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| **UNIVERSITY OF ENGINEERING AND MANAGEMENT, KOLKATA** |
| **DEPARTMENT OF ELECTRICAL ENGINEERING** |



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| **ABBREVIATIONS OF SUBJECT - GROUPS** | |
| GROUP NAME | TOPIC |
| HSMC | HUMANITIES, SOCIAL SCIENCE INCLUDING MANAGEMENT |
| BSC | BASIC SCIENCE |
| ESC | ENGINEERING SCIENCE |
| PCC | PROFESSIONAL CORE SUBJECTS |
| PEC | PROFESSIONAL ELECTIVE SUBJECT RELEVANT TO THE BRANCH |
| OEC | ELECTIVES FROM OTHER TECHNICAL / EMERGING FIELDS |
| **PROJ** | **PROJECT, SEMINAR AND INDUSTRIAL TRAINING** |

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| **EXECUTIVE SUMMARY OF PROPOSED SYLLABUS FOR UEM** | | | | | | | | |
| **SEMESTER**  **/GROUP** | **HSMC** | **BSC** | **ESC** | **PCC** | **PEC** | **OEC** | **PROJ &SEMINAR** | **TOTAL** |
| 3 | 0 |  | 4 | 16 |  |  | 0 | 20 |
| 4 | 0 | 7 |  | 15 |  |  | 0 | 22 |
| 5 | 3 |  |  | 12 | 3 | 3 | 0 | 21 |
| 6 | 3 |  |  | 10 | 6 | 3 | 0 | 22 |
| 7 | 3 |  |  |  | 6 | 6 | 3 | 18 |
| 8 | 0 |  |  |  | 3 | 6 | 8 | 17 |
| **GROUP TOTAL** | **9** | **7** | **4** | **53** | **18** | **18** | **11** | **120** |
| **AICTE** | **12** | **26** | **20** | **53** | **18** | **18** | **11** | **158** |
| UEM | Mandatory Additional Requirements (MAR) (3rdSem to 8thSem) (0.5x6) | | | | | | | 3 |
| UEM | MOOC (Mandatory for honours) (3rdSem to 8thSem) (3x6) | | | | | | | 18 |
| UEM | 1stSem and 2ndSem | | | | | | | 42 |
| **UEM** | **TOTAL CREDIT** | | | | | | | **183** |

**Program Educational Objectives (PEOs)**

The graduate will possess:

* Basic understanding of core electrical engineering built on foundation of physical science, mathematics, computing, and technology so as to pursue successful career/higher studies in Electrical Engineering.
* Broad based knowledge of Electrical Engineering suitable for research, development and innovation to meet diverse and multidisciplinary needs of industry and society.
* Adequate professional skills, to be analytical and logical so that they can quickly adapt to new work environment, assimilate information and solve challenging problems.
* Self learning capability, leadership qualities with strong communication skills and working in teams.
* Capacity to be productive with ethical values, conscious about social and environmental issues with lifelong learning attitude.

