# Government College of Engineering,

# Chhatrapati Sambhajinagar

## (An Autonomous Institute of Government of Maharashtra)

**Station Road, Osmanpura, Chhatrapati Sambhajinagar – 431005 (M. S.)**

**Phone – (0240) 2366101, 2366111, Fax (0240) 2332835**

## NEP Compliant B. Tech structure & Curriculum of Final Year B. Tech. (Electrical) 2026-27 onwards as per NEP2020

## Vision of the Institute

To be globally recognized leader in technical education through industry integration and societal wellbeing

## Mission of the Institute

1. To build career-ready graduates through multidisciplinary learning and industry-sync curricula

2. To promote ecosystem for cutting-edge research, patents, publications, IPR, innovation, technology transfer and entrepreneurship

3. To be a premier trusted partner of government allied bodies, industries, and society.



Dr. N. R. Bhasme
Head, Electrical

Dr. Anil Karwankar
Dean , Academics

B.Tech. Electrical Engineering Curriculum
With effect from Academic Year 2026–2027
*Approved in the 32nd Academic Council Meeting, dated 28th July 2026*

## Vision of the Electrical Engineering Department

To provide technical education in Electrical Engineering that empowers aspiring engineers from the region to become competitive, industry-ready & socially responsible

## Missions of the Electrical Engineering Department

- To impart strong fundamental technical knowledge through effective teaching and learning practices
- To encourage innovation, research aptitude & life-long learning
- To strengthen employability and industry readiness through industry-aligned trainings
- To inculcate professional and social ethics through value based activities and community engagement.

**PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)**

1. Our graduates will excel in professional careers in technology and management with appropriate consideration for safety, culture, energy optimization and environment.
2. Our graduates will excel in higher studies, research and competitive examinations.
3. Our graduates will become successful entrepreneurs.
4. Our graduates will practice good human values, professional ethics and social responsibilities

## **Program Outcomes** (Graduates Attributes as per NBA)

**1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

**2. Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

**3. Design/development of solutions:** Design solutions for complex engineering problems and design systems components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, social and environmental consideration. To use modern engineering IT tools to solve and model electrical engineering problems.

**4. Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

**5. Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including predictions and modeling to complex engineering activities with an understanding of the limitations

**6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, cultural issues and consequent responsibility relevant to sustainable professional engineering practice.

**7. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**8. Individual and collaborative research work:** Function effectively as an individual and as a member or leader in diverse teams, and multidisciplinary settings.

**9. Communications:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentations, make effective presentations and give and receive clear instructions.

**10. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.

**11. Life-long learning:** Recognize the need for and have preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

**Program Specific outcomes of EED of GECCS (From 2026)**

1. Demonstrate the ability to apply electrical engineering principles for the analysis, design, operation, and management of power systems and renewable energy systems to support sustainable and environmentally responsible development.
2. Apply the principles of electrical machines, power electronics, electrical drives, and control systems to develop, operate, and optimize industrial automation systems and energy-efficient electrical applications.
3. Apply modern engineering tools, simulation software, programming platforms, and analytical techniques to investigate, optimize, and solve complex real-world problems in electrical engineering.

**Total Credits for the completion of B. Tech. in Electrical Engineering:**

The total number of credits proposed for the four-year B. Tech Electrical Engineering with 1 Multidisciplinary minor (Compulsory) degree is **170** as per the structure given below**:** Structure of B. Tech. in Electrical Engineering with multidisciplinary minor:

| **Semester** | | **I** | **II** | **III** | **IV** | **V** | **VI** | **VII** | **VIII** | **Total Credits** |
|---|---|---|---|---|---|---|---|---|---|---|
| Basic Science Course | BSC | 08 | 08 | | -- | -- | -- | -- | -- | 16 |
| Engineering Science Course | ESC | 07 | 07 | | -- | -- | -- | -- | -- | 14 |
| Program Core Course (PCC) | Program Courses | -- | 02 | 14 | 12 | 08 | 10 | 06 | | 52 |
| Program Elective Course (PEC) | Program Elective | -- | -- | -- | -- | 07 | 07 | 06 | - | 20 |
| Multidisciplinary Minor (MD M) | Multidisciplinary Courses | | - | 04 | 03 | 04 | 03 | | | 14 |
| Open Elective (OE) Other than a particular program | OE | -- | -- | 03 | 02 | 03 | -- | -- | -- | 08 |
| Vocational and Skill Enhancement Course (VSEC) | Skill Courses | 02 | 02 | -- | 02 | -- | 02 | -- | -- | 08 |
| Ability Enhancement Course (AEC -01, AEC-02) | Humanities Social Science and Management (HSSM) | | 02 | -- | 02 | -- | -- | -- | -- | 04 |
| Entrepreneurship/Economics/ Management Courses | | -- | | 02 | 02 | -- | -- | -- | -- | 04 |
| Indian Knowledge System (IKS) | | 02 | | | -- | -- | -- | -- | -- | 02 |
| Value Education Course (VEC) | | -- | -- | 02 | 02 | -- | -- | -- | -- | 04 |
| Research Methodology | Experiential Learning Courses | -- | -- | -- | -- | -- | -- | 02 | - | 02 |
| Comm. Engg. Project (CEP)/Field Project (FP) | | -- | -- | 02 | -- | -- | -- | - | - | 02 |
| Project | | -- | -- | -- | -- | -- | -- | 04 | - | 04 |
| Internship/ OJT | | -- | --- | | | -- | -- | | 12 | 12 |
| Co-curricular Courses (CC) | Liberal Learning Courses | 02 | 02 | | -- | -- | -- | -- | - | 04 |
| **Total Credits (Major)** | | **21** | **23** | **27** | **25** | **22** | **22** | **18** | **12** | **170** |

Students can opt for any of the following as per the rules and regulations given by institute:

1. B. Tech with one Multidisciplinary Minor = Total 170 Credits,
2. B Tech with two Multidisciplinary Minors = Total 184 Credits,
3. B. Tech with one Multidisciplinary Minor and Honor = Total 188 Credits,
4. B. Tech with one Multidisciplinary Minor and Honor by research = Total 188 credits

**MULTIDISCIPLINARY MINOR (MD M) and OPEN ELECTIVE (OE)**

**Other than particular Program**

List of Multidisciplinary Minor Courses from other faculties: Total 14 Credits as per GR, Two courses of 4 credits and two courses of 3 credits. Open electives of 8 credits are offered, Two courses of 3 credits and 01 course of 02 credits.

| Specialization | Dramatics | Film Making | Fine Art | Music |
|---|---|---|---|---|
| **Multi-disciplinary Minor - 01** | Dramatic Theory, Literature | Videography + Cinematography | Applied Art (Digital Art) | Theory of Indian Music |
| **Multi-disciplinary Minor – 02** | Acting | Video Editing and Lighting | Painting (Generative Art) | Ancient and Modern Poetry |
| **Multi-disciplinary Minor – 03** | Directing | Story telling Story Boarding | Sculpture (3D-Space) | The Evolution of music |
| **Multi-disciplinary Minor – 04** | Playwriting | UI/UX and Animation | Visual Communication (Evolutionary Art) | Music and Film |
| **Multi-disciplinary Minor – 05** | Applied Interactive Theatre | Art of Visual Communication | Graphics Art (Print & Printing Art) | Introduction to Electronic and Computer Music |
| **Multi-disciplinary Minor - 06** | Technical Theatre | Film & TV Directing | Art Culture | Analysis of Tonal Music |

| Specialization | Management & Finance | Law | Social Science | Journalism |
|---|---|---|---|---|
| **Multi-disciplinary Minor - 01** | Micro-economics | Constitutional Law | Indian Economics | Principles of Communication |
| **Multi-disciplinary Minor – 02** | Corporate Social Responsibility | Human Rights & International Law | Introduction to Sociology | Fundamentals of Journalism |
| **Multi-disciplinary Minor – 03** | Principles of Accounting | Environmental Law | Geo- Informatics | Cyber Journalism |
| **Multi-disciplinary Minor – 04** | Business Intelligence | Civil Procedure Code (CPC) | Introduction to Political Sciences | Basics of Design & Graphics |
| **Multi-disciplinary Minor – 05** | Marketing Research | Land Laws including ceiling and other local laws | Corporate sociology | Mass Communication: Concepts and Processes |
| **Multi-disciplinary Minor - 06** | Corporate Governance and Business Ethics | Cyber Law | Modern India-Political, Economic & Social Ethos | IT and Online Journalism |

**In addition to above courses following Groups are offered as Multidisciplinary Minor by Electrical Engineering Department**

**Multidisciplinary Minor-I (Electrical Mobility)**

| Sr. No. | Course Code | Course Name | Pre-requisite | Credits L-T-P | Offered Semester | Suggested by dept |
|---|---|---|---|---|---|---|
| 1 | EEMDM2001 | Electric Machines for EV Applications | No | 3-0-0 | III | Electrical Dept |
| 2 | EEMDM2010 | Power Electronics & Electric Drives | No | 3-0-0 | IV | Electrical Dept |
| 3 | EEMDM2011 | Lab-Electric Machines & Power Electronics drives | No | 0-0-1 | IV | Electrical Dept |
| 4 | EEMDM3001 | Control & Instrumentation | No | 3-0-0 | V | Electrical Dept |
| 5 | EEMDM3010 | Energy storage systems | No | 3-0-0 | VI | Electrical Dept |
| 6 | EEMDM3011 | Lab-Control & Instrumentation, Energy Storage | No | 0-0-1 | VI | Electrical Dept |

**Multidisciplinary Minor-II (Renewable Energy Systems)**

| Sr. No. | Course Code | Course Name | Pre-requisite | Credits L-T-P | Offered Semester | Suggested by dept |
|---|---|---|---|---|---|---|
| 1 | EEMDM2002 | Renewable Energy Technology | No | 3-0-0 | III | Electrical Dept |
| 2 | EEMDM2012 | Grid Integration of Wind & Solar Systems | No | 3-0-0 | IV | Electrical Dept |
| 3 | EEMDM2013 | Lab RET | No | 0-0-1 | IV | Electrical Dept |
| 4 | EEMDM3002 | Energy Economics & Marketing | No | 3-0-0 | V | Electrical Dept |
| 5 | EEMDM3010 | Energy Storage Systems | No | 3-0-0 | VI | Electrical Dept |
| 6 | EEMDM3012 | Lab Energy Systems | No | 0-0-1 | VI | Electrical Dept |

**In addition to above courses following courses are offered as Open Elective Courses (OEC) by Electrical Engineering Department**
**List of Open Elective courses offered**

| Sr. No. | Course Code | Course Name | Pre-requisite | Credits L-T-P | Offered Semester | Suggested by dept |
|---|---|---|---|---|---|---|
| 1 | EEOEC2001 | Music Engineering | No | 3-0-0 | III | Electrical Dept |
| 2 | EEOEC2010 | Basic Engineering Economics | No | 2-0-0 | IV | Electrical Dept |
| 3 | EEOEC3001 | Building Services and Maintenance | No | 3-0-0 | V | Electrical Dept |

## HONORS

**Student has to choose One Honor program out of the Two Honor groups provided below**

**A) Electrical Engineering with Honors- (Advanced Power Systems)**

| Sr. No. | Course Code | Course Name | Credits L-T-P | Offered Semester | Suggested by dept |
|---|---|---|---|---|---|
| 1 | EEHNC7001 | Computer Aided Power System Analysis | 3-1-0 | V | Electrical Dept |
| 2 | EEHNC7002 | Advanced Power System Protection | 3-1-0 | VI | Electrical Dept |
| 3 | EEHNC7003 | Power Quality & Mitigation | 3-1-0 | VII | Electrical Dept |
| 4 | EEHNC7004 | Extra High Voltage AC Transmission | 3-1-0 | VII | Electrical Dept |
| 5 | EEHNC7005 | Mini Project | 0-0-2 | VIII | Electrical Dept |

**B) Electrical Engineering with Honors- (Advanced Power Electronics and Drives)**

| Sr. No. | Course Code | Course Name | Credits L-T-P | Offered Semester | Suggested by dept |
|---|---|---|---|---|---|
| 1 | EEHNC7006 | Analysis and Modeling of Electrical Machines | 3-1-0 | V | Electrical Dept |
| 2 | EEHNC7007 | Advanced Power Electronics | 3-1-0 | VI | Electrical Dept |
| 3 | EEHNC7008 | Control of Electric Drives | 3-1-0 | VII | Electrical Dept |
| 4 | EEHNC7009 | Industrial Automation & Control | 3-1-0 | VII | Electrical Dept |
| 5 | EEHNC7010 | Mini Project | 0-0-2 | VIII | Electrical Dept |



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Teaching and Evaluation Scheme from year 2023-24

**First Year B. Tech. Program in Electrical Engineering**

**Semester I**

| Semester I Courses | | | | Teaching Scheme | | | Continuous Evaluation in terms of Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr No** | **Category** | **Course Code** | **Course Name** | **TH** | **T** | **PR** | **Credits** | **ISE I** | **ISE II** | **ISE III** | **ESE** | **Total** |
| 1 | BSC | MABSC1002 | Mathematics I [ For EE and E&TC] | 3 | 1 | - | 4 | 15 | 15 | 10 | 60 | 100 |
| 2 | BSC | PHBSC1001 | Optics, Acoustics and Engineering Materials | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 3 | ESC | MEESC1008 | Basics of Mechanical Engineering and Graphics | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 4 | ESC | CSESC1005 | Programming for Problem Solving | 2 | - | - | 2 | 10 | 10 | - | 30 | 50 |
| 5 | BSC | PHBSC1003 | LAB PHYSICS | - | - | 2 | 1 | - | - | 25 | - | 25 |
| 6 | ESC | MEESC1009 | Basics of Mechanical Engineering and Graphics | - | - | 2 | 1 | - | - | 25 | - | 25 |
| 7 | ESC | CSESC1006 | Lab Programming for Problem Solving | - | - | 2 | 1 | - | - | 25 | - | 25 |
| 8 | AEC-01 | INAEC1001 | Communication Skills | 2 | - | | 2 | 10 | 10 | - | 30 | 50 |
| 9 | VSEC-01 | ETVSE1002 | Engineering Exploration | - | - | 4 | 2 | - | - | 25 | 25 | 50 |
| 10 | CC-01 | INCCC1101 | Yoga and Meditation | - | - | 4 | 2 | - | - | 50 | - | 50 |
| **Total** | | | | **13** | **1** | **14** | **21** | **65** | **65** | **180** | **265** | **575** |



