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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** | **ENGLISH - I**  | **CO1** | Develop knowledge in different fields and serve the society accordingly.(L3) |
| **CO2** | Develop listening skills to communicate effectively.(L3) |
| **CO3** |  Improve comprehension skills.(L2) |
| **CO4** |  Improve fluency of speech(L2) |
| **CO5** | Develop English language reading skills(L3) |
| **CO6** | Develop writing skills(L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | - | - | - | - | - | - | 3 | - | 2 | - | - |  |
| **CO2** | 1 | - | 1 | - | - | - | - | - | - | 3 | - | 2 | - | - |  |
| **CO3** | 1 | 1 | 1 | - | - | - | - | - | - | 3 | - | 3 | - | - |  |
| **CO4** | 1 | 1 | 1 | - | - | - | - | - | - | 3 | - | 2 | - | - |  |
| **CO5** | 2 | - | 2 | - | - | - | - | - | - | 3 | - | 3 | - | - |  |
| **CO6** | 2 | 1 | 2 | - | - | - | - | - | - | 3 | - | 2 | - | - |  |
|  |
| **C112** | **MATHEMATICS-I** | **CO1** | Apply first order and first degree differential equation to Newton’s law of cooling, law of natural growth, decay, orthogonal trajectories, electrical circuits and chemical reactions (L3) |
| **CO2** | Apply differential equations of higher order to L-C-R circuits and simple harmonic motion(L3) |
| **CO3** | Apply Laplace transforms to solve ordinary differential equations (L3) |
| **CO4** | Estimate the Maximum and Minimum of the function of two variables (L2) |
| **CO5** | Solve the partial differential equations of first order (L3) |
| **CO6** | Solve the higher order Partial Differential Equations with constant coefficients (L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 3 | 1 | 2 | - | - | - | - | - | 1 | - | 2 | - | - |  |
| **CO2** | 1 | 3 | 1 | 3 | - | - | - | - | - | - | - | 2 | - | - |  |
| **CO3** | 1 | 3 | 1 | 2 | - | - | - | - | - | 1 | - | 3 | - | - |  |
| **CO4** | 1 | 3 | 1 | 3 | - | - | - | - | - | - | - | 2 | - | - |  |
| **CO5** | 2 | 2 | 2 | 3 | - | - | - | - | - | 1 | - | 3 | - | - |  |
| **CO6** | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | - | - |  |
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| **CO-PO-PSO GRAND MATRIX** |
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| **C113****APPLIED PHYSICS** | **APPLIED CHEMISTRY** | **CO1** | **Develop the** knowledge of polymers as basic construction materials and its vital role in chemical and hardware industries.(L3) |
| **CO2** | Interpret the application of fuels and its energy – related problems in day to day life(L2) |
| **CO3** | Interpret the knowledge of electrochemistry and corrosion in chemical industries and other engineering areas (L2) |
| **CO4** | Interpret the knowledge of green chemistry and advanced materials like nano materials, super conductors and liquid crystals(L2) |
| **CO5** | Classify the utility of suitable Semi conductors, insulators and magnetic materials in different electronic appliances.(L1) |
| **CO6** | Classify different forms of conventional sources of energy and fuel cells(L1) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | - | 2 | - | - |  |
| **CO2** | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | 2 | - | - |  |
| **CO3** | 1 | 2 | 1 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |  |
| **CO4** | 1 | - | 1 | - | - | - | - | - | - | - | - | 2 | - | - |  |
| **CO5** | 1 | 1 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |  |
| **CO6** | 2 | 1 | 2 | - | - | - | - | - | - | - | - | 2 | - | - |  |
|  |
| **C114** | **ENIGINEERING MECHANICS**  | **CO1** | Understand the concepts of forces and its resolution in different planes, resultant of force system(L2) |
| **CO2** | Understand the forces acting on a body, their free body diagrams using graphical methods(L2) |
| **CO3** | Understand the concepts of centre of gravity (L2) |
| **CO4** | Understand the moments of inertia and their application(L2) |
| **CO5** | Analysis of frames and trusses(L4) |
| **CO6** | Analysis of different types of motion, friction, and application of work - energy method(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | - | 1 | - | - |  |
| **CO2** | - | 2 | 1 | 1 | - | - | - | - | - | 2 | - | 2 | - | - |  |
| **CO3** | 1 | 2 | 1 | 1 | - | - | - | - | - | 1 | - | 3 | - | - |  |
| **CO4** | 1 | - | 1 | - | - | - | - | - | - | 2 | - | 2 | - | - |  |
| **CO5** | 1 | 1 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |  |
| **CO6** | 2 | 3 | 2 | - | - | - | - | - | - | - | - | 2 | - | - |  |
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| **CO-PO-PSO GRAND MATRIX** |
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| **C115** | **COMPUTER PROGRAMMING**  | **CO1** | Understand the working of key components of a computer system. (L2) |
| **CO2** | Describe the fundamental programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.(L1) |
| **CO3** | Identify the right control statements based on the problem statement.(L1) |
| **CO4** | Understand procedural oriented programming using functions.(L2) |
| **CO5** | Distinguish homogenous and heterogeneous data types(L1) |
| **CO6** | Illustrate the concept of pointers and file system for handling data storage.(L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 2 | 2 | - | - | - | - | - | 3 | - | 1 | – | – |  |
| **CO2** | - | 1 | 3 | 1 | - | - | - | - | - | 2 | - | 2 | – | – |  |
| **CO3** | 1 | 1 | 1 | 1 | - | - | - | - | - | 1 | - | 2 | – | – |  |
| **CO4** | 1 | 3 | 1 | - | - | - | - | - | - | 2 | - | 1 | – | – |  |
| **CO5** | 1 | 1 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | – | – |  |
| **CO6** | 2 | 3 | 2 | - | - | - | - | - | - | 3 | - | 2 | - | - |  |
|  |
| **C116****ENVIRONMENTAL STUDIES VE ENGLISH LAB I** | **ENVIRONMENTAL STUDIES** | **CO1** | Intrerpret knowledge on Global environmental issues and Ecosystems.(L2) |
| **CO2** | Classify different natural resources and the need to its conservation(L1) |
| **CO3** | Interpret knowlegde on biodiversity of India and its conservation practices.(L2) |
| **CO4** | Extend the knowledge on various attributes of the pollutions, its prevention along with waste management practices.(L2) |
| **CO5** | Outline the Environmental legislation and social issues of India and the possible ways to combact the challenges(L1) |
| **CO6** | Interpret knowlegde on environmental assessment and the stages involved in EIA and the environmental audit(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | 1 | - | - | 3 | - | - | 3 | - | 1 | - | - |  |
| **CO2** | - | 1 | 1 | 1 | - | - | 3 | - | - | 2 | - | 2 | - | - |  |
| **CO3** | 1 | 1 | 1 | 1 | - | - | 3 | - | - | 1 | - | 2 | - | - |  |
| **CO4** | 1 | 1 | 1 | 1 | - | - | 2 | - | - | 2 | - | 1 | - | - |  |
| **CO5** | 1 | 1 | 1 | 1 | - | - | 3 | - | - | 1 | - | 1 | - | - |  |
| **CO6** | 1 | 1 | 1 | 1 | - | - | 3 | - | - | 1 | - | 1 | - | - |  |
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| **C117** | **ENGINEERING CHEMISTRY LABORATORY**  | **CO1** | Develop the knowledge of volumetric and instrumental methods of analysis in determining the quality of unknown products. (L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 3 | 2 | - | - | 3 | - | - | 1 | - | 1 | - | - |  |
|  |
| **C118** | **ENGLISH - COMMUNICATION SKILLS LAB- I**  | **CO1** | Develop LSRW Skills to communicate effectively.(L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | 2 | - | - | 2 | - | - | 3 | - | 1 | - | - |  |
|  |