**Program Outcomes (POs)**

|  |  |
| --- | --- |
| **PO1**  **Engineering Knowledge:** Ability to apply the knowledge of mathematics, science and engineering principles for modelling, analyzing and solving electrical engineering problems. | |
| **Competency** | **Indicators** |
| 1.1 Demonstrate competence in mathematical modeling | 1.1.1 Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problems  1.1.2 Apply advanced mathematical techniques to model and solve electrical engineering problems |
| 1.2 Demonstrate competence in basic sciences | 1.2.1 Apply laws of natural science to an electrical engineering problem |
| 1.3 Demonstrate competence in engineering fundamentals | 1.3.1 Apply fundamental engineering concepts to solve electrical engineering problems |
| 1.4 Demonstrate competence in specialized engineering knowledge to the program | 1.4.1 Apply Electrical engineering concepts to solve engineering problems |
| **PO2**  **Problem Analysis**: Identify, formulate and analyze real-life electrical engineering problems. | |
| **Competency** | **Indicators** |
| 2.1 Demonstrate an ability to identify and formulate complex engineering problem | 2.1.1 Articulate problem statements and identify objectives  2.1.2 Identify engineering systems, variables, and parameters to solve the electrical engineering problems  2.1.3 Identify the mathematical, engineering and other relevant knowledge that applies to a given problem |
| 2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem | 2.2.1 Reframe complex problems into interconnected sub-problems  2.2.2 Identify, assemble and evaluate information and resources.  2.2.3 Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions  2.2.4 Compare and contrast alternative solution processes to select the best process. |
| 2.3 Demonstrate an ability to formulate and interpret a model | 2.3.1 Combine scientific principles and electrical engineering concepts to formulate model/s (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy.  2.3.2 Identify assumptions (mathematical and physical) necessary to allow modelling of a system at the level of accuracy required. |
| 2.4 Demonstrate an ability to execute a solution process and analyze results | 2.4.1 Apply engineering mathematics and computations to solve mathematical models of electrical engineering  2.4.2 Produce and validate results through skilful use of contemporary engineering tools and models  2.4.3 Identify sources of error in the solution process, and limitations of the solution.  2.4.4 Extract desired understanding and conclusions consistent with objectives and limitations of the analysis |
| **PO3**  **Design/Development of Solutions:**Ability to design and develop solutions for real-life electrical engineering problems. | |
| **Competency** | **Indicators** |
| 3.1 Demonstrate an ability to define a complex/ open-ended problem in engineering terms | 3.1.1 Recognize that need analysis is key to good problem definition  3.1.2 Elicit and document, engineering requirements from stakeholders  3.1.3 Synthesize engineering requirements from a review of the state-of-the-art  3.1.4 Extract engineering requirements from relevant engineering Codes and Standards such as ASME, BIS, ISO and ASHRAE.  3.1.5 Explore and synthesize engineering requirements considering health, safety risks, environmental, cultural and societal issues  3.1.6 Determine design objectives, functional requirements and arrive at specifications |
| 3.2 Demonstrate an ability to generate a diverse set of alternative design solutions | 3.2.1 Apply formal idea generation tools to develop multiple engineering design solutions for electrical systems  3.2.2 Build models/prototypes to develop a diverse set of design solutions  3.2.3 Identify suitable criteria for the evaluation of alternate design solutions |
| 3.3 Demonstrate an ability to select an optimal design scheme for further development | 3.3.1 Apply formal decision-making tools to select optimal engineering design solutions for further development  3.3.2 Consult with domain experts and stakeholders to select candidate engineering design solution for further development in electrical systems |
| 3.4 Demonstrate an ability to advance an engineering design to defined end state | 3.4.1 Refine a conceptual design into a detailed design of electrical engineering systems within the existing constraints (of the resources)  3.4.2 Generate information through appropriate tests to improve or revise the design |
| **PO4**  **Conduct Investigation of Complex Problems:** Develop sophisticated equipment and experimental systems for carrying out detailed investigation to multifaceted electrical engineering problems. | |
| **Competency** | **Indicators** |
| 4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding | 4.1.1 Define a problem, its scope and importance for purposes of investigation  4.1.2 Examine the relevant methods, tools and techniques of experiment design, system calibration, data acquisition, analysis and presentation  4.1.3 Apply appropriate instrumentation and/or software tools to make measurements of physical quantities  4.1.4 Establish a relationship between measured data and underlying physical principles. |
| 4.2 Demonstrate an ability to design experiments to solve open-ended problems | 4.2.1 Design and develop an experimental approach, specify appropriate equipment and procedures  4.2.2 Understand the importance of the statistical design of experiments and choose an appropriate experimental design plan based on the study objectives |
| 4.3 Demonstrate an ability to analyze data and reach a valid conclusion | 4.3.1 Use appropriate procedures, tools and techniques to conduct experiments and collect data  4.3.2 Analyze data for trends and correlations, stating possible errors and limitations  4.3.3 Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions  4.3.4 Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions |
| **PO5**  **Modern Tool Usage:**Ability to develop and utilize modern tools for modelling, analyzing and solving electrical engineering problems. | |
| **Competency** | **Indicators** |
| 5.1 Demonstrate an ability to identify/ create modern engineering tools, techniques and resources | 5.1.1 Identify modern engineering tools such as computer-aided drafting, modelling and analysis; techniques and resources for engineering activities  5.1.2 Create/adapt/modify/extend tools and techniques to solve electrical engineering problems |
| 5.2 Demonstrate an ability to select and apply disciplinespecific tools, techniques and resources | 5.2.1 Identify the strengths and limitations of tools for (i) acquiring information, (ii) modelling and simulating, (iii) monitoring system performance, and (iv) creating electrical engineering designs.  5.2.2 Demonstrate proficiency in using discipline-specific tools |
| 5.3 Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem | 5.3.1 Discuss limitations and validate tools, techniques and resources  5.3.2 Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use. |
| **PO6**  **The Engineer and Society:** Dedication to work as an electrical engineer who is capable of identifying solutions to various local and global problems faced by the society. | |
| **Competency** | **Indicators** |
| 6.1 Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare | 6.1.1 Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional and local level |
| 6.2 Demonstrate an understanding of professional engineering regulations, legislation and standards | 6.2.1 Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public |
| **PO7**  **Environment & Sustainability:**Ability to design and develop modern systems for the upkeep of pollution free environment. | |
| **Competency** | **Indicators** |
| 7.1 Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts | 7.1.1 Identify risks/impacts in the life-cycle of an engineering product or activity  7.1.2 Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability |
| 7.2 Demonstrate an ability to apply principles of sustainable design and development | 7.2.1 Describe management techniques for sustainable development  7.2.2 Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline |
| **PO8**  **Ethics:** Willingness and ability to upkeep professional ethics and social values. | |
| **Competency** | **Indicators** |
| 8.1 Demonstrate an ability to recognize ethical dilemmas | 8.1.1 Identify situations of unethical professional conduct and propose ethical alternatives |
| 8.2 Demonstrate an ability to apply the Code of Ethics | 8.2.1 Identify doctrines of the professional code of ethics  8.2.2 Examine and apply moral & ethical principles to known case studies |
| **PO9**  **Individual and Team Work:** Willingness and ability to think independently, take initiative and lead a team of engineers or researchers. | |
| **Competency** | **Indicators** |
| 9.1 Demonstrate an ability to form a team and define a role for each member | 9.1.1 Recognize a variety of working and learning preferences; appreciate the value of diversity on a team  9.1.2 Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal. |
| 9.2 Demonstrate effective individual and team operations-- communication, problem solving, conflict resolution and leadership skills | 9.2.1 Demonstrate effective communication, problem-solving, conflict resolution and leadership skills  9.2.2 Treat other team members respectfully  9.2.3 Listen to other members  9.2.4 Maintain composure in difficult situations |
| 9.3 Demonstrate success in a team-based project | 9.3.1 Present results as a team, with smooth integration of contributions from all individual efforts |
| **PO10**  **Communication:** Ability to express ideas clearly and communicate orally as well as in writing with others. | |
| **Competency** | **Indicators** |
| 10.1 Demonstrate an ability to comprehend technical literature and document project work | 10.1.1 Read, understand and interpret technical and non-technical information  10.1.2 Produce clear, well-constructed, and well-supported written engineering documents  10.1.3 Create flow in a document or presentation - a logical progression of ideas so that the main point is clear |
| 10.2 Demonstrate competence in listening, speaking, and presentation | 10.2.1 Listen to and comprehend information, instructions, and viewpoints of others  10.2.2 Deliver effective oral presentations to technical and non-technical audiences |
| 10.3 Demonstrate the ability to integrate different modes of communication | 10.3.1 Create engineering-standard figures, reports and drawings to complement writing and presentations  10.3.2 Use a variety of media effectively to convey a message in a document or a presentation |
| **PO11**  **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles to manage projects in multidisciplinary environments | |
| **Competency** | **Indicators** |
| 11.1 Demonstrate an ability to evaluate the economic and financial performance of an engineering activity | 11.1.1 Describe various economic and financial costs/benefits of an engineering activity  11.1.2 Analyze different forms of financial statements to evaluate the financial status of an engineering project |
| 11.2 Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity | 11.2.1 Analyze and select the most appropriate proposal based on economic and financial considerations. |
| 11.3 Demonstrate an ability to plan/manage an engineering activity within time and budget constraints | 11.3.1 Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks.  11.3.2 Use project management tools to schedule an engineering project, so it is completed on time and on budget. |
| **PO12**  **Life Long Learning:** Willingness and ability to maintain lifelong learning process by way of participating in various professional activities. | |
| **Competency** | **Indicators** |
| 12.1 Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps | 12.1.1 Describe the rationale for the requirement for continuing professional development  12.1.2 Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap |
| 12.2 Demonstrate an ability to identify changing trends in engineering knowledge and practice | 12.2.1 Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current  12.2.2 Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field |
| 12.3 Demonstrate an ability to identify and access sources for new information | 12.3.1 Source and comprehend technical literature and other credible sources of information  12.3.2 Analyze sourced technical and popular information for feasibility, viability, sustainability, etc. |

