering aspect and growth of EHVAC Transmission line, trends and preliminaries, power handling capacity and line losses, calculation of line and ground parameters, transient stability limit, and surge impedance loading. Resistance of conductor and power loss, temperature rise and current carrying capacity of conductor, properties of bundled conductors, calculation of inductance and capacitance of bundled conductor, calculation of sequence inductances and capacitances, line parameters for modes of propagations.

**Unit II- Voltage gradients of conductor and corona loss**: **(6 Hrs )**

Charge-potential relations for multi-conductor lines, surface voltage gradient on conductor, distribution of voltage gradients on sub conductors of bundle. I 2R and corona loss, corona-loss formulae, charge-voltage diagram and corona loss, attenuation of traveling waves due to corona loss, Audible noise, corona pulses: their generation and properties, limits for radio interface fields

**Unit III- Theory of the Traveling waves and standing waves: (5Hrs)**

Travelling and standing waves at the power frequency, differential equations and solutions for general case, standing waves and natural frequencies, open ended line: double exponential response and response to sinusoidal Excitation, line energization with trapped charge voltage, reflection and refraction of traveling waves.

**Section II**

**Unit IV- Lightning and lightning protection & Insulation Co-ordinations**: **(6 Hrs)**

Lightning strokes to lines, their mechanism, General principle of the lightning protections problems, tower footing resistance, lightning arrestors and protective characteristics, Insulation level, Voltage withstands levels of protected equipment and insulation coordination based on lightning.

**Unit V- Over voltage in EHV system caused by switching operations**: **(7 Hrs)**

Origin of over-voltages and their types, short circuit current and circuit breaker, recovery voltage and circuit breaker, over-voltages caused by interruption of low inductive and capacitive currents, Ferro-resonance over-voltages, calculation of switching surges- single phase equivalents.

**Unit VI- Power frequency voltage control and over voltages** : **(5Hrs)**

Generalized constants, no load voltage conditions and charging current, power circle diagram and its use, cascade connection of components: shunt and series compensation, sub-synchronous resonance in seriescapacitor compensated lines, static reactive compensating systems ( Static VAR)

**Texts and references:**


**1)** Rakosh Das Begamudre ,"Extra high voltage AC transmission engineering", New AgePublication

**2)** EHV -AC and HVDC transmission system engineering analysis and design: John Wiley& sons.

**3)** EHV –AC and HVDC Transmission Engineering &Practice : S. Rao, Khanna Publishers, 3rd Edition, 2012

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VIII**

# ELECTRICAL GENERATION & UTILIZATION

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE410 EGUT | 3 | 1 | -- | 4 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | 25 | 10 | - | - |
| | | | | | ESE | 70 | 28 | -- | -- | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objectives:**

The objectives of the course are to make the students,

1) To understand the concept Electrical Energy Generation using Conventional Energy Sources
2) To analyze Solar Energy application.
3) To study about Electric traction

**Course Outcomes:**

Upon the successful completion of the course, students will be able to:

1) Explain about Electrical Utilization application
2) Explain the Non-Conventional energy
3) Explain about Electric traction. Use.

## Section –I

**Unit I: Electrical Energy Generation using Conventional Energy Sources: (8hr)**

Electric energy demand, Electric energy growth in India, Power crisis in India. Types of Generation: Diesel &Gas Power Plant: Advantages, Disadvantages, applications of Diesel plant. Gas Turbine plant: Principle of operation, Open cycle, closed cycle plant & Applications of gas plant. Thermal power plant: Main & auxiliary equipment's in Thermal plant. Hydroelectric Plant: Advantages, disadvantages, & Classifications of hydro plant. Nuclear Power Plant: Main parts of nuclear plant, advantages & disadvantages of nuclear plant. Co-Generation: Technologies, Industries suitable for Cogeneration.