|  **C119 C119** | **COMPUTER GRAMMING LAB**  | CO1 | Apply and practice logical ability to solve the problems and Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs (L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| CO1 | 1 | 1 | 2 | 1 | - | - | 3 | - | - | 3 | - | 1 | - | - |  |
|  |
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| **1-2** |
| **C121****MATHEMATICS-II** | **ENGLISH -II**  | **CO1** | Develop English language skills in letter writing(L3) |
| **CO2** | Improve technical writing skills(L2) |
| **CO3** | Interpret different cultural shocks due to globalization(L2) |
| **CO4** | Improve assertive skills(L2) |
| **CO5** | Develop vocabulary skills in English language(L3) |
| **CO6** | Apply various skills of grammar to speak and write flawless language(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 2 | 2 | - | - | - | 2 | - | - | 3 | - | 2 | - | - |  |
| **CO2** | - | 3 | 1 | - | - | - | 1 | - | - | 3 | - | 1 | - | - |  |
| **CO3** | 1 | 1 | 3 | - | - | - | 3 | - | - | 3 | - | 2 | - | - |  |
| **CO4** | 1 | 2 | 2 | - | - | - | 2 | - | - | 3 | - | 1 | - | - |  |
| **CO5** | 1 | - | 3 | - | - | - | 1 | - | - | 3 | - | 1 | - | - |  |
| **CO6** | 2 | 3 | 1 | - | - | - | 3 | - | - | 3 | - | 2 | - | - |  |
|  |
| **C122** | **MATHEMATICS-II** | **CO1** | Calculate a root of algebraic and transcendental equations. Explain relation between the finite difference operators(L2) |
| **CO2** | Compute interpolating polynomial for the given data.(L3) |
| **CO3** | Solve ordinary differential equations numerically using Euler’s and RK method(L3) |
| **CO4** | Find Fourier series and Fourier transforms for certain functions(L1) |
| **CO5** | Identification solve the different types of partial differential equations(L2) |
| **CO6** | Identify/classify and solve the different types of partial differential equations(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 3 | 1 | 2 | - | - | - | - | - | 1 | - | 2 | - | - |  |
| **CO2** | 1 | 3 | 1 | 3 | - | - | - | - | - | - | - | 2 | - | - |  |
| **CO3** | 1 | 3 | 1 | 2 | - | - | - | - | - | 1 | - | 3 | - | - |  |
| **CO4** | 1 | 3 | 1 | 3 | - | - | - | - | - | - | - | 2 | - | - |  |
| **CO5** | 2 | 2 | 2 | 3 | - | - | - | - | - | 1 | - | 3 | - | - |  |
| **CO6** | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | - | - |  |
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| **C123** | **MATHEMATICS-III** | **CO1** | Determine rank, Eigenvalues and Eigen vectors of a given matrix and solve simultaneous linear equations.(L1) |
| **CO2** | Solve simultaneous linear equations numerically using various matrix methods(L3) |
| **CO3** | Determine double integral over a region and triple integral over a volume(L1) |
| **CO4** | Calculate gradient of a scalar function, divergence and curl of a vector function(L2) |
| **CO5** | Determine line, surface and volume integrals.(L1) |
| **CO6** | Apply Green, Stokes and Gauss divergence theorems to calculate line, surface and volume integrals(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 3 | 1 | 2 | - | - | - | - | - | 1 | - | 2 | - | - |  |
| **CO2** | 1 | 3 | 1 | 3 | - | - | - | - | - | 1 | - | 2 | - | - |  |
| **CO3** | 1 | 3 | 1 | 2 | - | - | - | - | - | 1 | - | 3 | - | - |  |
| **CO4** | 1 | 3 | 1 | 3 | - | - | - | - | - |  | - | 2 | - | - |  |
| **CO5** | 2 | 2 | 2 | 3 | - | - | - | - | - | 1 | - | 3 | - | - |  |
| **CO6** | 2 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | - | - |  |
|  |
| **C124** | **APPLIED PHYSICS**  | **CO1** | Understand the Knowledge of Physical Optics phenomena like Interference, Diffraction (L2) |
| **CO2** | Understand the Knowledge of Polarization involving required to design instruments with higher resolution(l2) |
| **CO3** | Apply concepts of coherent sources, its realization and utility optical instrumentation.(L4) |
| **CO4** | Understand the concepts regarding the bulk response of materials to the EM fields (L2) |
| **CO5** | Analyse the study in the back-drop of basic quantum mechanics(L4) |
| **CO6** | Understand the physics of Semiconductors and their working mechanism for their utility in sensors.(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | - | 2 | - | - |  |
| **CO2** | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | 2 | - | - |  |
| **CO3** | 1 | 2 | 1 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |  |
| **CO4** | 1 | - | 1 | - | - | - | - | - | - | - | - | 2 | - | - |  |
| **CO5** | 1 | 1 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |  |
| **CO6** | 2 | 1 | 2 | - | - | - | - | - | - | - | - | 2 | - | - |  |
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| **C125** | **ELECTRICAL CIRCUIT ANALYSIS – I**  | **CO1** | Understand the concepts of passive elements, types of sources and various network reduction techniques.(L2) |
| **CO2** | Understand the applications of network topology to electrical circuits (L2) |
| **CO3** | Understand the concept of magnetic coupled circuit(L2) |
| **CO4** | Understand the behaviour of RLC networks for sinusoidal excitations.(L2) |
| **CO5** | Analyse the performance of R-L, R-C and R-L-C circuits with variation of one of the parameters and to understand the concept of resonance.(L4) |
| **CO6** | Understand the applications of network theorems for analysis of electrical networks.(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 2 | 2 | - | - | - | - | - | 3 | - | 1 | - | - |  |
| **CO2** | 1 | 1 | 1 | 1 | - | - | - | - | - | 3 | - | 2 | - | - |  |
| **CO3** | 1 | 2 | 1 | 1 | - | - | - | - | - | 3 | - | 1 | - | - |  |
| **CO4** | 1 | - | 2 | - | - | - | - | - | - | 3 | - | 3 | - | - |  |
| **CO5** | 1 | 1 | 2 | 1 | - | - | - | - | - | 3 | - | 1 | - | - |  |
| **CO6** | 2 | 1 | 2 | - | - | - | - | - | - | 3 | - | 2 | - | - |  |
|  |
| **C126** | **ENGINEERING DRAWING**  | **CO1** | Understand the need to enlarge or reduce the size of objects(L2) |
| **CO2** | Introduce orthographic projections and to project the points and lines parallel to one plane and inclined to other(L1) |
| **CO3** | Understand to draw the projections of the lines inclined to both the planes(L2) |
| **CO4** | Understand the students draw the projections of the various types of solids in different positions inclined to one of the planes.(L2) |
| **CO5** | Apply the object in 3D view through isometric views(L3) |
| **CO6** | Understand to represent and convert the isometric view to orthographic view and vice versa(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |  |
| **CO2** | 1 | 1 | - | 1 | - | - | - | - | - | 2 | - | 2 | - | - |  |
| **CO3** | 1 | 1 | 1 |  | - | - | - | - | - | 1 | - | 1 | - | - |  |
| **CO4** | 1 | 1 | 1 | 1 | - | - | - | - | - | 3 | - | 3 | - | - |  |
| **CO5** | 1 | - | 1 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |  |
| **CO6** | 2 | 1 | 1 | 1 | - | - | - | - | - | 2 | - | 2 | - | - |  |
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| **C127** | **ENGLISH LANGUAGE COMMUNICATION SKILLS LAB- II** | **CO1** | Develop LSRW Skills to communicate effectively which helps them face group discussions and interviews very confidently (L3) |
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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | 1 | - | - | - | - | - | 3 | - | 1 | - | - |  |
|  |
| **C128** | **APPLIED/ENGINEERING PHYSICS LAB**  | **CO1** | Determination of the physical values with targeted accuracy by explaining the principles involved in design of instruments.(L2) |