**Program Specific Outcomes (PSOs)**

At the end of the program, the students

* PSO1: Proficiency in use of software & hardware required to practice Electrical engineering profession.
* PSO2: Proficiency in developing wind & solar hybrid power generating systems.
* PSO3: Development of wireless control & automation and real time simulations for prototypes.

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| **UEM** |
| **COURSE STRUCTURE FOR B.Tech (Electrical Engineering)** |

Second year (Third semester)

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| **Theory** | | | | | | | |
| **SI.NO.** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | PCC-EE 301 | Electrical Circuit Analysis | 3 | 0 | 0 | 3 | 3 |
| 2 | PCC-EE 302 | Analog Electronics | 3 | 0 | 0 | 3 | 3 |
| 3 | PCC-EE 303 | Electrical Machines-I | 3 | 0 | 0 | 3 | 3 |
| 4 | PCC-EE 304 | Electromagnetic Field theory | 3 | 1 | 0 | 4 | 4 |
| 5 | ESC-ME 301 | Engineering Mechanics | 3 | 1 | 0 | 4 | 4 |
| 6 | MC-EE 301 | Environmental Science | 2 | 0 | 0 | 2 | 0 |
| 7 | HSMC 301 | Essential Studies for Professionals III | 2 | 0 | 0 | 2 | 0 |
| **Total of Theory** | | |  |  |  | **21** | **17** |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Practical/ Sessional** | | | | | | | |
| **SL.NO.** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | HSMC 381 | Skill Development for Professionals III | 0 | 0 | 2 | 2 | 0 |
| 2 | PCC-EE 392 | Electrical Circuit Analysis Lab | 0 | 0 | 2 | 2 | 1 |
| 3 | PCC-EE 392 | Analog Electronics Lab | 0 | 0 | 2 | 2 | 1 |
| 4 | PCC-EE 393 | Electrical Machines Lab-I | 0 | 0 | 2 | 2 | 1 |
| 5 | PROJ-EE 01 | Project I | 0 | 0 | 2 | 2 | 0 |
| 6 | MC381 | Mandatory Additional Requirements (MAR) | 0 | 0 | 0 | 0 | 0.5 |
| 7 | MOOC 3 | MOOCs (Mandatory for Honours) | 0 | 0 | 0 | 0 | 3 |
| **Total of Practical** | | |  |  |  | 10 | (3+3.5) |
| **Total of Semester** | | | | | | **31** | **20+3.5** |

**EE-2nd Year 1st Semester Course Outcomes**

**PCC-EE 301: Electrical Circuit Analysis**

**Course Outcomes:**

**CO1**: Apply different techniques and network theorems for analysis of electrical circuit and application of graph theory for electrical circuits.

