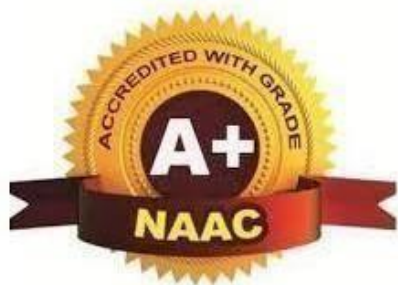




**TULSIRAMJI GAIKWAD-PATIL**  
**College of Engineering & Technology**

Mohgaon, Wardha Road, Nagpur - 441 108

**An Autonomous Institute**

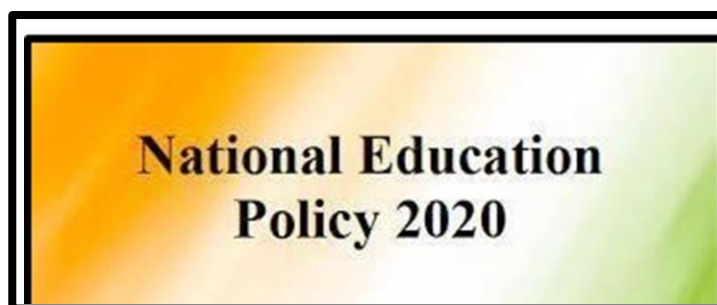


**DEPARTMENT OF ELECTRICAL ENGINEERING**

**B.Tech. Electrical Engineering**

**Teaching Scheme**

Considering



From

**Academic Year 2024-25**

## **Vision of Institute**

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

## **Mission of Institute**

1. To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.
2. To provide facilities and services to meet the challenges of Industry and Society.
3. To facilitate socially responsive research, Innovation and entrepreneurship.
4. To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

## **Vision of the Department**

To emerge as a learning hub and center of excellence in the domain of Electrical Engineering.

## **Mission of the Department**

1. To disseminate knowledge replete with quality education in the field of Electrical Engineering in meticulous and methodical manner.
2. To provide platform to address societal issues as well as challenges faced by industries.
3. To develop research culture and inculcate innovative and entrepreneurial skills.
4. To ensure overall development of students and staff by instilling knowledge and professional ethics as a part of lifelong learning.

## **Program Education Objectives (PEO)**

1. Demonstrate and analyze the fundamental knowledge with respect to the various domains of Electrical Engineering.
2. Investigate and apply modern tools to develop innovativeness in different applications of the Electrical Engineering domain.
3. Integrate new emerging trends and concepts in the Electrical Engineering profession for sustainable development.
4. Develop professionals having managerial and administrative Qualities for Electrical Engineering related industries.
5. Promote lifelong learning, to prepare for the next challenges in the field of Electrical Engineering.

## **Program Outcomes(PO)**

- 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 system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 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 software tools including prediction 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, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
- 9. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. 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 and in multidisciplinary environments.
- 12. Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

## **Program Specific Outcomes (PSO)**

**PSO1:** Formulate the solutions to Electrical and Electronics Engineering problems using the basic concepts.

**PSO2:** Develop the process to interpret network parameters in power system operation and control with their protection and driving mechanisms.

**PSO3:** Apply project-based learning to conduct experiments with Electrical Machines, Power Electronics to develop energy efficient systems.

**Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur**  
(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

**SCHEME OF INSTRUCTION & SYLLABI**

**Programme: Electrical Engineering (NBA Accredited)**

**Scheme of Instructions: fourth Year B.Tech. in Electrical Engineering (As Per NEP 2020)**

**Semester-VII**

| SN           | Sem | Type    | BoS/<br>Dept | Sub Code    | Subject                      | T/P | Contact Hours |           |           | Credits   | % Weightage |            |            | ESE<br>Duration | Total<br>Marks |
|--------------|-----|---------|--------------|-------------|------------------------------|-----|---------------|-----------|-----------|-----------|-------------|------------|------------|-----------------|----------------|
|              |     |         |              |             |                              |     | L             | P         | Hrs       |           | CT/IA       | CA         | ESE        |                 |                |
| 1            | VII | PCC     | EE           | BEE34801    | EHVAC & HVDC Transmission    | T   | 4             | -         | 4         | 3         | 30          | 10         | 60         | 3 Hrs           | 100            |
| 2            | VII | RM      | ME           | BME34802    | Research Methodology         | T   | 4             | -         | 4         | 4         | 30          | 10         | 60         | 3 Hrs           | 100            |
| 3            | VII | Project | EE           | BEE34803    | Project                      | P   | -             | 8         | 8         | 3         | -           | 50         | 50         | 2 Hrs           | 100            |
| 4            | VII | PEC     | EE           | BEE34704-06 | Program Elective-IV          | T   | 3             | -         | 3         | 4         | 30          | 10         | 60         | 3 Hrs           | 100            |
| 5            | VII | PEC     | EE           | BEE34804-06 | Program Elective-V           | T   | 3             | -         | 3         | 3         | 30          | 10         | 60         | 3 Hrs           | 100            |
| 6            | VII | PCC     | EE           | BEE34810    | High Voltage Engineering Lab | P   | -             | 2         | 2         | 1         | -           | 25         | 25         | 2 Hrs           | 50             |
| 7            | VII | MDM     | MBA          | BBA34801    | Project Management & Finance | T   | 4             | -         | 4         | 4         | 30          | 10         | 60         | 3 Hrs           | 100            |
| <b>Total</b> |     |         |              |             |                              |     | <b>16</b>     | <b>10</b> | <b>27</b> | <b>22</b> | <b>135</b>  | <b>125</b> | <b>375</b> | <b>19 Hrs</b>   | <b>650</b>     |

| Course Category | BSC/ESC(Basic Science Course/ Engineering Science Course.) | PCC (Programme Core courses) | PEC (Programme Elective courses) | Multidisciplinary courses | SEC(Skill Course) | Humanities Social Science & Management | Experiential Learning Courses | CC (Liberal Learning Courses) |
|-----------------|------------------------------------------------------------|------------------------------|----------------------------------|---------------------------|-------------------|----------------------------------------|-------------------------------|-------------------------------|
| Credits         | --                                                         | 04                           | 06                               | 04                        | --                | --                                     | 04                            | 04                            |
| Cumulative Sum  | 16/13                                                      | 47                           | 20                               | 22                        | 08                | 14                                     | 22                            | 04                            |

**PROGRESSIVETOTALCREDITS:126+22=148**



  
**HOD**  
 Department Of Electrical Engineering  
 Tulsiramji Gaikwad - Patil College  
 Of Engineering And Technology  
 Nagpur

# Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering (NBA Accredited)

Scheme of Instructions: fourth Year B.Tech. in Electrical Engineering (As Per NEP 2020)

Semester– VII

| SN           | Sem | Type               | BoS/<br>Dept | Sub Code        | Subject                                           | T/P | Contact Hours |           |           | Credits   | % Weight age |           |            | ESE<br>Duration | Total<br>Marks |
|--------------|-----|--------------------|--------------|-----------------|---------------------------------------------------|-----|---------------|-----------|-----------|-----------|--------------|-----------|------------|-----------------|----------------|
|              |     |                    |              |                 |                                                   |     | L             | P         | Hrs       |           | CT/IA        | CA        | ESE        |                 |                |
| 1            | VII | PCC                | EE           | BEE34701        | Power Quality(MOOCs<br>4 Week Course)             | T   | 2             | -         | 2         | 2         | -            | 25        | 25         | 2 Hrs           | 50             |
| 2            | VII | Internship/<br>OJT | EE           | BEE34702        | Internship/On Job<br>Training                     | P   | -             | 24        | 24        | 12        | -            | 50        | 50         | 2 Hrs           | 100            |
| 3            | VII | PEC                | EE           | BEE34703-<br>05 | Program Elective–IV<br>(MOOCs 12 Week<br>Course ) | T   | 4             | -         | 4         | 4         | 14           | 6         | 30         | 2 Hrs           | 50             |
| <b>Total</b> |     |                    |              |                 |                                                   |     | <b>6</b>      | <b>24</b> | <b>30</b> | <b>18</b> | <b>15</b>    | <b>80</b> | <b>105</b> | <b>10 Hrs</b>   | <b>200</b>     |

| Course Category | BSC/ESC(Basic<br>Science Course/<br>Engineering<br>Science Course.) | PCC<br>(Programme<br>Core<br>courses) | PEC<br>(Programme Elective<br>courses) | Multidisciplinary<br>courses | SEC(Skill Course) | Humanities Social<br>Science<br>&Management | Experiential<br>Learning Courses | CC (Liberal<br>Learning Courses |
|-----------------|---------------------------------------------------------------------|---------------------------------------|----------------------------------------|------------------------------|-------------------|---------------------------------------------|----------------------------------|---------------------------------|
| Credits         | --                                                                  | 02                                    | 02                                     | 02                           | --                | --                                          | 12                               | --                              |
| Cumulative Sum  | 16/13                                                               | 43                                    | 14                                     | 20                           | 08                | 14                                          | 14                               | 04                              |

PROGRESSIVE TOTAL CREDITS: 148+18=166



  
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## Program: Electrical Engineering

List of **Program Electives** offered By Electrical Engineering Department (NBA Accredited)

| Program Elective-I                                | Program Elective-II                             | Program Elective-III                            | Program Elective-IV                                                     | Program Elective-V                                |
|---------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------|
| Semester V                                        | Semester VI                                     | Semester VI                                     | Semester VII                                                            | Semester VIII                                     |
| <b>BEE33505</b> -Solar Energy Utilization         | <b>BEE33604</b> -Wind Energy Utilization        | <b>BEE33607</b> -Ginning Process                | <b>BEE34703</b> –Technologies for Clean and Renewable Energy Production | <b>BEE34804</b> -Ginning Management               |
| <b>BEE33506</b> -Utilization of Electrical Energy | <b>BEE33605</b> –Power Plant Engineering        | <b>BEE33608</b> -Electrical Distribution System | <b>BEE34704</b> -Elements of Substation Design                          | <b>BEE34805</b> -Power System Operation & Control |
| <b>BEE33507</b> -High Voltage Engineering         | <b>BEE33606</b> -FlexibleAC Transmission System | <b>BEE33609</b> –Electric Vehicles              | <b>BEE34705</b> -Introduction to Smart Grid                             | <b>BEE34806</b> –Power System Deregulation        |

## Program: Electrical Engineering

List of **Open Electives** offered By Electrical Engineering Department (NBA Accredited)

| Open Elective-I                                            | Open Elective-II                    | Open Elective-III             |
|------------------------------------------------------------|-------------------------------------|-------------------------------|
| Semester-III                                               | Semester-IV                         | Semester-V                    |
| <b>BEE32303</b> : Introduction to Renewable Energy Sources | <b>BEE32404</b> :Power Plant System | <b>BEE33504</b> :Energy Audit |

| Course Category       | BSC(Basic Science Course) | ESC (Engineering Science Course.) | PCC (Programme Core courses | PEC (Programme Elective courses) | Multidisciplinary courses | VSEC(Skill Course) | Humanities Social Science& Management | Experiential Learning Courses | CC(Liberal Learning Courses | Semester Wise Credits |
|-----------------------|---------------------------|-----------------------------------|-----------------------------|----------------------------------|---------------------------|--------------------|---------------------------------------|-------------------------------|-----------------------------|-----------------------|
| <b>Semester-I</b>     | 08                        | 04                                | 02                          | --                               | --                        | 02                 | 02                                    | --                            | 02                          | <b>20</b>             |
| <b>Semester-II</b>    | 08                        | 08                                | --                          | --                               | --                        | 02                 | 02                                    | --                            | 02                          | <b>22</b>             |
| <b>Semester-III</b>   | --                        | --                                | 08                          | --                               | 06                        | 01                 | 04                                    | 02                            | --                          | <b>21</b>             |
| <b>Semester-IV</b>    | --                        | --                                | 10                          | --                               | 04                        | 02                 | 06                                    | --                            | --                          | <b>22</b>             |
| <b>Semester-V</b>     | --                        | --                                | 11                          | 04                               | 06                        | --                 | --                                    | --                            | --                          | <b>21</b>             |
| <b>Semester-VI</b>    | --                        | --                                | 08                          | 08                               | 02                        | 02                 | --                                    | --                            | --                          | <b>20</b>             |
| <b>Semester-VII</b>   | --                        | --                                | 04                          | 02                               | 02                        | --                 | --                                    | 12                            | --                          | <b>20</b>             |
| <b>Semester-VIII</b>  | --                        | --                                | 04                          | 06                               | 02                        | --                 | --                                    | 08                            | --                          | <b>20</b>             |
| <b>Cumulative Sum</b> | <b>16</b>                 | <b>13</b>                         | <b>47</b>                   | <b>20</b>                        | <b>22</b>                 | <b>08</b>          | <b>14</b>                             | <b>22</b>                     | <b>04</b>                   | <b>166</b>            |