**Unit II: Solar Energy: (8hr)**

A) Introduction, Beam & Diffuse solar radiation, Measurement of solar radiation, Derived solar angles, sunrise sunset & day length, sunrise hour angle, solar collectors, storage of solar energy, solar water heaters, distillation, solar still, solar cooker, estimation of average solar radiation

B) Solar Photovoltaic: Introduction, Solar cell characteristics & losses. Emerging solar technologies, Solar PV modules, Design of PV module, Sizing of Battery, inverter & charge controller.

C) PV module power output, IV curve for PV module, batteries for PV cell, Battery charge controllers, Types of PV systems: Grid tie PV system, Standalone PV system, direct PV system.

**Unit III: Wind Energy: (8hr)**

A) Introduction, Principle of wind energy conversion, power duration & velocity duration characteristics of wind, advantages & disadvantages of WECS, Classification of wind mills, basic components of wind mill, aerodynamic forces acting on wind mill blades, Design considerations of horizontal axis & vertical axis wind mill, Wind Data &site selection considerations, Social economic & environmental considerations.

**Section –II**

**Unit-IV: Electric Heating and Welding (8hr)**

Classification of electric heating, heating methods, Resistance heating, design of heating element, Arc furnaces, induction heating, Induction furnaces, Dielectric heating, Electric arc welding, welding transformer, Power supply and control of electric welding, Laser beam welding.

**Unit-V: Electric traction (8hr)**

DC, AC and composite traction systems, main line and suburban systems, Comparison with Diesel-Electric traction, traction equipment's, Trolley wire, catenaries, Feeding and distribution systems, negative booster, overhead lines, current
collectors, traction substations .

**Unit-VI ( 8hr)**

A)Train movement and Energy consumption: Trapezoidal and quadrilateral speed-time curves, Maximum, average and scheduled speeds, Mechanics of train movement, tractive effort calculation, Power and energy output from driving axles, Specific Energy Output. B) Braking & control of traction motors: Vacuum brake and Air brake systems, regenerative braking, calculation of energy returned during regenerative braking. D.C. series, A.C. series and 3 Phase Induction motors for traction, Brief introduction to rheostatic speed control methods, drum controller, Multiple Unit Control, Static control of traction motors. Use of microprocessors for control of traction motors.

**Texts and references:**


1) Generation of Electrical energy by Dr. B.R. Gupta. S. Chand Publications.
2) Non Conventional& Renewable energy sources by S.S. Thipse Narosa publishing house.
3) Utilization of Electric Power and Electric Traction: J.B. Gupta, 8th Edition
4) Art and science of Utilization of Electric Energy: H. Partab
5) A course in Electrical Power: Soni, Gupta and Bhatnagar
6) Utilization of Electric Energy: Openshaw Taylor

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

# Seminar

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE-411 **Seminar** | 01 | 01 | -- | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | -- | -- | - | - | - | - |
| | | | | | ESE | -- | -- | 50 | 20 | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objectives:**

1. Create awareness about latest technological aspects
2. Improve presentation and communication skills
3. Improve skills related to search on the internet
4. Motivate for research in respective area
5. Provide platform for interaction amongst students on advanced and/or emerging topics of technology.

**Course Objectives:** Upon successful completion of this course, the student will be able to

1. Have and develop presentation skills.
2. Impart knowledge in different aspects of knowledge domains.
3. Make them aware of knowledge in industry perspective and new industry trends.
4. Build confidence and improve communication skills.
5. Collect ideas through literature survey about new innovations, analyze and present them.
6. Sharpen their personality and intelligence.

**Schedule for the semester:**

1st week: Discussion of relevance, objectives and outcome expectations with students.

2nd to 4th week: Preliminary discussions, topic identification and synopsis submission, topic approval by guide.

**5th to 10th week:** Collecting detailed information, discussion with guide, preparation of Seminar report and PPT, approval from guide.

**11th to 14th week:** Seminar delivery by each student for 20 minutes followed by question answer session and discussion for 10 minutes. Each student should deliver seminar in front of other students from the batch, guide and another expert appointed by HOD

**Topic selection**

Individual student shall chose seminar topic from engineering/allied/applied field under the guidance of allotted guide. Student should collect information from reference books, handbooks, technical research journals, catalogues, etc. related with the topic and beyond the details covered in the curriculum of mechanical engineering undergraduate course.