**CO2**: Solve first and second order networks and evaluates the steady state and transient response of the systems and application of Laplace transformation

**CO3**: Describe the elements of AC circuits, the phasor concept, three-phase ac circuits and analyze magnetically coupled circuits

**CO4**: Understand the features of two port networks and obtain their equivalent circuits.

**PCC –EE 302: Analog Electronics**

**Course Outcomes:**

**CO1:** Acquire knowledge on the fundamentals of analog integrated circuits and characteristics of transistors

**CO2:** Design and analyze the different characteristics of various rectifiers and amplifier circuits

**CO3:** Analyze input/output relation for various simple applications of OP-Amp in analog circuits and operation of feedback amplifiers

**CO4:** Develop design competence in linear and non-linear OP-Amp Circuits

**PCC-EE 303 Electric Machine -I**

**Course Outcomes:**

**CO1:**Understand the concepts of magnetic circuits.

**CO2:** Understand the operation of dc machines.

**CO3:**Analyze the differences in operation of different dc machine configurations

**CO4:** Analyze the single phase and three phase transformers circuits

**PCC –EE 304 Electromagnetic Field Theory**

**Course Outcomes:**

**CO1:** Apply vector calculus to understand the behavior of static electric and magnetic field.

**CO2:** Solve Laplace and Poisson’s equations for analysis of conductors, dielectrics and capacitances.

**CO3:** Identify the appropriate magnetic material for design purpose of electromagnetic machines and analyze electromagnetic wave propagation in different media and its interfaces.

**CO4:** Understand Maxwell’s equation in different forms (differential and integral) and analyze time varying magnetic fields.

**ESC-ME 301 Engineering Mechanics**

**Course Outcomes:**

**CO1:** Understand the concepts of co-ordinate systems

**CO2:**Analyze the three-dimensional motion

**CO3:**Understand the concepts of rigid bodies and analyze the free-body diagrams of different arrangements

**CO4:**Analyze the torsional motion and bending moment

**MC-EE 301 Environmental Science**

**Course Outcomes:**

**CO1:**To instill the spirit of environmental enthusiasm and environmentalism.

**CO2:**To make them aware of the environmental problems faced by the modern man in terms of pollution, deforestation and in general the environmental degradation.

**CO3:**To enable them to think in terms of sustainable envelopment based on the knowledge they have in different subjects of science and engineering

**CO4:**To make them think in terms of scientific and technological advancement in the system.

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| **UEM** |
| **COURSE STRUCTURE FOR B. Tech (Electrical Engineering)** |

Second year (Fourth semester)

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| **Theory** | | | | | | | |
| **SI.**  **NO.** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | BSC-M 401 | Mathematics-III (Probability & Statistics) | 3 | 1 | 0 | 4 | 4 |
| 2 | BSC-EE 401 | Biology -I | 2 | 1 | 0 | 3 | 3 |
| 3 | PCC-EE401 | Digital Electronics | 3 | 0 | 0 | 3 | 3 |
| 4 | PCC-EE402 | Electrical Machines -II | 3 | 0 | 0 | 3 | 3 |
| 5 | PCC-EE403 | Power Electronics | 3 | 0 | 0 | 3 | 3 |
| 6 | PCC-EE 404 | Signals & Systems | 2 | 1 | 0 | 3 | 3 |
| 7 | MC-EE 401 | Indian Constitution | 2 | 0 | 0 | 2 | 0 |
| 8 | HSMC 401 | Essential Studies for Professionals IV | 2 | 0 | 0 | 2 | 0 |
| **Total of Theory** | | |  |  |  | **23** | **19** |

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| **Practical/Sessional** | | | | | | | |
| **SL.**  **NO.** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | PCC-EE 491 | Digital Electronics Laboratory | 0 | 0 | 2 | 2 | 1 |
| 2 | PCC-EE 492 | Electrical Machines Laboratory-II | 0 | 0 | 2 | 2 | 1 |
| 3 | PCC-EE 493 | Power Electronics Lab | 0 | 0 | 2 | 2 | 1 |
| 4 | HSMC 481 | Skill Development for Professionals IV | 0 | 0 | 2 | 2 | 0 |
| 5 | PROJ-EE 02 | Project II (Data Structures) | 0 | 0 | 0 | 2 | 0 |
| 6 | MC481 | Mandatory Additional Requirements (MAR) | 0 | 0 | 0 | 0 | 0.5 |
| 7 | MOOC 4 | MOOCs (Mandatory for Honours) | 0 | 0 | 0 | 0 | 3 |
| **Total of Practical** | | |  |  |  | 10 | (3+3.5) |
| **Total of Semester** | | | | | | **33** | **22+3.5** |

**EE-2nd Year 2nd Semester Course Outcomes**

**BSC-M-401: Mathematics & Statistics-III**

**Course Outcomes:**

**CO1**: Apply the basic concepts of Probability related to binomial and multinomial distributions, Poisson’s approximation, Bernoulli trials, Variance and Chebyshev’s inequality.