**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

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**Fourth Year (Semester-VIII) B. Tech. Electrical  
Engineering**

**BEE34801: EHVAC & HVDC Transmission**

| Teaching Scheme |             | Examination Scheme             |          |
|-----------------|-------------|--------------------------------|----------|
| Lectures        | 3 Hrs./week | CT                             | 30Marks  |
| Tutorial        | 0 Hrs./week | CA                             | 10Marks  |
| Total Credit    | 3           | ESE                            | 60Marks  |
|                 |             | Total                          | 100Marks |
|                 |             | Duration of ESE: 03 Hrs.00Min. |          |

**Course Objective:**

|   |                                                                                                                                                                                                                                                     |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | To understand the fundamentals of EHVAC and HVDC transmission systems, including the need for extra high voltage transmission, comparison between AC and DC systems, types of HVDC links, and their practical applications in modern power systems. |
| 2 | To analyze the electrical and electrostatic behavior of EHVAC transmission lines, including corona phenomena, field calculations, losses, radio interference, audible noise, and methods for their mitigation.                                      |
| 3 | To study the design, operation, and control of HVDC systems, including converter configurations, terminal equipment, control strategies, protection schemes, harmonics generation, filter design, and reactive power requirements.                  |

| Course Contents |                                                                                                                                                                                                                                                                                                                                                                | Hours |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Unit I</b>   | <b>Unit 1: Introduction to EHVAC and HVDC Transmission</b><br>Need for EHVAC transmission: Power handling capacity, line losses, corona loss, radio interference, and audible noise. Comparison of EHVAC and HVDC systems. Applications of HVDC transmission. Kinds of DC links: Monopolar, Bipolar, and Homopolar links. Components of an HVDC system.        | (9)   |
| <b>Unit II</b>  | <b>Unit 2: Electrostatics of EHVAC Lines</b><br>Electrostatic field calculation of EHVAC lines. Corona: Corona types, critical disruptive voltages, and factors affecting corona. Methods for reducing corona power loss. Corona current waveform and charge-voltage diagram. Audible noise and radio interference calculation and minimization.               | (9)   |
| <b>Unit III</b> | <b>Unit 3: HVDC Terminal Equipment and Converters</b><br>Converter configuration: 3-phase bridge converter (Graetz circuit). Analysis of 3-phase converter: With and without overlap angle, converter transformer rating. Earth Electrode and Ground Return: Location and configuration. Multi-terminal HVDC system: Series and parallel connected converters. | (9)   |

|                        |                                                                                                                                                                                                                                                                                                             |            |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Unit IV</b>         | <b>Unit 4: HVDC System Control</b><br>Power flow control in HVDC systems. Control characteristics: Constant current, Constant voltage, and constant ignition/excitation angle control. Converter firing control systems. Protection of HVDC systems: Faults, DC circuit breakers, and reactor requirements. | <b>(9)</b> |
| <b>Unit V</b>          | <b>Unit 5: Harmonics and Filters in HVDC</b><br>Generation of harmonics in HVDC systems. Harmonic analysis and filter design (AC and DC side filters). Reactive power requirements in HVDC systems.                                                                                                         | <b>(9)</b> |
| <b>Text Books</b>      |                                                                                                                                                                                                                                                                                                             |            |
| 1                      | K.R. Padiyar, "HVDC Power Transmission Systems," New Age International Publishers.                                                                                                                                                                                                                          |            |
| 2                      | R.D. Begamudre, "Extra High Voltage AC Transmission Engineering," New Age International Publishers.                                                                                                                                                                                                         |            |
| <b>Reference Books</b> |                                                                                                                                                                                                                                                                                                             |            |
| 1                      | S. Rao, "EHVAC and HVDC Transmission Engineering and Practice," Khanna Publishers                                                                                                                                                                                                                           |            |

| <b>BEE34801</b>   | <b>Course Outcomes</b>                                                          | <b>CL</b> |
|-------------------|---------------------------------------------------------------------------------|-----------|
| <b>BEE34801.1</b> | Calculate power handling capacity and design parameters for EHVAC lines.        | <b>4</b>  |
| <b>BEE34801.2</b> | Analyze the Corona effect on transmission lines and methods to mitigate it.     | <b>3</b>  |
| <b>BEE34801.3</b> | Distinguish between different types of HVDC links and converter configurations. | <b>3</b>  |
| <b>BEE34801.4</b> | Analyze power flow, converter control, and design filters for HVDC systems      | <b>3</b>  |
| <b>BEE34801.5</b> | Apply appropriate protection schemes (circuit breakers) for HVDC systems        | <b>4</b>  |



  
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**Fourth Year (Semester-VIII) B. Tech. Electrical Engineering**

**BME34802: Research Methodology**

| Teaching Scheme |             |  | Examination Scheme            |          |
|-----------------|-------------|--|-------------------------------|----------|
| Lectures        | 4 Hrs./week |  | CT                            | 30Marks  |
| Tutorial        | 0 Hrs./week |  | CA                            | 10Marks  |
| Total Credit    | 4           |  | ESE                           | 60Marks  |
|                 |             |  | Total                         | 100Marks |
|                 |             |  | Duration of ESE:03 Hrs.00Min. |          |

**Course Objective:**

|   |                                                                                    |
|---|------------------------------------------------------------------------------------|
| 1 | Understand the fundamentals, types, and process of research.                       |
| 2 | Develop skills for problem identification, literature review, and research design. |
| 3 | Learn data collection, analysis, and interpretation techniques.                    |
| 4 | Understand ethical issues, IPR, and research publication.                          |
| 5 | Develop technical writing and report preparation skills.                           |

| Course Contents |                                                                                                                                                                                                                                                                                                                              | Hours |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| UNIT I          | <b>Introduction to Research Methodology:</b> Meaning, objectives, and significance of research, Types of research (basic, applied, descriptive, analytical), Research process and scientific method, Research problem: identification and formulation, Criteria of good research, Research ethics and challenges in research | (9)   |
| UNIT II         | <b>Research Design and Literature Review:</b> Meaning and need of research design, Types of research design (exploratory, descriptive, experimental), Steps in research design, Literature review: importance, sources, and methods, Hypothesis formulation and testing, Research planning and proposal preparation          | (9)   |
| UNIT III        | <b>Data Collection and Sampling Techniques:</b> Types of data: primary and secondary, Methods of data collection (survey, observation, interview, questionnaire), Questionnaire design and scaling techniques, Sampling: probability and non-probability methods, Sample size determination and sampling errors              | (9)   |
| UNIT IV         | <b>Data Analysis and Interpretation:</b> Data processing: editing, coding, classification, tabulation, Statistical tools: mean, median, standard deviation, Hypothesis testing (t-test, chi-square, ANOVA basics), Use of software tools (SPSS/Excel basics), Interpretation and presentation of data.                       | (9)   |
| UNIT V          | <b>Research Ethics, IPR and Report Writing:</b> Research ethics and plagiarism, Intellectual Property Rights (IPR): patents, copyrights, Structure of research report/thesis, Technical writing and documentation, Referencing styles (APA/IEEE), Paper publication and presentation skills                                  | (9)   |