**Instructions for report writing and presentation**

Prepare two hard copies of seminar report of 20 to 30 pages each (one for student and other for department). For standardization of the seminar reports the following format should be strictly followed. Student should also submit soft copy of the seminar report and presentation.

1. Page size: Trimmed A4
2. Top Margin: 1.00 Inches
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inches
6. Para Text: Font - Times New Roman; 12 Point
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right aligned and in footer. Font Times New Roman; 12 Point
9. Headings: Times New Roman, 14 Point, Bold face

Certificate: All Students Should Attach Standard Format

The entire seminar should be documented as one chapter. The usual steps involved in writing report are: (a) logical analysis of the subject-matter; (b) preparation of the final outline; (c) preparation of the rough draft; (d) rewriting and polishing; (e) preparation of the final bibliography; and (f) writing the final draft. For more details about report writing and formats students and guide are advised to refer, "Kothari, C.R., *Research Methodology Methods and Techniques*, New Delhi,New Age International (P) Ltd., Publishers, 2nd Edition, 2004" Record of the referred literature should be submitted in either hard or soft form at the time of seminar presentation.

**Seminar work load**

1. 2 hours work load/practical batch/faculty

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VII**

## PROJECT PHASE-II

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| PCC-EE-412 **PP-II** | -- | -- | 04 | 04 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | -- | -- | - | - | - | - |
| | | | | | ESE | -- | -- | 50 | 20 | 50 | 20 |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objectives:**

1. To allow students to demonstrate a wide range of the skills learned at the College of Engineering during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation.
2. To encourage multidisciplinary research through the integration learned in a number of courses.
3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation

The assembly of components shall be done in project II. The testing shall be completed and necessary changes, if required shall be made. The project should be presented before the external examiner in working condition along with documents showing evidences of participation in state/ National level project competition. A journal/conference paper published/ presented on project work is expected. The project batch shall be eligible to gent more than 80% of marks in term work/ external examination if above conditions are satisfied

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VIII**

# PLC & SCADA Applications
# (Open Elective-II)

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| OCE-EE-402 **PLCSA** | 03 | -- | -- | 03 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | - | - | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objectives:**

The objectives of the course are to make the students,

1. Provides the student with basic knowledge of the industrial automation systems design, installation, modification, maintenance, and repair.
2. At the end of this semester students will able to understand the SCADA system components, SCADA communication, SCADA applications and for the design and implementation of a SCADA System.

**Course Outcomes:**

After completion of this course students will be able to:

1. A synthesis of automatic control, real time systems and instrumentation engineering.
2. Automation concentrates on the structural problems in manufacturing systems, processing industries or power industries.
3. The subject's focus is on the coordination of and interaction between many different components such as machines or processes, rather than control of individual components.
4. Acquire knowledge about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server.

5. Acquire knowledge about SCADA communication, various industrial communication technologies, open standard communication protocol.
6. Learn and understand about SCADA applications in transmission and distribution sector, industries etc.
7. Gain knowledge and understanding for the design and implementation of a SCADA System

**SECTION-I**

**Unit No I: (6 Hrs)**

Introduction to PLC: Definition & History of PLC, Overall PLC system, PLC Input & Output Unit No's, central processing unit, CPUs & Programmer/monitors, Solid state memory, the processor, Input Unit No's (Interfaces), Power supplies, PLC advantages & disadvantages. Selection criteria for PLC.

**Unit No II: (6 Hrs)**

Programming of PLC: Programming equipments, proper construction of PLC ladder diagram, Basic components & their symbols in ladder diagram, Fundamentals of ladder diagram, Boolean logic & relay logic, and analysis of rungs. Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices, programming ON/OFF Inputs to produce ON/OFF outputs.

**Unit No III: (8 Hrs)**

Advanced PLC Function: Analog PLC operation, PID control of continuous processes, simple closed loop systems, problems with simple closed loop systems, closed loop system using Proportional, Integral & Derivative (PID), PLC interface, and Industrial process example. Motors Controls: AC Motor starter, AC motor overload protection, DC motor controller, Variable speed (Variable Frequency) AC motor Drive.