**CO2**: Solve problems related to continuous probability distribution and bivariate distribution

**CO3**: Understand the basic concepts of statistics based on central tendency, correlation, regression and evaluation of statistical parameters

**CO4**: Study the various concepts of applied statistics and analyse small samples of data using different tests.

**BSC-EE-401: Biology-I**

**Course Outcomes:**

**CO1:** Describe how biological observations of 18th century lead to major discoveries and discuss about the underlying criterions such as morphological, biochemical and ecological

**CO2:** Highlight the concepts of recessiveness and dominance during passage of genetic material and study about the building blocks of life

**CO3:** Classify the enzymes and distinguish between different enzyme actions

**CO4:**Identify DNA as genetic material, analyse the biological processes and classify the microorganisms

**PCC-EE 401 Digital Electronics**

**Course Outcomes:**

**CO1:**Understand the working of logic families and logic gates.

**CO2:** Design and implement Combinational and Sequential logic circuits

**CO3:** Understand the process of Analog to Digital conversion and Digital to Analog conversion

**CO4:**Be able to use PLDs to implement the given logical problem

**PCC –EE 402 -Electrical Machines-II**

**Course Outcomes:**

**CO1:** Acquire knowledge about the constructional details and principle of operation of alternators.

**CO2:** Acquire knowledge about the working, testing and applications of synchronous machines as generators and motors.

**CO3:** Acquire knowledge about the constructional details and principle of operation of three phase and single phase induction motors.

**CO4:** Acquire knowledge about the starting, speed control, testing and applications of induction motors.

**PCC –EE 403 -Power Electronics**

**Course Outcomes:**

**CO1:**Understand the differences between signal level and power level devices

**CO2:**Analyze controlled rectifier circuits

**CO3:**Analyze the operation of DC-DC choppers

**CO4:**Analyze the operation of voltage source inverters

**PCC-EE 404Signals & Systems**

**Course Outcomes:**

**CO1:**Understand the concepts of continuous time and discrete time systems.

**CO2:** Apply Fourier Transform, Discrete-Time Fourier Transform and Discrete Fourier Transform to different types of signals.

**CO3:**Apply Laplace and z-transform to different systems

**CO4:** Understand sampling theorem and its implications.

**MC EE 401 Indian Constitution**

**Course Outcomes:**

**CO1**: Understand the meaning and importance of Constitution

**CO2**: Explain about making of Indian Constitution - contribution of Constituent assembly on it.

**CO3**: Describe the Salient (Outstanding) features of Indian Constitution.

**CO4**:Describe the importance of Preamble of the Indian Constitution and its significance.

**PROJ-EE 02 Data Structures & Algorithm**

**Course Outcomes:**

**CO1: A**nalyze the algorithm to determine the time and computation complexity and justify the correctness. Students should be able use Big 'O' notation to express algorithmic run time.

**CO2:**For a given Search problem (Linear Search and Binary Search) student should be able to implement it using C programming. Student should also be able to write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.

**CO3:**For a given problem of Stacks, Queues and linked list student should able to implement it using C programming and analyze the same to determine the time and computation complexity.

**CO4:**Student should be able to implement using C programming, Tree search and traversal algorithms and determine the time and computation complexity.

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| **UEM** |
| **COURSE STRUCTURE FOR B.Tech (Electrical Engineering)** |

Third year (Fifth semester)

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| **Theory** | | | | | | | |
| **SI.NO.** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | PCC-EE 501 | Power systems –I (Apparatus and Modelling) | 3 | 0 | 0 | 3 | 3 |
| 2 | PCC-EE 502 | Control Systems | 3 | 0 | 0 | 3 | 3 |
| 3 | PCC-EE 503 | Microprocessors | 3 | 0 | 0 | 3 | 3 |
| 4 | PEC-EE 501 | Electrical Machine Design | 3 | 0 | 0 | 3 | 3 |
| 5 | OEC-EE 501 | Object Oriented Programming & Java | 2 | 0 | 0 | 2 | 2 |
| 6 | HSMC 501 | Principles of Management | 3 | 0 | 0 | 3 | 3 |
| 7 | HSMC 502 | Essential Studies for Professionals V | 2 | 0 | 0 | 2 | 0 |
| **Total of Theory** | | |  |  |  | **19** | **17** |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Practical/Sessional** | | | | | | | |
| **SL.NO.** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | PCC-EE 591 | Power Systems Laboratory - I | 0 | 0 | 2 | 2 | 1 |
| 2 | PCC-EE 592 | Control Systems Laboratory | 0 | 0 | 2 | 2 | 1 |
| 3 | PCC-EE 593 | Microprocessors Laboratory | 0 | 0 | 2 | 2 | 1 |
| 4 | OEC-EE 591 | Object Oriented Programming & JavaLab | 0 | 0 | 2 | 2 | 1 |
| 5 | HSMC 581 | Skill Development for Professionals V | 0 | 0 | 2 | 2 | 0 |
| 6 | PROJ-EE 03 | Project III | 0 | 0 | 0 | 2 | 0 |
| 7 | MC581 | Mandatory Additional Requirements (MAR) | 0 | 0 | 0 | 0 | 0.5 |
| 8 | MOOC 5 | MOOCs (Mandatory for Honours) | 0 | 0 | 0 | 0 | 3 |
| **Total of Practical** | | |  |  |  | 12 | (4+3.5) |
| **Total of Semester** | | | | | | **31** | **21+3.5** |