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## Semester II

| Semester II Courses | | | | Teaching Scheme | | | Continuous Evaluation in terms of Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr. No** | **Category** | **Course Code** | **Course Name** | **TH** | **T** | **PR** | **Credits** | **ISE I** | **ISE II** | **ISE III** | **ESE** | **Total** |
| 1 | BSC | MABSC1004 | Mathematics II [For EE and E&TC] | 3 | 1 | - | 4 | 15 | 15 | 10 | 60 | 100 |
| 2 | BSC | CHBSC1002 | Battery Science, Lubricants and Green Chemistry | 3 | | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 3 | ESC | EEESC1001 | Fundamentals of Electrical Engineering | 3 | | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 4 | ESC | EEESC1002 | Basics of Electronic Circuits | 3 | | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 5 | BSC | CHBSC1003 | Lab Chemistry | - | - | 2 | 1 | - | - | 25 | - | 25 |
| 6 | PCC | EEPCC1001 | Electrical Engineering Practice | 1 | - | - | 1 | - | 15 | 10 | - | 25 |
| 7 | PCC | EEPCC1002 | Lab-Electrical Engineering Practice | | | 2 | 1 | | | 25 | | 25 |
| 8 | ESC | EEESC1003 | Lab Basics of Electronics Circuits | - | - | 2 | 1 | - | - | 25 | - | 25 |
| 9 | VSEC-02 | EEVSE1001 | Electrical Workshop | | | 4 | 2 | - | - | 50 | | 50 |
| 10 | IKS-01 | EEIKS1101 | Vedic Mathematics | 2 | | | 2 | 10 | 10 | - | 30 | 50 |
| 11 | CC-02 | INCCC 1002<br>INCCC 1003<br>INCCC 1004 | NSS /Sports/ Club Activities | 2 | | | 2 | - | - | 50 | - | 50 |
| | **Total** | | | **17** | **1** | **10** | **23** | **70** | **85** | **225** | **270** | **650** |

## Exit Course

| **Exit option : Award of UG Certificate in Major with 44 credits and an additional 8 credits from following Exit Courses** | | | | |
|---|---|---|---|---|
| **Sr. No** | **Course Code** | **Course Title** | **Mode** | **Credits** |
| 1 | EEEXC1001 | Electrification of building | Online/ Offline certification **courses** Work based vocational courses or internship or apprenticeship during summer vacation | 4 |
| | | AND | | |
| 2 | EEEXC1002 | Electrical Panel Design and Implementation | | 4 |



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## Second Year B. Tech. Program in Electrical Engineering
## Semester III

| Semester III Courses | | | | Teaching Scheme | | | Continuous Evaluation in terms of Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr No** | **Category** | **Course Code** | **Course Name** | **TH** | **T** | **PR** | **Credits** | **ISE I** | **ISE II** | **ISE III** | **ESE** | **Total** |
| 1 | PCC | EEPCC2000 | Mathematics for Electrical Engineering | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 2 | PCC | EEPCC 2001 | Network Analysis | 3 | | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 3 | PCC | EEPCC2002 | Electrical Machines- I | 3 | | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 4 | PCC | EEPCC 2004 | Lab Network Analysis | - | - | 2 | 1 | | | 25 | 25 | 50 |
| 5 | PCC | EEPCC 2005 | Lab Electrical Machines- I | | | 2 | 1 | | | 25 | 25 | 50 |
| 6 | PCC | EEPCC2003 | Electrical Measurement & Instrumentation | 2 | - | - | 2 | 10 | 10 | - | 30 | 50 |
| 7 | PCC | EEPCC2006 | Lab Electrical Measurement & Instrumentation | - | - | 2 | 1 | | - | 25 | 25 | 50 |
| 8 | MD M-1 | | | 4 | | | 4 | 15 | 15 | 10 | 60 | 100 |
| 9 | OE- I | | | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 10 | EEM | EEEEM2001 | Consumer Psychology | 2 | | | 2 | 10 | 10 | - | 30 | 50 |
| 11 | VEC-I | CEVEC0010 | Environmental Studies | 2 | | | 2 | 10 | 10 | - | 30 | 50 |
| 12 | CEP | EECEP2001 | Community Engg Project | | | 4 | 2 | | | 50 | | 50 |
| | | | **Total** | **22** | **-** | **10** | **27** | **105** | **105** | **175** | **465** | **850** |



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## Semester IV

| Semester IV Courses | | | | Teaching Scheme | | | Continuous Evaluation in terms of Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr .No.** | **Category** | **Course Code** | **Course Name** | **TH** | **T** | **PR** | **Credits** | **ISE I** | **ISE II** | **ISE III** | **ESE** | **Total** |
| 1 | PCC | EEPCC2011 | Electromagnetic Field | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 2 | PCC | EEPCC2012 | Electrical Machines- II | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 3 | PCC | EEPCC2013 | Power System-I | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 4 | PCC | EEPCC2014 | Digital Circuits | 2 | - | - | 2 | 10 | 10 | - | 30 | 50 |
| 5 | PCC | EEPCC2015 | Lab Electrical Machines- II | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 6 | AEC | EEAEC2010 | Technical Communication | 2 | | | 2 | 10 | 10 | - | 30 | 50 |
| 7 | MD -2 | | | 3 | | | 3 | 15 | 15 | 10 | 60 | 100 |
| 8 | OE- II | EEOEC2012 | | 2 | - | - | 2 | 10 | 10 | | 30 | 50 |
| 9 | VSEC-I | EEVSE2010 | Lab Digital Circuit | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 10 | VSE | EEVSE2011 | Lab Numerical Computational Techniques | - | | 2 | 1 | - | - | 25 | 25 | 50 |
| 11 | VEC | INVEC1001 | Universal Human Values | 2 | | | 2 | 10 | 10 | | 30 | 50 |
| 12 | EEM | EEEEM2010 | Electricity Market and Management | 2 | | | 2 | 10 | 10 | | 30 | 50 |
| | | | **Total** | **22** | **-** | **06** | **25** | **110** | **110** | **115** | **435** | **800** |

***Bridge course of Two credits is mandatory for Direct second year admitted students in IV th semester Exit Course**

| Exit option : Award of UG Diploma in Major with 88 credits and an additional 8 credits from following Exit Courses | | | | |
|---|---|---|---|---|
| Sr. No | Course Code | Course Title | Mode | Credits |
| 1 | EEEXC2001 | Repairing and maintenance of Electrical Appliances | Online/ Offline certification courses Skill based courses, internship, mini projects etc. offered during summer vacation | 4 |
| | | And | | |
| 2 | EEEXC2002 | Industrial Electrical systems installation and maintenance | | 4 |



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## Third Year B. Tech. Program in Electrical Engineering
## Semester V

| Semester V Course | | | | Teaching Scheme | | | Continuous Evaluation in terms of Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr No** | **Category** | **Course Code** | **Course Name** | **TH** | **T** | **PR** | **Credits** | **ISE I** | **ISE II** | **ISE III** | **ESE** | **Total** |
| 1 | PCC | EEPCC3001 | Control Systems | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 2 | PCC | EEPCC3002 | Power System -II | 3 | | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 3 | PEC-I | | | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 4 | # PEC-II | | | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 5 | **MD-M-3** | | | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 6 | OE-III | | | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 7 | PCC | EEPCC3003 | Lab Control Systems | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 8 | PCC | EPCC3004 | Lab Power System-II | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 9 | Lab PEC I | | | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 10 | Lab MDM 3 | | | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 11 | *HNC | EEHNC7001/ EEHNC7006 | Computer Aided Power System analysis/ Analysis and Modeling of Electrical Machines | 3 | 1 | - | 4 | 15 | 15 | 10 | 60 | 100 |
| | **Total with single minor(without Honor)** | | | **18** | **-** | **08** | **22** | **90** | **90** | **160** | **460** | **800** |
| | *** Total with single minor and Honor** | | | **21** | **1** | **08** | **26** | **105** | **105** | **170** | **520** | **900** |

# PEC II courses student can opt from NPTEL/ MOOCs/ SWAYAM , *HNC students opting for honor course, 4 credits will be added

**Professional Electives**

| **PEC I** | **Course Title** | **PEC II** | **Course Title** |
|---|---|---|---|
| EEPEC3001 | Renewable Energy Technology | EEPEC3007 | Electrical Machine Design |
| EEPEC 3002 | Lab Renewable Energy Technology | EEPEC 3008 | Smart Grid Technology |
| EEPEC 3003 | High Voltage Engineering | EEPEC 3009 | Energy storage Systems |
| EEPEC 3004 | Lab High Voltage Engineering | EEHNC7001 | Computer Aided Power System Analysis |
| EEPEC 3005 | Industrial Electrical Systems | EEHNC7006 | Analysis and Modeling of Electrical Machines |
| EEPEC 3006 | Lab Industrial Electrical Systems | | |



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## Semester VI

| Semester VI Course | | | | Teaching Scheme | | | Continuous Evaluation in terms of Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr No** | **Category** | **Course Code** | **Course Name** | **TH** | **T** | **PR** | **Credits** | **ISE I** | **ISE II** | **ISE III** | **ESE** | **Total** |
| 1 | PCC | EEPCC3010 | Microcontrollers | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 2 | PCC | EEPCC3011 | Power System Protection | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| | PCC | EEPCC3012 | Power Electronics | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 3 | PCC | EEPCC3013 | Lab-Power System Protection | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 4 | PEC-III | | | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 5 | Lab-PEC III | | | | | 2 | 1 | - | - | 25 | 25 | 50 |
| 6 | PEC-IV | | | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 7 | MD M-4 | | | 3 | | | 3 | 15 | 15 | 10 | 60 | 100 |
| 8 | VSEC | EEVSE3011 | Lab Microcontrollers | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 9 | VSEC | EEVSE3012 | Lab Power Electronics | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 10 | *HNC | EEHNC7002/ EEHNC7007 | Advanced Power System Protection/ Advanced Power Electronics | 3 | 1 | - | 4 | 15 | 15 | 10 | 60 | 100 |
| | **Total with single minor(without Honor)** | | | **21** | **-** | **06** | **22** | **90** | **90** | **160** | **400** | **800** |
| | *** Total with single minor and Honor** | | | **24** | **1** | **06** | **26** | **105** | **105** | **170** | **460** | **900** |

# #PEC II courses student can opt from NPTEL/ MOOCs/ SWAYAM

*HNC students opting for honor course, 4 credits will be added and can opt from NPTEL/ MOOCs/ SWAYAM

**Program Electives and Honor Courses**

| PEC III | Course Title | PEC IV | Course Title |
|---|---|---|---|
| EEPEC3015 | Advanced Control Systems | EEPEC3021 | Energized Irrigation Systems |
| EEPEC 3016 | Lab Advanced Control Systems | EEPEC 3022 | Optimization Techniques |
| EEPEC 3017 | Internet of Things | EEPEC 3023 | Utilization of Electrical Energy |
| EEPEC 3018 | Lab IoT | EEPEC 3024 | Electrical and Hybrid Vehicles |
| EEPEC 3019 | Machine Learning for Electrical Engineering | *EEHNC7002 | Advanced Power System Protection |
| EEPEC 3020 | Lab Machine Learning for Electrical Engineering | *EEHNC7007 | Advanced Power Electronics |

## Exit courses

| Exit option : Award of B. Vocational in Major with 132 credits and an additional 8 credits from following Exit Courses | | | | |
|---|---|---|---|---|
| **Sr. No** | **Course Code** | **Course Title** | **Mode** | **Credits** |
| 1 | EEEXC3001 | Installation of Transformer | Online/ Offline certification courses Skill based courses, internship, mini projects etc. offered during summer vacation | 4 |
| AND | | | | |
| 2 | EEEXC3002 | Industrial Electrical Systems | | 4 |



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## Semester VII

### B Tech (Electrical with Single Minor) Total Credits- 170

| Semester VIII Course | | | | Teaching Scheme | | | Continuous Evaluation in terms of Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr No** | **Category** | **Course Code** | **Course Name** | **TH** | **T** | **PR** | **Credits** | **ISE I** | **ISE II** | **ISE III** | **ESE** | **Total** |
| 1 | PCC | EEPCC4001 | Electrical Drives | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 2 | PCC | EPCC4002 | Lab Electrical Drives | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 3 | PCC | EEPCC4003 | Digital Signal Processing | 2 | - | - | 2 | 10 | 10 | - | 30 | 50 |
| 4 | ** PEC-V | | | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 5 | ** PEC-VI | | | 3 | | | 3 | 15 | 15 | 10 | 60 | 100 |
| 6 | RM | MERMC4002 | Research Methodology | 2 | - | - | 2 | 10 | 10 | - | 30 | 50 |
| 7 | Project | EEPRJ4001 | Project | - | - | 8 | 4 | - | - | 50 | 50 | 100 |
| 8 | * HNC | EEHNC7003/EEHNC7008 | Power Quality & Mitigation/ Industrial Automation & Control | 3 | 1 | - | 4 | 15 | 15 | 10 | 60 | 100 |
| 9 | * HNC | EEHNC7004/EEHNC7009 | EHVAC / Control of Electrical Drives | 3 | 1 | - | 4 | 15 | 15 | 10 | 60 | 100 |
| | **Total with single Minor** | | | **13** | **-** | **10** | **18** | **65** | **65** | **105** | **315** | **550** |
| | *** Total with single Minor & Honor** | | | **13+6** | **2** | **10** | **18+8** | **95** | **95** | **125** | **435** | **750** |

**May be completed online mode or allied courses from MOOCs by the students who wish to go for one semester long internship in Industry/Research Organization. However, normal track students will complete these courses in offline mode in college.

