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| **VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY** |
| **DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING** |
| **CO-PO-PSO GRAND MATRIX** |
| By the end of the each course student will be able to  |
| **1-1** |
| **C111** | **COMMUNICATIVE ENGLISH** | CO1 | **Identify** the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (L3) |
| CO2 | **Formulat**e sentences using proper grammatical structures and correct word forms (L3) |
| CO3 | speak clearly on a specific topic using suitable discourse markers in informal discussions (L3) |
| CO4 | **write** summaries based on global comprehension of reading/listening texts (L3) |
| CO5 | **Produce** a coherent paragraph interpreting a figure/graph/chart/table (L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
| CO2 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
| CO3 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
| CO4 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
| CO5 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
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| **C112** | **Mathematics-I** | CO1 | **Summarize** the first order ordinary Differential equations and analyze their applications.Or analyze applications of first order ordinary Differential equations (L2) |
| CO2 | **Classify** and solve the higher order ordinary differential equations and its applications.(l2) |
| CO3 | **Apply** Laplace transformations and Evaluate the improper integral(L3) |
| CO4 | **Define** partial differentiation and Compute extreme values.(L3) |
| CO5 | **Construct** the Partial differential equations and Solve first order partial differential equations(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **C113** | **APPLIED PHYSICS** | CO1 | **Understand** the principles such as interference and diffraction to design and enhance the resolving power of various optical instruments(L2) |
| CO2 | **Learn** the basic concepts of LASER light Sources and Apply them to holography(L3) |
| CO3 | **Study** the magnetic and dielectric materials to enhance the utility aspects of materials(L2) |
| CO4 | **Learn** the fundamental concepts of Quantum behavior of matter.(L3) |
| CO5 | **Identify** the type of semiconductors using Hall Effect.(L3) |
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|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
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| **VASIREDDY VENKATADRI INSTITUTE OF TECHNOGY** |
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| **CO-PO-PSO GRAND MATRIX** |
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| **C114** | Programming for Problem Solving using C | CO1 | **Understand** algorithms and basic terminology of C (L2) |
| CO2 | **Solve** problems using control structures and modular approach(L3) |
| CO3 | **Make** use of 1D and 2D arrays along with strings for linear data handling(L3) |
| CO4 | **Determine** the use of pointers and structures(L4) |
| CO5 | **Implement** various operations on data files(L4) |
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|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 1 | 2 | 3 | 2 | 1 | - | - | - | 3 | 3 | 1 | 2 | 1 | 2 |
| CO2 | 2 | 3 | 3 | 2 | - | - | - | - | 1 | 1 | 2 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | 2 | 1 | 2 | 2 | 2 | 3 |
| CO4 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | 1 | 2 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | 1 | 2 | 2 | 1 | 2 |
| **C115** | **ENGINEERING GRAPHICS**  | CO1 | Prepare engineering drawings as per BIS conventions (L2) |
| CO2 | Produce computer generated of orthographic projections of Lines and Plane surfaces using CAD software (L3) |
| CO3 | Use the knowledge of orthographic projections of Solids to represent engineering information/concepts and present the same in the form of drawings (L3) |
| CO4 | Use the knowledge of sectional views and Development of Solid Surfaces in Real time Applications(L3) |
| CO5 | Develop isometric drawings of simple objects reading the orthographic projections of those objects(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 1 | 1 | – | 3 | – | – | – | – | 2 | – | 1 | – | 1 |
| CO2 | 2 | 1 | 1 | – | 3 | – | – | – | – | 2 | – | 1 | – | 1 |
| CO3 | 2 | 2 | 2 | – | 3 | – | – | – | – | 2 | – | 1 | – | 1 |
| CO4 | 2 | 2 | 2 | – | 3 | – | – | – | – | 2 | – | 1 | – | 1 |
| CO5 | 2 | 2 | 2 | – | 3 | – | – | – | – | 2 | – | 1 | – | 1 |
| **C116** | **COMMUNICATIVE ENGLISH LAB I** | CO1 | Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and speak clearly on a specific topic using suitable discourse markers in informal discussions (L3) |
| CO2 | Take notes while listening to a talk/lecture; to answer questions in English; formulate sentences using proper grammatical structures and correct word forms; and use language effectively in competitive examinations (L3) |
| CO3 | write summaries based on global comprehension of reading/listening texts; produce a coherent write-up interpreting a figure/graph/chart/table; and use English as a successful medium of communication. (L3) |
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|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
| CO2 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
| CO3 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
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| **CO-PO-PSO GRAND MATRIX** |
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| **C117** | Applied Physics Lab | CO1 | Operate optical instruments like microscope and spectrometer(L2) |
| CO2 | Determine thickness of a paper with the concept of interference (L2) |
| CO3 | Estimate the wavelength of different colours using diffraction grating and resolving power(L3) |
| CO4 | Plot the intensity of the magnetic field of circular coil carrying current with distance(L1) |
| CO5 | Calculate the band gap of a given semiconductor(L1) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
|  |
| **C118** | Programming for problem Solving Using C  **Lab** | CO1 | **Comprehend** the various concepts of a C language(L2) |
| CO2 | **Develop** algorithms and flowcharts((L3) |
| CO3 | **Design** and development of C problem solving skills(L4) |
| CO4 | **Acquire** modular programming skills.(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 1 | 2 | 3 | 2 | 1 | - | - | - | 3 | 3 | 1 | 2 | 1 | 2 |
| CO2 | 2 | 3 | 3 | 2 | - | - | - | - | 1 | 1 | 2 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | 2 | 1 | 2 | 2 | 2 | 3 |
| CO4 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | 1 | 2 | 2 | 2 | 2 |
|  |
|  **C119** | **CONSTITUTION OF INDIA** | CO1 | Know the sources, features and principles of Indian Constitution(L1) |
| CO2 | Learn about Union Government, State government and its administration(L2) |
| CO3 | Get acquainted with Local administration and Pachayati Raj.(L2) |
| CO4 | Be aware of basic concepts and developments of Human Rights.(L2) |
| CO5 | Gain knowledge on roles and functioning of Election Commission(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | - | 3 | - | - | 3 | - | 2 | 3 | - | 3 | 2 | - | - |
| CO2 | 2 | - | 2 | - | - | 2 | - | 2 | 2 | - | 3 | 2 | - | - |
| CO3 | 3 | - | 3 | - | - | 2 | - | 2 | 2 | - | 3 | 3 | - | - |
| CO4 | 2 | - | 3 | - | - | 2 | - | 2 | 2 | - | 3 | 3 | - | - |
| CO5 | 3 | - | 1 | - | - | 3 | - | 3 | 3 | - | 3 | 2 | - | - |