## Section –II

**Unit No IV: (10 Hrs)**

**Introduction to SCADA:** Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation Industries.

**SCADA System Components:** Schemes- Remote Terminal Unit (RTU), Intelligent Electronic

Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems.

**Unit No V: (6 Hrs)**

SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system, SCADA Communication: various industrial communication technologies -wired and wireless methods and fiber optics.

**Unit No VI: (6 Hrs)**

SCADA Applications: Utility applications- Transmission and Distribution sector -operations, monitoring, analysis and improvement. Industries - oil, gas and water. Case studies, Implementation, Simulation Exercises.

**Text Books/Reference Books:**


1. Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson, 2nd Edition Static Reactive power compensation : T.J.E. Miller, John Wiley and sons New
2. John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications"
3. John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", 5th Edition
4. Batten G. L., "Programmable Controllers", McGraw Hill Inc., Second Edition
5. Bennett Stuart, "Real Time Computer Control", Prentice Hall, 1988
6. Doebelin E. O., "Measurement Systems", McGraw-Hill International Editions, Fourth Edition, 1990
7. Krishna Kant, "Computer Based Industrial Control", PHI
8. M. Chidambaram, "Computer Control of Process", Narosha Publishing
9. P. K. Srivstava, "Programmable Logic Controllers with Applications", BPB Publications
10. Stuart A. Boyer: SCADA-Supervisory Control and Data Acquisition, Instrument Society of America Publications,USA,2004
11. Gordon Clarke, Deon Reynders: Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems, Newnes Publications, Oxford, UK,2004
12. William T. Shaw, Cyber security for SCADA systems, Penn Well Books, 2006

13. David Bailey, Edwin Wright, Practical SCADA for industry, Newnes, 2003
14. Michael Wiebe, A guide to utility automation: AMR, SCADA, and IT systems for electric power, Penn Well 1999

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VIII**

# VLSI Design & Embedded System

**(Open Elective-II)**

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| OCE-EE-402 **VLSI & ED** | 03 | -- | -- | 03 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | - | - | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Outcomes:** After completion of this course students will be able to:

1. Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & Bi CMOS Technologies etc.
2. Basic Electrical Properties of MOS and Bi CMOS Circuits.
3. Acquire knowledge about Introduction to Embedded system and understanding the of embedded systems
4. Acquire knowledge about Introduction to Embedded system and understanding the of embedded systems
5. Acquire knowledge about Study of characteristics and quality attributes of embedded system, embedded Systems-Application-and Domain-Specific and Designing Embedded Systems with 8 bit Microcontrollers – 8051.Learn and understand about CMOS Testing.
6. Acquire knowledge about Hardware Software Co-Design and Program Modelling.

## SECTION-I

**Unit No I: Introduction to VLSI Design (8 Hrs)**

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS Technologies; Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation, Probe testing,

Integrated Resistors and Capacitors, CMOS Nanotechnology.

**Unit No II: Basic Electrical Properties (8 Hrs)**

Basic Electrical Properties of MOS and Bi CMOS Circuits: Ids-$V_{ds}$ relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit ωo; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

**Unit No III: VLSI Circuit Design Processes (8 Hrs)**

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

## Section –II

**Unit No IV: Introduction to Embedded Systems: (08 Hrs)**

What is an Embedded System, Embedded Systems vs. General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose of Embedded Systems.

**The Typical Embedded System**: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components, PCB and Passive Components.

**Unit No V: (10 Hrs)**

**Characteristics and Quality Attributes of Embedded Systems**: Characteristics of an Embedded System, Quality Attributes of Embedded Systems.

**Embedded Systems-Application-and Domain-Specific** : Washing Machine-Application-Specific Embedded System, Automotive-Domain-Specific Examples of Embedded System,

**Designing Embedded Systems with 8 bit Microcontrollers – 8051:** Factors to be Considered in Selecting a Controller, Why 8051 Microcontroller.