**Text Books**

|                        |                                                                                                                                                          |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                      | Research Methodology: Methods and Techniques”, by C. R. Kothari, Gaurav Garg, 4th Edition, New Age International Publishers, New Delhi, 2019.            |
| 2                      | Research Methodology: A Step-by-Step Guide for Beginners”, by Ranjit Kumar, 4th Edition, SAGE Publications, New Delhi, 2014.                             |
| <b>Reference Books</b> |                                                                                                                                                          |
| 1                      | Research Design: Qualitative, Quantitative, and Mixed Methods Approaches”, by John W. Creswell, J. David Creswell, 5th Edition, SAGE Publications, 2018. |
| 2                      | The Craft of Research, by Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, 4th Edition, University of Chicago Press, 2016.                         |

| BEE33601   | Course Outcomes                                                                | CL |
|------------|--------------------------------------------------------------------------------|----|
| BME34802.1 | <b>Explain</b> concepts of research, types, and methodologies.                 | 4  |
| BME34802.2 | <b>Identify</b> and formulate research problems with proper literature review. | 3  |
| BME34802.3 | <b>Apply</b> research design and sampling techniques.                          | 3  |
| BME34802.4 | <b>Analyse</b> data using statistical tools and interpret results.             | 3  |
| BME34802.5 | <b>Demonstrate</b> knowledge of research ethics, IPR, and technical writing.   | 4  |



  
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|                                                                                   |                                                                                                                                                                                                                                                                                                                                              |  |                           |                                                                                     |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------|-------------------------------------------------------------------------------------|
|  | <b>Tulsiramji Gaikwad-Patil College of Engineering and Technology</b><br>Wardha Road, Nagpur-441108<br><b>NAAC Accredited (A+ Grade) &amp; NBA Accredited</b><br><b>An Autonomous Institute affiliated to RTMNU Nagpur</b>                                                                                                                   |  |                           |  |
| <b>Fourth Year (Semester-VIII) B. Tech. Electrical Engineering</b>                |                                                                                                                                                                                                                                                                                                                                              |  |                           |                                                                                     |
| <b>BEE34804: Program Elective-V: Ginning Management</b>                           |                                                                                                                                                                                                                                                                                                                                              |  |                           |                                                                                     |
| <b>Teaching Scheme</b>                                                            |                                                                                                                                                                                                                                                                                                                                              |  | <b>Examination Scheme</b> |                                                                                     |
| <b>Lectures</b>                                                                   | 4 Hrs./week                                                                                                                                                                                                                                                                                                                                  |  | <b>CT</b>                 | 30 Marks                                                                            |
| <b>Tutorial</b>                                                                   | 0 Hrs./week                                                                                                                                                                                                                                                                                                                                  |  | <b>CA</b>                 | 10 Marks                                                                            |
| <b>Total Credit</b>                                                               | 4                                                                                                                                                                                                                                                                                                                                            |  | <b>ESE</b>                | 60 Marks                                                                            |
|                                                                                   |                                                                                                                                                                                                                                                                                                                                              |  | <b>Total</b>              | 100 Marks                                                                           |
|                                                                                   |                                                                                                                                                                                                                                                                                                                                              |  |                           | <b>Duration of ESE: 03 Hrs. 00 Min.</b>                                             |
| <b>Course Objective:</b>                                                          |                                                                                                                                                                                                                                                                                                                                              |  |                           |                                                                                     |
| 1                                                                                 | <b>To develop knowledge of safety practices and fire protection systems</b> in the ginning industry including prevention and control of hazards related to cotton, electrical systems, oil, and inflammable materials.                                                                                                                       |  |                           |                                                                                     |
| 2                                                                                 | <b>To understand installation, commissioning, and maintenance of ginning plants</b> , including machine layout, operation sequencing, preventive maintenance, and troubleshooting for efficient plant performance.                                                                                                                           |  |                           |                                                                                     |
| 3                                                                                 | To analyze techno-commercial and marketing aspects of ginning plants, covering site selection, plant design, cost estimation, financial planning, and customer-oriented decision-making.                                                                                                                                                     |  |                           |                                                                                     |
| <b>Course Contents</b>                                                            |                                                                                                                                                                                                                                                                                                                                              |  |                           | <b>Hours</b>                                                                        |
| <b>Unit I</b>                                                                     | Safety in Ginning Industry-Prevention of Fire, related to cotton, fibre, Electrical, oil and inflammable. Design of Fire Fighting system, elements of FFS.                                                                                                                                                                                   |  |                           | <b>(9)</b>                                                                          |
| <b>Unit II</b>                                                                    | Installation and Commissioning of Ginning Plant, Basic foundation drawing, layout of machine, material handling device, machine balancing knowledge for lifting and shifting, safety norms. Commissioning... Machine setting parameters as per manuals. Operation sequencing, no load trials, production norms, knowledge of product output. |  |                           | <b>(9)</b>                                                                          |
| <b>Unit III</b>                                                                   | Maintenance of Ginning Plant, Preventive maintenance of complete plant, Ginning machine, Automation, Conveying system, consumables and tools, cleaning and greasing, trial run to find defects.                                                                                                                                              |  |                           | <b>(9)</b>                                                                          |
| <b>Unit IV</b>                                                                    | Techno Commercial aspects of Ginning Industry... Size of Cotton Ginnery, selection of site, plant layout, material handling, equipment selection, moisture maintenance, working period, capital requirements, operating cost, working capital, means of finance, profitability                                                               |  |                           | <b>(9)</b>                                                                          |
| <b>Unit V</b>                                                                     | Marketing of Ginning Plant... Area wise Survey and Technology requirements, Customer identification, price/cost of Ginning Plant, making customer quality conscious rather than cost, discussion on site selection, requirements of plant and machinery, PEB, Electrical Panel, Fire Fighting System, Civil work.                            |  |                           | <b>(9)</b>                                                                          |