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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | 1 | - | - | - | - | - | 2 | - | 1 | - | - |  |
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|  |
| **C1219** | **ENGINEERING WORKSHOP & IT WORKSHOP**  | **CO1** | Make different basic prototypes in the trades of carpentry, fitting and tin smithy & perform basic house wiring techniques like series and parallel connection & stair case wiring.(L2) |
| **CO2** | Demonstrate assembling and dissembling of a computer system and get’s hands on experience in trouble shooting a system and hands-on practice on basic engineering trades and skills.(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |  |
| **CO2** | 1 | 1 | 2 | 1 | - | - | - | - | - | 1 | - | 2 | - | - |  |
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| **2-1** |
| **C211** | **ELECTRICAL CIRCUIT ANALYSIS-II**  | **CO1** | Understand the concepts of balanced and unbalanced three-phase circuits(L2) |
| **CO2** | Understand the transient behaviour of electrical networks with DC, pulse excitations.(L2) |
| **CO3** | Understand the transient behaviour of electrical networks with AC excitations(L2) |
| **CO4** | Apply the performance of a network based on input and output excitation/response(L4) |
| **CO5** | Understand the realization of electrical network function into electrical equivalent passive elements(L2) |
| **CO6** | Understand the application of fourier series and fourier transforms for analysis of electrical circuits.(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 3 |  |
| **CO2** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 3 |  |
| **CO3** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 3 |  |
| **CO4** | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 3 |  |
| **CO5** | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 |  |
| **CO6** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 3 |  |
|  |
| **C212** | **ELECTRICAL MACHINES – I**  | **CO1** | Understand the unifying principles of electromagnetic energy conversion.(L2) |
| **CO2** | Understand the construction, principle of operation and performance of DC machines.(L2) |
| **CO3** | Understand the characteristics, performance, methods of speed control and testing methods of DC motors.(L20 |
| **CO4** | Understand the performance of single-phase transformers with equivalent circuit models.(L2) |
| **CO5** | Understand the methods of testing of single-phase transformer(L2) |
| **CO6** | Analyze the three phase transformers and achieve three phases to two phase conversion(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | - | - | - | - | - | 3 | 1 | 1 | 2 | - | 2 | 3 |  |  |
| **CO2** | 1 | - | - | - | - | - | 3 | 1 | 1 | 2 | - | 2 | 2 | 2 |  |
| **CO3** | 3 | 2 | - | - | - | - | - | 3 | 3 | - | 1 | - | 2 |  |  |
| **CO4** | 1 | - | - | - | - | - | 3 | 1 | 1 | 2 | - | 2 |  | 1 |  |
| **CO5** | 1 | - | - | - | - | - | 3 | 1 | 1 | 2 | - | 2 |  | 2 |  |
| **CO6** | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 1 |  |  |
|  |
| **VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY** |
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| **C213** | **BASIC ELECTRONICS AND DEVICES**  | **CO1** | Demonstrate the basic concepts of semiconductor physics to understand the operation of diodes and transistors(L3) |
| **CO2** | Describe the operation and characteristics of PN junction diode and special diodes(L2) |
| **CO3** | Classify the operation of rectifiers and filters(L1) |
| **CO4** | Explain the Classification, Construction, Characteristics and Operation of various BJT’s, FET’s & MOSFET’s.(L1) |
| **CO5** | Evaluate different biasing, stabilization and compensation techniques used in BJT & FET circuits(L5) |
| **CO6** | Compute various parameters related to Transistor Amplifiers using Hybrid Model(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | - |  |
| **CO2** | 1 | - | 1 | - | - | - | - | - | - | - | - | - | 1 | - |  |
| **CO3** | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | - |  |
| **CO4** | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | - |  |
| **CO5** | 3 | - | 2 | - | - | - | - | - | - | - | - | - | 1 | - |  |
| **CO6** | 2 | 1 | 2 | - | - | - | - | - | - | - | - | - | 1 | - |  |
|  |
| **C214** | **ELECTROMAGNETIC FIELDS**  | **CO1** | Understand the electric fields and potentials using guass’s law or solving Laplace’s or Possion’s equations, for various electric charge distributions (L2) |
| **CO2** | Design & calculation of capacitance, energy stored in dielectrics(L3) |
| **CO3** | Understand the magnetic field intensity due to current, the application of ampere’s law and the Maxwell’s second and third equations(L2) |
| **CO4** | Analyse the magnetic forces and torque produced by currents in magnetic field (L4) |
| **CO5** | Understand the self and mutual inductances and the energy stored in the magnetic field. (L2) |
| **CO6** | Calculate induced e.m.f., understand the concepts of displacement current and Poynting vector.(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |  |
| **CO3** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO4** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 3 |  |
| **CO5** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 3 |  |
| **CO6** | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 3 | 3 |  |
|  |
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| **C215** | **THERMAL AND HYDRO PRIME MOVERS**  | **CO1** | Understand the types of prime movers(L2) |
| **CO2** | Understand the information and its utilities through the standard steam data tables and charts.(L2) |
| **CO3** | Understand the gas turbine fundamentals, the governing cycles and the methods to improve the efficiency of gas turbines(L2) |
| **CO4** | Understand the fundamental of fluid dynamic equations and its applications fluid jets(L2) |
| **CO5** | Understand the constructional features, operational details of various types of hydraulic turbines. (L2) |
| **CO6** | Apply types of hydroelectric power plants, estimation and calculation of different loads by considering various factors (L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 2 | 2 | 2 | - | 3 | 3 | - | - | - | - | 2 | 2 | - |  |
| **CO2** | 2 | 2 | 2 | 2 | - | 3 | 3 | - | - | - | - | 2 | - | 2 |  |
| **CO3** | 2 | 2 | 2 | 2 | - | 3 | 3 | - | - | - | - | 2 | 2 | - |  |
| **CO4** | 2 | 2 | 2 | 2 | - | 3 | 3 | - | - | - | - | 2 | 3 | 2 |  |
| **CO5** | 2 | 2 | 2 | 2 | - | 3 | 3 | - | - | - | - | 2 | 3 | 2 |  |
| **CO6** | 2 | 2 | 2 | 2 | - | 3 | 3 | - | - | - | - | 2 | 3 | 2 |  |
|  |
| **C216** | **MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**  | **CO1** | Understand the concept and nature of Managerial Economics and its relationship with other disciplines. (L2) |
| **CO2** | Understand the Concept of Demand (L2) |
| **CO3** | Demand forecasting, Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis (L3) |
| **CO4** | Understand the nature of markets, Methods of Pricing in the different market structures(L2) |
| **CO5** |  Apply the different Accounting Systems, preparation of Financial Statement (L4) |
| **CO6** | Understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | - | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO2** | 3 | - | 2 | - | - | - | - | - | - | - | - | 2 | 3 | 2 |  |
| **CO3** | 2 | - | 2 | - | - | - | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO4** | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 3 | 2 |  |
| **CO5** | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 3 | 3 |  |