**EE-3rd Year 1st Semester Course Outcomes**

**PCC -EE-501 -Power Systems-I**

**Course Outcomes:**

**CO1:** Awareness of general structure of power systems.

**CO2:** Impart the knowledge of generation of electricity based on conventional and nonconventional energy sources and the concept of microgrid and distributed generation.

**CO3:** To make students capable of analysis of mechanical and electrical design aspects of transmission system, protective relays and circuit breakers.

**CO4:** Enable the students to do analysis of different types of distribution systems its design.

**PCC -EE-502- Control Systems**

**Course Outcomes:**

**CO1:** Obtain models of dynamic systems in transfer function and state space forms.

**CO2:** Understand the common control schemes and analyze the response of discrete control

**CO3:** Analyze the system response and stability in both time-domain and frequency domain and learn the features to design compensators using time-domain and frequency domain specifications.

**CO4:** Analyze the system response and stability of systems represented in state space form and to design compensators for systems modelled in state space form.

**PCC –EE 503- Microprocessors**

**Course Outcomes:**

**CO1:**Learn about the basics of microprocessor architecture

**CO2:**Study about the instruction set and application of the instructions to perform assembly language programming

**CO3:**Describe the Interfacing design for memory and I/O devices

**CO4:**Describe the Interfacing of Communication interfaces and stepper motor interfacing

**PEC- EE 501 Electrical Machine Design**

**Course Outcomes:**

**CO1:** Acquire knowledge to carry out a detailed design of a dc machine and provide the information required for the fabrication of the same along with an estimate of various performance indices.

**CO2:** Acquire knowledge to carry out a detailed design of a transformer and provide the information required for the fabrication of the same along with an estimate of various performance indices.

**CO3:** Acquire knowledge to carry out a detailed design of an alternator and provide the information required for the fabrication of the same along with an estimate of various performance indices.

**CO4:** Acquire knowledge to carry out a detailed design of an induction machine and provide the information required for the fabrication of the same along with an estimate of various performance indices.

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| **UEM** |
| **COURSE STRUCTURE FOR B. Tech (Electrical Engineering)** |

Third year (Sixth semester)

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| **Theory** | | | | | | | |
| **SI.NO.** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | PCC-EE 601 | Power Systems –II (Operation & Control) | 3 | 0 | 0 | 3 | 3 |
| 2 | PCC-EE 602 | Measurements and Instrumentation | 2 | 0 | 0 | 2 | 2 |
| 3 | PCC-EE 603 | Electronics Design | 1 | 0 | 0 | 1 | 1 |
| 4 | PEC-EE 601 | 1. Digital Control Systems 2. Control System Design | 3 | 0 | 0 | 3 | 3 |
| 5 | PEC-EE 602 | 1. Digital Signal Processing 2. Computer Architecture | 3 | 0 | 0 | 3 | 3 |
| 6 | OEC-EE 601 | Database Management System | 2 | 0 | 0 | 2 | 2 |
| 7 | HSMC 601 | Engineering Economics | 3 | 0 | 0 | 3 | 3 |
| 8 | HSMC 602 | Essential Studies for Professionals VI | 2 | 0 | 0 | 2 | 0 |
| **Total of Theory** | | |  |  |  | **19** | **17** |