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| **CO-PO-PSO GRAND MATRIX** |
| **1-2** |
| **C121** | **MATHEMATICS-II** | CO1 | Evaluate approximate in the roots of polynomial and transcendental equations by different algorithms(L4) |
| CO2 | Solve system of linear algebraic equations using Gauss Jacobi, Gauss Seidel and apply Newton’s forward and backward interpolation and Lagrange’s formulae for equal and unequal intervals(L3) |
| CO3 | Apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations and also by Laplace the transforms for solving differential equations(L3) |
| CO4 | Find or compute the Fourier series of periodic signals(L4) |
| CO5 | Know and be able to apply integral expressions for the forwards and inverse Fourier transform to range of non-periodic waveforms(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
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| **C122** | **Mathematics III** | CO1 | Develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6) |
| CO2 | solve system of linear algebraic equations using Gauss elimination, Gauss Jordan (L3) |
| CO3 | To interpret the physical meaning of different operators such as gradient, curl and divergence (L5) |
| CO4 | Estimate the work done against a field, circulation and flux using vector calculus (L5) |
| CO5 | Identify the solution methods for partial differential equation that model physical processes (L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
|  |
| **C123** | **Applied Chemistry** | CO1 | Explain the preparation, properties and applications of thermoplastics, thermosettings, elastomers and conducting polymers(L2) |
| CO2 | Know the importance of various materials and their uses in the construction of batteries and fuel cells(L1) |
| CO3 | Know the applications of advanced materials in various industries(L1) |
| CO4 | Apply the principles of supramolecular chemistry in the applications of molecular machines, need of green chemistry.(L3) |
| CO5 | Explain the principles of spectrometry such as UV, IR, and NMR(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | - | - | - | - | 3 | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | - | - | - | - | 2 | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | - | - | - | - | 2 | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | - | - | - | - | 3 | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | - | - | - | - | 3 | - | - | - | - | - | - | - |

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| **C124** | **DATA STRUCTURES** | CO1 | **Implement** various operations on linear lists.(L2) |
| CO2 | **Apply** data structure strategies like stacks and queues for exploring complex data structures.(L3) |
| CO3 | **Analyze** performance and trade-offs of static and dynamic data structures(L4) |
| CO4 | **Incorporate** data structures into the applications such as binary trees, binary search trees(L2) |
| CO5 | **Identify** appropriate data structure algorithms for graphs(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 1 |
| CO2 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | 1 |
| CO3 | 1 | - | 2 | 2 | - | - | - | - | - | - | - | - | 2 | 1 |
| CO4 | 2 | - | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 |
| CO5 | - | 2 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | 1 |
|  |
| **C125** | **BASIC CIRCUIT ANALYSIS**  | CO1 | Various electrical networks in presence of active and passive elements(L1) |
| CO2 | Understand the R, L, C network with sinusoidal excitation(L2) |
| CO3 | Understand the R, L, C network with variation of any one of the parameters i.e R, L, C. and f(L2) |
| CO4 | Apply Electrical networks by using principles of network theorems(L3) |
| CO5 | Understand the magnetic circuit with various dot conventions(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 |  |
| CO2 | 3 | 2 | 2 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | 2 | 2 |
| CO4 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 1 |
| CO5 | 2 | 2 | 2 | 1 | - | 1 | - | - | - | - | - | 1 | 1 |  |
|  |
| **C126** | **COMMUNICATIVE ENGLISH LAB - II** | CO1 | Prioritize information from reading texts after selecting relevant and useful points and paraphrase short academic texts using suitable strategies and conventions (L3) |
| CO2 | Make formal structured presentations on academic topics using PPT slides with relevant graphical elements (L3) |
| CO3 | Participate in group discussions using appropriate conventions and language strategies (L3) |
| CO4 | Prepare a CV with a cover letter to seek internship/ job (L2) |
| CO5 | Collaborate with a partner to make presentations and Project Reports (L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
| CO2 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
| CO3 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
| CO4 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |
| CO5 | - | - | - | - | - | - | - | - | 2 | 3 | - | 1 | - | - |

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| **C127** |  **Applied chmistrylab** | CO1 | To estimate the amount of metal ions present in different solutions (L4 & L3) |
| CO2 | To analyze the quality parameters of water (L4) |
| CO3 | To determine the strength of different solutions by using different instrumentation techniques (L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 3 | - | - | - | - | - | - | 2 | - | - | - | - | - |
| CO2 | 2 | 2 | - | - | - | - | - | - | 2 | - | - | - | - | - |
| CO3 | 2 | 3 | - | - | - | - | - | - | 2 | - | - | - | - | - |
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| **C128** | **DATA STRUCTURES LAB** | CO1 | Implement the data structures with the basic level knowledge(L2) |
| CO2 | Design and analyze the time efficiency of the data structure.(L3) |
| CO3 | Design and analyze the Space efficiency of the data structure in the memory(L3) |
| CO4 | Identifies the appropriate data structure for given problem.(L2) |
| CO5 | Compare and Contrast various data structures and design techniques in the area of Performance.(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | - | - |
|  |
| **C129** | **ENGINEERING WORK SHOP** | CO1 | Apply wood working skills in real world applications. (L3) |
| CO2 | Build different parts with metal sheets in real world applications. (L3) |
| CO3 | Apply fitting operations in various applications. (L3) |
| CO4 | Apply different types of basic electric circuit connections. (L3) |
| CO5 | Demonstrate soldering and brazing. (L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | 2 |
| CO2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | 2 |
| CO3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | 2 |
| CO4 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | 2 |
| CO5 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | 2 |