| **CO6** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 3 | 3 |  |
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| **C217** | **THERMAL AND HYDRO LAB**  | **CO1** | Apply the performance evaluation methods of various internal combustion engines, flow measuring equipment and hydraulic turbines and pumps. (L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 2 | 2 | - | - | - | - | 3 | - | - | - | 2 | - | 1 | 2 |  |
|  |
|  **C218** | **ELECTRICAL CIRCUITS LAB**  | **CO1** | Apply various thermos, determination of self and mutual inductances, two port parameters of a given electric circuits. (L4) |
| **CO2** | Able to draw locus diagrams. Waveforms and phasor diagram for lagging and leading networks.(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 2 |  | 3 | - | - | - | - | 2 | - | - | - | 2 | 2 |  |
| **CO2** | 2 | 2 | 2 | 3 | - | - | - | - | 2 | - | - | - | 3 | 2 |  |
| **2-2** |
| **C221** | **ELECTRICAL MEASUREMENTS**  | **CO1** | Understand the principle of operation and working of different types of instruments. Measurement of voltage and current. (L2) |
| **CO2** | Understand the working principle of operation of different types of instruments for measurement of power and energy. (L2) |
| **CO3** | Understand the principle of operation and working of dc and ac potentiometers. (L2) |
| **CO4** | Understand the principle of operation and working of various types of bridges for measurement of parameters –resistance, inductance, capacitance and frequency.(L2) |
| **CO5** | Understand the principle of operation and working of various types of magnetic measuring instruments. (L2) |
| **CO6** | Applications of CRO for measurement of frequency, phase difference and hysteresis loop using Lissajous patterns. (L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | 2 |  |
| **CO2** | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 2 |  |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO4** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO5** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |  |
| **CO6** | 2 | 2 | - | 2 | - | - | - | - | - | - | - | - | 3 | 2 |  |
|  |
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|  **C222** | **ELECTRICAL MACHINES – II** | **CO1** | Understand the principle of operation and performance of 3-phase induction motor. (L2) |
| **CO2** | Quantify the performance of induction motor and induction generator in terms of torque and slip.(L1) |
| **CO3** | Understand the torque producing mechanism of a single phase induction motor.(L2) |
| **CO4** | Understand the principle of emf generation, the effect of armature reaction and predetermination of voltage regulation in synchronous generators. (L2) |
| **CO5** | Apply parallel operation and control of real and reactive powers for synchronous generators.(L4) |
| **CO6** | Understand the operation, performance and starting methods of synchronous motors.(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 2 | 1 | 1 | - | 1 | 2 | - | - | 2 | 2 | 2 | 2 | 2 |  |
| **CO2** | 3 | 3 | 2 | 2 | - | 1 | - | - | - | 2 | - | 1 | 2 | 2 |  |
| **CO3** | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 2 |  |
| **CO4** | 3 | 3 | 2 | 1 | 3 | 2 | 1 | - | - | - | 1 | 2 | 3 | 2 |  |
| **CO5** | 3 | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 2 | 3 | 2 |  |
| **CO6** | 3 | 2 | 1 | 1 | 3 | 2 | 1 | - | - | 2 | 2 | 2 | 3 | 2 |  |
|  |
| **C223** | **SWITCHING THEORY AND LOGIC DESIGN** | **CO1** | Explain the different types of number systems, number conversions, codes and logic gates.(L1) |
| **CO2** | Apply the concepts of Boolean algebra and use the knowledge of K-maps and tabular method for minimization of Boolean expressions.(L4) |
| **CO3** | Construct the higher order modules from their lower order structures of various combinational logic circuits.(L2) |
| **CO4** | Explain the design of different programmable logic devices.(L1) |
| **CO5** | Develop various sequential circuits like registers, counters by using basic flipflops.(L3) |
| **CO6** | Apply the knowledge of flipflops to construct different finite state machines.(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO2** | 3 | 2 | 1 | 1 | 3 | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO3** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO4** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO5** | 3 | 2 | 1 | 1 | 3 | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO6** | 3 | 2 | 1 | 1 | 3 | - | - | - | - | - | - | - | 2 | 2 |  |
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| **C224** | **CONTROL SYSTEMS**  | **CO1** | Understand the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function. (L2) |
| **CO2** | analyze the time response of first and second order systems and improvement of performance by proportional plus derivative and proportional plus integral controllers. (L4) |
| **CO3** | Investigate the stability of closed loop systems using Routh’s stability criterion and the analysis by root locus method.(L3) |
| **CO4** | Understand the Frequency Response approaches for the analysis of linear time invariant (LTI) systems using Bode plots, polar plots and Nyquist stability criterion.(L2) |
| **CO5** | Analyse the basic aspects of design and compensation of linear control systems using Bode plots.(L4) |
| **CO6** | Analyse the state models and analyze the systems. To present the concepts of Controllability and Observability.(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | 3 | 3 | 2 |  |
| **CO2** | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 3 | 3 | 2 |  |
| **CO3** | 2 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | 3 | 3 | 2 |  |
| **CO4** | 1 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO5** | 1 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | 3 | 3 | 2 |  |
| **CO6** | 1 | 1 | 1 | 1 | 2 | - | - | - | - | - | - | 3 | 3 | 2 |  |
|  |
| **C225** | **POWER SYSTEMS-I** | **CO1** | Understand the principle of operation of different components of a thermal power stations.(L2) |
| **CO2** | Understand the principle of operation of different components of a Nuclear power stations. (L2) |
| **CO3** | Apply the concepts of DC/AC distribution systems and voltage drop calculations.(L4) |
| **CO4** | Understand the constructional and operation of different components of an Air and Gas Insulated substations(L2) |
| **CO5** | Understand the constructional details of different types of cables.(L2) |
| **CO6** | Apply different types of load curves and tariffs applicable to consumers. (L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
| **CO2** | 1 | 3 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
| **CO3** | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
| **CO4** | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
| **CO5** | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
| **CO6** | 2 | 3 | 2 | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
|  |
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| **C226** | **MANAGEMENT SCIENCE**  | **CO1** | Understand the management functions. (L2) |
| **CO2** | Understand the global leadership (L2) |
| **CO3** | Understand the organizational behavior. (L2) |
| **CO4** | Understand the functional management (L2) |
| **CO5** | Understand the project management (L2) |
| **CO6** | Understand the strategic management.(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | - | - | - | - | - | - | - | 2 | - | 3 | - | - | - |  |