### Program Electives

| **PEC V** | **Course Title** | **PEC VI** | **Course Title** |
|---|---|---|---|
| EEPEC4001 | Power Systems Dynamics and Stability | EEPEC4011 | Electrical Power Distribution system |
| EEPEC4002 | HVDC and FACTs | EEPEC 4012 | Energy Conservation & Management |
| EEPEC 4003 | Power Systems Planning Operation & Control | EEPEC 4013 | PLC and Automation |
| **Honor I-1 EEHNC7003** | **Power Quality & Mitigation** | **Honor II- EEHNC 7008** | **Industrial Automation & Control** |
| **Honor I-1-EEHNC7004** | **EHVAC Transmission** | **Honor I-1-EEHNC7009** | **Control of Electrical Drives** |

## Semester VIII

**Teaching and Evaluation Scheme from year 2026-27(With Single Minor**

**(One semester long Internship **)**

**B Tech (Electrical with Single minor) Total Credits-170**

| Semester VII Course | | | | Teaching scheme | | | Continuous Evaluation in terms of Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr No** | **Category** | **Course Code** | **Course Name** | **TH** | **T** | **PR** | **Credits** | **ISE I** | **ISE II** | **ISE III** | **ESE** | **Total** |
| 1 | **INT | EEINT4001 | Internship | | | 24 | 12 | - | 50 | 50 | 100 | 200 |
| 2 | * HNC | EEHNC7005/ EEHNC7010 | Mini Project | | - | 04 | 2 | - | - | 25 | 25 | 50 |
| | **Total with single Minor** | | | **-** | **-** | **24** | **12** | **0** | **50** | **50** | **100** | **200** |
| | **Total with single Minor and Honor** | | | **-** | **-** | **24+4** | **12+2** | **0** | **50** | **75** | **125** | **250** |

*HNC courses student can opt from NPTEL/ MOOCs/ SWAYAM

!**B Tech (Electrical Honors with Single minor) Total Credits- 188**

## Course Category wise Credit distribution

| Sr. No. | Course Category | Credits |
|---|---|---|
| 1 | Basic Science Courses (BSC) | 16 |
| 2 | Engineering Science Courses (ESC) | 14 |
| 3 | Program Core Courses (PCC) | 52 |
| 4 | Program Elective Courses (PEC) | 20 |
| 5 | Open Elective other than particular program (OE) | 08 |
| 6 | Minors (MDM) | 14 |
| 6 | Vocational and Skill Enhancement Course (VSEC) | 8 |
| 7 | Humanities Social Science and Management (HSSM)<br>AEC<br>EEM<br>IKS<br>VEC | <br>4<br>4<br>2<br>4 |
| 8 | Experiential Learning (EL)<br>RM<br>CEP/FP<br>Project<br>Internship | -<br>2<br>2<br>4<br>12 |
| 9 | Co-curricular And Extracurricular Activities(CCA) | 4 |
| **10** | **Total Credits** | **170** |



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## Semester VII (2026-27)

### B Tech (Electrical with Single Minor) Total Credits- 170

| Semester VIII Course | | | | Teaching Scheme | | | Continuous Evaluation in terms of Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr No** | **Category** | **Course Code** | **Course Name** | **TH** | **T** | **PR** | **Credits** | **ISE I** | **ISE II** | **ISE III** | **ESE** | **Total** |
| 1 | PCC | EEPCC4001 | Electrical Drives | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 2 | PCC | EPCC4002 | Lab Electrical Drives | - | - | 2 | 1 | - | - | 25 | 25 | 50 |
| 3 | PCC | EEPCC4003 | Digital Signal Processing | 2 | - | - | 2 | 10 | 10 | - | 30 | 50 |
| 4 | ** PEC-V | | | 3 | - | - | 3 | 15 | 15 | 10 | 60 | 100 |
| 5 | ** PEC-VI | | | 3 | | | 3 | 15 | 15 | 10 | 60 | 100 |
| 6 | RM | MERMC4002 | Research Methodology | 2 | - | - | 2 | 10 | 10 | - | 30 | 50 |
| 7 | Project | EEPRJ4001 | Project | - | - | 8 | 4 | - | - | 50 | 50 | 100 |
| 8 | * HNC | EEHNC7003/EEHNC7008 | Power Quality & Mitigation/Industrial Automation & Control | 3 | 1 | - | 4 | 15 | 15 | 10 | 60 | 100 |
| 9 | * HNC | EEHNC7004/EEHNC7009 | EHVAC / Control of Electrical Drives | 3 | 1 | - | 4 | 15 | 15 | 10 | 60 | 100 |
| | **Total with single Minor** | | | **13** | **-** | **10** | **18** | **65** | **65** | **105** | **315** | **550** |
| | *** Total with single Minor & Honor** | | | **13+6** | **2** | **10** | **18+8** | **95** | **95** | **125** | **435** | **750** |

**May be completed online mode or allied courses from MOOCs by the students who wish to go for one semester long internship in Industry/Research Organization. However, normal track students will complete these courses in offline mode in college.

### Program Electives V, VI

| PEC V | Course Title | PEC VI | Course Title |
|---|---|---|---|
| EEPEC4001 | Power Systems Dynamics & Stability | EEPEC4011 | Electrical Power Distribution system |
| EEPEC4002 | HVDC and FACTs | EEPEC 4012 | Energy Conservation & Management |
| EEPEC 4003 | Power Systems Planning Operation & Control | EEPEC 4013 | PLC and Automation |
| **Honor I-1 EEHNC7003** | **Power Quality & Mitigation** | **Honor II- EEHNC 7008** | **Industrial Automation & Control** |
| **Honor I-1-EEHNC7004** | **EHVAC Transmission** | **Honor I-1-EEHNC7009** | **Control of Electrical Drives** |



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| EEPCC 4001: Electrical Drives | |
|---|---|
| **Teaching Scheme**<br>Lectures : 3 Hrs/Week<br>Tutorial : 0<br>Total Credits : 3 | **Examination Scheme**<br>ISE I : 15 Marks<br>ISE II : 15 Marks<br>ISE III : 10 Marks<br>ESE :60 Marks |

**Course Description:** In this curriculum, students will be explored to fundamentals, control and operation of AC & DC drives. They will be also introduced to industrial applications of drives.

**Course Objectives:**

The objective of the course is to give exposure to the students of -

1. Fundamental of electrical drives.
2. Control & operation of AC & DC drives.
3. Various industrial applications of AC and DC drives.

**Course Outcomes:**

The students will be able to

| |
|---|
| **CO1:** Analyze the performance characteristics of electrical drives and solve related numerical problems |
| **CO2:**Evaluate the performance of DC motor drives under various operating conditions |
| **CO3:** Analyze controlled rectifier fed and chopper fed dc drive systems |
| **CO4:** Analyze induction motor drives and apply appropriate operating techniques using power electronics converters |
| **CO5:** Select suitable electrical drives for industrial applications with emphasis on energy conservation |

**Detailed Syllabus**

| | |
|---|---|
| **Unit-I** | **Fundamentals of Electrical Drives:**<br>Concept of electrical drives, Fundamental torque equation, Speed Torque conventions & multi-quadrant operation, Equivalent value of drive parameters, Components of load torque, Nature & classification of load torque, Steady state stability, Modes of operation, Selection of motor power rating: Thermal model, Classes of motor duty, Motor rating |
| **Unit-II** | **DC Drives:**<br>DC motors and their performance analysis, Starting, Methods of Braking-Regenerative, Dynamic and Plugging, Transient analysis, Methods of Speed control, Ward Leonard drives, PMDC Motor |
| **Unit-III** | **Control of DC Drives:**<br>Controlled rectifier fed dc drives, 1-phase full and half controlled rectifier-control, 3-phase full and half controlled rectifier control, Multi quadrant operation of fully-controlled rectifier-fed DC motor, Chopper control of separately excited dc motor, Chopper control of series motor |
| **Unit-IV** | **AC Drives and its control:**<br>Analysis and performance of 3-phase induction motors, Starting, Methods of Braking-Regenerative, Dynamic and Plugging, Methods of Speed control, Voltage source inverter (VSI) control, Current source inverter (CSI) control, Slip power recovery schemes, Control of 1-phase induction motor |
| **Unit-V** | **Industrial Applications and Energy Conservation:**<br>Solar powered drives, Battery powered vehicles, Important features of Traction drive, Traction motors, Other industrial applications, Energy conservation in electrical drives |

**Text Books:**


1) G. K. Dubey, "Fundamental of Electrical Drives", Second Edition. Narosa Publishing House, New Delhi, India.
2) M. H. Rashid, "Power Electronics", III Edition (Low Price), Pearson Education Pvt. Ltd. New Delhi, India.
3) B. K. Bose, "Modern Power Electronics and AC Drives", Low Price Edition, Pearson Education Pvt. Ltd. New Delhi, India.
4) R. Krishnan, "Electrical Motor Drives: Modeling, Analysis and Control", Low Price Edition, Prentice Hall of India, New Delhi, India.


**Mapping of Course outcomes (CO) with program outcomes(PO):**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | 1 | 1 | 2 | 2 | 2 | | 2 | | 3 | |
| CO2 | 3 | 2 | 1 | | 1 | 1 | 2 | 2 | 2 | | 2 | | 3 | |
| CO3 | 3 | 2 | 1 | | 2 | 1 | 2 | 2 | 2 | | 2 | | 3 | |
| CO4 | 3 | 2 | 1 | | 2 | 1 | 2 | 2 | 2 | | 2 | | 3 | |
| CO5 | 3 | 3 | 1 | | 1 | 2 | 2 | 2 | 2 | | 2 | | 3 | |

**1 -Low 2-Medium 3-High**

**ISE III's Assessment:** It will be based on **any ONE** of the following: 10 Marks

1. Multiple Choice Objective Test
2. Assignments/PPT presentation on allotted topics
3. Quiz
4. Surprise Test

**Sample Assessment Pattern:**

| **Assessment Pattern Level No.** | **Knowledge Level** | **ISE I** | **ISE II** | **ISE III** | **End Semester Examination** |
|---|---|---|---|---|---|
| K1 | Remember | - | - | - | - |
| K2 | Understand | 10 | 10 | 04 | 18 |
| K3 | Apply | 05 | 05 | 04 | 24 |
| K4 | Analyze | | | 02 | 18 |
| K5 | Evaluate | | | - | - |
| K6 | Create | | | - | - |
| **Total Marks: 100** | | **15** | **15** | **10** | **60** |

**Sample Assessment Table:**

| **Assessment Tool** | **K2+K3** | **K2+K3** | **K2+K3** | **K2+K3+K4** | **K2+K3+ K4** |
|---|---|---|---|---|---|
| | C01 | C02 | C03 | CO4 | CO5 |
| ISE I (15 Marks) | 10 | 5 | - | - | - |
| ISE II (15 Marks) | - | - | 10 | 5 | - |
| ISE III (10 Marks) | 02 | 02 | 02 | 02 | 02 |
| ESE Assessment (60 Marks) | 12 | 12 | 12 | 12 | 12 |

**Designed by Dr. N. R. Bhasme**



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| EEPCC4002: Lab Electrical Drives | |
|---|---|
| **Teaching Scheme**<br>Practical : 2 Hrs/Week<br>Total Credits : 1 | **Examination Scheme**<br>Term Work : 25 Marks<br>Practical Examination : 25 Marks |

**Course Objectives:**

The objective of the course is to give exposure and hands on training to the students to

1. Operate and carry out performance analysis of DC motor drives
2. Operate and carry out performance analysis of AC motor drives

**Course Outcomes:**

The students will be able to

| |
|---|
| **CO1:** Demonstrate basic operations of AC and DC drives |
| **CO2:** Use AC & DC drives |
| **CO3:** Analyze performance of AC and DC drives |
| **CO4:** Record the operations and write technical reports |
| **CO5:** Work individually and in a team effectively |

**List of Experiments:**

Term work shall consist of a record of minimum eight experiments based on hardware set up/ modeling & simulation using electrical software/analysis/mini project/industrial problems/industrial visit from the following list.

| Sr. No. | Details |
|---|---|
| 1 | Direction control and speed control of DC motor drives |
| 2 | Starting, stopping and accelerating & decelerating time adjustments of DC motor drives |
| 3 | Braking and protection of DC motor drives |
| 4 | Performance analysis of DC motor drives using Jones Chopper |
| 5 | Starting, stopping and accelerating & decelerating time adjustments of AC motor drives |
| 6 | Torque-speed characteristics of AC motor |
| 7 | V/F ratio control of AC motor drive |
| 8 | Speed control of 3-phase slip ring induction motor |
| 9 | Slip power recovery of Induction motor |
| 10 | Industrial applications of AC motor drives |
| 11 | Industrial applications of DC motor drives |
| 12 | Report on visit to industry using electrical drives |

**Term Work:**

The term work shall consist of performance of above enlisted experiments and submission of technical write up. The term work will be assessed by the Course Coordinator.

**Practical Examination:**

The practical examination will consist of performance of experiment and viva-voce or viva voce on the complete curriculum of the lab course. The internal and external examiners appointed by the Controller of Examination will assess the performance of the student.

**Mapping of Course outcomes with program outcomes:**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | 2 | | 1 | 2 | | 2 | |
| CO2 | 3 | | 1 | 2 | 3 | | | 2 | | 2 | 2 | | 2 | |
| CO3 | 3 | 3 | 1 | 2 | 3 | | | 2 | | 2 | 2 | | 2 | |
| CO4 | | | | | | | 3 | 2 | | 2 | 2 | | 2 | |
| CO5 | | | | | | | 3 | 2 | 3 | 2 | 2 | | 2 | |

**1- Low 2-Medium 3-High**

**Designed by**
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| EEPCC 4003: Digital Signal Processing | |
|---|---|
| **Teaching Scheme**<br>Lectures : 2 Hrs/Week<br>Tutorial : 0<br>Total Credits : 2 | **Examination Scheme**<br>ISE I : 10 Marks<br>ISE II : 10 Marks<br>ISE III : 00 Marks<br>End-Semester Exam :30 Marks |

**Course Description**: This course introduces the basic concepts and techniques for processing signals on a computer, important methods in DSP, digital filter design and transform-domain processing.

**Course Objectives:**

The objectives of the course are to give exposure of

1. Basic concepts and techniques for processing signals on a computer.
2. Important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.
3. Applications of DSP

**Course Outcomes:**

After completing the course, students will able to:

| | |
|---|---|
| CO1 | classify signals mathematically in continuous & discrete-time, frequency domain and analyze using Z transform |
| CO2 | interpret the Discrete-Fourier Transform (DFT) & FFT algorithm |
| CO3 | design digital filters for various applications |
| CO4 | apply digital signal processing for the analysis of real-life signals |

**Detailed Syllabus:**

| | |
|---|---|
| **Unit 1** | **Discrete time Signals and Systems:**<br>Discrete time signals and systems: Characterization and classification of Signals, typical signal processing operations, examples of typical Signals, necessity of DSP Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate . z-Transform, Region of Convergence, Shift Invariant systems using z transform. |
| **Unit 2** | **Discrete Fourier Transform:**<br>Discrete Fourier Transform, Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's identity, implementation of Discrete Time Systems. |
| **Unit 3** | **Design of Digital filters:**<br>Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing |
| **Unit 4** | **Applications of Digital Signal Processing**<br>Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter. Spectral analysis of sinusoidal signals, non stationary signals, random signals |

**Text / Reference Books:**

1.R. Babu. , "Digital Signal Processing", Laxmi Publication Ltd.