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|  **C1210** | Environmental Studies | CO1 | Understand the concepts of the ecosystem (L2) |
| CO2 | Understand the natural resources and their importance (L2) |
| CO3 | Learn the biodiversity of India and the threats to biodiversity ,and Apply conservation practices (L1) |
| CO4 | Understand Social issues both rural and urban environment and learn Various attributes of the pollution and their impacts (L2) |
| CO5 | Understand About environmental Impact assessment and Evaluate the stages involved in EIA (L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | - | - | - | - | 2 | 3 | 2 | - | - | - | - | - | - |
| CO2 | 1 | - | - | - | - | 2 | 3 | 2 | - | - | - | - | - | - |
| CO3 | 1 | - | - | - | - | 2 | 3 | 2 | - | - | - | - | - | - |
| CO4 | 2 | - | - | - | - | 2 | 3 | 1 | - | - | - | - | - | - |
| CO5 | 1 | - | - | - | - | 2 | 3 | 2 | - | - | - | - | - | - |
| **2-1** |
| **C211** | **COMPLEX VARIABLES AND STATISTICAL METHODS** | CO1 | Cauchy-Riemann equations to complex function in order to determine whether a given continuous function is analytic(L3) |
| CO2 | The differentiation, integration of complex functions used in engineering problems and make use of Cauchy residue theorem to evaluate certain integrals(L3) |
| CO3 | Discrete and continuous probability distributions and design the components of a classical hypothesis test (L6) |
| CO4 | The statistical inferential methods based on small and large sampling tests(L4) |
| CO5 | Interpret the association of characteristics and through correlation and regression tools.(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - |
|  |
| **C212** | **PYTHON PROGRAMMING** | CO1 | Identify the basic python constructs with a view of using them in problem solving(L3) |
| CO2 | Apply control structures and use python lists in examples of problem solving(L5) |
| CO3 | Explore the utility of functions in modular programming using python(L6) |
| CO4 | Apply the concepts of Object Oriented Programming to solve the real-time problems(L4) |
| CO5 | Interface hardware components with Raspberry Pi using Python APIs.(L6) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | - | 3 | - | - | - | - | - | - | 2 | 3 | 1 |
| CO2 | 3 | 2 | 1 | - | 3 | - | - | - | - | - | - | 2 | 3 | 1 |
| CO3 | 3 | 2 | 1 | - | 3 | - | - | - | - | - | - | 2 | 3 | 1 |
| CO4 | 3 | 2 | 3 | - | 3 | - | 2 | - | - | - | - | 2 | 3 | 1 |
| CO5 | 3 | 2 | 3 | 3 | 3 | - | 2 | - | - | - | - | 2 | 3 | 1 |

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| **C213** | **BASIC ELECTRONIC DEVICES AND CIRCUITS**  | CO1 | Develop through basic knowledge on the behavior and the characteristics of semiconductor junction(L2) |
| CO2 | Demonstrate the usage of diodes in various applications(L3) |
| CO3 | Acquire knowledge on the operations of BJT, FET, and MOSFET(L2) |
| CO4 | Learn the art of biasing of BJTs and FETs, small signal low frequency models of BJTs and FETS in amplifier analysis(L4) |
| CO5 | Learn the feedback topology of amplifier and applications of transistors(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | - | 3 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO3 | - | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO4 | - | 3 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO5 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - | 2 |
|  |
| **C214** | Electrical machines -I | CO1 | Understand the concepts of energy conversion and principle operation of DC Generator(L2) |
| CO2 | Examine the significance of Back EMF and Production of Torque in DC Motor(L3) |
| CO3 | Analyze the speed control methods and performance of DC Machine(L4) |
| CO4 | Quantify the performance of single phase transformers(L5) |
| CO5 | Empathise parallel operation of transformers and three-phase to two-phase Conversion(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 |
| CO2 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | - | 3 | 2 | 3 |
| CO3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 |
| CO4 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | - | 2 | 3 | 1 |
| CO5 | 3 | 1 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 3 |
|  |
| **C215** | **ELECTRICAL CIRCUIT ANALYSIS** | CO1 | Understand the various electrical three phase networks under balanced and unbalanced loads with different methods (L2) |
| CO2 | Apply transient response of various electrical networks with DC excitation(L3) |
| CO3 | Apply transient response of electrical networks with AC excitation.(L3) |
| CO4 | Understand the various Two port network parameters and their mutual relations(L2) |
| CO5 | Synthesis procedure for drawing equivalent electrical network for a given transfer functions.(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 | 1 |
| CO2 | 1 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 1 | 1 |

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| **VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY** |
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| **CO-PO-PSO GRAND MATRIX** |
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| **C216** | **ELECTROMAGNETIC FIELDS** | CO1 | The student will be able to calculate the electric field and potentials using Gauss’s law and Laplace equation(L2) |
| CO2 | The student will be able to evaluate capacitance for different configurations(L2) |
| CO3 | The student will be able to find magnetic field intensity of different configurations using Biot-Savart’s law and Ampere’s law(L2) |
| CO4 | The student will be able to calculate magnetic forces and torque produced by currents in magnetic fields(L3) |
| CO5 | The student will be able to quantify inductance and evaluation of induced EMF in time varying fields(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 3 | 2 | 2 | 2 | - | 1 | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 3 | 2 | 3 | 2 | - | 1 | - | - | - | - | - | 1 | 2 | 3 |
| CO4 | 2 | 2 | 2 | 2 | 1 | 1 | - | - | - | - | - | 1 | 2 | 2 |
| CO5 | 2 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | - | 1 | 1 |
|  |
| **C217** | **PYTHON PROGRAMMING LAB** | CO1 | Demonstrates the use of an interpreted language for problem solving through control statements including loops and conditionals(L1) |
| CO2 | Practice with data structures for quick programming solutions(L3) |
| CO3 | Demonstrates software building for real needs through OOPS approach(L2) |
| CO4 | Comprehend functions and modules & exception handling(L3) |
| CO5 | Use of python standard libraries to handle IOT based applications(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | - | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 |
| CO2 | - | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 1 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 |
| CO4 | 1 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 |
| CO5 | 1 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 |
|  |
|  **C218** | **BASIC ELECTRONIC DEVICES AND CIRCUITS LAB** | CO1 | Measure voltage, frequency and phase of any waveform using CRO (L2) |
| CO2 | Generate sine, square and triangular waveforms with required frequency and amplitude using function generator (L2) |
| CO3 | Analyze the characteristics of different electronic devices such as diodes etc.(L4) |
| CO4 | Analyze and design simple circuits like rectifiers, power supplies and transistors etc., (L4) |
| CO5 | Analyze and design simple circuits like rectifiers, power supplies and amplifiers etc., (L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO5 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 2 |

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|  **C219** | **ELECTRICAL CIRCUIT ANALYSIS LAB** | CO1 | Understand network theorems for different circuits(L2) |
| CO2 | Evaluate the two port network parameters(L4) |
| CO3 | Examine the resonance condition of AC circuits(L3) |
| CO4 | Determine the self and mutual inductance of coupled circuits.(L2) |
| CO5 | Analyse electrical circuits using software(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 2 | 2 | - | 2 | 1 | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 1 | 1 | 1 | - | 2 | 1 | - | - | - | - | 1 | 2 | 1 |
| CO3 | 2 | 2 | 1 | 1 | - | 1 | 1 | - | - | - | - | 1 | 2 | 1 |
| CO4 | 2 | 2 | 2 | 1 | - | 2 | 2 | - | - | - | - | 2 | 2 | 1 |
| CO5 | 2 | 1 | 2 | 1 | - | 1 | 1 | - | - | - | - | 2 | 2 | 1 |
|  |
|  **C2110** | Essence of Indian Traditional Knowledge  | CO1 | Understand the concept of Traditional knowledge and its importance (L2) |
| CO2 | Know the need and importance of protecting traditional knowledge.(L1) |
| CO3 | Understand legal framework of TK, Contrast and compare the ST and other traditional forest dwellers (L2) |
| CO4 | Know the various enactments related to the protection of traditional knowledge.(L1) |
| CO5 | Understand the concepts of Intellectual property to protect the traditional knowledge (L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | - | - | - | - | 2 | 3 | 2 | 1 | 1 | - | - | - | - |
| CO2 | 2 | - | - | - | - | 2 | 3 | 2 | 1 | 1 | - | - | - | - |
| CO3 | 1 | - | - | - | - | 2 | 3 | 2 | 2 | 2 | - | - | - | - |
| CO4 | 2 | - | - | - | - | 2 | 3 | 1 | 1 | 1 | - | - | - | - |
| CO5 | 1 | - | - | - | - | 2 | 3 | 2 | 2 | 2 | - | - | - | - |