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| **Practical/Sessional** | | | | | | | | | |
| **SL.NO.** | | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** | |
| 1 | | PCC-EE691 | Power Systems Laboratory – II | 0 | 0 | 2 | 2 | 1 | |
| 2 | | PCC-EE 692 | Measurements and Instrumentation Lab | 0 | 0 | 2 | 2 | 1 | |
| 3 | | PCC-EE 693 | Electronics Design Laboratory | 0 | 0 | 4 | 4 | 2 | |
| 4 | | OEC-EE 691 | Database Management System Laboratory | 0 | 0 | 2 | 2 | 1 | |
| 5 | | HSMC 681 | Skill Development for Professionals VI | 0 | 0 | 2 | 2 | 0 | |
| 6 | | PROJ-EE 03 | Project (Summer Internship) | 0 | 0 | 0 | 0 | 0 | |
| 7 | | MC681 | Mandatory Additional Requirements (MAR) | 0 | 0 | 0 | 0 | 0.5 | |
| 8 | | MOOC 6 | MOOCs (Mandatory for Honours) | 0 | 0 | 0 | 0 | 3 | |
| **Total of Practical** | | | |  |  |  | 12 | (5+3.5) | |
| **Total of Semester** | | | | | | | **31** | **22+3.5** | |
| **EE-3rd Year 2nd Semester Course Outcomes**  **PCC EE 601 Power Systems-II**  **Course Outcomes:**  **CO1:**Use numerical methods to analyze a power system in steady state.  **CO2:**Understand stability constraints in a synchronous grid and methods to control voltage, frequency and power flow  **CO3:**Understand monitoring and control of a power system  **CO4:**Understand the basics of power system economics  **PCC EE 602 Measurement& Instrumentation**  **Course Outcomes:**  **CO1:** Design and validate DC and AC bridges.  **CO2:** Analyze the dynamic response and the calibration of several measuring instruments.  **CO3:** Learn about various measurement devices, their characteristics, their operation and their limitations.  **CO4:** Understand computerized data acquisition systems and indicating instruments  **PCC-EE 603 Electronics Design**  **Course Outcomes:**  **CO1:**Understand the practical issues related to practical implementation of applications using electronic circuits  **CO2:**Design analog systems and interfacing of analog and digital systems  **CO3:**Embedded Systems and electronic system design using microcontrollers CPLDs and FPGAs  **CO4:**PCB system design and layout along with system assembly considerations  **PEC-EE 601B-Control Systems Design**  **Course Outcomes:**  **CO1:**Understand various design specifications  **CO2:**Design control systems in the frequency and time domain and realization of compensators.  **CO3:**Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID)  **CO4:**Design controllers using the state-space approach  **PEC-EE-602A- Digital Signal Processing**  **Course Outcomes:**  **CO1:** Acquire knowledge about the time domain representation and classification of discrete time signals and systems, time domain analysis of linear time invariant discrete time systems representation of total response in various formats.  **CO2:** Acquire knowledge about the application of discrete time Fourier transform, Discrete Fourier series and z-transform for discrete time signal representation and analysis of linear time invariant systems discrete time systems.  **CO3:** Acquire knowledge about the application of discrete Fourier transform in signal representation and system analysis and DFT computation using FFT algorithms.  **CO4:** Acquire knowledge about the design methods for IIR and FIR filters and their realization structures and learn about the finite word length effects in the implementation of digital filters.  **PEC-EE 602B-Control Systems Design**  **Course Outcomes:**  **CO1:**Understand various design specifications  **CO2:**Design control systems in the frequency and time domain and realization of compensators.  **CO3:**Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID)  **CO4:**Design controllers using the state-space approach  **OEC-EE 601Data Base Management System**  **Course Outcomes:**  **CO1**: Describe the fundamental elements of relational database management systems.  **CO2:** Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.  **CO3:**Design ER-models to represent simple database application scenarios and convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.  **CO4**: Improve the database design by normalization and familiarization with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.  **HSMC-601 Economics for Engineers**  **Course Outcomes:**  **CO1:** Develop ideas of the basic characteristics of Indian economy, its potential on natural resources and understand the importance, causes and impact of population growth with economic development.  **CO2**: Grasp the importance of planning undertaken by the government of India, have knowledge on the various objectives, failures and achievements as the foundation of the ongoing planning and economic reforms taken by the government.  **CO3**: Understand agriculture as the foundation of economic growth and development, analyze the progress and changing nature of agricultural sector and its contribution to the economy as a whole.  **CO4:** Not only be aware of the economy as a whole, they would understand the basic features of Mizoram’s economy, sources of revenue, how the state government finances its program and projects.  **UEM** | | | | | | | |
| **COURSE STRUCTURE FOR B.Tech (Electrical Engineering)** | | | | | | | |
| **Fourthyear (Seventh semester)** | | | | | | | |

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| **Theory** | | | | | | | |
| **SL.NO.** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | PEC-EE 701 | 1. Power quality &FACTS 2. Power System Protection 3. Power System Dynamics & Control | 3 | 0 | 0 | 3 | 3 |
| 2 | PEC-EE 702 | 1. Wind and Solar Power EnergySystems 2. Electrical and Hybrid Vehicles | 3 | 0 | 0 | 3 | 3 |
| 3 | OEC-EE 701 | Data Science & Data Analytics | 2 | 0 | 0 | 2 | 2 |
| 4 | OEC-EE 702 | 1. Optimization Techniques      1. Robotics and Automation | 3 | 0 | 0 | 3 | 3 |
| 5 | HSMC-701 | Human Resource Development & OrganizationalBehaviour | 3 | 0 | 0 | 3 | 3 |
| 6 | HSMC 702 | Essential Studies for Professionals VII | 2 | 0 | 0 | 2 | 0 |
| **Total of Theory** | | |  |  |  | **16** | **14** |