| **CO2** | 1 | 2 | 1 | - | - | - | - | - | 2 | - | 3 | - | - | - |  |
| **CO3** | 3 |  | - | - | - | - | - | - | 2 | 1 | 3 | - | - | - |  |
| **CO4** | - | 2 | - | - | - | - | - | - | 2 | - | 3 | - | - | - |  |
| **CO5** | - | - | 1 | - | - | - | - | 2 | 2 | 3 | 3 | - | - | - |  |
| **CO6** | 2 | - | - | - | - | - | - |  | 2 | - | 3 | - | - | - |  |
|  |
| **C227** | **ELECTRICAL MACHINES – I LABORATORY** | **CO1** | Analyse the performance of DC machines and Transformers. (L4) |
| **CO2** | Understand control the speed of DC motor(L2) |
| **CO3** | achieve three phase to two phase transformation(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 3 | 2 | - | - | - | - | - | 3 | 2 | - | 2 | 3 | 2 |  |
| **CO2** | 3 | 3 | 2 | - | - | - | - | - | 3 | 2 | - | 2 | 3 | 2 |  |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | 3 | 2 | - | 2 | 3 | 2 |  |
|  |
| **C228** | **ELECTRONIC DEVICES AND CIRCUITS LAB**  | **CO1** |  | Analyse the V-I characteristics and to determine the relevant parameters from the obtained graphs. (L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | - | 1 | - | 2 | - | - | - | - | - | - | - | 2 | 2 |  |
|  |
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|  **C311** | **POWER SYSTEMS–II** | **CO1** | Understand parameters of various types of transmission lines during different operating conditions. (L2) |
| **CO2** | Understand the performance of short and medium transmission lines(L2) |
| **CO3** | Understand the performance and modeling of long transmission lines(L2) |
| **CO4** | Understand travelling waves on transmission lines.(L2) |
| **CO5** | Understand various factors related to charged transmission lines.(L2) |
| **CO6** | Understand sag/tension of transmission lines and performance of line insulators.(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 1 | 1 | 1 | 1 | 2 | - | - | - | - | - | - | 1 | 2 |  |
| **CO2** | 2 | 3 | 1 | 2 | 2 |  | - | - | - | - | - | 1 | 2 | 2 |  |
| **CO3** | 2 | 2 | 2 | 2 |  | 2 | - | - | - | - | - | 1 | - | 2 |  |
| **CO4** | 2 | 3 | - | 1 | 1 |  | - | - | - | - | - | - | 1 | 2 |  |
| **CO5** | - | - | 1 | 1 | 1 | 2 | - | - | - | - | - | - | - | 2 |  |
| **CO6** | - | 2 | 2 | 1 | 1 | 2 | - | - | - | - | - | 2 | - | 2 |  |
|  |
| **C312** | **RENEWABLE ENERGY SOURCES**  | **CO1** | Analyze solar radiation data, extra-terrestrial radiation, and radiation on earth’s surface.(L4) |
| **CO2** | Design solar thermal collectors, solar thermal plants.(L3) |
| **CO3** | Design solar photo voltaic systems.(L3) |
| **CO4** | Develop maximum power point techniques in solar PV and wind energy systems(L4) |
| **CO5** | Understand the wind energy conversion systems, wind generators, power generation.(L2) |
| **CO6** | Understand the basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 2 |  |  |  |  |  |  |  |  | 1 |  |  | 2 |  |
| **CO2** | 3 | 3 | 2 | 1 | 1 | 1 |  |  |  |  |  |  | 2 | 2 |  |
| **CO3** | 3 |  | 2 | 2 | 2 | 2 |  |  |  |  | 3 |  | 2 | 2 |  |
| **CO4** | 3 | 3 | 1 | 1 | 1 | 1 |  |  |  |  | 2 |  | 1 | 2 |  |
| **CO5** | 1 |  |  |  |  |  | 3 | 1 | 1 | 2 |  | 2 | 2 | 2 |  |
| **CO6** | 1 |  |  |  |  |  | 3 | 1 | 1 | 2 |  | 2 | 2 | 2 |  |
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|  |
| **C313** | **SIGNALS & SYSTEMS**  | **CO1** | Understand the signals and systems and principles of vector spaces, Concept of orthgonality.(L2) |
| **CO2** | Analyze the continuous-time signals and continuous-time systems using Fourier series, Fourier transform and Laplace transform(L4) |
| **CO3** | Apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct back.(L3) |
| **CO4** | Understand the relationships among the various representations of LTI systems(L2) |
| **CO5** | Understand the Concepts of convolution, correlation, Energy and Power density spectrum and their relationships(L2) |
| **CO6** | Apply z-transform to analyze discrete-time signals and systems(L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** |  | 1 | - | - | - | - | 1 | - | - | - | 1 | 2 | 2 | 2 |  |
| **CO2** |  | 1 | - | - | - | - |  | - | - | - | - | 1 | 1 | 2 |  |
| **CO3** |  | 3 | - | - | - | - | 1 | - | - | - | 1 | 1 | 1 | 2 |  |
| **CO4** |  | 3 | - | 2 | - | - | 2 | - | - | - | 1 | 1 | 1 | 2 |  |
| **CO5** |  | 1 | - | - | - | - | 1 | - | - | - | 2 | 1 | 1 | 2 |  |
| **CO6** |  | 3 | - | - | - | - | 1 | - | - | - | 1 | 1 | 1 | 2 |  |
|  |
| **C314** | **PULSE AND DIGITAL CIRCUITS**  **LAB** | **CO1** | Understand the concept of wave shaping circuits, Switching Characteristics of diode and transistor.(L2) |
| **CO2** | Apply the fundamental concepts of wave shaping for various switching and signal generating circuits.(L3) |
| **CO3** | Design different multi vibrators and time base generators(L3) |
| **CO4** | Understand the functioning of different types of time-base Generators(L2) |
| **CO5** | Utilize the non-sinusoidal signals in many experimental research areas(L2) |
| **CO6** | Design linear and non-linear wave shaping circuits.(L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | 2 |  |
| **CO2** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | 2 |  |
| **CO3** | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 |  |
| **CO4** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | 2 |  |
| **CO5** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | 2 |  |
| **CO6** | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 |  |
|  |
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|  |
| **C315** | **POWER ELECTRONICS**  | **CO1** | Understand the characteristics of various power semiconductor devices and to design firing circuits for SCR.(L2) |
| **CO2** | Understand the operation of single phase full–wave converters and analyze harmonics in the input current.(L2) |
| **CO3** | Apply the operation of three phase full–wave converters.(L3) |
| **CO4** | Understand the operation of different types of DC-DC converters.(L2) |
| **CO5** | Understand the operation of inverters and application of PWM techniques for voltage control and harmonic mitigation(L2) |
| **CO6** | Analyze the operation of AC-AC regulators(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 2 | 1 | 1 | 1 | 2 | 1 | - | - | - | - | - | 1 | 2 |  |
| **CO2** | 2 | 3 | 2 | 2 | 2 |  | 1 | - | - | - | - | - | 1 | 2 |  |
| **CO3** | 2 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | 1 | 2 |  |
| **CO4** | 2 | 3 | - | 1 | 1 | - | 1 | - | - | - | - | - |  | 2 |  |
| **CO5** | 1 | 3 | 1 | 1 | 1 | 2 | - | - | - | - | - | - | 1 | 2 |  |
| **CO6** | 2 | 2 | 2 | 1 | 1 | 2 | - | - | - | - | - | - | 2 | 2 |  |
|  |
| **C316** | **ELECTRICAL MACHINES – II LAB**  | **CO1** | Assess the performance of single phase and three phase induction motors. (L1) |
| **CO2** | Understand the speed of three phase induction motor(L2) |
| **CO3** | Analyse the regulation of three–phase alternator by various methods(L4) |
| **CO4** | Understand the Xd/ Xq ratio of alternator and asses the performance of three–phase synchronous motor.(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 3 | 1 | - | - | - | - | - | 3 | - | - | 3 | 2 | 2 |  |
| **CO2** | 2 | 3 | 1 | - | 1 | - | - | - | 3 | - | - | 3 | 2 | 2 |  |
| **CO3** | 2 | 3 | 1 | - | - | - | - | - | 3 | - | - | 3 | 2 | 2 |  |
| **CO4** | 2 | 3 | 1 | - | - | - | - | - | 3 | - | - | 3 | 2 | 2 |  |
|  |
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|  |
| **C317** | **CONTROL SYSTEMS LAB**  | **CO1** | analyze the performance and working Magnetic amplifier, D.C and A.C. servo motors and synchronous motors. (L4) |