**Unit No VI: Hardware Software Co-Design and Program Modelling: (06 Hrs)**

Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modelling Language (UML), Hardware Software Trade-offs

**Text Books/Reference Books:**


1. Essentials of VLSI circuits and systems – Kamran Eshraghian, EshraghianDougles and A Pucknell, PHI, 2005 Edition
2. CMOS VLSI Design – A circuits and systems perspective, Neil H. E Weste, David Harris, Ayan Banerjee, pearson, 2009.
3. VLSI Desing- K .Lal Kishore, V. S. V. Prabhakar, I.K International, 2009.
4. CMOS logic circuit Design - John .P. Uyemura, Springer, 2007.
5. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
6. VLSI Design – A.Albert Raj, Latha, PHI, 2008
7. Introduction to VLSI – Mead & Convey, BS Publications, 2010
8. Introduction to embedded Systems: K.V.Shibu, Mc Graw Hill Education.
9. ARM system developers guide designing & optimizing system software : Andrew N, Dominic loss and Chris Wright.
10. Embedded Systems (Architecture Programming & Design) by Rajkamal Second Edition.

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VIII**

# Electrical Maintenance and Electrical Energy Audit

**(Open Elective-II)**

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| OCE-EE-402 **EMEEA** | 03 | -- | -- | 03 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | - | - | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

## Course Objectives:

The objectives of the course are to make the students,

1. Identify a wide range of electrical equipment & devices and understand their principles of operation / connections
2. Demonstrate an understanding of electrical systems, switchgear and circuit types.
3. Recognize the most common industrial motor types and understand their operation, connections and maintenance requirements
4. Perform electrical isolation, testing for dead, etc on a wide range of devices and circuits safely.
5. Learn the methods of energy audit and usage of instruments.
6. Analyze and report the outcome of energy audit.

**Course Outcomes:** After completion of this course students will be able to:

1. Comply with published electrical codes and safety standards.
2. Install electrical systems/equipment in new construction under supervision of a journey person.

3. Troubleshoot, repair, and conduct routine maintenance of electrical systems/equipment.
4. Conceptual knowledge of the technology, economics and regulation related issues associated with energy conservation and energy auditing
5. Identify and evaluate the common energy conservation opportunities in different energy intensive industrial equipment's.
6. Understand the need for energy audit and examine the economic evaluation of energy conservation solutions adopted.

**SECTION-I**

**Unit No I: Introduction to Electrical Maintenance (10 Hrs)**

Types of maintenance, maintenance schedules, procedures, Maintenance of Motors: Over hauling of motors, preventive maintenance, and trouble shopping of electric motors. Maintenance of Transmission and Distribution System, danger notice, caution notice permit to work, arranging of shutdowns personally and temporary earths cancellation of permit and restoration of supply, Patrolling and visual inspection of lines – points to be noted during patrolling from ground: special inspections and night inspections, Location of faults using Meggar, effect of open or loose neutral connections provision of proper fuses on service lines and their effect on system, causes and dim and flickering light.

**Unit No II: Maintenance of Distribution Transformers: (08 Hrs)**

Transformer maintenance and points to be attended to be attended to in respect of various items of equipment, Checking of insulation resistance transformer oil level and BDV test of oil, measurement of earth resistance.

**Unit No III: Maintenance of Grid Substations: (06 Hrs)**

Checking and maintenance of bus bars, isolating switches, HT/LT circuit breakers, LT switches, Power Transformers.

## Section –II

**Unit No IV: General Aspects of Energy Management and Energy Audit (06 Hrs)**

Definition, Need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments

**Unit No V: Energy Audit Methodology & Recent Trends (10 Hrs)**

Current Practices, Integration of two or more systems, Switching of Energy Sources, Reportwriting, preparations and presentations of energy audit reports, Post monitoring of energy conservation projects, MIS ,Case-studies / Report studies of Energy Audits. Guidelines for writing energy audit report, data presentation in report, findings recommendations, impact of renewable energy on energy audit recommendations. Case studies of implemented energy cost optimization projects in electrical utilities as well as thermal utilities.