2. A. Ambardar, "Digital Signal Processing: A Modern Introduction", Penram International Publishing (India) Pvt. Ltd.

3. Proakis, "Digital Signal Processing", Pearson Education Limited

4. Oppenheim and Schafer, "Discrete-Time Signal Processing", Prentice-Hall, 1989.

5. Rabiner, R. Lawrence, "Theory and Application of Digital Signal Processing", Gold, Bernard, Prentice-Hall

**Mapping of Course Outcome with Program Outcomes:**

| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 1 | 3 | | 2 | 2 | | | 1 | 1 | 2 | 1 |
| CO2 | 3 | 3 | 2 | 1 | 3 | | 2 | 2 | | | 1 | 1 | 2 | 1 |
| CO3 | 3 | 3 | 2 | 1 | 3 | | 2 | 2 | 1 | | 1 | 1 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 1 | 3 | 1 | 1 | 2 | 1 | | | 1 | 2 | 1 |

**1 – Low 2 – Medium 3 High**

**ISE III Assessment:** Teachers Assessment is based on one of the / or combination of few of following

1. Assignments based on Numerical
2. Objective type test.
3. MATLAB based network problems

**Sample Assessment Pattern:**

| **Assessment Pattern Level No.** | **Knowledge Level** | **ISE I** | **ISE II II** | **ISE III Assignment** | **End Semester Examination** |
|---|---|---|---|---|---|
| K2 | Understand | 5 | 5 | | 10 |
| K3 | Apply | 5 | 5 | | 10 |
| K4 | Analyze | | | | 10 |
| K5 | Evaluate | | | | |
| K6 | Create | | | | |
| **Total Marks 100** | | 10 | 10 | | 30 |

**Sample Assessment Table:**

| Assessment Tool | K2+K3 | K2+K3 | K2+K3 | K2+k3+K4 |
|---|---|---|---|---|
| | C01 | C02 | C03 | CO4 |
| ISE I, ISE II (Test 30 Marks) | 05 | 05 | | |
| ISE I, ISE II (Test 30 Marks) | | | 05 | 05 |
| ESE Assessment (30 Marks) | 8 | 8 | 8 | 6 |

**Designed by**

**Dr. S. S. Kulkarni, Dr. N. J. Phadkule**

| EEPRJ 4001: Project | |
|---|---|
| **Teaching Scheme**<br>Practical: 12 Hrs/Week<br>Credit: 6 | **Examination Scheme**<br>ISE I/ Term Work : 50 Marks<br>Practical viva :50 Marks<br>Total : 100 Marks |

**Term Work**

Projects should be based on Software based simulation/Case study/ Analysis/ Design Methodology/ Hardware/ Industry based. It is expected that the broad area project shall be finalized by the student at the end of sixth semester. The work is to be completed by the end of semester VII. Students shall give the presentation on the project and shall submit the progress report in the following format.

i. Title
ii. Abstract
iii. Introduction
iv. Project objectives
v. Literature survey
vi. Work to be completed
vii. Expected results and conclusion
viii. References

**Term Work:**

1. Students will demonstrate the project and give a presentation on the project.
2. The project report contains a minimum of 40 pages and it will have one section on the impact of proposed ideas/work on the environment and society.

**Course Description:** The student shall collect, review, compile, comprehend, present research literature and identify the problem for the project in the field of Electrical Engineering. Students will give a presentation on work done by them on any topic of the recent technology which may include some simulation carried out by the student.

**Course Objectives:**

- To understand the "Product Development Process" including budgeting through Project
- To plan for various activities of the project and distribute the work amongst team members
- To inculcate electronic hardware implementation skills
- To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project
- To understand the importance of document design by compiling Technical Report on the Project work carried out

**Course Outcomes:** At the end of course students will be able to **:**

- Understand, plan and execute a Project
- Implement electronic hardware by learning PCB artwork design, soldering techniques, testing, and troubleshooting etc.
- Prepare a technical report based on the project

- Deliver technical seminar based on the Project work carried out

- **Course Contents:**
- Mini Project Work should be carried out in the Laboratory.
- Data sheets may be referred, well known project designs ideas can be necessarily adapted from recent issues of electronic design magazines
- Hardware/Software based projects can be designed
- Following areas are just a guideline
- Instrumentation and Control Systems
- Power Electronics
- Embedded Systems/ Microcontroller based projects should preferably use Microchip PIC controllers/ATmega controller/AVR microcontrollers
- Power system based
- Demonstration and Group presentations. Logbook for all these activities shall be maintained and shall be produced at the time of examination
- A project report with following contents shall be prepared:
    - Specifications/Block diagram/Circuit diagram/Selection of components, calculations
    - Simulation results
    - Layout versus schematic verification report
    - Testing procedures/Test results Conclusion

    References

**Term Work:**

The Project shall consist of a collection of literature from a chosen field of Electrical Engineering from various sources such as refereed journals, proceedings of national international conferences, PG/PhD thesis etc. Based on the literature survey, case studies, data collection, surveys, pilot studies, mathematical/analytical modeling, etc., the candidate shall define the problem for the project.

The candidate shall prepare a technical report in a prescribed format and present before a panel of examiners consisting of a guide and at least one faculty member of the department.

**Evaluation of Project Ph II:** It consists of two parts.

**Part-I: Evaluation for 25 Marks:** A mid-term evaluations for 25 marks out of 50 marks shall be done as per the schedule given in the institute academic calendar. Students should prepare a power point presentation and present before the panel of examiners and class students and should be able to answer questions asked by the panel of examiners and class students. The panel of examiner will assess the contents and presentation and give the suggestions, if any and assign the marks. In this phase students are expected to collect and present substantial literature.

**Part-II: Evaluation for 50 Marks:** Students should prepare technical report in prescribed format duly incorporating suggestions of Part-I and present power point presentation before the panel of examiners and class students. The student should be able to answer the questions asked. The panel of examiner will assess the seminar contents and seminar presentation and assign the marks. In this phase the students are expected to define the problem for dissertation through further literature survey, case studies, data collection, surveys, pilot studies, mathematical/analytical modeling, etc., as necessary.

**Table 2: Assessment Table:**

| Assessment Tool | CO1 | CO2 | CO3 |
|---|---|---|---|
| | K2,K3, K4 | K2,K3,K4 | K2,K3,K4,K5 |
| Term Work- 50 Marks | 20 | 20 | 10 |
| Viva-voce Assessment-50 Marks | 10 | 20 | 20 |

**Table 3: Assessment Pattern:**

| Assessment Pattern Level No. | Knowledge Level | Term Work Assessment | Viva-voce Examination |
|---|---|---|---|
| K1 | Remember | | |
| K2 | Understand | | |
| K3 | Apply | 20 | 20 |
| K4 | Analyze | 20 | 20 |
| K5 | Evaluate | 10 | 10 |
| K6 | Create | -- | -- |
| **Total Marks** | | **50** | **50** |

**Designed by**
**Dr. N. J. Phadkule, Dr. N. R. Bhasme**

## Syllabus for Program Electives V, VI

| PEC V | Course Title | PEC VI | Course Title |
|---|---|---|---|
| EEPEC4001 | Power Systems Dynamics and Stability | EEPEC4011 | Electrical Power Distribution Systems |
| EEPEC4002 | HVDC and FACTs | EEPEC 4012 | Energy Conservation & Management |
| EEPEC4003 | Power Systems Planning Operation & Control | EEPEC 4013 | PLC and Automation |
| **Honor I-1 EEHNC7003** | **Power Quality & Mitigation** | **Honor II- EEHNC 7008** | **Industrial Automation & Control** |
| **Honor I-1-EEHNC7004** | **EHVAC Transmission** | **Honor I-1-EEHNC7009** | **Control of Electrical Drives** |

| EEPEC 4001: Power Systems Dynamics and Stability<br>(Professional Elective V) | |
|---|---|
| **Teaching Scheme**<br>Lectures : 3 Hrs/Week<br>Tutorial : 0<br>Total Credits : 3 | **Examination Scheme**<br>ISE I : 15 Marks<br>ISE II : 15 Marks<br>ISE III : 10 Marks<br>ESE Exam :60 Marks |

**Course description:**

This course deals with various stability conditions of the power system, causes for instability and methods of stability enhancement. This course deals with various excitation control methods, reactive power compensation and load frequency control.

**Course Objectives:**

The objective of the course is to give exposure to the students of-

1. concepts of power system stability.
2. transient stability and methods of analysis.
3. excitation systems and small signal stability
4. concept of voltage stability
5. various methods of voltage stability improvement

**Course Outcomes:**

After completing the course, students will able to-

| | |
|---|---|
| **CO1** | explain various stability conditions of power systems |
| **CO2** | analyze stability under various conditions using numerical methods |
| **CO3** | evaluate the effect of excitation on small signal stability |
| **CO4** | analyze the concepts of voltage stability |
| **CO5** | identify and apply various methods of stability improvement |

**Detailed Syllabus:**

| | |
|---|---|
| **Unit I** | **Power System Stability :**<br>concept of steady state, transient and dynamic stability, classification of stability-rotor angle and voltage stability, synchronous machine representation, classical model, load modeling, modeling of excitation systems, modeling of prime movers, stability problem, power angle equation, node elimination techniques, steady state stability limit, methods to determine steady state stability limit, Clarke diagram |
| **Unit II** | **Transient stability analysis :**<br>Swing equation, equal area criterion, solution of swing equation, numerical methods: Euler method, Runge-Kutta method, critical clearing time and angle effect of excitation system and governors, Multi-machine stability, extended equal area criterion, transient energy function approach, effect of type of fault, grounding, reclosing on transient stability limit |
| **Unit III** | **Excitation System:** Excitation System requirements, Elements of an excitation system, types of excitation systems.<br>**Small signal stability:** State space representation, Eigenvalues, modal matrices, small signal stability of single machine infinite bus system, synchronous machine classical model representation, effect of field circuit dynamics, effect of excitation system, small signal stability of a multi machine system. |
| **Unit IV** | **Voltage stability:** Basic concepts of voltage stability, role of reactive power, on voltage stability, P-V and Q-V profiles, mechanism and causes of voltage stability collapse, prevention of voltage collapse, voltage stability indicators, reactive compensation methods |

| | |
|---|---|
| **Unit V** | **Methods of improving stability:** Transient stability enhancement, small signal stability enhancement, high speed fault clearing, steam turbine fast valuing, high speed excitation systems, fundamentals and performance of Power System Stabilizer, multi band PSS, three dimensional PSS Location and dispatch of reactive power by VAR sources |

**Text and Reference Books:**


1. W.D. Stevenson, "Elements of Power Systems Analysis", McGraw Hill
2. K. R. Padiyar, "Power System Dynamics: Stability and Control", BS Publications, Second Edition, 2008.
3. Wadhawa C.L, "Electrical Power System", Wiley Eastern ltd.
4. I.J. Nagrath and D.P. Kothari, "Modern Power System Analysis", Tata McGraw-Hill
5. HadiSaadat, " Power System Analysis", Tata McGraw-Hill
6. O.I. Elgerd, "Electric Energy Systems Theory" , Tata McGraw-Hill
7. Stevenson W.D. and Grainger J.J., "Power System Analysis", McGraw-Hill
8. PrabhaKundur , "Power System Stability And Control", Tata McGraw-Hill


**Mapping of Course Outcome with Program Outcomes:**

| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 1 | | | 1 | 1 | 1 | 1 | | |
| CO2 | 3 | 2 | | | | 1 | | | 1 | 1 | 1 | 1 | | |
| CO3 | 3 | 2 | | | | 1 | | | 1 | 1 | 1 | 1 | | |
| CO4 | 3 | 2 | | | | 1 | | | 1 | 1 | 1 | 1 | | |
| CO5 | 3 | 2 | | | | 1 | | | 1 | 1 | 1 | 1 | | |

**1-Low, 2-Medium 3- High**

**ISE III Assessment:** Teachers Assessment is based on one of the or combination of the following. However, the course coordinator has to announce assessment components at the beginning of the course.

1. Presentation on latest topics/Real life problems related with the subject
2. Assignments
3. Simulations problems
4. Quiz
5. MCQ Test

**Sample Assessment Pattern:**

| **Sample Assessment Pattern Level No.** | **Knowledge Level** | **ISE I** | **ISE II** | **ISE III** | **End Semester Examination** |
|---|---|---|---|---|---|
| K1 | Remember | | | | |
| K2 | Understand | 5 | 5 | 5 | 30 |
| K3 | Apply | 5 | 5 | 5 | 30 |
| K4 | Analyze | | | | |
| K5 | Evaluate | | | | |
| K6 | Create | | | | |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Sample Assessment Table:**

| Assessment Tool | K2+K3 | K2+ K3 | K2+ K3 | K2 | K2+ K3 |
|---|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 | CO5 |
| ISE I (15 Marks) | 10 | 5 | | | |
| ISE II ( 15 Marks) | | | 10 | 5 | |
| ISE III Assessment (10 Marks) | | | | 5 | 5 |
| ESE Assessment (60 Marks) | 12 | 12 | 12 | 12 | 12 |

**Designed by**
**Prof. S. S. Dhamse**

| EEPEC4002: HVDC and FACTS (Professional Elective V) | |
|---|---|
| **Teaching Scheme** | **Examination Scheme** |
| Lectures : 3 Hrs./Week | ISE I : 15 Marks |
| Tutorial : 00 | ISE II : 15 Marks |
| Total Credits : 03 | ISE III : 10 Marks |
| | ESE Exam : 60 Marks |

**Course Description**: This is an elective course & covers the different aspects of power systems in restructured environments.

**Course Objectives:**

The objectives of the course is to give exposure to the students of-

1. Configuration and working of HVDC systems
2. Various control schemes for DC power transmission
3. Different protection schemes of HVDC systems
4. Operation and applications of shunt, series and combined compensators

**Course Outcomes:** After completing the course, students will able to:

| | |
|---|---|
| CO1 | discuss the HVDC transmission systems and its converters |
| CO2 | differentiate the various control schemes for DC power transmission |
| CO3 | identify the suitable methods to reduce the harmonics in HVDC system |
| CO4 | analyze suitable compensation methods for AC transmission systems |
| CO5 | select and apply various reactive power compensation schemes in AC transmission systems |

**Detailed Syllabus:**

| | |
|---|---|
| **Unit 1** | **Introduction of HVDC systems:** AC and DC transmission systems, application of DC transmission, types of DC links, layout of a HVDC converter station. HVDC converters, pulse number, analysis of Graetz circuit with and without overlap, converter bridge characteristics, equivalent circuits or rectifier and inverter configurations, twelve pulse converters |
| **Unit 2** | **Converter & HVDC System Control:** Principles of DC Link Control-Converters Control Characteristics-system control hierarchy, firing angle control, current and extinction angle control, starting and stopping of DC link |
| **Unit 3** | **Harmonics, Filters and Reactive Power Control:** Introduction, generation of harmonics, AC and DC filters. Reactive Power Requirements in steady state, sources of reactive power, static VAR systems. **Power Flow Analysis in AC/DC Systems:** Modeling of DC/AC converters, Controller Equations-Solutions of AC/DC load flow-Simultaneous method-Sequential method.. |
| **Unit 4** | **Introduction to FACTS:** Flow of power in AC parallel paths and meshed systems, basic types of FACTS controllers, brief description and definitions of FACTS controllers. **Static Shunt-Compensators:** Objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators, SVC and STATCOM, comparison between SVC and STATCOM. |
| **Unit 5** | **Static Series-Compensators**: Objectives of series compensation, variable impedance type-thruster switched series capacitors (TCSC), and switching converter type series compensators, static series synchronous compensator (SSSC)-power angle characteristics-basic operating control schemes. **Combined Compensators:** Introduction, unified power flow controller (UPFC), basic operating principle, independent real and reactive power flow controller, control structure. |

**Text and Reference Books:**


1. HVDC Transmission, S. Kamakshaiah, V. Kamaraju, The Mc-Graw Hill

2. HVDC power Transmission systems by K.R. Padiyar, Wiley Eastern Limited
3. Understanding of FACTS by N.G. Hingorani & L. Gyugyi, IEEE Press.
4. Flexible AC Transmission Systems (FACTS) Young Huasong & Alian T. hons, The Institution of Electrical Engineers, IEEE Power and Energy Series 30.