| <b>Text Books</b>      |                                                                         |
|------------------------|-------------------------------------------------------------------------|
| 1                      | Cotton Ginners Handbook, W. S. Anthony, U.S. Department of Agriculture. |
| 2                      | Cotton Processing & Technology, Hua Wang, Hafeezullah Memon, Springer.  |
|                        | Handbook of Natural Fibres Volume 2, Woodhead / Elsevier                |
| <b>Reference Books</b> |                                                                         |
| 1                      | Cotton Ginnery Handbook USDA                                            |

| <b>BEE34804</b>   | <b>Course Outcomes</b>                                                                                                                                                 | <b>CL</b> |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>BEE34804.1</b> | Explain safety practices and fire prevention methods in the ginning industry, including hazards related to cotton, electrical systems, oil, and inflammable materials. | <b>2</b>  |
| <b>BEE34804.2</b> | Apply knowledge of installation and commissioning processes of ginning plants, including machine layout, foundation, and operation sequencing.                         | <b>3</b>  |
| <b>BEE34804.3</b> | Analyze maintenance requirements of ginning plants, including preventive maintenance, fault identification, and system performance improvement.                        | <b>4</b>  |
| <b>BEE34804.4</b> | Evaluate techno-commercial aspects such as site selection, plant capacity, cost estimation, and financial feasibility of ginning industries.                           | <b>5</b>  |
| <b>BEE34804.5</b> | Develop strategies for marketing and customer-oriented planning of ginning plants, including technology selection and cost-quality considerations.                     | <b>6</b>  |



  
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| <b>Fourth Year (Semester-VII) B. Tech. Electrical Engineering</b>                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                      |                                                                                     |
| <b>BEE34805: Program Elective-V: Power System Operation &amp; Control</b>         |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                      |                                                                                     |
| <b>Teaching Scheme</b>                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Examination Scheme</b>            |                                                                                     |
| <b>Lectures</b>                                                                   | 4 Hrs./week                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>CT</b>                            | 30Marks                                                                             |
| <b>Tutorial</b>                                                                   | 0 Hrs./week                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>CA</b>                            | 10Marks                                                                             |
| <b>Total Credit</b>                                                               | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>ESE</b>                           | 60Marks                                                                             |
|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Total</b>                         | 100Marks                                                                            |
|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Duration of ESE:03 Hrs.00Min.</b> |                                                                                     |
| <b>Course Objective:</b>                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                      |                                                                                     |
| <b>1</b>                                                                          | Understand the overall operation of power systems and the need for coordinated control in day-to-day functioning.                                                                                                                                                                                                                                                                                                                                     |                                      |                                                                                     |
| <b>2</b>                                                                          | Develop the ability to model and analyze real and reactive power control actions, including voltage regulation using appropriate compensating devices.                                                                                                                                                                                                                                                                                                |                                      |                                                                                     |
| <b>3</b>                                                                          | Apply the principles of day-ahead and real-time economic generation scheduling for efficient power system operation.                                                                                                                                                                                                                                                                                                                                  |                                      |                                                                                     |
| <b>Course Contents</b>                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                      | <b>Hours</b>                                                                        |
| <b>Unit I</b>                                                                     | <b>INTRODUCTION</b><br>Power scenario in Indian grid – National and Regional load dispatching centers – Requirements of good power system – Necessity of voltage and frequency regulation – real power vs frequency and reactive power vs voltage control loops - System load variation, load curves – Load forecasting – Computational methods in load forecasting – Load shedding and Islanding – deregulation - Basics of electrical energy tariff |                                      | <b>(9)</b>                                                                          |
| <b>Unit II</b>                                                                    | <b>UNIT COMMITMENT:</b> 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                                                                         |                                      | <b>(9)</b>                                                                          |
| <b>Unit III</b>                                                                   | <b>REACTIVE POWER – VOLTAGE CONTROL:</b> Generation and absorption of reactive power – Basics of reactive power control – Automatic Voltage Regulator (AVR) – Brushless AC excitation system – Block diagram representation of AVR loop static and dynamic analysis – Stability compensation – Voltage drop in transmission line – Methods of reactive power injection – Tap changing transformer, SVC and STATCOM for voltage control                |                                      | <b>(9)</b>                                                                          |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Unit IV</b>         | <b>ECONOMIC OPERATION OF POWER SYSTEM</b><br><br>Statement of economic dispatch problem – Input and output characteristics of thermal plant incremental cost curve – Optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) – Base point and participation factors method. Statement of Unit Commitment (UC) problem – Constraints on UC problem – Solution of UC problem using priority list – Special aspects of short term and long-term hydrothermal scheduling problems. | <b>(9)</b> |
| <b>Unit V</b>          | <b>COMPUTER AIDED CONTROL OF POWER SYSTEM</b><br><br>Need of computer control of power system – Concept of energy control centers and functions – PMU system monitoring, Data acquisition and controls – System hardware configurations – SCADA and EMS functions – State estimation – Measurements and errors – Weighted least square estimation – Various operating states – State transition diagram.                                                                                                                                         | <b>(9)</b> |
| <b>Text Books</b>      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |
| 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                      | “Power System Analysis”, J.B. Gupta, S.K. Kataria and Sons, Reprint 2013 Edition                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |
| <b>Reference Books</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |
| 1                      | C.L.Wadhwa, ‘Power System Analysis’, New Age International- 6th Edition, 2010.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |
| 2                      | “Power System Operation and Control”, A. Chakrabarti, S. Halder , PHI Learning3rd Edition, 2010                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |

| <b>BEE34805</b>   | <b>Course Outcomes</b>                                                                                                     | <b>CL</b> |
|-------------------|----------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>BEE34805.1</b> | <b>Understand</b> the day-to-day operation of the power system.                                                            | <b>2</b>  |
| <b>BEE34805.2</b> | <b>Analyze</b> the control actions that are implemented to meet the minute-to-minute variation of system real power demand | <b>4</b>  |
| <b>BEE34805.3</b> | <b>Analyze</b> the compensators for reactive power control and various devices used for voltage control.                   | <b>4</b>  |
| <b>BEE34805.4</b> | <b>Prepare</b> day ahead and real time economic generation scheduling                                                      | <b>6</b>  |
| <b>BEE34805.5</b> | <b>Understand</b> the necessity of computer control of power systems.                                                      | <b>2</b>  |



  
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## **Fourth Year (Semester-VII) B. Tech. Electrical Engineering**