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| **2-2** |
|  |
|  **C221** | **THERMAL AND HYDRO PRIME MOVERS** **Languages** | CO1 | Explain the fundamental concepts of Thermodynamics and also apply the laws of thermodynamics to cycles, cyclic devices(L3) |
| CO2 | Understand about the working of IC engines and gas turbine plants including its performance evaluation.(L3)  |
| CO3 | Analyze the energy transfers and transformations while steam is flowing through the blades of steam turbine. (L4)  |
| CO4 | Understand about fluid properties and also apply the Bernoulli’s theorem for flowing fluids. (L3) |
| CO5 | Compute the performance of hydraulic turbines and also understand working of the hydraulic pumps(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 1 | - | - | 2 | - | - | - | - | - | 1 | 2 | 2 |
| CO2 | 3 | 3 | 1 | - | - | 2 | 1 | - | - | - | - | 1 | 2 | 2 |
| CO3 | 3 | 3 | 1 | - | - | 2 | - | - | - | - | - | 1 | 2 | 2 |
| CO4 | 3 | 3 | 1 | - | - | 2 | - | - | - | - | - | 1 | 2 | 2 |
| CO5 | 3 | 3 | 1 | - | - | 2 | - | - | - | - | - | 1 | 2 | 2 |
| **C222** | **LINEAR IC APPLICATIONS** | CO1 | **Explain** the DC and AC analysis of Differential Amplifier, and performance parameters of OP-Amp (L2) |
| CO2 | **Demonstrate** the usage of operational amplifier in various applications(L3) |
| CO3 | **Explain** the working principles of Active filters, Multipliers and Modulators using Op-Amp.(L2) |
| CO4 | **Learn** the internal structure, pin diagrams and operations of different IC’s(L3) |
| CO5 | **Learn** the circuits of data converters and **Compare** among them in terms of Parameters(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | - |  |  | - | - | - | - | - | - | - | 3 | - |
| CO2 |  | 3 | - | 2 |  | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 2 | 3 | - |  |  | - | - | - | - | - | - | - | 2 | - |
| CO4 | 2 |  | - | 3 |  | - | - | - | - | - | - | - | 3 | 2 |
| CO5 | 2 |  | - |  | 2 | - | - | - | - | - | - | - | 2 | 2 |

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| **C223** | **ELECTRICAL MACHINES - II** | CO1 | Explain the operation and performance of three phase induction motor(L1) |
| CO2 | Analyse the torque-speed relation, starting and speed control of induction motor(L4) |
| CO3 | Describe the torque production and starting methods of single-Phase induction motor.(L1) |
| CO4 | Empathise the Principle, Voltage Regulation and Parallel operation of synchronous generator(L2) |
| CO5 | Realize the operation, performance and starting methods of synchronous motor(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | - | - | 1 | - | - | - | - | - | - | 1 | 2 | 2 |
| CO2 | 2 | 3 | - | - | 1 | - | - | - | - | - | - | - | 2 | - |
| CO3 | 3 | 1 | - | - | 1 | - | - | - | - | - | - | 1 | 1 | 2 |
| CO4 | 2 | 3 | - | - |  | - | - | - | - | - | - | - | 2 | 1 |
| CO5 | 2 | 1 | - | - | 1 | - | - | - | - | - | - | - | 1 | - |
|  |
| **C224** | **CONTROL SYSTEMS** | CO1 | Implements the transfer function using block diagram algebra and signal flow graph(L3) |
| CO2 | Determine time response specifications of second order systems and Error constants(L3) |
| CO3 | Analyze stability using Routh’s stability criterion and the root locus method(L4) |
| CO4 | Analyze the stability using Bode plot and Nyquist criterion(L4) |
| CO5 | Estimate the state models and understanding the concepts of Controllability and Observability(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | 2 | 2 | 1 | - | - | - | - | - | 2 | 2 | 2 |
| CO2 | 3 | 3 | 2 | 1 | 2 | 1 | - | - | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 2 | 1 | 2 | 3 | 2 | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | 2 | 2 | 3 | 3 | 3 | 1 | - | - | - | - | - | 2 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | 3 |
|  |
| **C225** | **POWER SYSTEMS-1** | CO1 | Understand the working of hydro and thermal power plants (L2) |
| CO2 | Explain the working of nuclear, gas, diesel power plants and non-conventional energy sources(L3) |
| CO3 | Analyze transmission lines parameters(L4) |
| CO4 | Evaluate the performance of AC and DC distribution systems(L5) |
| CO5 | Analyze the different load curves and tariff methods(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 1 |  | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| CO5 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | 1 |

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| **C226** | **DIGITAL ELECTRONICS** | CO1 | Distinguish the analog and digital systems, apply positional notations, number systems, computer codes in digital systems(L3) |
| CO2 | Uunderstand the Boolean Algebra theorems, simplify and design logic circuits(L2) |
| CO3 | Implement combinational logic circuit design and modular combinational circuits using encoders, decoders, multiplexers and demultiplexers.(L3) |
| CO4 | Understand the basic elements of sequential logic circuits(L2) |
| CO5 | Design and analyze sequential circuits(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | - | 3 |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | - | 3 |
| CO3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | - | 3 |
| CO4 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | - | 3 |
| CO5 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | - | 3 |
|  |
|  **C227** | **THERMAL AND HYDRO PRIME MOVERS LAB** | CO1 | Compute the performance of the IC Engines for a given conditions and also draw the valve and port timing diagrams(L3) |
| CO2 | Determine the frictional power by using the Morse test, retardation test and motoring test.(L3) |
| CO3 | Calibrate discharge measuring devices and finding discharge through the venture meter and the orifice meter.(L3) |
| CO4 | Analyze the performance of hydraulic machines(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | - | 2 | - | 2 | - | - | 3 | - | - | - | 2 | 1 |
| CO2 | 3 | 3 | - | 2 | - | 2 | - | - | 3 | - | - | - | 2 | 1 |
| CO3 | 3 | 3 | - | 2 | - | 2 | - | - | 3 | - | - | - | 2 | 1 |
| CO4 | 3 | 3 | - | 2 | - | 2 | - | - | 3 | - | - | - | 2 | 1 |
|  |
| **C228** | **ELECTRICAL MACHINES-1 LAB** | CO1 | Analyze the characteristics and performance of DC generator(L4) |
| CO2 | Investigate the speed control and testing methods of DC motors(L3) |
| CO3 | Determine the performance of DC machines by direct and indirect loading methods(L2) |
| CO4 | Perform various types of tests on transformers for assessing losses(L3) |
| CO5 | Achieve three-phase to two phase transformation(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | - | 1 |
| CO2 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | - | 1 |
| CO4 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | - | 1 |
| CO5 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - |

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| **C229** | **CONTROL SYSTEMS LAB** | CO1 | Able to analyze the time response of a second order system(L4) |
| CO2 | Able to analyze the effect ofP, PI,PD, PID controllers and Lag, Lead compensators(L4) |
| CO3 | Analyze the performance and working of magnetic amplifier, DC, AC servomotors and synchros(L4) |
| CO4 | Able to judge the stability in time and frequency domain.(L5) |
| CO5 | Able to test the controllability and observability(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 1 | - | 1 | 1 | - | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 | 1 | 1 |
| CO3 | 1 | - | - | - | 1 | - | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 1 | 1 | - | - | 1 | - | - | - | - | - | - | 1 | 2 | 2 |
| CO5 | 1 | 1 | - | - | 1 | - | - | - | - | - | - | - | 2 | 2 |
|  |
|  **C2210** | **SOCIAL RELEVANT PROJECT** **LAB** | CO1 | Acquire the requisite skills and to apply the same to a given problem in the relevant technical area.(L2) |
| CO2 | Independently analyze and discuss complex inquiries/problems within the given constraints and handle larger problems at an advanced level within the technical area.(L3) |
| CO3 | Reflect on, evaluate, and critically assess one’s own results and correlate it with other scientific results.(L3) |
| CO4 | Document and present one’s own work for a given target group, with strict requirements on structure, format and language usage.(L2) |
| CO5 | Identify one’s need for updating skills and knowledge and to continuously develop one’s own competencies(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | - | - | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 2 | 3 |
| CO2 | 3 | 3 | - | - | 3 | 3 | 2 | - | 3 | 3 | 3 | 3 | 2 | 3 |
| CO3 | 3 | 3 | - | - | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | - | - | 3 | 3 | 3 | - | 2 | 2 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | - | - | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 |
| **3-1** |
| **C311** | **POWER SYSTEMS-II** | CO1 | **Evaluate** the performance of transmission lines(L5) |
| CO2 | **Understand** the Power systems transients, travelling waves (L2) |
| CO3 | **Evaluate** the various factors governing the performance of transmission line(L5) |
| CO4 | **Analyze** the sag and tension calculations and overhead line insulators(L4) |
| CO5 | **Evaluate** the bus admittance matrix & bus impedance matrix(L5) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 1 |  |
| CO3 | 2 | 1 |  | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| CO5 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | 1 |
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| **C312** | **SPECIAL ELECTRICAL MACHINES** | CO1 | To understand theory of different permanent magnetic material and applications(L2) |
| CO2 | To explain the performance and control of stepper motors, and their applications(L2) |
| CO3 | To describe the operation and characteristics of switched reluctance motor(L2) |
| CO4 | To explain the operation permanent magnet brushless square wave and sine wave motors(L2) |
| CO5 | To explain the theory of travelling magnetic field and applications of linear motors(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 3 | 1 | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 2 | 2 | 3 | 1 | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 2 | 2 | 3 | 1 | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 2 | 2 | 3 | 1 | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 2 | 2 | 3 | 1 | - | - | - | - | - | - | - | 1 | - | - |
|  |
| **C313** | **POWER ELECTRONICS** | CO1 | Design firing circuits for SCR(L4) |
| CO2 | Evaluate the performance of converters and can suggest the converter required for DC drives(L5) |
| CO3 | Analyze the source current harmonics(L4) |
| CO4 | Understand the operation of different types of DC-DC converters(L2) |
| CO5 | Examine the operation of inverters and application of PWM techniques for voltage control and harmonic mitigation(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | 2 | 3 | - | - | - | - | - | - | 2 | 2 | 3 |
| CO2 | 3 | 2 | - | 2 | 2 | - | - | - | - | - | - | 3 | 3 | 3 |
| CO3 | 3 | - | 2 | 3 | 2 | - | - | - | - | - | - | 1 | 2 | 3 |
| CO4 | 3 | 2 | - | 1 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO5 | 3 | - | - | 2 | 3 | - | - | - | - | - | - | 2 | 3 | 3 |
|  |
| **C314** | **INTERNET OF THINGS** | CO1 | Understand the concepts and designing of IoT(L2) |
| CO2 | Explain the concepts of networking and building blocks of IoT(L2) |
| CO3 | Analyze changes in architectures of IoT and its challenges(L4) |
| CO4 | Explain the procedure of IoT Design Methodology(L2) |
| CO5 | DesignIoT solutions to different real time problems(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | - | 2 | - | 3 | - | - | - | - | - | - | - | 1 | - |
| CO3 | - | - | 2 | - | 3 | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | - | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| CO5 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - | - |

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| **VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY** |
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| **CO-PO-PSO GRAND MATRIX** |
|  |
| **C315** | **NEURAL NETWORKS & FUZZY LOGIC** | CO1 | Understand the concept of artificial neuron(L2) |
| CO2 | Know various ANN architectures and learning strategies(L3) |
| CO3 | Understand ANN paradigm and its application to solve Electrical Engineering problems(L3) |
| CO4 | Understand fuzzy set theory and membership functions(L2) |
| CO5 | Design Fuzzy Logic System for Electrical Engineering problems(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 1 |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | 2 | 3 |
| CO4 | 3 | 3 | - | - | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO5 | 3 | 3 | - | - | - | - | - | - | - | - | - | 2 | 3 | 3 |
|  |
| **C316** | **HIGH VOLTAGE ENGINEERING** | CO1 | Acquainted with the performance of high voltages with regard to different configurations of electrode systems(L4) |
| CO2 | Understand theory of breakdown and withstand phenomena of all types of dielectric materials(L2) |
| CO3 | Acquaint with the techniques of generation of AC,DC and Impulse voltages(L2) |
| CO4 | Apply knowledge for measurement of high voltage and high current AC, DC and Impulse.(L3) |
| CO5 | Experiment to measure dielectric property of electrical material and know the techniques of testing various equipment used in HV systems.(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 1 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | 1 |
| CO2 | 3 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 2 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | 1 | 2 |
| CO4 | 2 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | 1 |
| CO5 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | 2 |
|  |
| **C317** | **ELECTRICAL MACHINES-II** **LAB** | CO1 | Able to assess the performance of three phase induction motor. (**L4**) |
| CO2 | Able to control the speed of three phase induction motor. (L2) |
| CO3 | Able to assess the performance of single phase induction motor. (L4) |
| CO4 | Able to predetermine the regulation of three–phase alternator by various methods. (L5) |
| CO5 | Able to find the Xd / Xq ratio of alternator and asses the performance of three–phase synchronous motor. (L4). |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | 2 |
| CO2 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 1 | - | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 |
| CO4 | 2 | 3 | - | 1 | - | - | - | - | - | - | - | 1 | 2 | 2 |
| CO5 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - |

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| **C318** | **POWER ELECTRONICS LAB** | CO1 | Study the characteristics of various power electronic devices and analyze gate drive circuits of IGBT.(L3) |
| CO2 | Analyze the performance of single phase and three phase full wave bridge converters with both resistive and inductive loads.(L3) |
| CO3 | Understand the operation of single phase AC voltage regulator with resistive and inductive loads.(L2) |
| CO4 | Understand the working of Buck converter, Boost converter, single phase square wave inverter and PWM inverter.(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | - | - | - | - | - | - | - | 2 | - | - | - | 1 | - |
| CO2 | 2 | - | - | - | - | - | - | - | 2 | - | - | - | 1 | - |
| CO3 | 3 | - | - | - | - | - | - | - | 2 | - | - | - | 1 | - |
| CO4 | 2 | - | - | - | - | - | - | - | 2 | - | - | - | 1 | - |
|  |
|  **C319** | **IoT LAB** | CO1 | Determine the various codes of Arduino, Nodemcu& Raspberry pi Programming. (L4) |
| CO2 | Differentiate the features of various IOT platforms.(L4) |
| CO3 | Able to choose the best available IOT principle for solving the problem(L4) |
| CO4 | Able to design simple IOT applications using Arduino, NodeMcu and Raspberry pi boards(L6) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | - | - | 2 | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO2 | - | - | - | 2 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | - | - | - | - | 3 | - | - | - | - | - | - | - | - | 2 |
| CO4 | - | - | 3 | - | - | - | - | - | 2 | - | 3 | - | - | 3 |
| **3-2** |
| **C321** | **MANAGERIAL ECONOMIC AND FINANCIAL ANALYSIS** | CO1 | To equipped with the knowledge of estimating the Demand and demand elasticities for a product.(L1) |
| CO2 | The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs(L1) |
| CO3 | To understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.(L2) |
| CO4 | To prepare Financial Statements and the usage of various Accounting tools for analysis(L2) |
| CO5 | To evaluate various investment project proposals with the help of capital budgeting techniques for decision making.(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | **-** | **-** | **-** | **-** | **-** | 1 | - | - | 1 | - | - | - | **-** | **-** |
| CO2 | **-** | **-** | **-** | **-** | **-** | 1 | - | 2 | 1 | 2 | 2 | 2 | **-** | **-** |
| CO3 | **-** | **-** | **-** | **-** | **-** | 1 | - | - | 1 | - | - | - | **-** | **-** |
| CO4 | **-** | **-** | **-** | **-** | **-** | 1 | - | 2 | 1 | 2 | 2 | - | **-** | **-** |
| CO5 | **-** | **-** | **-** | **-** | **-** | 1 | - | 2 | 1 | 2 | 3 | 3 | **-** | **-** |

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| **C322** | **MICROPROCESSORS AND MICROCONTROLLERS** | CO1 | Understand the concepts of 8086 architecture, register and memory organization(L1) |
| CO2 | Understand and apply the concepts of the modes of operations and instruction set to develop the Assembly level language programs.(**L3)** |
| CO3 | Classify the types of interfacing devices and implement to interface with 8086(**L1)** |
| CO4 | Explain the 8051 architecture and its features.(**L1)** |
| CO5 | Understand the PIC18 architecture and Develop the programs using C (L**3)** |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | - |  | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | - |  | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | - |  | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - | - |
|  |
| **C323** | **ELECTRICAL MEASUREMENTS & INSTRUMENTATION** | CO1 | Choose suitable instrument for measurement of ac and dc Electrical quantities.(L3) |
| CO2 | Understand the concepts used in measurement of power, power factor, and energy & know the application of synchro scope and sequence indicators.(L2) |
| CO3 | Select suitable bridge for measurement of electrical parameters.(L3) |
| CO4 | Acquire proper knowledge to use various types of Transducers and able to measure various non-electric quantities & frequency of signals with CRO(L3) |
| CO5 | Acquire proper knowledge and working principle of various types of digital instruments(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 |  | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
|  |
| **C324** | **POWER SYSTEMS-III** | CO1 | Expressing the load flow solution of a power system network using different types of load flow methods.(L2) |
| CO2 | Evaluate the fault current for different types of faults with a view to provide data for the design of protective devices.(L5) |
| CO3 | Analyze the steady state and transient stability concepts of a power system.(L4) |
| CO4 | Calculate optimal scheduling for generators with and without losses.(L4) |
| CO5 | Acquire the knowledge of load frequency control for various systems.(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 |
| CO2 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 1 |
| CO4 | 2 | - | 3 | 3 | 2 | - | - | - | - | - | - | - | 1 | 3 |
| CO5 | 2 | - | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 |

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| **C325** | **BIG DATA ANALYTICS** | CO1 | Understand the concepts of Data mining and Big Data Analytics, Analyze Hadoop Architecture (L2) |
| CO2 | Master the concepts of Hadoop Distributed File System.(L3) |
| CO3 | Acquire knowledge on Map Reduce Framework.(L5) |
| CO4 | Apply Pig and Hive concepts for Data Processing. (L3) |
| CO5 | Analyze the Data Analytics on Smart Grid. (L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | - | - | 1 | 2 | - | - | - | - | - | - | - | - | - |
| CO2 | 1 | - | - | - | 2 | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | - | - | - | 2 | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | - | - | 1 | 3 | - | - | - | - | - | - | - | - | - |
| CO5 | 1 | - | - | - | 3 | - | - | - | - | - | - | - | - | - |
|  |
| **C326** | **RENEWABLE ENERGY SOURCES** | CO1 | Analyze solar radiation data, extraterrestrial radiation. radiation on earth’s surface.(L4) |
| CO2 | Design solar thermal collectors, solar thermal plants.(L5)  |
| CO3 | Design solar photo voltaic systems and wind energy conversion systems.(L5)  |
| CO4 | Understand working of hydro, tidal and wave power plant operations.(L2) |
| CO5 | Explain importance of fuel cell and geothermal system (L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | - | - | - | 2 | 2 | - | - | - | - | 1 | 2 | 2 |
| CO2 | 3 | 1 | - | - | - | 2 | 2 | - | - | - | - | 2 | 1 | 2 |
| CO3 | 3 | 2 | - | - | - | 2 | 2 | - | - | - | - | 1 | 2 | 2 |
| CO4 | 3 | 3 | - | - | - | 1 | 2 | - | - | - | - | 2 | 2 | 1 |
| CO5 | 3 | 1 | - | - | - | 2 | 2 | - | - | - | - | 2 | 2 | 1 |
|  |
| **C327** | **MICROPROCESSORS AND MICROCONTROLLERS LAB** | CO1 | Understand and apply the fundamentals of assembly level programming of microprocessor.(L2) |
| CO2 | Design and implement 8051 microcontroller based systems(L2) |
| CO3 | Design interfacing circuits with 8086. (L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | 2 | 1 |
| CO2 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | - | - | 2 | 1 |