**ISE III Assessment:** It is based on one or combination of the following.

1. Presentation on latest topics/Real life problems related with the subject
2. Simulations problems
3. Quiz
4. MCQ

**Mapping of Course Outcome with Program Outcomes:**

| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 1 | | 2 | 2 | | | 1 | 2 | 1 | |
| CO2 | 3 | 2 | 2 | 1 | 1 | | 2 | 2 | | | 1 | 2 | 1 | |
| CO3 | 3 | 2 | 2 | 1 | 1 | | 2 | 2 | 1 | | 1 | 2 | 1 | |
| CO4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | | | 2 | 1 | |
| CO5 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | | | 2 | 1 | |

**1-Low,2-Medium, 3-High**

**Sample Assessment Pattern:**

| **Assessment Pattern Level No.** | **Knowledge Level** | **ISE I** | **ISE II** | **ISE III** | **End Semester Examination** |
|---|---|---|---|---|---|
| K1 | Remember | | | | |
| K2 | Understand | 10 | 10 | | 20 |
| K3 | Apply | 5 | 5 | 5 | 20 |
| K4 | Analyze | | | 5 | 20 |
| K5 | Evaluate | | | | |
| K6 | Create | | | | |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Sample Assessment Table**:

| Assessment Tool | K1+K2 | K2+K3 | K2+K3 | K2+K3 | K2+K3 |
|---|---|---|---|---|---|
| | C01 | C02 | C03 | CO4 | CO5 |
| ISE I (15 Marks) | 10 | 05 | | | |
| ISE II (15 Marks) | | | 10 | 05 | |
| ISE III Assessment (10 Marks) | | | 5 | 5 | 10 |
| ESE Assessment (60 Marks) | 12 | 12 | 12 | 12 | 12 |

**Designed by**
**Dr. S. S. Mopari**



Dr. N. R. Bhasme
Head, Electrical

Dr. Anil Karwankar
Dean , Academics

B.Tech. Electrical Engineering Curriculum
With effect from Academic Year 2026–2027
*Approved in the 32nd Academic Council Meeting, dated 28th July 2026*

| EEPEC4003: Power System Planning, Operation & Control (Program Elective V) | |
|---|---|
| **Teaching Scheme** | **Examination Scheme** |
| Lectures: 3 Hrs/Week | ISE I :15 Marks |
| Tutorial: 0 Hr/Week | ISE I :15 Marks |
| Credits: 03 | ISE III : 10 Marks |
| | End-Semester Examination : 60 Marks |

**Course Description**: This course covers aspects of planning, operation and control of power systems.

**Course Objectives:** The objectives of the course are to introduce & explain:
1. Planning & forecasting of loads
2. Methods to determine transmission loss
3.load frequency control.
4.Real & reactive power control
5. Operation & control of interconnected power systems

**Course Outcomes:** After completing the course, students will able to:

| | |
|---|---|
| CO1 | Explain load forecasting and load frequency control |
| CO2 | Analyze various methods of real & reactive power control |
| CO3 | Analyze various methods for economic operation of power system |
| CO4 | Apply unit commitment for reliable operation of power system |
| CO5 | Explain computer control & Low carbon operations in power system |

**Detailed Syllabus:**

| | |
|---|---|
| **Unit 1** | **Introduction & Load frequency Control**<br>Objectives of planning-Long and short term planning, Load forecasting, characteristics of loads, methodology of forecasting-energy forecasting, peak demand forecasting, total forecasting, annual and monthly peak demand forecasting<br>Basics of speed governing mechanism and modeling -speed- load characteristics, load sharing between two synchronous machines in parallel. Control area concept. Load Frequency Control of a single area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two- area system |
| **Unit 2** | **Reactive Power and Voltage Control:**<br>Basics of reactive power control, Excitation, systems, modeling. Static and dynamic analysis: stability compensation generation and absorption of reactive power. Methods of voltage control. MVAR injection of switched capacitors, series and shunt compensation, Load compensation and system compensation, FACT controllers |
| **Unit 3** | **Economic Operation:**<br>Statement of economic dispatch problem – cost of generation-Incremental cost curve - co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. Economic Aspects of Power Generation: Load curve, load duration and integrated load duration curves – load demand, diversity, capacity, utilization and plant use factors |

| | |
|---|---|
| **Unit 4** | **Unit Commitment**:<br>Statement of Unit Commitment problem-constraints, spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints. Solution methods – Priority list methods - forward dynamic programming approach. Numerical problems on priority-list method using full- load average production cost and Forward DP method. |
| **Unit 5** | **Computer control & Low carbon operations:**<br>Need for computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions- SCADA and EMS functions.<br>Low carbon power system operations, emission dispatch model, emission reduction policies , emission trading & deregulation of power sector |

**Text and Reference Books**


1. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill,Publishing Company Ltd, New Delhi, 30th reprint,2007.
3. P. Kundur, Neal J. Balu, 'Power System Stability & Control', IEEE, 1998.
4. Chakrabarti & Haldar, "Power System Analysis: Operation and Control", PHI India, 2004 Edition.
5. C.L.Wadhwa, 'Power System Analysis', New Age International- 6th Edition, 2010,
6. Robert Miller, James Malinowski, 'Power System Operation', Tata McGraw Hill Publishing Company Ltd, New Delhi, 3E, JUN-09.


**ISE III Assessment:** It is based on any one or combination of the following.

1. Presentation on latest topics/Real life problems related with the subject
2. Simulations problems
3. Quiz
4. MCQ

**Sample Assessment Pattern:**

| **Assessment Pattern Level No.** | **Knowledge Level** | **ISE I** | **ISE II** | **ISE III** | **End Semester Examination** |
|---|---|---|---|---|---|
| K1 | Remember | | | | |
| K2 | Understand | 10 | 10 | | 20 |
| K3 | Apply | 5 | 5 | 5 | 20 |
| K4 | Analyze | | | 5 | 20 |
| K5 | Evaluate | | | | |
| K6 | Create | | | | |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Sample Assessment table**:

| Assessment Tool | K1+K2 | K2+K3 | K2+K3 | K2+K3 | K2+K3 |
|---|---|---|---|---|---|
| | C01 | C02 | C03 | CO4 | CO5 |
| ISE I (15 Marks) | 10 | 5 | | | |
| ISE II (15 Marks) | | | 10 | 5 | |
| ISE III Assessment (10 Marks) | | | 5 | 5 | |
| ESE Assessment (60 Marks) | 12 | 12 | 12 | 12 | 12 |

**Designed by**
**Prof. M.R.Bachawad**



Dr. N. R. Bhasme
Head, Electrical

Dr. Anil Karwankar
Dean , Academics

B.Tech. Electrical Engineering Curriculum
With effect from Academic Year 2026–2027
*Approved in the 32nd Academic Council Meeting, dated 28th July 2026*

| EEPEC 4011: Electrical Power Distribution Systems (Professional Elective VI) | | | |
|---|---|---|---|
| **Teaching Scheme** | | **Examination Scheme** | |
| Lectures | : 3 Hrs./Week | ISE I | : 15 Marks |
| Tutorial | : 00 | ISE II | : 15 Marks |
| Total Credits | : 03 | ISE III | : 10 Marks |
| | | End Semester Exam | : 60 Marks |

**Course Description:** This is the course in Electrical Engineering which introduces the basic concepts and techniques for processing signals on a computer and being familiar with filter design, transform-domain processing and importance of Signal Processors.

**Course Objectives:** The objectives of the course are to give exposure to-

1. Distinguish between transmission, and distribution line and design the feeders
1. Design of distribution feeders and select appropriate substation location
3. Compute power loss and voltage drop of the feeders
4. Design protection of distribution systems
5. Understand the importance of voltage control and power factor improvement

**Course Outcomes:**

After completing the course, students will able to:

| | |
|---|---|
| **CO1** | Understand the general concepts of distribution systems and difference between transmission systems and distribution systems |
| **CO2** | Design the distribution feeders and secondary distribution system and Identify and select appropriate sub–station location |
| **CO3** | Analyze a distribution system for voltage drop and power loss calculation |
| **CO4** | Understand faults on distribution systems and protective devices and its coordination for protection of distribution systems. |
| **CO5** | Analyze Voltage control and Power factor improvement procedures for distribution systems. |

**Detailed Syllabus:**

| | |
|---|---|
| **Unit I** | **Introduction and General concepts**<br>Introduction to Distribution Systems, Load modeling and Characteristics-Coincidence factor, Contribution factor, loss factor, Relationship between the load factor and loss factor, Classification and characteristics of loads -Residential, commercial, Agricultural and Industrial. Distribution System Planning |
| **Unit II** | **Distribution Feeders and Substations**<br>**Distribution Feeders:** Design Considerations of distribution feeders: Radial, loop and network types of primary feeders, Voltage levels, Feeder loading, general circuit constants (A, B, C, D) to radial feeders, Basic design practice of the secondary distribution system.<br>**Substations:** Location of substations, Rating of distribution substation, Service area within primary feeders- Benefits and methods of optimal location of substations. |
| **Unit III** | **Distribution System Analysis:**<br>**Voltage drop and power–loss calculations**: Derivation for voltage drop and power loss in lines-Uniformly distributed loads and non-uniformly distributed loads -Numerical problems-Three phase balanced primary lines. Power Flow Analysis of balanced distribution system |
| **Unit IV** | **Protective Devices & Coordination:** Objectives of Distribution system protection, Types of common faults and procedure for fault calculation<br>**Protective devices:** Principle of operation of fuses, circuit reclosers and line sectionalizers and circuit breakers.<br>**Coordination of Protective device**s: General coordination procedure |
| **Unit V** | **Voltage control and Power factor improvement:**<br>**Voltage Control:** Equipment for voltage control, Effect of series capacitors, Effect of AVB/AVR - Line drop compensation, Numerical problems.<br>**Power factor improvement:** Capacitive compensation for power factor control, Different types of power capacitors, shunt and series capacitors, Effect of shunt capacitors (Fixed and switched), Power factor correction, Capacitor allocation, Economic justification, Procedure to determine the best capacitor location, Numerical problems. |

**Text/ Reference Books**


1. Electrical Power Distribution Systems by V.Kamaraju, Right Publishers.
2. Electric Power Distribution – by A.S. Pabla, Tata McGraw–hill Publishing company, 4th edition, 1997.
3. Distribution System Modeling and Analysis by William H Kersting- CRC Press,Taylor and Francis Group 3rd Edition, 2012
4. 2. Turan Gonen, Electric Power Distribution System Engineering, CRC Press, 3rd Edition 2014.

**Mapping of Course Outcome with Program Outcomes:**

| Course Outcome | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | P O7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 | PS O 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | 1 | 1 | | | 1 | | | 1 | | 1 | 2 |
| CO2 | 3 | 2 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 2 |
| CO3 | 3 | 2 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | | 1 | | 1 | 2 |
| CO4 | 3 | 2 | 2 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 2 |
| CO5 | 3 | 2 | 1 | 2 | 1 | | | | 1 | | | 1 | | 1 | 2 |

**1 –Low 2 – Medium 3 –High**

**ISE III Assessment:** It is of 10 marks based on one of the / or combination of few of following,

1. Assignment, 2. MCQ

**Sample Assessment Pattern:**

| **Level No.** | **Knowledge Level** | **ISE I** | **ISE II** | **ISE III** | **End Semester Examination** |
|---|---|---|---|---|---|
| K2 | Understand | 10 | 10 | | 20 |
| K3 | Apply | 5 | 5 | 5 | 20 |
| K4 | Analyze | | | 5 | 20 |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Sample Assessment Table:**

| Assessment Tool | K2+K3 | K2+K3 | K2+K3 | K2+k3+K4 | K2+k3+K4 |
|---|---|---|---|---|---|
| | C01 | C02 | C03 | CO4 | CO5 |
| ISE I, ISE II (30 Marks) | 06 | 06 | 06 | 06 | 06 |
| ISE III (10 Marks) | 2 | 2 | 2 | 2 | 2 |
| ESE (60 Marks) | 12 | 12 | 12 | 12 | 12 |

**Designed by**
**Dr. Sunanda Ghanegaonkar**

| EEPEC4012 : Energy Conservation and Management<br>(Program Elective VI) | |
|---|---|
| **Teaching Scheme** | **Examination Scheme** |
| Lectures : 3 Hrs/Week | ISE I : 15 Marks |
| Tutorial : 0 | ISE II : 15 Marks |
| Total Credits : 3 | ISE III : 10 Marks |
| | ESE Exam :60 Marks |

**Course description:**

The course is aimed to provide detailed understanding of energy conservation and management. Energy-Economics & Environment and their energy audit & financial management.

**Course objectives:**

The objective of the course is to give exposure to the students of

1. Challenges associated with commercial and non-commercial energy
2. Different terms and principles of energy conservation audit & management and energy audit report
3. Simple pay-back period of ENCON opportunities
4. Efficient electricity utilization and identify energy saving potential
5. Efficient heat utilization and identify energy saving potential

**Course outcomes:**

After completing the course, students will able to

| | |
|---|---|
| **CO1.** | Differentiate between commercial and non-commercial energy |
| **CO2** | Demonstrate the knowledge of energy conservation and energy audit |
| **CO3** | Identify the financial aspects of energy conservation opportunities |
| **CO4** | Evaluate & apply the energy saving and conservation in different electrical systems |
| **CO5** | Evaluate and apply the energy saving and conservation in different thermal systems |

**Detailed Syllabus**

| | |
|---|---|
| **Unit-I** | **Energy Scenario:**<br>Energy sources-primary and secondary, commercial and non-commercial, energy scenario in India and global scenario, Energy security, energy and GDP, energy intensity, energy conservation and its importance, Energy Conservation Act 2001 and related policies, role of non-conventional and renewable energy |
| **Unit-II** | **Energy Audit:**<br>Strategy of energy audit, detailed and walkthrough energy audit, comparison with standards, considerations in implementing energy with conservations programs, instruments for energy audit, energy audit of illumination system, energy audit of electrical systems, energy audit of heating ventilation and air conditioning systems, energy audit of compressed air system, energy audit of building, energy audit of thermal systems, distribution and utilization systems, economic analysis, bench marking, energy conservation Act 2003 |
| **Unit-III** | **Financial Analysis and Management:**<br>Investment need, financial analysis techniques, calculation of simple pay-back period, return on investment, cash flows, risk and sensitivity analysis, time value of money, net present value, breakeven analysis, cost optimization, cost and price of energy services, cost of energy generated through distributed generation |

| | |
|---|---|
| **Unit-IV** | **Energy efficiency in Electrical Utility:**<br>Losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors. |
| **Unit-V** | **Energy Efficiency in Thermal Utility:**<br>Compressed air systems: Types of air compressors, compressor efficiency, efficient compressor operation, compressed air systems component, capacity assessment, leakage test, factors affecting the performance and saving opportunities, HVAC and refrigeration systems, vapor compression refrigeration cycle refrigerants, coefficient of performance, capacity factors affecting refrigeration and air conditioning systems, performance and saving opportunities, vapor absorption refrigeration systems, principle types, saving potential, fan and blowers, types, performance evaluation<br>Types of captive power plants, Cogeneration-Cogeneration technologies, industries suitable for cogeneration |

**Text and Reference Books:**


1. Guide books for National Certification Examination for Energy Manager/ Energy Auditors Book-1, General Aspects, Book-2 Thermal Utilities, Book-3 Electrical Utilities, Book-4.
2. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
3. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press
4. Carbon Capture and Sequestration: Integrating Technology, Monitoring and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing
5. Heating and Cooling of Buildings- Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill Publication, 1994
6. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
7. B. E. Kushare "Handbook on Energy Efficient Motors", International Copper promotion counsel (India).