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| **Practical/Sessional** | | | | | | | |
| **SL.NO.** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | OEC-EE 781 | Data Science & Data AnalyticsLab | 0 | 0 | 2 | 2 | 1 |
| 2 | HSMC 781 | Skill Development for Professionals VII | 0 | 0 | 2 | 2 | 0 |
| 3 | PROJ-EE 04 | Project Stage – I | 0 | 0 | 6 | 6 | 3 |
| 4 | MC781 | Mandatory Additional Requirements (MAR) | 0 | 0 | 0 | 0 | 0.5 |
| 5 | MOOC 7 | MOOCs (Mandatory for Honours) | 0 | 0 | 0 | 0 | 3 |
| **Total of Practical** | | |  |  |  | 10 | (4+3.5) |
| **Total of Semester** | | | | | | **26** | **18+3.5** |

**EE-4th Year 1st Semester Course Outcomes**

**PEC-EE 701A Power Quality & FACTS**

**Course Outcomes:**

**CO1:**Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation

**CO2:**Understand the working principles of FACT devices and their operating characteristics

**CO3:**Understand the basic concepts of power quality

**CO4:**Understand the working principles of devices to improve power quality

**PEC-EE 701B Power System Protection**

**Course Outcomes:**

**CO1:**Understand the different components of a protection system

**CO2:**Evaluate fault current due to different types of fault in a network

**CO3:**Understand the protection schemes for different power system components and for different systems

**CO4:**Understand the basic principles of digital protection and the use of wide-area measurements

**PEC-EE 701C Power System Dynamics & Control**

**Course Outcomes:**

**CO1:**Understand the problem of power system stability and its impact on the system

**CO2:**Analyze linear dynamical systems and use of numerical integration methods

**CO3:**Model different power system components for the study of stability

CO4:Understand the methods to improve stability

**PEC-EE 702A Wind and Solar Power Energy Systems**

**Course Outcomes:**

CO1: Understand the energy scenario and the consequent growth of power generation from the renewable sources

CO2: Understand the basic physics of wind and solar power generation

CO3: Understand the power electronics interfaces for wind and solar power generation

CO4:Understand the issues related to grid integration of solar and wind energy systems.

**PEC-EE 702B Electrical and Hybrid vehicles**

**Course Outcomes:**

**CO1:**Understand the models of hybrid vehicles

**CO2:**Describe the various models of hybrid vehicles and analyze their performance

**CO3:**Understand the different possible ways of energy storage

CO4:Understand the different strategies related to energy storage systems

Fourth year (Eighth semester)

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| **Theory** | | | | | | | |
| **SL.NO.** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | PEC-EE 801 | 1. H.V.D.C. Transmission System 2. Electrical Drives 3. Industrial Electrical System | 3 | 0 | 0 | 3 | 3 |
| 2 | OEC-EE 801 | 1. Big Data Analytics & Applications 2. Machine Learning & IOT | 3 | 0 | 0 | 3 | 3 |
| 3 | OEC-EE 802 | 1. VLSI Circuits 2. Digital Image Processing 3. Embedded System | 3 | 0 | 0 | 3 | 3 |
| 4 | HSMC 801 | Essential Studies for Professionals VIII | 2 | 0 | 0 | 2 | 0 |
| **Total of Theory** | | |  |  |  | **11** | **9** |

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| **Practical/ Sessional** | | | | | | | |
| **SINO** | **Paper Code** | **Paper Name** | **L** | **T** | **P** | **Total** | **Credits** |
| 1 | HSMC 881 | Skill Development for Professionals VIII | 0 | 0 | 2 | 2 | 0 |
| 2 | PROJ-EE 05 | Project Stage-II | 0 | 0 | 16 | 16 | 8 |
| 3 | MC881 | Mandatory Additional Requirements (MAR) | 0 | 0 | 0 | 0 | 0.5 |
| 4 | MOOC 8 | MOOCs (Mandatory for Honours) | 0 | 0 | 0 | 0 | 3 |
| **Total of Practical** | | |  |  |  | 18 | (8+3.5) |
| **Total of Semester** | | | | | | **29** | **17+3.5** |

**EE-4th Year 2nd Semester Course Outcomes**

**PEC-EE 801A HVDC Transmission System**

**Course Outcomes:**

**CO1:**Understand the advantages of dc transmission over ac transmission

**CO2:**Understand the operation of Line Commutated Converters and Voltage Source Converters

**CO3:**Understand the control strategies in HVDC transmission system

**CO4:**Understand the improvement of power system stability using HVDC system

**PEC-EE 801B Electrical Drives**

**Course Outcomes:**

**CO1:**Understand the characteristics of various dc and induction motors

**CO2:**Understand the principles of speed control of dc and induction motors

**CO3:**Understand the application of power electronic converters for speed control of dc motors

**CO4:**Understand the application of power electronic converters for speed control of induction motors

**PEC-EE 801C Industrial Electrical Systems**

**Course Outcomes:**

**CO1:**Understand the electrical wiring systems for residential, industrial and commercial customers

**CO2:**Representation of the systems with standard symbols, drawings and single line diagram

**CO3:**Understand the various components of industrial electrical systems

**CO4:**Analyze and select the proper size of various electrical system components

**OEC-EE 802B Digital Image Processing**

**Course Outcomes:**

**CO1:**Understand the different aspects of 2D signals.

**CO2:** Understand the different transforms

**CO3:**Understand the tools of imaging

**CO4:**Analyze the different steps of imaging.