| **CO2** | Design P,PI,PD and PID controllers(L3) |
| **CO3** | Design lag, lead and lag–lead compensators(L3) |
| **CO4** | Analyse the temperature control using PID controller. (L4) |
| **CO5** | Understand the transfer function of D.C.motor. (L4) |
| **CO6** | Understand the position of D.C servo motor performance. (L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 2 | 2 | 3 | - | - | - | - | 2 | - | - | - | 3 | 2 |  |
| **CO2** | 2 | 2 | 2 | 3 | - | - | - | - | 2 | - | - | - | - | 2 |  |
| **CO3** | 2 | 2 | 2 | 3 | - | - | - | - | 2 | - | - | - | - | 2 |  |
| **CO4** | 2 | 2 | 2 | 3 | - | - | - | - | 2 | - | - | - | - | 2 |  |
| **CO5** | 2 | - | 2 | 3 | - | - | - | - | 2 | - | - | - | 3 | 2 |  |
| **CO6** | 2 | 2 | 2 | 3 | - | - | - | - | 2 | - | - | - | 3 | 2 |  |
|  |
| **C318** | **ELECTRICAL MEASUREMENTS LAB**  | **CO1** | Measure the electrical parameters voltage, current, power, energy and electrical characteristics of resistance, inductance and capacitance.(L2) |
| **CO2** | Able to test transformer oil for its effectiveness(L3) |
| **CO3** | Able to measure the parameters of inductive coil(L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | - | - | 3 | - | - | - | - | 1 | - | - | - | 2 | 2 |  |
| **CO2** | 1 | 1 | 1 | 3 | - | - | - | - | 1 | - | - | - | 2 | 2 |  |
| **CO3** | 1 | 1 | - | 3 | - | - | - | - | 1 | - | - | - | 2 | 2 |  |
|  |
| **C319** | **INTELLECTUAL PROPERTY RIGHTS AND PATENTS**  | **CO1** |  Understand the IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents. (L2) |
| **CO2** |  Understand an insight on Copyrights, Patents and Software patents which are instrumental for further advancements(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | - | - | - | - | - | - | - | 1 | - | - | - | 2 | 2 |  |
| **CO2** | 1 | 1 | 1 | - | - | - | - | - | 1 | - | - | - | 2 | 2 |  |
|  |
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| **3-2** |
| **C321** | **POWER ELECTRONIC CONTROLLERS & DRIVES**  | **CO1** | Understand the fundamentals of electric drive and different electric braking methods.(L2) |
| **CO2** | Analyze the operation of three phase converter-controlled dc motors and four quadrant operation of dc motors using dual converters.(L4) |
| **CO3** | Apply to discuss the converter control of dc motors in various quadrants(L3) |
| **CO4** | Understand the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.(L2) |
| **CO5** | Understand the principles of static rotor resistance control and various slip power recovery schemes.(L2) |
| **CO6** | Understand the speed control mechanism of synchronous motors(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
| **CO2** | 1 | 3 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
| **CO3** | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
| **CO4** | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
| **CO5** | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
| **CO6** | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |  |
|  |
| **C322** | **POWER SYSTEM ANALYSIS**  | **CO1** | Understand the impedance diagram for a power system network and to understand per unit quantities.(L2) |
| **CO2** | Understand to form a Y bus and Z bus for a power system networks(L2) |
| **CO3** | Understand the load flow solution of a power system using different methods.(L2) |
| **CO4** | Apply the fault currents for all types faults to provide data for the design of protective devices.(L3) |
| **CO5** | Understand the sequence components of currents for unbalanced power system network.(L2) |
| **CO6** | analyze the steady state, transient and dynamic stability concepts of a power system.(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 3 | 2 | 2 | - | - | 1 | - | - | - | - | - | 2 | 2 |  |
| **CO2** | 2 | 2 | 2 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 |  |
| **CO3** | 2 | 2 | 2 | 2 | - | - | 1 | - | - | - | - | - | 2 | 2 |  |
| **CO4** | 2 | 2 | 3 | 3 | - | - | 1 | - | - | - | - | - | 2 | 2 |  |
| **CO5** | 2 | 2 | 3 | 3 | - | - | 2 | - | - | - | - | - | 2 | 2 |  |
| **CO6** | 2 | 3 | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 |  |
|  |
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|  |
| **C323** | **MICROPROCESSORS AND MICROCONTROLLERS**  | **CO1** | Understand the organization and architecture of Micro Processor(L2) |
| **CO2** | Understand addressing modes to access memory(L2) |
| **CO3** | Understand 8051 micro controller architecture(L2) |
| **CO4** | Understand the programming principles for 8086 and 8051(L2) |
| **CO5** | Understand the interfacing of MP with IO as well as other devices(L2) |
| **CO6** | Understand how to develop cyber physical systems(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | - | 1 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO2** | - | 1 | - | 1 | 1 | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO3** | - | 1 | - | 1 | 2 | - | - | - | - | - | 1 | - | 2 | 2 |  |
| **CO4** | - | 1 | - | 1 | 1 | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO5** | - | 1 | - | 1 | - | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO6** | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | - | 2 | 2 |  |
|  |
|  **C324** | **DATA STRUCTURES THROUGH C++**  | **CO1** | Distinguish between procedures and object oriented programming.(L1) |
| **CO2** | Apply advanced data structure strategies for exploring complex data structures.(L3) |
| **CO3** | Compare and contrast various data structures and design techniques in the area of Performance.(L1) |
| **CO4** | Implement data structure algorithms through C++. • Incorporate data structures into the applications such as binary search trees, AVL and B Trees(L4) |
| **CO5** | Implement all data structures like stacks, queues, trees, lists (L4) |
| **CO6** | Implement graphs and compare their Performance and trade offs(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 3 | 2 | 2 | - | - | 1 | - | - | - | - | - | 2 | 2 |  |
| **CO2** | 2 | 2 | 2 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 |  |
| **CO3** | 2 | 2 | 2 | 2 | - | - | 1 | - | - | - | - | - | 2 | 2 |  |
| **CO4** | 2 | 2 | 3 | 3 | - | - | 1 | - | - | - | - | - | 2 | 2 |  |
| **CO5** | 2 | 2 | 3 | 3 | - | - | 2 | - | - | - | - | - | 2 | 2 |  |
| **CO6** | 2 | 3 | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 |  |
|  |
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|  **C325** | **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) |
| **CO6** | Calculate life cycle costing analysis and return on investment on energy efficient technologies.(L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | - | - | - | 1 | 2 | - | - | - | 1 | 1 | - | 2 |  |
| **CO2** | 2 | 2 | - | - | - | 1 | 1 | - | - | - | 1 | 1 | - | 2 |  |
| **CO3** | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 1 | 1 | 2 |  |
| **CO4** | 2 | 1 | - | - | 1 | 1 | 1 | - | - | - | 2 | 1 | - | 2 |  |
| **CO5** | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 |  |
| **CO6** | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | - | 2 |  |
|  |
| **C326** | **POWER ELECTRONICS LAB** | **CO1** | Understand the characteristics of various power electronic devices and analyze gate drive circuits of IGBT.(L2) |
| **CO2** | analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads.(L4) |
| **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.(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 1 | 1 | 3 | - | - | - | - | 1 | - | - | - | 2 | 2 |  |