**Mapping of Course outcome with program outcomes:**

| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 1 | 1 | 1 | | | | 2 | 2 | |
| CO2 | 3 | 1 | | | | 1 | 1 | 1 | | | | 2 | 2 | |
| CO3 | 3 | 1 | | | | | | | | | | 2 | 2 | |
| CO4 | 3 | 1 | 1 | | | 1 | | 1 | | | | 2 | 2 | |
| CO5 | 3 | 1 | | | | | | 1 | | | | 2 | 2 | |

**1- Low 2- Medium 3- High**

**Sample Assessment Pattern:**

| **Assessment Pattern Level No.** | **Knowledge Level** | **ISE I** | **ISE II II** | **ISE III Assignment** | **End Semester Examination** |
|---|---|---|---|---|---|
| K1 | Remember | | | | |
| K2 | Understand | 10 | 10 | | 20 |
| K3 | Apply | 5 | 5 | 5 | 20 |
| K4 | Analyze | | | 5 | 20 |
| K5 | Evaluate | | | | |
| K6 | Create | | | | |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Sample Assessment Table:**

| Assessment Tool | K2+K3 | K2+K3 | K2+K3 | K2+k3+K4 | k2+k3 |
|---|---|---|---|---|---|
| | C01 | C02 | C03 | CO4 | CO5 |
| ISE I, ISE II (Test 30 Marks) | 10 | 05 | 10 | 05 | |
| ISE III Assessment (10 Marks) | 2 | 2 | 2 | 2 | 2 |
| ESE Assessment (60 Marks) | 12 | 12 | 12 | 12 | 12 |

**ISE III Assessment:** Teacher's Assessment is based on one of the /or combinations of the few of the following.

1. Assignments
2. Models/ Presentations
3. Multiple choice questions test
4. Quiz

**Designed by**
**Prof. B. T. Deshmikh**

| EEPEC 4013: PLC and Automation<br>(Program Elective VI) | |
|---|---|
| **Teaching Scheme**<br>Lectures : 3 Hrs/Week<br>Tutorial : 0<br>Total Credits : 3 | **Examination Scheme**<br>ISE I : 15 Marks<br>ISE II : 15 Marks<br>ISE III/TA : 10 Marks<br>ESE Exam :60 Marks |

**Course Description:** This course introduces the principles, architecture, programming, and industrial applications of Programmable Logic Controllers (PLC) and Supervisory Control ,Data Acquisition (SCADA) systems and automation. Students will learn industrial automation concepts, PLC programming using IEC 61131-3 standards, HMI development, communication protocols, SCADA architecture, and integration of PLC-SCADA systems for modern industrial processes.

**Course Objectives:** -The objectives of the course are to

1. Identify the core differences between fixed, programmable, and flexible automation systems.
2. Develop PLC programs using standard Ladder Logic (LD) code structure.
3. Create structured, reusable function blocks to streamline programming for recurring tasks.
4. Design clean, intuitive HMI graphic screens for real-time machine monitoring.
5. Establish data communication lines using Modbus, Profibus, and Industrial Ethernet.

**Unit wise Course Outcomes expected:** Students will be able to

| | |
|---|---|
| **CO1.** | Explain the architecture and operation of PLC-based industrial automation systems |
| **CO2** | Develop PLC programs using ladder logic and other IEC 61131-3 programming languages |
| **CO3** | Design and implement industrial control applications using timers, counters, sequential logic, industrial communication protocols and networking |
| **CO4** | Develop SCADA applications for process monitoring, data acquisition, and supervisory control |
| **CO5** | Integrate PLC and SCADA systems for real-time industrial automation applications. |

**Detailed Syllabus:**

| | |
|---|---|
| **Unit-I** | **Introduction to Industrial Automation and PLC Fundamentals**<br>Evolution of industrial automation ,Relay-based control systems and limitations ,Introduction to PLC, PLC architecture and hardware components, CPU, memory, power supply, I/O modules, PLC scan cycle, PLC selection criteria ,Applications of PLC in industries |
| **Unit-II** | **PLC Programming Fundamentals**<br>IEC 61131-3 programming standards ,Ladder Diagram (LD) ,Basic instructions ,Contacts, Coils ,Set/Reset ,Internal relays and memory bits ,Timer instructions ,Counter instructions, Arithmetic and comparison instructions, Program documentation and troubleshooting |

| | |
|---|---|
| **Unit-III** | **Advanced PLC Programming and Industrial Applications**<br>Sequential control systems ,State-machine concepts ,Shift registers ,Data handling instructions ,Analog signal processing ,PID control in PLC ,Safety PLC concepts ,Motor control applications ,Conveyor automation Packaging and process automation systems Industrial communication requirements ,Serial communication fundamentals ,Modbus RTU and Modbus TCP/IP , Profibus ,Profinet , Ethernet/IP , DeviceNet, OPC architecture ,Industrial IoT concepts |
| **Unit-IV** | **SCADA Systems and Human Machine Interface**<br>SCADA architecture ,Components of SCADA systems ,Remote Terminal Units (RTU) ,Data acquisition concepts ,HMI design principles ,Alarm management ,Historical data logging ,Trend analysis ,Report generation |
| **Unit-V** | **PLC-SCADA Integration and Industry 4.0 Applications**<br>PLC-SCADA integration architecture ,Real-time monitoring and control ,Database connectivity ,Cloud-based SCADA ,Cybersecurity in industrial control systems ,Industry 4.0 concepts ,Smart manufacturing ,Digital twins ,Case studies in power plants, process industries, and manufacturing systems |

**Text /reference books:**


1. Programmable Logic Controllers, Author: Frank D. Petruzella,Publication: McGraw Hill
2. Dobrivojie Popovic, Vijay P**.** Bhatkar, "Distributed Computer Control for Industrial Automation", Dekker Publications.
3. Webb and Reis," Programmable Logic Controllers: Principles and Applications", PHI.
4. Automation, production systems, and computer-integrated manufacturing, author: mikell p. groover, publication: pearson education
5. Introduction to industrial automation, author: stamatios manesis & george nikola kopoulos, publication: crc press (taylor & francis group)


**Mapping of Course outcome with program outcomes:**

| Course Outcome | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | 2 | | 2 | 1 | 1 | | 2 | 2 | 2 | |
| CO2 | 3 | 2 | | | 2 | | 2 | 1 | 1 | | 2 | 2 | 2 | |
| CO3 | 3 | 2 | 1 | 1 | 2 | | 2 | 1 | 1 | | 2 | 2 | 2 | |
| CO4 | 3 | 2 | 1 | 1 | 2 | | 2 | 1 | 1 | | 2 | 2 | 2 | |
| CO5 | 3 | 2 | 1 | | 2 | | 2 | 1 | 1 | | 2 | 2 | 2 | |

**1- Low 2- Medium 3- High**

**ISE III Assessment:** The teacher's assessment should be done based on any one or combination of any two of the following schemes.( 10 M)

1. Assignments
2. Objective type test
3. Modeling using any electrical software
4. Technical/Industrial visit report/Quiz

**3. Assessment Table:**

| Assessment Tool | K1+K2+ K3 | K1+K2+ K3 | K1+ K2 | K2 | K1+K3 |
|---|---|---|---|---|---|
| Course Outcome | CO1 | CO2 | CO3 | CO4 | CO5 |
| ISE I :15 Marks | 10 | 5 | | | |
| ISE II : 15 Marks | | | 10 | 5 | |
| ISE III :10 Marks | | | | 05 | 05 |
| ESE Assessment 60 Marks | 12 | 12 | 12 | 12 | 12 |



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**4. Assessment Pattern:**

| Assessment Pattern Level No. | Knowledge Level | ISE I | ISE II | ISE III Assessment | End Semester Examination |
|---|---|---|---|---|---|
| K1 | Remember | | | | - |
| K2 | Understand | 5 | 5 | | 20 |
| K3 | Apply | 5 | 5 | 5 | 20 |
| K4 | Analyze | 5 | 5 | 5 | 20 |
| **Total** | | 15 | 15 | 10 | 60 |

**Designed by Dr. N. R. Bhasme, Prof. B. T. Deshmukh**

| MERMC4002: Research Methodology | |
|---|---|
| **Teaching Scheme**<br>Lectures : 02 Hrs/Week<br>Tutorial : 00<br>Total Credits : 02 | **Examination Scheme**<br>ISE I : 10 Marks<br>ISE II : 10 Marks<br>ISE III : 00 Marks<br>End -Semester Exam : 30 Marks |

**Course Outcomes:**

After completing the course students will able to

| Course Outcomes | |
|---|---|
| **CO1** | Formulate a research problem and design a structured methodology for engineering investigations. |
| **CO2** | Analyze experimental data using statistical methods and regression techniques. |
| **CO3** | Prepare technical reports and research papers while adhering to ethical guidelines and IPR protocols. |

**Detailed Syllabus:**

| | |
|---|---|
| **Unit 1** | **Introduction to Research and Research Design:**<br>Meaning, objectives, and types of research. Research process. Defining the research problem in Mechanical Engineering. Research design: features of a good research design. Sampling design. Measurement and scaling techniques. Methods of data collection: Experimental and Survey methods. |
| **Unit 2** | **Data Analysis and Optimization Techniques:**<br>Data analysis and statistical methods. Hypothesis testing. T-test and Analysis of Variance (ANOVA). Correlation and Regression analysis. Introduction to statistical tools (MATLAB/Excel) for data analysis. Introduction to optimization techniques. Taguchi Method. Basics of Response Surface Methodology (RSM) for thermal and manufacturing engineering problems. |
| **Unit 3** | **Technical Writing, Research Ethics, and Intellectual Property Rights:**<br>Structure of technical reports, thesis, and research papers. Technical writing and documentation. Referencing styles (IEEE). Plagiarism and plagiarism detection. Ethics in engineering research. Intellectual Property Rights (IPR): Copyrights, Patents, Trademarks, and Industrial Designs. Basics of patent drafting and filing process. |

**Text and Reference Books**


1. C.R. Kothari and Gaurav Garg, "Research Methodology: Methods and Techniques**,'** New Age International Publishers, 2019
2. Douglas C. Montgomery," Design and Analysis of Experiments', John Wiley & Sons, 2012
3. Ronald E. Walpole," Probability and Statistics for Engineers and Scientists", Macmillan USA, 1993
4. Madhav Phadke," Quality Engineering Using Robust Design", UDVELI books publication, 2021
5. George C. Runger,' Applied Statistics and Probability for Engineers", John Wiley & Sons Inc, 2013
6. Douglas C. Montgomery,' Introduction to Linear Regression Analysis", Wiley India Pvt Ltd, 2006
7. Robert A. Day," How to Write and Publish a Scientific Paper", Cambridge University Press, 7th edition, 2024




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**Online resources:**

- https://onlinecourses.nptel.ac.in/noc21_ge03/preview
- https://www.mendeley.com/guides/citation-guides/
- https://www.mathworks.com/products/statistics.html
- https://www.wipo.int/edocs/pubdocs/en/wipo-pub-1081-1-en-introduction-to-the-international-intellectual-property-legal-framework.pdf

**Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | 3 | - |
| CO2 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 3 | - |
| CO3 | 1 | - | - | 3 | - | - | - | 3 | - | 3 | 2 | 3 | 2 |

**1 – Low 2 – Medium 3 - High**

**Assessment:**

**ISE I:** Shall be on the basis of Class Tests on First and Second unit.

**ISE II:** Shall be based on class test on third unit

| EEHNC7003 : Power Quality and Mitigation<br>(Honor course) | |
|---|---|
| **Teaching Scheme**<br>Lectures : 03 Hrs/Week<br>Tutorial : 00<br>Total Credits : 03 | **Examination Scheme**<br>ISE I : 15 Marks<br>ISE II : 15 Marks<br>ISE III : 10 Marks<br>End -Semester Exam : 60 Marks |

**Course Description:** This course introduces power quality causes, its effects and requirement of power quality improvements and its mitigation techniques.

**Course Objectives:**

The objective of the course is to give exposure to the students of

1. Power quality problems and classification of power quality events
2. Different methods of monitoring power quality and standards for power quality
3. Passive shunt and series compensators
4. Active Shunt and Series Compensators
5. Unified Power Quality Compensators

**Course outcomes:**

After completing the course, students will able to

| | |
|---|---|
| **CO1.** | Define power quality as per international standards. |
| **CO2** | Describe and analyze voltage quality and its control |
| **CO3** | Describe and analyze PQ monitoring and the concepts of waveform distortion |
| **CO4** | Identify and analyze sources of harmonics |
| **CO5** | Evaluate effects of harmonics and identify power quality mitigation techniques |

| | |
|---|---|
| **UNIT-I** | **Introduction to Power Quality:**<br>Introduction, definition of power quality, Power Quality Terminologies, classification of power quality problems, Causes of power quality problems. Sources of power quality problem, Effects of power quality problems on users, Classification of mitigation techniques for power quality problems |
| **UNIT-II** | **Voltage Quality:** Introduction; Sources of Sags, Swell, Unbalance and Flicker; Voltage quality standards; Effects of sags, Swell, Unbalance and Flicker; Voltage sag magnitude due to fault; Voltage sag magnitude calculation based on influence of cross section of conductor, transformer and fault levels; Critical distance for a voltage sag magnitude; Causes of phase angle jumps in voltage; Classification of voltage sags, voltage sag transformation due to transformers.<br>Methods for improving Voltage Quality: Introduction; Dynamic Voltage Restorer (DVR): Operating principle, Configurations, State of the art, Design and control strategies. Three-phase four-wire DVR. |
| **UNIT-III** | **Power Quality Standards & Monitoring:**, Power Quality Standards IEEE, IEC&EN, Monitoring equipments, communication systems<br>**Waveform Distortion:** Introduction, Voltage versus current distortion, Harmonics versus transients, Harmonics indices: Total Harmonics Distortion (THD) and Total Demand distortion (TDD); Harmonic standards; Harmonic analysis; Harmonic phase sequence; Triplen harmonics; Inter-harmonics |

| | |
|---|---|
| **UNIT-IV** | **Harmonic Sources:** Harmonics generated from electrical machines such as transformers and rotating machines; Arcing devices; Static power conversion: Phase controlled and uncontrolled rectifiers, AC voltage regulators, Cyclo-converters, Pulse width modulated inverters; Converter fed ac and dc drives |
| **UNIT-V** | **Effects of Harmonics and mitigation techniques:** Effects of harmonics on rotating machines; Effect of harmonics on static power plant; Power assessment with distorted waveforms; Effect of harmonics on measuring instruments; Harmonic interference with ripple control systems; Harmonic interference with power system protection; Effect of harmonics on consumer equipment; Interference with communication systems.<br>Harmonic Elimination: Passive power filters, Shunt active power filters, Configurations, State of the art, Design and control strategies. Three-phase four-wire shunt active power filters, hybrid filters |

**Text and Reference Books:**


1. Bhim Singh, AmbrishChandra(2015) "Power Quality Problem and Mitigation Techniques" , Wiley Publications (ISBN: 9781118922057)
2. C. Sankaran (2002)" Power Quality" CRC Press Publication.
3. Math, H.J. Bollen, "Understanding power quality problem" Standard Publication.
4. Roger C. Dugan, "Electrical power system quality"2nd edition, McGraw-Hill Publication.
5. Mohammed A.S. Masoum, EwaldF.Fuchs " Power Quality in power systems and electric machines",2nd Edition, Kindle Edition,(ISBN: 978-0123695369)


**Mapping of Course outcome with Program Outcomes**

| Course outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| CO2 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 2 | 2 |
| CO3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| CO4 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 2 | 2 |
| CO5 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 2 | 2 |

**1- Low 2- Medium 3- High**

**Sample Assessment Table:**

| Assessment Tool | K2+K3 | K2+K3 | K2+K3 | K2+K3+ K4 | K2+K3+K4 |
|---|---|---|---|---|---|
| Course outcomes | CO1 | CO2 | CO3 | CO4 | CO5 |
| ISE I 15Marks | 10 | 5 | | | |
| ISE II 15Marks | | | 10 | 5 | |
| ISE III Assessment 10 Marks | 2 | 2 | 2 | 2 | 2 |
| ESE Assessment 60 Marks | 12 | 12 | 12 | 12 | 12 |

**ISE III Assessment:**

Teacher's Assessment is based on one of the following.