### **BEE34806: Program Elective-V: Power System Deregulation**

| Teaching Scheme |             |  | Examination Scheme            |          |
|-----------------|-------------|--|-------------------------------|----------|
| Lectures        | 4 Hrs./week |  | CT                            | 30Marks  |
| Tutorial        | 0 Hrs./week |  | CA                            | 10Marks  |
| Total Credit    | 4           |  | ESE                           | 60Marks  |
|                 |             |  | Total                         | 100Marks |
|                 |             |  | Duration of ESE:03 Hrs.00Min. |          |

#### **Course Objective:**

|   |                                                                                                                      |
|---|----------------------------------------------------------------------------------------------------------------------|
| 1 | To explain the deregulated electricity market models functioning around the world.                                   |
| 2 | To understand the operational and planning activities in power generation. .                                         |
| 3 | To solve transmission pricing and understand strategies in congestion management                                     |
| 4 | To study the development of competition in electricity distribution companies.                                       |
| 5 | To outline the salient features of Indian Electricity Act and the formation and operation of Indian power exchanges. |

| Course Contents |                                                                                                                                                                                                                                                                                                                      | Hours |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Unit I          | <b>Need and conditions for deregulation:</b> Introduction of market structure, market architecture, spot market, forward markets and settlements. Review on concepts of marginal cost of generation, least-cost operation, and incremental cost of generation. Comparison between old and new power system operation | (9)   |
| Unit II         | <b>Electricity sector structures and ownership /management:</b> The forms of ownership and management. Different structure models like monopoly model, purchasing agency model, wholesale competition model, retail competition model                                                                                | (9)   |
| Unit III        | <b>Locational marginal pricing:</b> Framework and methods for the analysis of Bilateral and pool markets, LMP based markets, auction models and price formation, price based unit commitment.                                                                                                                        | (9)   |
| Unit IV         | <b>Transmission network and market power:</b> Power wheeling transactions and marginal costing, transmission costing. Congestion management methods- market splitting, countertrading, effect of congestion on LMPs.                                                                                                 | (9)   |
| Unit V          | <b>Ancillary Services and System Security in Deregulation:</b> Classifications and definitions, ancillary services management in various markets, regulatory issues involved in the deregulation of the power industry.                                                                                              | (9)   |

#### **Text Books**

|   |                                                                                                                                                                   |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Kankar Bhattacharya, Math H.J.Bollen and JappE.Daalder, "Operation of Restructured Power Systems", Kluwer Academic Publishers, 2001 (For Units – I, II, IV and V) |
| 2 | Mohammad Shahedipour, HatimYamin and Zuyi Li, "Market Operations in Electric Power Systems –                                                                      |

|                        |                                                                                                                             |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------|
|                        | Forecasting, Scheduling and Risk Management”, IEEE-Wiley Interscience Publication, 2002. (For Units – I and III)            |
| <b>Reference Books</b> |                                                                                                                             |
| 1                      | Loi Lei Lai, “Power System Restructuring and Deregulation”, 1 st edition, John Wiley & Sons Ltd., 2012.                     |
| 2                      | Mohammad Shahidepour and Muwaffaqalomoush, “Restructured Electrical Power Systems”, 1 st Edition, Marcel Decker Inc., 2001. |
| 3                      | Power System Economics: Designing markets for electricity by S. Stoft, John Wiley & Sons Inc Publishers, 2002               |

| <b>BEE34806</b>   | <b>Course Outcomes</b>                                                                                   | <b>CL</b> |
|-------------------|----------------------------------------------------------------------------------------------------------|-----------|
| <b>BEE34806.1</b> | Understand the developments in restructuring of power systems                                            | <b>4</b>  |
| <b>BEE34806.2</b> | Explore issues like congestion management, transmission pricing, ancillary services management.          | <b>3</b>  |
| <b>BEE34806.3</b> | Analyze the concepts of locational marginal pricing and financial transmission rights.                   | <b>3</b>  |
| <b>BEE34806.4</b> | Understand typical issues in electricity markets and how these are handled world-wide in various markets | <b>3</b>  |
| <b>BEE34806.5</b> | To develop an understanding of ancillary services and system security in deregulated power systems       | <b>5</b>  |



  
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| <b>Fourth Year (Semester-VII) B. Tech. Electrical Engineering</b>                 |                                                                                                                                                                                                          |                                        |                                                                                     |
| <b>BEE34810: High Voltage Engineering Lab</b>                                     |                                                                                                                                                                                                          |                                        |                                                                                     |
| <b>Teaching Scheme</b>                                                            |                                                                                                                                                                                                          | <b>Examination Scheme</b>              |                                                                                     |
| <b>Practical</b>                                                                  | 2Hrs./week                                                                                                                                                                                               | <b>CA</b>                              | 25 Marks                                                                            |
| <b>Total Credit</b>                                                               | 1                                                                                                                                                                                                        | <b>ESE</b>                             | 25 Marks                                                                            |
|                                                                                   |                                                                                                                                                                                                          | <b>Total</b>                           | 50 Marks                                                                            |
|                                                                                   |                                                                                                                                                                                                          | <b>Duration of ESE: 2 Hrs. 00 Min.</b> |                                                                                     |
| <b>Course Outcome:</b>                                                            |                                                                                                                                                                                                          |                                        |                                                                                     |
| <b>1</b>                                                                          | Demonstrate the concepts of high voltage engineering in lightning discharge.                                                                                                                             |                                        |                                                                                     |
| <b>2</b>                                                                          | Explain measurement and calculation of high voltage and current using different tests. .                                                                                                                 |                                        |                                                                                     |
| <b>3</b>                                                                          | Interpret breakdown mechanism in solid liquid and gaseous medium lightning and switching over voltage and insulation coordination.                                                                       |                                        |                                                                                     |
| <b>4</b>                                                                          | Classify different methods of generation and measurement of high voltage and currents.                                                                                                                   |                                        |                                                                                     |
| <b>5</b>                                                                          | Discuss methods of non-destructive and High Voltage testing of apparatus                                                                                                                                 |                                        |                                                                                     |
| <b>Course Contents</b>                                                            |                                                                                                                                                                                                          |                                        | <b>Cos</b>                                                                          |
| <b>1</b>                                                                          | Illustrate & Perform the Horn gap.                                                                                                                                                                       |                                        | <b>CO1</b>                                                                          |
| <b>2</b>                                                                          | Determine the dielectric strength of transformer oil                                                                                                                                                     |                                        | <b>CO1</b>                                                                          |
| <b>3</b>                                                                          | Determination of breakdown voltage for different types of insulating materials                                                                                                                           |                                        | <b>CO2</b>                                                                          |
| <b>4</b>                                                                          | Determine the components, control and operation of 150kV, 225J impulse generator                                                                                                                         |                                        | <b>CO2</b>                                                                          |
| <b>5</b>                                                                          | Determine the breakdown characteristics of air under the influence of uniform and non-uniform AC field, using electrode configurations                                                                   |                                        | <b>CO3</b>                                                                          |
| <b>6</b>                                                                          | Demonstrate Sphere gap for measurement of High DC, AC and impulse voltages                                                                                                                               |                                        | <b>CO3</b>                                                                          |
| <b>7</b>                                                                          | Demonstrate & Corona Phenomenon                                                                                                                                                                          |                                        | <b>CO4</b>                                                                          |
| <b>8</b>                                                                          | Functioning of Voltage Doublers Circuit                                                                                                                                                                  |                                        | <b>CO4</b>                                                                          |
| <b>9</b>                                                                          | Functioning Critical Flashover of a Sphere Gap Using Impulse Voltage Generator                                                                                                                           |                                        | <b>CO5</b>                                                                          |
| <b>10</b>                                                                         | 3-Stage Cockroft Walton Voltage Multiplier                                                                                                                                                               |                                        | <b>CO5</b>                                                                          |
| <b>11</b>                                                                         | Critical Flashover of a Sphere Gap using IVG                                                                                                                                                             |                                        | <b>CO5</b>                                                                          |
| <b>Text Books</b>                                                                 |                                                                                                                                                                                                          |                                        |                                                                                     |
| <b>1</b>                                                                          | High Voltage Engineering by M.S. Naidu and V. Kamaraju, TMH Publications.                                                                                                                                |                                        |                                                                                     |
| <b>2</b>                                                                          | High Voltage Engineering by C.L. Wadhwa, New Age International (P) Ltd.                                                                                                                                  |                                        |                                                                                     |
| <b>Reference Books</b>                                                            |                                                                                                                                                                                                          |                                        |                                                                                     |