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| **C328** | **ELECTRICAL EASUREMENTS &INSTRUMENTATION LAB** | CO1 | Calibrate various electrical measuring instruments(L4) |
| CO2 | Measure various electrical parameters(L3) |
| CO3 | Choose suitable instrument for given measurement(L5) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | - | - | 1 | - | - | - | - | 1 | - | 1 | 2 | 1 |
| CO2 | 3 | 2 | - | - | 2 | - | - | - | - | 2 | - | 1 | 2 | 1 |
| CO3 | 3 | 2 | - | - | 2 | - | - | - | - | 1 | - | 1 | 2 | 1 |
|  |
|  **C329** | Mini Project | CO1 | Collaborate with team members and procure the requirements of the mini project to be developed(L1) |
| CO2 | Build necessary design specifications and documents for the chosen mini project(L2) |
| CO3 | Develop apt domain and technical knowledge to implement/code the application (L3) |
| CO4 | Test and deploy the mini project after implementation(L4) |
| CO5 | Demonstrate the mini project comprehensively with necessary tools(L3) |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | - | 3 | - | - | 1 | 1 | 2 | 2 | 2 | 3 | 2 |
| CO2 | 1 | 3 | 3 | - | 2 | - | - | - | 1 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 1 | 3 | 2 | - | 2 | - | - | - | 2 | 3 | 1 | 1 | 2 | 3 |
| CO4 | 1 | 3 | 3 | - | 1 | - | - | - | 1 | 1 | 2 | 1 | 2 | 2 |
| CO5 | 2 | 2 | 1 | - | 1 | - | - | - | 1 | 2 | 2 | 2 | 3 | 1 |
| **4-1** |
| **C411** | **Management Science** | CO1 | Apply management and motivation theories to renovate the practice of management(L3) |
| CO2 | Explain concepts of quality management and use process control charts, concepts and tools of quality engineering in the design of products and process controls(L2) |
| CO3 | Appraise the functional management challenges associated with high levels of change in the organizations.(L4) |
| CO4 | Identify activities with their interdependency and use scheduling techniques of project management PERT/CPM(L2) |
| CO5 | Develop global vision and management skills both at strategic level and interpersonal level.(L4) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 1 | - | - | - | - | 1 | - | 3 | 3 | 3 | - | 2 | 1 | - |
| CO2 | 2 | - | - | - | - | 1 | - | 3 | 3 | 3 | - | 2 | 1 | - |
| CO3 | 1 | - | - | - | - | 1 | - | 3 | 3 | 3 | - | 2 | 1 | - |
| CO4 | 2 | - | - | - | - | 1 | - | 3 | 3 | 3 | - | 2 | 1 | - |
| CO5 | 1 | - | - | - | - | 1 | - | 3 | 3 | 3 | - | 2 | 1 | - |

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| **C412** | **Switchgear and Protection** | CO1 | Acquire the knowledge of protection systems and operation of circuit breakers(L2) |
| CO2 | Describe the operating principles of various types of relays.(L2) |
| CO3 | Select appropriate protection scheme for AC generator and transformer (L30 |
| CO4 | Choose appropriate protection scheme for transmission lines and know about different neutral grounding techniques(L3) |
| CO5 | Understand the reasons behind over voltages and operation of lightning arrester along with latest trends in protection system(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 2 | - | - | - | 2 | - | - | - | - | 1 | 2 | 2 |
| CO2 | 2 | 2 | 2 | - | - | - | 2 | - | - | - | - | 1 | 2 | 2 |
| CO3 | 3 | 3 | 1 | - | - | - | 2 | - | - | - | - | 1 | 2 | 2 |
| CO4 | 3 | 3 | 1 | - | - | - | 2 | - | - | - | - | 1 | 2 | 1 |
| CO5 | 2 | 2 | 1 | - | - | - | 1 | - | - | - | - | 1 | 1 | 2 |
|  |
| **C413** | **FACTS** | CO1 | Understand the power flow control in transmission lines using FACTS controllers.(L2) |
| CO2 | Explain the operation and control of voltage source and current source converters.(L3) |
| CO3 | Analyze the compensation methods to improve stability and reduce power oscillations in the transmission lines.(L4) |
| CO4 | Understandthe methods of compensations using series compensators.(L2) |
| CO5 | Explain operation and control of Unified Power Flow Controller (UPFC) and Interline Power Flow Controller(IPFC).(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | 1 | 2 | 2 |
| CO2 | 3 | 2 | 1 | - | 1 | - | - | - | - | - | - | 2 | 1 | 2 |
| CO3 | 2 | 2 | 2 | - | 3 | - | - | - | - | - | - | 1 | 2 | 2 |
| CO4 | 2 | 2 | 1 | - | 2 | - | - | - | - | - | - | 2 | 2 | 1 |
| CO5 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | 2 | 2 | 1 |