1. Assignments
2. Models/ Presentations
3. Multiple choice questions test
4. Quiz

**Sample Assessment Pattern**

| Assessment Pattern | Knowledge Level | ISE I | ISE II | ISE III Assessment | End Semester Examination |
|---|---|---|---|---|---|
| K1 | Remember | | | | - |
| K2 | Understand | 5 | 5 | | 20 |
| K3 | Apply | 5 | 5 | 5 | 20 |
| K4 | Analyze | 5 | 5 | 5 | 20 |
| **Total** | | 15 | 15 | 10 | 60 |

**Designed by Prof. B. T. Deshmukh**

| EEHNC7004 EHVAC Transmission (Honor course) | |
|---|---|
| **Teaching Scheme**<br>Lectures : 03 Hrs/Week<br>Tutorial : 00<br>Total Credits : 03 | **Examination Scheme**<br>ISE I : 15 Marks<br>ISE II : 15 Marks<br>ISE III : 10 Marks<br>ESE Exam : 60 Marks |

**Course description**: This course introduces the concepts of EHV AC Transmission System and its various aspects.

**Course Objectives:** The objective of the course is to give exposure to the students of

1. Basic aspects of EHVA.C. power transmission
2. Reflection and Refraction of Traveling Waves
3. Various causes of over voltages**.**
4. Reactive power flow in Power Systems.
5. Power Transfer Stability Limits of EHV Lines

**Course Outcomes:**

After completing the course, students will able to:

| | |
|---|---|
| CO1 | Describe EHVAC Power Transmission systems & evaluate surface voltage gradient |
| CO2 | Explain Traveling Waves & Standing Waves |
| CO3 | Analyze the causes of over voltages in EHV systems |
| CO4 | Explain reactive power flow & stability conditions |
| CO5 | Evaluate conditions for power transfer |

**Detailed Syllabus:**

| | |
|---|---|
| **Unit-1** | **EHV AC Transmission Line Fundamentals**<br>**Introduction to EHV Transmission**<br>Evolution and need for EHV and UHV transmission, Standard transmission voltage levels, Power transfer capability and transmission limits, Surge Impedance Loading (SIL), Line losses and efficiency considerations<br>**Electric Field Effects of EHV Lines**<br>Surface voltage gradient on conductors, Corona phenomenon and corona loss, Radio interference and audible noise, Electrostatic field under EHV lines, Measurement and mitigation of electric field effect |
| **Unit-2** | **Traveling Waves and Transients on Transmission Lines**<br>**Traveling Wave Theory**<br>Generation of traveling waves, Propagation on transmission lines, Reflection and refraction at discontinuities, Bewley lattice diagrams, Basic principles of traveling-wave-based fault location and protection.<br>**Line Energization and Transient Response**<br>Switching transients during line energization, Line energization with trapped charge, Transient response of systems with lumped inductance and capacitance. |
| **Unit-3** | **Switching Surges in EHV Systems**<br>**Origin and classification of overvoltages**<br>Switching overvoltages in EHV systems, Energization and reclosing surges, Interruption of inductive currents, Interruption of capacitive currents<br>**Control and Coordination**<br>Calculation and estimation of switching surges, Methods of overvoltage control, Pre-insertion resistors, Surge arresters, Insulation coordination for switching surges |

| | |
|---|---|
| **Unit-4** | **Reactive Power Control and Compensation of EHV Lines**<br>**Reactive Power Characteristics of Long Lines:**Reactive power generation and absorption in transmission lines, Voltage regulation of EHV lines, Ferranti effect<br>**Compensation Techniques:**Shunt reactors, Shunt capacitors, Series compensation, Static VAR Compensator (SVC), STATCOM (introductory treatment)<br>**Voltage Control:**Generator excitation control, Transformer tap-changing, Reactive power management in interconnected systems |
| **Unit-5** | **Power Transfer Capability and Voltage Stability**<br>**Power Transfer Limits:**Thermal limit, Voltage regulation limit, Steady-state stability limit, Practical transmission capability.<br>**Voltage Stability of EHV Systems:**Voltage stability concepts, Voltage collapse phenomenon, Receiving-end voltage characteristics, Maximum power transfer and voltage stability limit, Reactive power requirement at voltage stability limit, Methods for improving voltage stability<br>**Rotor Angle (Power Angle) Stability:** Steady-state stability, Transient stability, Dynamic stability (concepts only) |

**Text and Reference Books:**


1. A. Chakrabarti, D.P.Kothari, A.K. Mukhopadhyay ,"Performance, operation & control of EHV power transmission system " , wheeler publications
2. Rakosh Das Begamudre,"Extra high-voltage A.C. transmission Engineering" New Age International Pvt. Ltd.
3. S.Rao,"EHVAC and HVDC Transmission Engineering & Practice" , Khanna Publications


**Mapping of Course outcome with Program Outcomes:**

| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PS O1 | PS O 2 | PS O 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 2 | 2 | 2 | 1 | 2 | 1 | 3 | 1 | |
| CO2 | 3 | 2 | | | | 2 | 2 | 2 | 1 | 2 | 1 | 3 | 1 | |
| CO3 | 3 | 1 | | | | 2 | 2 | 2 | 1 | 2 | 1 | 3 | 1 | |
| CO4 | 3 | 1 | | | | 2 | 2 | 2 | 1 | 2 | 1 | 3 | 1 | |
| CO5 | 3 | 2 | | | | 2 | 2 | 2 | 1 | 2 | 1 | 3 | 1 | |

**1 – Low 2 – Medium 3 – High**

**ISE III Assessment: It is based** on one or combination of the following.

1.Assignments
2. MCQ
3. Quiz
4. Presentation on latest topics/Real life problems related with the course

**Sample Assessment Pattern:**

| **Assessment Pattern Level No.** | **Knowledge Level** | **ISE 1** | **ISE 2** | **ISE III Assignment** | **End Semester Examination** |
|---|---|---|---|---|---|
| | | | | | |
| K2 | Understand | 5 | 5 | | 20 |
| K3 | Apply | 5 | 5 | | 20 |
| K4 | Analyze | 5 | 5 | 5 | 20 |
| K5 | Evaluate | | | 5 | |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |



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**Sample Assessment table:**

| Assessment Tool | K2+K3 | K2+K3 | k2+k3 | K2+K3 | K2+K3 |
|---|---|---|---|---|---|
| | C01 | C02 | C03 | CO4 | CO5 |
| ISE I test (15 Marks) | 10 | 5 | | | |
| ISE II test (15 Marks) | | | 10 | 05 | |
| Teachers Assessment (10 Marks) | 02 | 02 | 02 | 02 | 02 |
| ESE Assessment (60 Marks) | 12 | 12 | 12 | 12 | 12 |

**Designed by Shri S. P. Vasekar**

| EEHNC7005 Mini-Project | | | |
|---|---|---|---|
| **Teaching Scheme** | | **Examination Scheme** | |
| Practical | :4hrs | ISE III | : 25 Marks |
| Total Credits | : 2 | ES E | : 25 Marks |

**Course Description:** The student shall collect, review, compile, comprehend, present research literature and identify the problem of the Electrical Power System. Students will present seminars on work done by them on any topic of recent technology. The seminar may include some simulation carried out by the student.

**Course Objectives:**

- To understand the "Product Development Process" including budgeting through Mini Project
- To plan for various activities of the project and distribute the work amongst team members
- To inculcate electronic hardware implementation skills
- To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project
- To understand the importance of document design by compiling Technical Report on the Mini Project work carried out

**Course Outcomes:** At the end of course students will be able to **:**

- Understand, plan and execute a Mini Project
- Implement electronic hardware by learning PCB artwork design, soldering techniques, testing, and troubleshooting etc.
- Prepare a technical report based on the Mini project
- Deliver technical seminar based on the Mini Project work carried out

**Course Contents:**

- Mini Project Work should be carried out in the Laboratory.
- Data sheets may be referred, well known project designs ideas can be necessarily adapted from recent issues of electronic design magazines
- Hardware/Software based projects can be designed
- Following areas are just a guideline
- Instrumentation and Control Systems
- Power Electronics
- Embedded Systems/ Microcontroller based projects should preferably use Microchip PIC controllers/AT mega controller/AVR microcontrollers
- Power system based
- Demonstration and Group presentations. Logbook for all these activities shall be maintained and shall be produced at the time of examination
- A project report with following contents shall be prepared:
  - Specifications/Block diagram/Circuit diagram/Selection of components, calculations
  - Simulation results
  - Layout versus schematic verification report
  - Testing procedures/Test results Conclusion

**Term Work:**

The Mini Project with Seminar shall consist of collection of literature from a chosen field of Electrical Engineering from various sources such as refereed journals, proceedings of national international conferences etc. Based on the literature survey,

case studies, data collection, surveys, pilot studies, mathematical/analytical modeling, etc., as necessary the candidate shall define the problem for the dissertation.

The candidate shall prepare a technical report in a prescribed format and present before a panel of examiners consisting of a guide and at least one faculty member of the department.

**Viva Voce Examination:** It consists of two parts.

**Part-I: Mid-Term Evaluation for 25 Marks:** A mid-term evaluations for 25 marks out of 50 marks shall be done as per the schedule given in the institute academic calendar. Students should prepare a power point presentation and present before the panel of examiners and class students and should be able to answer questions asked by the panel of examiners and class students. Panel of examiner consists of a guide as internal examiner and one faculty member appointed by the DCoE as external examiners. The panel of examiner will assess the contents and presentation and give the suggestions, if any and assign the marks out of 10. In this phase students are expected to collect and present substantial literature.

**Part-II: End Semester Evaluation for 25 Marks:** Students should prepare technical report in prescribed format duly incorporating suggestions of Part-I and present power point presentation before the panel of examiners and class students. The student should be able to answer the questions asked. The panel of examiner will assess the seminar contents and seminar presentation and assign the marks out of 25. In this phase the students are expected to define the problem for dissertation through further literature survey, case studies, data collection, surveys, pilot studies, mathematical/analytical modeling, etc., as necessary.

**Assessment Pattern:**

| Assessment Pattern Level No. | Knowledge Level | Term Work Assessment | Viva-voce Examination |
|---|---|---|---|
| K1 | Remember | 5 | |
| K2 | Understand | 10 | |
| K3 | Apply | 10 | 10 |
| K4 | Analyze | | 10 |
| K5 | Evaluate | | 5 |
| **Total Marks** | | **25** | **25** |

| EEHNC 7008 Industrial Automation & Control (Honors course) | | | |
|---|---|---|---|
| **Teaching Scheme** | | **Examination Scheme** | |
| Lectures | : 3 Hrs/Week | ISE I | : 15 Marks |
| Tutorial | : 0 Hr/Week | ISE II | : 15 Marks |
| Total Credits | : 3 | ISE III | : 10 Marks |
| | | End -Semester Exam | : 60 Marks |

**Course Description:** -This course introduces the basic concept of process control, building blocks of automation, various control configurations and industrial automation.