|   |                                                                                                 |
|---|-------------------------------------------------------------------------------------------------|
| 1 | High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl,by Elsevier..                    |
| 2 | High Voltage Insulation Engineering by Ravindra Arora, Wolfgang New Age Internationals (P) Ltd. |
| 3 | High voltage Engineering, Theory and Practice , Mazen Abdel Salam, Hussein Anis, Ahdan EI-      |



  
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## **Fourth Year (Semester-VII) B. Tech. Electrical Engineering**

### **BBA34801:: Project Management & Finance**

| Teaching Scheme |             | Examination Scheme            |          |
|-----------------|-------------|-------------------------------|----------|
| Lectures        | 4 Hrs./week | CT                            | 30Marks  |
| Tutorial        | 0 Hrs./week | CA                            | 10Marks  |
| Total Credit    | 4           | ESE                           | 60Marks  |
|                 |             | Total                         | 100Marks |
|                 |             | Duration of ESE:03 Hrs.00Min. |          |

### **Course Objective:**

|   |                                                                                                                                                            |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | To understand project fundamentals, develop project structuring skills, and analyze different organizational structures for effective project management   |
| 2 | To understand project planning, cost estimation, financial projections, and apply scheduling techniques like PERT and CPM for effective project management |
| 3 | To understand project planning, cost estimation, financial analysis, and apply PERT & CPM techniques for effective scheduling and decision-making          |
| 4 | To understand project structuring, quality planning, evaluation, closure, and audit processes for effective project management.                            |
| 5 | To understand financial concepts and apply capital budgeting and project appraisal techniques for effective financial decision-making.                     |

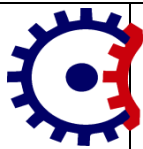
| Course Contents |                                                                                                                                                                                                                                                                                                                             | Hours |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Unit I</b>   | <b>Introduction to Project Financial Management</b><br>Introduction, Project Objectives and Policies, Work Breakdown Structure, Project Report, Forms of Project Organisation, Line and Staff Organisation, Divisional Organisation, Matrix Organisation.                                                                   | (9)   |
| <b>Unit II</b>  | <b>Project Planning</b><br>Principles of Planning Estimating the Cost of the Project, Understanding Cost of Capital, Calculating Cost of Project, Projected Financial Statements: Tools of Profit Planning, Projected Income Statement (PIS), Projected Balance Sheet (PBS), PERT & CPM for scheduling and time estimation. | (9)   |
| <b>Unit III</b> | <b>Project Process</b><br>Introduction, 4D Model of Appreciative Inquiry, Four Stages of AI Process, McKinsey 7S Framework, Nine Key Knowledge Areas of Project Management, PRINCE2: A Structured Approach to Project Management.                                                                                           | (9)   |
| <b>Unit IV</b>  | <b>Tools and Techniques of Project Management</b><br>The Project Closure Report, Work Breakdown Structure, Cost Breakdown Structure (CBS), Project Quality Plan (PQP), Project Evaluation Rules, Project Review, Project Completion or Closure Report, Project Audit Life Cycle.                                            | (9)   |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Unit V</b>          | <b>Financial Management Basics</b><br>Financial concepts: Time Value of Money , Risk and Return , Financial statements analysis, Break-even analysis, Leverage concepts.<br><b>Project Finance and Capital Budgeting</b><br>Capital budgeting techniques: Net Present Value (NPV) , Internal Rate of Return (IRR) Payback period, Cost of capital, Sources of finance (equity, debt) , Project appraisal and cash flow analysis. | <b>(9)</b> |
| <b>Text Books</b>      |                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |
| 1                      | K.K. Chitkara – Project Management: Planning, Scheduling and Controlling Publisher: McGraw Hill                                                                                                                                                                                                                                                                                                                                  |            |
| 2                      | Prasanna Chandra – Projects: Planning, Analysis, Selection, Financing, Implementation and Review Publisher: McGraw Hill                                                                                                                                                                                                                                                                                                          |            |
| 3                      | Harold Kerzner – Project Management: A Systems Approach to Planning, Scheduling, and Controlling Publisher: Wiley                                                                                                                                                                                                                                                                                                                |            |
| <b>Reference Books</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |
| 1                      | Project Management Institute (PMI) – A Guide to the Project Management Body of Knowledge (PMBOK Guide) Publisher: PMI                                                                                                                                                                                                                                                                                                            |            |
| 2                      | Richard A. Brealey, Stewart Myers & Franklin Allen – Principles of Corporate Finance Publisher: McGraw Hill                                                                                                                                                                                                                                                                                                                      |            |

| BBA34801   | Course Outcomes                                                                                                                         | CL |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------|----|
| BBA34801.1 | Identify roles of stakeholders and project managers in project execution.                                                               | 4  |
| BBA34801.2 | Apply project planning tools such as PIS , Projected Balance Sheet (PBS) PERT, and CPM for scheduling and time estimation.              | 3  |
| BBA34801.3 | Apply these frameworks and methodologies to improve project planning, execution, and organizational effectiveness.                      | 3  |
| BBA34801.4 | Interpret Work Breakdown Structure (WBS) and Cost Breakdown Structure (CBS) for effective project planning and cost control.            | 3  |
| BBA34801.5 | Apply project structuring, evaluation, closure, and audit techniques to ensure effective project completion and performance assessment. | 4  |