**Unit No VI: Energy Efficiency in Electrical Utilities (06 Hrs)**

**Electrical system:** Electricity billing, electrical load management and maximum demand control, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses.

**Electric motors**: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

**Fans and blowers:** Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities.

**Lighting System:** Light source, choice of lighting, luminance requirements, and energy conservation avenues.

**Text Books/Reference Books:**


1. Testing, Commissioning Operation and Maintenance of Electrical Equipment : S Rao, Khanna Technical Publication ,New Delhi.
2. Preventive Maintenance of Electrical Apparatus : SK Sharotri, Katson Publishing House Ludhiana
3. Electric Energy Generation, Utilisation and Conservation Sivaganaraju, S Pearson, New Delhi, 2012
4. Energy Management: W.R.Murphy, G.Mckay (Butterworths).

5. Industrial Energy Conservation: D.A. Reay (Pergammon Press)
6. Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley Interscience Publication.

**SHIVAJI UNIVERSITY, KOLHAPUR**

**FINAL YEAR B.TECH (ELECTRICAL) SEMESTER -VIII**

## ADVANCED MICROCONTROLLER AND ITS APPLICATIONS
## (Open Elective-II)

| Course Code And Title | Teaching Scheme | | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory (Marks) | | Practical(Marks) | | POE(Marks) | |
| | L | T | P | Credit | Scheme | Max. | Min. for Passing | Max. | Min. for passing | Max. | Min. for passing |
| OCE-EE-402 AMIA | 03 | -- | -- | 03 | ISE | - | - | -- | -- | - | - |
| | | | | | MSE | 30 | 12 | - | - | - | - |
| | | | | | ESE | 70 | 28 | - | - | -- | -- |

ISE: In Semester Evaluation MSE: Mid Semester Evaluation ESE: End Semester Evaluation

**Course Objectives:**

1. This course is intended to provide basic knowledge of different advanced microcontrollers and their applications.
2. It intends to impart skills to write programs in assembly and in embedded C language.
3. It develops ability of logical thinking to interface microcontroller with outside world.

**Course Outcomes:** After completion of this course students will be able to:

1. **Understand** the basics of microcontrollers.
2. **Translate** the architecture and block diagram of various microcontrollers.
3. **Apply** logic with the help of instructions sets to achieve desired program
4. **Design and develop** various interfacing devices with or without the help of serial communication modules.

### SECTION-I

**Unit No I: 1 Overview of Microcontroller systems (04 Hrs)**

Purpose of micro controller, Difference between microprocessor and microcontroller, Advantages and Disadvantages, Block diagram of a microcontroller – operation, Architecture, RISC and CISC processors, Memory organization, ports, interrupts.

**Unit No II: ARM Microcontroller (08 Hrs)**

Introduction to ARM7TDMI processor – Pin Description, Pin functionality, internal architecture, Instruction Set and Instruction Cycle timings, ARM 32- bit and THUMB (16-bit) operating modes, Switching between ARM and THUMB instructions. Types of memory – Code memory, External Memory, Internal memory, Register Set.

**Unit No III: Microcontroller PIC16F877 (07 Hrs)**

PIC16F877 Instructions Set, addressing modes, Assembly language Programs. PIC16F877 PERIPHERALS: Timers, CCP modules, ADC modules, configuration word and programming.

**SECTION-II**

**Unit No IV: Serial Communication Modules (06 Hrs)**

UART, I2C, PSP, EEPROM, Reset, Oscillator modes, configuration word and programming.

**Unit No V: Interfacing (07 Hrs)**

RPM meter, event counter, temperature, controller. (Programs in assembly and C)

**PRACTICALS:**

The Practicals shall consist of **Five** software programs and **Three** Interfacing.

**Text Books/Reference Books:**


1. J.B.PEATMAN Design with PIC microcontrollers-, PHI 1998.
2. Barrnett Cox & Cull Embedded C programming and the microchip PIC- Thomson Publications 2004.
3. Ajay .V. Deshmukh Micro Controller theory and Application, TATA McGraw –Hill, 2008, 1st Edition