| **CO2** | 1 | 1 | - | 3 | - | - | - | - | 1 | - | - | - | 2 | 2 |  |
| **CO3** | 1 | 1 | - | 3 | - | - | - | - | 1 | - | - | - | 2 | 2 |  |
| **CO4** | 1 | 1 | - | 3 | - | - | - | - | 1 | - | - | - | 2 | 2 |  |
|  |
| **C327** | **MPMC LAB** | **CO1** | Understand to write assembly language program using 8086 micro based on arithmetic, logical, and shift operations. (L2) |
| **CO2** | Able to interface 8086 with I/O and other devices.(L1) |
| **CO3** | Able to do parallel and serial communication using 8051 & PIC 18 micro controllers.(L1) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 2 | 2 | 2 | 3 | - | - | - | 1 | - | - | 1 | 2 | 2 |  |
| **CO2** | 1 | 2 | 2 | 3 | 3 | 2 | 2 | - | 2 | 2 | 2 | 2 | 2 | 2 |  |
| **CO3** | 1 | 2 | 2 | 2 | 3 | - | - | - | 1 | - | - | 1 | 2 | 2 |  |
|  |
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| **C328** | **DATASTRUCTURES THROUGH C LAB**  | **CO1** | Design and analyze the time and space efficiency of the data structure. (L3) |
| **CO2** | Identity the appropriate data structure for given problem(L2) |
| **CO3** | Practical knowledge on the application of data structures. (L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 3 | 1 | - | 3 | - | - | - | - | 3 | - | 3 | 2 | 1 |  |
| **CO2** | 3 | 3 | 1 | - | 3 | - | - | - | - | 3 | - | 3 | 2 | 2 |  |
| **CO3** | 3 | 3 | 1 | - | 3 | - | - | - | - | 3 | - | 3 | 2 | 1 |  |
|  |
| **C329** | **PROFESSIONAL ETHICSAND HUMAN** | **CO1** | Understanding of a variety issue that are encountered by every professional in discharging professional duties.(L2) |
| **CO2** |  Understand the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively. (L2) |
|  |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 1 | 1 | 1 | - | - | - | - | - | 1 | - | - | - | 2 | 2 | 1 |
| **CO2** | 1 | 1 | 1 | - | - | - | - | - | 1 | - | - | - | 2 | 2 | 1 |
| **4-1** |
| **C411****C411** | **UTILIZATION OF ELECTRICAL ENERGY**  | **CO1** | Classify electric drives and identify a suitable motor for electric drives and industrial applications.(L1) |
| **CO2** | Identify most appropriate heating or welding techniques for suitable applications.(L1) |
| **CO3** | Demonstrate the terms used in illumination, state and apply laws of Illumination.(L2) |
| **CO4** | Design different lighting systems, estimate and recommend illumination levels produced by various sources.(L3) |
| **CO5** | Determine the speed/time characteristics of different types of traction motors.(L2) |
| **CO6** | Estimate energy consumption levels at various modes of operation.(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 1 | 3 | 1 | - | 1 | 1 | - | - | - | - | - | 1 | 3 | 2 |  |
| **CO2** | 3 | 1 | 1 | - | 1 | 1 | - | - | - | - | - | 1 | 3 | 2 |  |
| **CO3** | 1 | 1 | 3 | - | 1 | 1 | - | - | - | - | - | 1 | - | 2 |  |
| **CO4** | 1 | 1 | 3 | - | 1 | 1 | - | - | - | - | - | 1 | - | 2 |  |
| **CO5** | 1 | 3 |  | - | 1 | 1 | - | - | - | - | - | 1 | 3 | 2 |  |
| **CO6** | 1 | 3 | 1 | - | 1 | 1 | - | - | - | - | - | 1 | 3 | 2 |  |
|  |
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|  |
| **C412** | **LINEAR IC APPLICATIONS**  | **CO1** | Analyze different differential Amplifier. (L4) |
| **CO2** | Measure different parameters of the operational amplifiers. (L2) |
| **CO3** | Demonstrate linear and non linear applications of Operational Amplifiers (L4) |
| **CO4** | Design various types of Active Filters(L3) |
| **CO5** | Construct circuits using IC-555 timer and PLL for different applications. (L2) |
| **CO6** | Illustrate the operation of various types of DACs, ADCs using operational amplifier. (L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | - | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |  |
| **CO2** | - | - | - | 2 | - | - | - | - | - | - | - | - | 2 | 2 |  |
| **CO3** | 1 | - | - | - | - | - | - | - | - | - | - | 3 | 1 | 2 |  |
| **CO4** | - | - | 2 | - | - | - | - | - | - | - | - | - | 3 | 2 |  |
| **CO5** | - | - | 3 | - | - | - | - | - | - | - | - | 3 | 1 | 2 |  |
| **CO6** | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | 2 |  |
|  |
| **C413** | **POWER SYSTEM OPERATION AND CONTROL** | **CO1** | Analyze the optimal scheduling of Generators with and without losses. (L4) |
| **CO2** | Discuss the hydrothermal scheduling. (L1) |
| **CO3** | Explain the unit commitment problem(L1) |
| **CO4** | Illustrate the Load frequency control problem. (L3) |
| **CO5** | Outline the importance of PI controllers in single area and two area systems(L1) |
| **CO6** | Describe the reactive power control and line power compensation(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 3 | 2 | - | - | 2 | 2 | - | - | - | - | 2 | - | 2 |  |
| **CO2** | 3 | 2 | 2 | - | - |  | 2 | - | - | - | - | 2 | - | 2 |  |
| **CO3** | 2 | 3 | - | - | - |  | 2 | - | - | - | - | 2 | - | 2 |  |
| **CO4** | 3 | 2 | 2 | - | - | 2 | 2 | - | - | - | - | 2 | - | 2 |  |
| **CO5** | 2 | 2 | 3 | - | - | 2 | - | - | - | - | - | 2 | - | 2 |  |
| **CO6** | 3 | 2 | 2 | - | - | 2 | - | - | - | - | - | 2 | - | 2 |  |
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| **C414** | **SWITCHGEAR AND PROTECTION** | **CO1** | Understand the principle of arc interruption for application to high voltage, different types of circuit breakers. (L2) |
| **CO2** | Demonstrate the working principle and operation of different types of electromagnetic protective relay(L4) |
| **CO3** | Illustrate the acquire knowledge of Fault and protective schemes for high power generator and transformer(L3) |
| **CO4** | Outline protective schemes used for feeders and bus bars(L1) |
| **CO5** | Interpret the different types of static relays and their applications (L3) |
| **CO6** | Relate different types of over voltage protection schemes for insulation coordination(L1) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO2** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO3** | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 3 | 2 |  |
| **CO4** | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO5** | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO6** | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | 2 | 2 |  |
|  |
| **C415** | **INSTRUMENTATION**  | **CO1** | Label various types of signals. (L1) |
| **CO2** | Make use of various types of transducers.(L3) |
| **CO3** | Examine and measure various parameters such as strain, velocity, temperature, pressure etc.( L4) |
| **CO4** | Explain working principle of various types of digital voltmeters. (L2) |
| **CO5** | Measure various parameters like phase and frequency of a signal with the help of CRO. (L3) |
| **CO6** | Discuss and handle various types of signal analyzers. (L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | 1 | 2 | 1 |  |
| **CO2** | 3 | 3 | 3 | 3 | 1 | 1 | - | - | - | - | - | 2 | 1 | 2 |  |
| **CO3** | 3 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | 1 | - | 1 |  |
| **CO4** | 2 | 2 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | 2 | 2 |  |
| **CO5** | 3 | 2 | 3 | 2 | - | 1 | - | - | - | - | - | - | 1 | 1 |  |
| **CO6** | 2 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | - | 1 | 2 | 3 |  |
|  |
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| **C416** | **SPECIAL ELECTRICAL MACHINES**  | **CO1** | Understand the theory of operation and control of switched reluctance motor.(L2) |
| **CO2** | Understand the performance and control of stepper motors, and their applications.(L2) |