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| **C414** | **Cyber Security** | CO1 | To understand cyber-attacks.(L2) |
| CO2 | To know the cyber laws and cyber forensic. (L2) |
| CO3 | To protect them self and ultimately the entire Internet community from such attacks.(L3) |
| CO4 | To understand the security and privacy implications in organization.(L2) |
| CO5 | To know the data privacy issues.(L1) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | - | - | - | 2 | - | - | - | - | 2 | - | 2 | 2 | 2 |
| CO2 | 3 | - | - | - | 2 | - | - | - | - | 2 | - | 2 | 2 | 2 |
| CO3 | 2 | - | - | - | 2 | - | - | - | - | 1 | - | 2 | 2 | 2 |
| CO4 | 3 | - | - | - | 3 | - | - | - | - | 2 | - | 3 | 2 | 2 |
| CO5 | 2 | - | - | - | 3 | - | - | - | - | 2 | - | 2 | 2 | 2 |
|  |
| **C415** | **Electric Drives** | CO1 | Understand the fundamentals of electric drive and different electric braking methods.(L2) |
| CO2 | Analyze the operation of three phase converter fed dc motors and four quadrant operations of dc motors using dual converters.(L4) |
| CO3 | Describe the converter control of dc motors in various quadrants of operation(L3) |
| CO4 | Interpreting the concept of speed control of induction motor by using AC voltage controllers and Differentiate the stator side control and rotor side control of three phase induction motor.(L2) |
| CO5 | Estimate the speed control mechanism of synchronous motors(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| CO2 | 2 | 3 | 1 | 3 | - | - | - | - | - | - | - | 2 | 3 | 2 |
| CO3 | 2 | 2 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| CO4 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 |
|  |
| **C416** | **Power Systems Lab** | CO1 | Understand affect of various faults in various power system components.(L2) |
| CO2 | Students can execute energy management systems functions at load(L3) |
| CO3 | determine the parameters of various power system components(L4) |
| CO4 |  understand the power flows and stability in power system.(L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 1 | 1 | 1 | 1 | 1 | - | - | - | 1 | - | - | - | - | 2 |
| CO2 | 1 | 2 | - | - | - | - | - | - | 1 | - | - | - | - | 2 |
| CO3 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | - | - | - | - | 1 |
| CO4 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | - | - | - | - | 1 |

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| **VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY** |
| **DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING** |
| **CO-PO-PSO GRAND MATRIX** |
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| **C417** | **Big Data Analytics Lab** | CO1 | **Applying Java concepts required for developing MapReduce programs.** (L3) |
| CO2 | understand the fundamental concepts of Big Data & Hadoop framework. (L2) |
| CO3 | **Demonstrate**the knowledge of big data analytics and implement different file management task in Hadoop. (L3) |
| CO4 | **Analyze**and perform different operations on data using Pig Latin scripts.(L4). |
| CO5 | **Illustrate**and apply different operations on relations and databases using Hive. (L4) |
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|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | - | 1 | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 2 | - | - | 1 | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 2 | - | 1 | 1 | - | - | - | - | - | - | - | 1 | - | 2 |
| CO4 | 2 | 3 | 3 | - | 3 | - | - | - | - | 1 | - | 2 | 3 | - |
| CO5 | 2 | 3 | 3 | - | 3 | - | - | - | - | 1 | - | 2 | 3 | - |
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|  **C418** |  Project stage- I  | CO1 | Collaborate with team members in analyzing the requirements of the project to be developed(L5) |
| CO2 | Build necessary design specifications and documents for the chosen project(L5) |
| CO3 | Develop apt domain and technical knowledge to implement/code the application(L3) |
| CO4 | Test and deploy the project after implementation(L4) |
| CO5 | Demonstrate the project comprehensively with necessary tools(L3) |
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|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 3 | 3 | - | - | 1 | 3 | 2 | 2 | 2 | 3 | 2 |
| CO2 | 1 | 3 | 3 | 2 | 2 | - | - | - | - | 3 | 3 | 3 | 3 | 2 |
| CO3 | 1 | 3 | 2 | 2 | 2 | - | - | - | 2 | 3 | 1 | 1 | 2 | 3 |
| CO4 | 2 | 3 | 3 | 2 | 1 | - | - | - | 1 | 1 | 2 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | 3 | 1 |
| **4-2** |
| **C421** | **UTILIZATION OF ELECTRICAL ENERGY** | CO1 | Summarizing the various electric heating and welding procedures(L2) |
| CO2 | Articulate the terminology of illumination, Explain the working of electric lamps and design of lightning schemes(L3) |
| CO3 | Determine the systems of electric traction, speed-time curves and mechanics of movement.(L3) |
| CO4 | Understand the braking methods used in traction systems and calculate different performance parameters of traction(L4) |
| CO5 | Examine different real time electrical appliances and applications in electric vehicles(L3) |
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|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 1 | 2 | - | - | 2 | 2 | - | - | - | - | 2 | 2 | 2 |
| CO2 | 3 | 2 | 1 | - | - | 2 | 2 | - | - | - | - | 2 | 3 | 3 |
| CO3 | 2 | 2 | 2 | - | - | 3 | 3 | - | - | - | - | 2 | 2 | 2 |
| CO4 | 2 | 1 | 2 | - | - | 2 | 2 | - | - | - | - | 2 | 2 | 2 |
| CO5 | 2 | 1 | 2 | - | - | 3 | 1 | - | - | - | - | 2 | 2 | 2 |

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| **C422** | **DATA ANALYTICS FOR SMART GRIDS**  | CO1 | Understandthe basics of conventional grid and Transformation tosmart grid using new technologies.(L2) |
| CO2 | Describe the major components, grid layout and standards of smart grids.(L2) |
| CO3 | Interpret thevarious smart gridcommunication and measurement technologies.(L3) |
| CO4 | Analyzethe data collection devices and data management in smart grids.(L4) |
| CO5 | Appraisethe different power system issues using data analytic tools.(L5) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | - | - | 2 | - | 3 | - | - | - | 2 | 2 | 2 | 2 | - | 2 |
| CO2 | - | - | 2 | - | - | - | - | - | - | 2 | 2 | 2 | - | 2 |
| CO3 | - | - | - | - | - | - | - | - | 2 | 3 | 2 | 2 | - | 2 |
| CO4 | - | - | 2 | - | 2 | - | - | - | - | 2 | 3 | 2 | - | 2 |
| CO5 | - | - | - | - | 2 | - | - | - | - | 2 | 2 | 2 | - | 2 |
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| **C423** | **SIGNALS AND SYSTEMS**  | CO1 | Understand various types of signals mathematically and able to calculate complex Fourier spectrum(L2) |
| CO2 | Analyse the continuous-time signals and continuous-time systems using Fourier transform and Apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct the original signal from samples.(L4) |
| CO3 | Understand the concept convolution, correlation, energy spectral density and power spectral density.(L2) |
| CO4 | Compute Laplace transforms to analyze continuous time signals and systems and understand the concept of region of convergence.(L4)  |
| CO5 | Compute Z-transform to analyze discrete-time signals and systems, and understand the concept of region of convergence. (L4)  |
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|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| CO2 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 3 | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 | 3 |
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| **C424** | Project stage -II | CO1 | Collaborate with team members in analyzing the requirements of the project to be developed(L5) |
| CO2 | Build necessary design specifications and documents for the chosen project(L5) |
| CO3 | Develop apt domain and technical knowledge to implement/code the application(L3) |
| CO4 | Test and deploy the project after implementation(L4) |
| CO5 | Demonstrate the project comprehensively with necessary tools(L3) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 3 | 2 |
| CO2 | 1 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 1 | 3 | 2 | 2 | 3 | 2 |  2 | 2 | 2 | 3 | 1 | 1 | 2 | 3 |
| CO4 | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 1 |