  
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| <b>Final Year (Semester-VII ) B. Tech. Electrical Engineering</b>                            |                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                        |  |                                                                                    |              |
| <b>Program Electives – BEE34703:Technologies for clean &amp; Renewable Energy Production</b> |                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                        |  |                                                                                    |              |
| <b>Teaching Scheme</b>                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                        |  | <b>Examination Scheme</b>                                                          |              |
| <b>Lectures</b>                                                                              | 4 Hrs/week                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                        |  | <b>CT</b>                                                                          | <b>30</b>    |
| <b>Tutorial</b>                                                                              | 0 Hrs/week                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                        |  | <b>CA</b>                                                                          | <b>10</b>    |
| <b>Total Credit</b>                                                                          | 4                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                        |  | <b>ESE</b>                                                                         | <b>60</b>    |
|                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                        |  | <b>Total</b>                                                                       | <b>100</b>   |
|                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                        |  | <b>Duration of ESE: 03 Hrs 00 Min.</b>                                             |              |
| <b>Course Objectives:</b>                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                        |  |                                                                                    |              |
| 1                                                                                            | Students will be able to explain energy demand, conventional and renewable energy sources, and their environmental impacts including climate change and GHG emissions                                                                                                                                                                                                                                                      |                                                                                                                                                                                                        |  |                                                                                    |              |
| 2                                                                                            | Students will be able to describe working principles and applications of solar, wind, hydro, geothermal, and biomass energy systems.                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                        |  |                                                                                    |              |
| 3                                                                                            | Students will be able to compare different energy production technologies (including hydrogen, clean coal, and waste-to-energy) and suggest sustainable solutions for energy generation.                                                                                                                                                                                                                                   |                                                                                                                                                                                                        |  |                                                                                    |              |
| <b>Course Contents</b>                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                        |  |                                                                                    | <b>Hours</b> |
| <b>Unit I</b>                                                                                | <b>Fundamentals of Energy and Environment:</b> Energy demand, conventional vs. renewable sources, and the environmental impacts of fossil fuels. Climate change, greenhouse gas (GHG) emissions, and global sustainability mandates. The hydrogen economy, "green" hydrogen vs. conventional production (grey/blue hydrogen).Production technologies (water electrolysis, steam methane reforming), storage, and transport |                                                                                                                                                                                                        |  |                                                                                    | <b>(9)</b>   |
| <b>Unit II</b>                                                                               | <b>Cleaner Routes for Conventional Fuel :</b> Coal Upgrading: Coal characterization, gasification, coal liquefaction, and clean coal technologies (e.g., carbon capture and storage - CCS).Petroleum & Gas: Crude oil refining, cleaner petroleum routes, and upgrading gaseous fuels                                                                                                                                      |                                                                                                                                                                                                        |  |                                                                                    | <b>(9)</b>   |
| <b>Unit III</b>                                                                              | <b>Solar Energy Technologies :</b> Solar Photovoltaics (PV): Semiconductor properties, PV cell physics, module design, balance of system (BOS) components, and grid integration. Solar Thermal: Solar radiation geometry, flat plate collectors, concentrating solar power (CSP), and industrial applications                                                                                                              |                                                                                                                                                                                                        |  |                                                                                    | <b>(9)</b>   |
| <b>Unit IV</b>                                                                               | <b>Wind, Hydro, and Geothermal Energy :</b> Wind Power: Wind resource assessment, aerodynamics of turbines, Betz's law, onshore/offshore farms, and power conditioning. Hydroelectric & Geothermal: Hydropower classification, turbines, geothermal reservoirs, and energy extraction processes                                                                                                                            |                                                                                                                                                                                                        |  |                                                                                    | <b>(9)</b>   |

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|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Unit V</b>          | <b>Biomass and Waste-to-Energy:</b> Biomass characterization, thermo chemical conversion (combustion, gasification, pyrolysis), and biochemical conversion (anaerobic digestion, fermentation). Municipal solid waste (MSW) processing, waste heat recovery, and cogeneration | <b>(9)</b> |
| <b>Text Books</b>      |                                                                                                                                                                                                                                                                               |            |
| 1                      | Energy Management Handbook – Wayne C. Turner, Wiley Publication                                                                                                                                                                                                               |            |
| 2                      | Renewable Energy Resources – John Twidell and Tony Weir                                                                                                                                                                                                                       |            |
| <b>Reference Books</b> |                                                                                                                                                                                                                                                                               |            |
| 1                      | 1. Non-Conventional Energy Sources – G.D. Rai                                                                                                                                                                                                                                 |            |
| 2                      | 2. Renewable Energy: Power for a Sustainable Future – Godfrey Boyle                                                                                                                                                                                                           |            |
| 3                      | 3. Solar Engineering of Thermal Processes – John A. Duffie and William A. Beckman                                                                                                                                                                                             |            |
| 4                      | 4. Wind Energy Explained – James F. Manwell, Jon G. McGowan, and Anthony L. Rogers                                                                                                                                                                                            |            |
| 5                      | 5. Biomass Energy Systems – D.P. Mishra                                                                                                                                                                                                                                       |            |

| <b>BEE34703</b> | <b>Course Outcomes</b>                                                                               | <b>CL</b> |
|-----------------|------------------------------------------------------------------------------------------------------|-----------|
| BEE34703.1      | <b>Explain</b> energy, environmental issues, renewable sources, sustainability and hydrogen economy. | 2         |
| BEE34703.2      | <b>Analyze</b> hydrogen production, storage, transportation and cleaner fuel technologies.           | 4         |
| BEE34703.3      | <b>Analyze</b> solar PV and thermal energy conversion technologies and grid integration.             | 4         |
| BEE34703.4      | <b>Analyze</b> wind, hydro and geothermal energy conversion systems.                                 | 4         |
| BEE34703.5      | <b>Evaluate</b> biomass, waste-to-energy, waste heat recovery and cogeneration technologies.         | 5         |



  
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