**Course Objectives:** -The objective of the course is to give exposure to the students of

1. Various measurement systems using sensors
2. Different process control configurations
3. Controllers used in industry
4. PLC systems used in Industry

**Unit wise Course Outcomes expected:** Students will be able to

| |
|---|
| **CO1**. explain various sensors for measurement of physical parameters |
| **CO2.** illustrate various control configurations used in process control |
| **CO3.** analyze controller performance like P, PI, PID in systems |
| **CO4.** understand PLC operation and implement for systems |
| **CO5**. compare various SCADA, DCS configurations for application |

**Detail syllabus:**

| | |
|---|---|
| **Unit-I** | **Introduction to Industrial Automation and Control** Architecture of Industrial Automation Systems, Introduction to sensors and measurement systems, Temperature measurement, Pressure and Force measurements , Displacement and speed measurement, Flow measurement techniques, Measurement of level, humidity, pH etc., |
| **Unit-II** | **Signal Conditioning:** Instrumentation amplifiers, basic characteristics. Chopped and Modulated DC Amplifiers, Isolation amplifiers, Opto-couplers-Buffer amplifiers. Noise Reduction Techniques in Signal Conditioning-Fundamentals of 4-20 mA current loops. Regulators and power supplies for industrial instrumentation. Estimation of errors and Calibration, Bus standard for communication between instruments-GPIB (IEEE-488 bus), RS 232 and RS 485 interface, Optical Fiber Based Signal Transmission-Piezoelectric Couplers, Intelligent transmitters. Interrupt-based Data Acquisition. Software Design Strategies-Hardware Vs Software Interrupts-Foreground/ background Programming Techniques. |
| **Unit-III** | **Type of Controllers:** Open-loop Vs Closed Loop control, Servo Vs Regulator Operation of Closed Loop System, Feedback and Feed forward Control Configuration, Cascade, Feed forward, and Ratio Control, multi loop Cascade Control, Feed forward Control, Feed forward- Feedback control configuration, Ratio Controller, PID control, Controller Tuning |
| **Unit-IV** | **Sequence Control:** Introduction, Basic parts of a PLC, Operation of a PLC, Basic symbols used in PLC, realization, Difference between PLC and Hardwired systems, Difference between PLC and computer, Relay logic to ladder logic, Ladder commands, Examples of PLC ladder diagram realization, PLC timers, PLC counters and examples, Classification of PLCs. |
| **Unit-V** | **DCS and SCADA system:** History of DCS, DCS concepts, DCS hardware & software, DCS structure, Advantages and disadvantages of DCS, Representative DCS, SCADA, SCADA hardware & software, DDC, Components and Working of DDC, Benefits of DDC, Digital controller realization, discrete domain analysis, Networking of sensors, Actuators, controllers, CANBUS, PROFIBUS AND MODBUS. |

**Text books:**

1. Dobrivojie Popovic, Vijay P**.** Bhatkar, “Distributed Computer Control for Industrial Automation”, Dekker Publications.
2. Webb and Reis,” Programmable Logic Controllers: Principles and Applications”, PHI.
3. S.K. Singh, “Computer Aided Process Control”, PHI
4. Garry Dunning, “Introduction to Programmable Logic Controllers”, Thomson Learning.
5. N. E. Battikha, “The Management of Control System: Justification and Technical Auditing”, ISA
6. Krishna Kant, “Computer Based Process Control”, PHI
7. Fu, Lee, Gonzalez, “Robotic Control, sensing and Intelligence”, Tata McGraw-Hill

**2. ISE III Assessment: It is** based on any one or combination of the following

1. Assignments
2. Objective type test
3. Modeling of electrical machines using any electrical software
4. Technical/Industrial visit report/Quiz

**3 Sample Assessment Pattern:**

| **Assessment Pattern Level No.** | **Knowledge Level** | **ISE 1** | **ISE 2** | **ISE III Assignment** | **End Semester Examination** |
|---|---|---|---|---|---|
| | | | | | |
| K2 | Understand | 5 | 5 | | 20 |
| K3 | Apply | 5 | 5 | | 20 |
| K4 | Analyze | 5 | 5 | 5 | 20 |
| K5 | Evaluate | | | 5 | |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**4. Sample Assessment table:**

| Assessment Tool | K2+K3 | K2+K3 | k2+k3 | K2+K3 | K2+K3 |
|---|---|---|---|---|---|
| | C01 | C02 | C03 | CO4 | CO5 |
| ISE I test (15 Marks) | 10 | 5 | | | |
| ISE II test (15 Marks) | | | 10 | 05 | |
| Teachers Assessment (10 Marks) | 02 | 02 | 02 | 02 | 02 |
| ESE Assessment (60 Marks) | 12 | 12 | 12 | 12 | 12 |

**Designed By**
**Dr. S. S. Kulkarni**



Dr. N. R. Bhasme
Head, Electrical

Dr. Anil Karwankar
Dean , Academics

B.Tech. Electrical Engineering Curriculum
With effect from Academic Year 2026–2027
*Approved in the 32nd Academic Council Meeting, dated 28th July 2026*

| EEHNC 7009 Control of Electrical Drives (Honors course) | | | |
|---|---|---|---|
| **Teaching Scheme** | | **Examination Scheme** | |
| Lectures | : 3 Hrs/Week | ISE I | : 20 Marks |
| Tutorial | : 0 Hr/Week | ISE II | : 20 Marks |
| Total Credits | : 3 | ISE III | : 10 Marks |
| | | End -Semester Exam | : 60 Marks |

**Course Description**: The objective of this course is to give exposure to the students of fundamentals, operations, control and analysis of DC motor and AC motor electrical drives. It also covers the industrial application of it.

**Course Objective:**

The objective of this course is to give exposure to the students of

1. Fundamentals of an electrical drives
2. Basics, Control and analysis of DC motor drives
3. Basics, Control and analysis of Induction motor drives
4. Vector control of Induction motor drives
5. Basics, Control and analysis of PM Synchronous and Brushless DC motor drives

**Course Outcomes**

After completing the course, students will able to:

| | |
|---|---|
| CO1 | Describe fundamentals of an electrical drives |
| CO2 | Explain the operations and analysis of Phase controlled and Chopper controlled DC Motor drives |
| CO3 | Explain the operations and analysis of Phase controlled and Frequency Controlled Induction Motor Drives |
| CO4 | Discuss the principle and analysis of Vector controlled Induction Motor Drives |
| CO5 | Discuss the principle of operation, analysis of P.M. Synchronous and Brushless DC Motor Drives |

**Detailed Syllabus:**

| | |
|---|---|
| **Unit 1** | **Phase Controlled and Chopper Controlled DC Motor Drives:**<br>Phase Controlled- Introduction, Principle of DC motor speed control, Phase controlled converters, Steady state analysis of three phase converter controlled DC Motor drives, Applications.<br>Chopper Controlled- Introduction, Principle of the chopper, Four quadrant Chopper circuit, Chopper for inversion, Steady state analysis of chopper controlled DC motor drives, Applications. |
| **Unit 2** | **Voltage Fed and Current Fed Converters:**<br>Voltage Fed Converters- Introduction, Single phase inverters, Three phase bridge inverters, multi stepped inverters, PWM techniques, Three level inverters, hard switching effects, resonant inverters, soft- switched inverters, dynamic and regenerative drive braking, PWM rectifiers, Static VAR compensators.<br>Current Fed Converters- Introduction, General operation of six stepped thyristor inverter, Load commutated inverters, Force commutated inverters, harmonic heating and torque pulsation, multi stepped inverters, inverter with self commutated devices. |

| | |
|---|---|
| **Unit 3** | **Induction Motor Slip-Power Recovery Drives:**<br>Introduction, Doubly fed machine speed control by rotor rheostat, static Kramer drives, Static Scherbius drive, modified static Scherbius drive. Principle of vector control of IM, Indirect vector control with feedback, Indirect vector control with feed-forward, Indirect vector control in various frames of reference, Decoupling of vector control with feed forward compensation, Direct Torque Control of IM, control of wound rotor induction machine, introduction to five-phase induction motor drives |
| **Unit 4** | **Control and Estimation of Induction Motor Drives**:<br>Introduction, Induction Motor control with small signal model, Scalar Control, Vector or Field oriented control, Sensorless vector control, direct torque and flux control, Adaptive control, Self commissioning drive. |
| **Unit 5** | **Control and Estimation of Synchronous Motor Drives:**<br>Permanent Magnet Drives: Expression for torque, Model of PMSM, Implementation of vector control for PMSM, BLDC drives Switched Reluctance Motor Drives: Torque expression, converters for SRM drives, Sinusoidal SPM machine drives, Synchronous reluctance machine drive, sinusoidal IPM machine drive, trapezoidal SPM machine drive, Wound Field synchronous machine drive, switched reluctance motor drives. |

**Textbooks/References:**


1. B. K. Bose, "Modern Power Electronics and AC drives", Pearson Education, Asia, 2003
2. R. Krishan, "Electric Motor Drives-Modeling Analysis and Control", Pearson Prentice Hall.
3. G.K. Dubey, "Fundamentals of Electrical Drives", Narosa Publication
4. N.K. De and P.K.Sen "Electric Drives", Prentice Hall India
5. B.K. Bose, "Power Electronics and Variable Frequency Drive", IEEE Press, 2000
6. VedamSubramanyam, "Electric Drives Concepts and Applications", Tata McGraw-Hill


**ISE III Assessments:**

Assessments will be based on any one or two of the following:

1. Assignment 10 Marks
2. MCQ 10Marks
3. PPT 10Marks
4. Surprise Test 10Marks

**Sample Assessment Pattern:**

| Assessment Pattern Level No. | Knowledge Level | Test | Teachers Assessment | End Semester Examination |
|---|---|---|---|---|
| K1 | Remember | 05 | - | 12 |
| K2 | Understand | 10 | 10 | 36 |
| K3 | Apply | 05 | 10 | 12 |
| K4 | Analyze | - | - | - |
| K5 | Evaluate | - | - | - |
| K6 | Create | - | - | - |
| **Total Marks: 100** | | **20** | **20** | **60** |

**Sample Assessment Table:**

| **Assessment Tool** | **K1+K2+K3** | **K1+K2+K3** | **K1+K2+K3** | **K1+K2+K3** | **K1+K2+K3+K4** |
|---|---|---|---|---|---|
| | C01 | C02 | C03 | CO4 | CO5 |
| ISE I Test (15 Marks) | 8 | 7 | - | - | - |
| ISE II Test (15 Marks) | 0 | | 8 | 7 | - |
| ISE III Assessment (10 Marks) | 0 | 0 | 0 | 5 | 5 |
| ESE Assessment (60 Marks) | 12 | 12 | 12 | 12 | 12 |

**Designed by Dr. N.R. Bhasme**

| EEHNC7010 Mini-Project | | | |
|---|---|---|---|
| **Teaching Scheme** | | **Examination Scheme** | |
| Practical | :4hrs | ISE III | : 25 Marks |
| Total Credits | : 2 | ESE | : 25 Marks |

**Course Description:** The student shall collect, review, compile, comprehend, present research literature and identify the problem of Electrical Power System. Students will present seminar on work done by them on any topic of recent technology. The seminar may include some simulation carried out by the student.

**Course Objectives:**

- To understand the "Product Development Process" including budgeting through Mini Project
- To plan for various activities of the project and distribute the work amongst team members
- To inculcate electronic hardware implementation skills
- To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project
- To understand the importance of document design by compiling Technical Report on the Mini Project work carried out

**Course Outcomes:** At the end of course students will be able to **:**

- Understand, plan and execute a Mini Project
- Implement electronic hardware by learning PCB artwork design, soldering techniques, testing, and troubleshooting etc.
- Prepare a technical report based on the Mini project
- Deliver technical seminar based on the Mini Project work carried out

**Course Contents:**

- Mini Project Work should be carried out in the Laboratory.
- Data sheets may be referred, well known project designs ideas can be necessarily adapted from recent issues of electronic design magazines
- Hardware/Software based projects can be designed
- Following areas are just a guideline
- Instrumentation and Control Systems
- Power Electronics
- Embedded Systems/ Microcontroller based projects should preferably use Microchip PIC controllers/AT mega controller/AVR microcontrollers
- Power system based
- Demonstration and Group presentations. Logbook for all these activities shall be maintained and shall be produced at the time of examination
- A project report with following contents shall be prepared:
  - Specifications/Block diagram/Circuit diagram/Selection of components, calculations
  - Simulation results
  - Layout versus schematic verification report
  - Testing procedures/Test results Conclusion

**Term Work:**

The Mini Project with Seminar shall consist of collection of literature from a chosen field of Electrical Engineering from various sources such as refereed journals, proceedings of national international conferences etc. Based on the literature survey,

case studies, data collection, surveys, pilot studies, mathematical/analytical modeling, etc., as necessary the candidate shall define the problem for the dissertation.

The candidate shall prepare a technical report in a prescribed format and present before a panel of examiners consisting of a guide and at least one faculty member of the department.

**Viva Voce Examination:** It consists of two parts.

**Part-I: Mid-Term Evaluation for 25 Marks:** A mid-term evaluations for 25 marks out of 50 marks shall be done as per the schedule given in the institute academic calendar. Students should prepare a power point presentation and present before the panel of examiners and class students and should be able to answer questions asked by the panel of examiners and class students. Panel of examiner consists of a guide as internal examiner and one faculty member appointed by the DCoE as external examiners. The panel of examiner will assess the contents and presentation and give the suggestions, if any and assign the marks out of 10. In this phase students are expected to collect and present substantial literature.

**Part-II: End Semester Evaluation for 25 Marks:** Student should prepare technical report in prescribed format duly incorporating suggestions of Part-I and present power point presentation before the panel of examiners and class students. The student should be able to answer the questions asked. The panel of examiner will assess the seminar contents and seminar presentation and assigns the marks out of 25. In this phase the students is expected to define the problem for dissertation through further literature survey, case studies, data collection, surveys, pilot studies, mathematical/analytical modeling, etc., as necessary.

**Assessment Pattern:**

| Assessment Pattern Level No. | Knowledge Level | Term Work Assessment | Viva-voce Examination |
|---|---|---|---|
| K1 | Remember | 5 | |
| K2 | Understand | 10 | |
| K3 | Apply | 10 | 10 |
| K4 | Analyze | | 10 |
| K5 | Evaluate | | 5 |
| **Total Marks** | | **25** | **25** |

# Semester VIII
## One Semester Internship

| Semester VII Course | | | | Teaching scheme | | | Continuous Evaluation in terms of Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr No** | **Category** | **Course Code** | **Course Name** | **TH** | **T** | **PR** | **Credits** | **ISE I** | **ISE II** | **ISE III** | **ESE** | **Total** |
| 1 | **INT | EEINT4001 | Internship | | | 24 | 12 | 00 | 50 | 50 | 100 | 200 |
| 2 | * HNC | EEHNC7005/ EEHNC7010 | Mini Project | | - | 04 | 2 | - | - | 25 | 25 | 50 |
| | **Total with single Minor** | | | **-** | **-** | **24** | **12** | **00** | **50** | **50** | **100** | **200** |
| | **Total with single Minor and Honor** | | | **-** | **-** | **24 +4** | **12+2** | **00** | **50** | **75** | **125** | **250** |



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| EEINT4001: Internship | |
|---|---|
| **Teaching Scheme**<br>Total Credits :12 | **Examination Scheme**<br>ISE I : 0 Marks<br>ISE II :50 Marks<br>ISE III :50 Marks<br>End -Semester Exam : 100 Marks<br>Total Marks :200Marks |

**Course Description:** Industrial training (In-Plant Training/Internship) refers to work experience done during the program of study that is relevant to professional development prior to graduation. The training will provide an industrial exposure to the students and opportunity to develop as per the expectations and requirement of industry giving a good start of the career.

The students shall study the technology, processes, practices and work culture in the industry during the training. They shall also work on the project, if allotted. A faculty from the institute and one mentor from the industry will guide the students. The training period will be of minimum 90 working days.

ISE I, II and III: The evaluation is done through reviews. The student has to present his work during the internship. Every candidate has to give a presentation in presence of faculty members and students. The Head of the department will appoint two internal examiners to assess the term work; guide shall be one of the examiners. The student has to prepare typed report of about 25 pages or more, on the work carried out in the respective industry.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Observe & experience the practices, processes and work culture of the industry |
| **CO2** | Apply engineering concepts to solve the problems |
| **CO3** | Develop employability skills and attitude |

**Mapping of Course outcome with Program Outcomes:**

| Program Outcome | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | PSO1 | 2 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | 3 |
| CO3 | | | | | | 1 | 1 | 1 | 3 | 2 | 2 | | | |

**1 – Low 2 – Medium 3 -High**

**Assessment Table:**

| Assessment Tool | K2 | K2 | A3 |
|---|---|---|---|
| | CO1 | CO2 | CO3 |
| ISE II (50 Marks) | 20 | 20 | 10 |
| ISE III (50 Marks) | 20 | 20 | 10 |
| ESE (100 Marks) | 40 | 40 | 20 |