| **CO3** | Analyse the operation and characteristics of permanent magnet dc motor.(L4) |
| **CO4** | Analyse the distinguish between brush dc motor and brush less dc motor**.(L4)** |
| **CO5** | Understand the theory of travelling magnetic field in liners motors(L2) |
| **CO6** | applications of linear motors(L1) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |  |
| **CO2** | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |  |
| **CO3** | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |  |
| **CO4** | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |  |
| **CO5** | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |  |
| **CO6** | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |  |
|  |
| **C417** | **ELECTRICAL SIMULATION LAB**  | **CO1** | Simulate Single phase AC voltage controller and single-phase full converter(L3) |
| **CO2** | Analyze the three phase circuits for balanced load and unbalanced load(L4) |
| **CO3** | Design the Integrator and Differentiator circuits(L3) |
| **CO4** | Examine the DC separately excited motor and 5th order system using transfer function approach(L5) |
| **CO5** | Analyse the buck converter full converter AC voltage controller and PWM inverter(L4) |
| **CO6** | Simulate the modelling of transformer and lossy transmission line(L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 2 | - | 3 | 2 | - | - | - | 2 | - | - | - | - | 2 |  |
| **CO2** | 2 | 2 | - | 3 | 2 | - | - | - | 2 | - | - | - | - | 2 |  |
| **CO3** | 2 | - | 2 | 3 | 2 | - | - | - | 2 | - | - | - | - | 2 |  |
| **CO4** | 2 | 2 | - | 3 | 2 | - | - | - | 2 | - | - | - | 2 | 2 |  |
| **CO5** | 2 | 2 | - | 3 | 2 | - | - | - | 2 | - | - | - | 2 | 2 |  |
| **CO6** | 2 | 2 | - | 3 | 2 | - | - | - | 2 | - | - | - | 2 | 2 |  |
|  |
| **C418** | **POWER SYSTEMS LAB**  | **CO1** | Understand the parameters of various power system components which are frequently occur in power system studies(L2) |
| **CO2** | Analyse energy management systems functions at load dispatch center.(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 2 | 2 | - | 3 | 2 | - | - | - | 2 | - | - | - | 2 | 2 |  |
| **CO2** | 2 | 2 | - | 3 | 2 | - | - | - | 2 | - | - | - | 2 | 2 |  |
|  |
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| **C421** | **DIGITAL CONTROL SYSTEMS**  | **CO1** | Understand the concepts of digital control systems and assemble various components associated with it. Advantages compared to the analog type.(L2) |
| **CO2** | Extend z–transformations and their role in the mathematical analysis of different systems (like Laplace transforms in analog systems). (L4) |
| **CO3** | model the discrete–time systems in state–space and evaluation of state transition matrix(L3) |
| **CO4** | Examine the stability of the system using different tests.(L4) |
| **CO5** | Examine the conventional method of digital control systems in the w–plane(L4) |
| **CO6** | Analyze the concept of design of state feedback control by the pole placement method(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 2 |  |
| **CO2** | 1 | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 |  |
| **CO3** | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 2 |  |
| **CO4** | 1 | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 |  |
| **CO5** | 1 | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 2 |  |
| **CO6** | 1 | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 2 |  |
|  |
| **C422** | **H.V.D.C. TRANSMISSION**  | **CO1** | Understand basic concepts of HVDC Transmission.(L2) |
| **CO2** | Analyse the converter configuration.(L4) |
| **CO3** | Understand the control of converter and HVDC Transmission.(L2) |
| **CO4** | Understand the significance of reactive power control and AC/Dc load flow.(L2) |
| **CO5** | Understand the different converter faults, protection and effect of harmonics.(L2) |
| **CO6** | Analyse the leave low pass and high pass filters.(L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 2 | - | - | - | 2 | - | - | - | - | - | 2 | - | 2 |  |
| **CO2** | 2 | - | 3 | - | - | 2 | - | - | - | - | - | 2 | - | 2 |  |
| **CO3** | 2 | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | - | 2 |  |
| **CO4** | 3 | 2 | 2 | - | - | 2 | - | - | - | - | - | 2 | - | 2 |  |
| **CO5** | 2 | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | - | 2 |  |
| **CO6** | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 2 | - | 2 |  |
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| **C423****ELECTRICAL DISTRIBUTION SYSTEMS**  | **ELECTRICAL DISTRIBUTION SYSTEMS**  | **CO1** | Outline the various factors of distribution system also understand them with few numerical examples. (L1) |
| **CO2** | Develop the various types of feeders and substations with their ratings and locations to build in distribution system. (L4) |
| **CO3** | Identify the voltage drop and power loss in distribution system. (L3) |
| **CO4** | Understand the protection scheme and its coordination in distribution system.(L2)  |
| **CO5** | Illustrate the effect of compensation techniques for pf improvement with few numerical examples. (L3) |
| **CO6** | Demonstrate the effect of voltage and current in distribution system performance and their control techniques with few numerical examples. (L4) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 2 | - | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO2** | 2 | - | 3 | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO3** | 2 | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO4** | 3 | 2 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO5** | 2 | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO6** | 2 | 3 | - | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
|  |
|  **C424** | **FLEXIBLE ALTERNATING CURRENT TRANSMISSION** | **CO1** | Understand the basics of power flow control in transmission lines using FACTS controllers(L2) |
| **CO2** | Understand the operation and control of voltage source converter(L2) |
| **CO3** | Understand compensation methods to improve stability and reduce power oscillations of a power system. (L2) |
| **CO4** | Apply the methods for shunt compensation using static VAR compensators(L4) |
| **CO5** | Apply the methods for compensation using series compensators. (L4) |
| **CO6** | Understand the operation of Unified Power Flow Controller (UPFC).(L2) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 2 | - | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO2** | 1 | - | 3 | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO3** | 3 | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO4** | 1 | 2 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO5** | 1 | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
| **CO6** | 1 | 3 | - | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |  |
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| **C425** | **PROJECT** | **CO1** | Identify the real-world power system(L1) |
| **CO2** | Analyze , design and implement solutions methodologies (L4) |
| **CO3** | Apply modern engineering tools for solving the problems (L3) |
| **CO4** | Write technical report following professional ethics (L3) |
|  |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |  |
| **CO1** | 3 | 2 | - | - | - | 2 | 3 | - | - | 3 | - | 2 | 3 | 2 |  |
| **CO2** | 1 | - | 3 | - | - | 2 | 2 | - | - | 3 | - | 2 | 2 | 2 |  |
| **CO3** | 3 | 3 | 2 | - | - | 2 | 3 | - | - | 2 | - | 2 | 3 | 2 |  |
| **CO4** | 1 | 2 | 2 | - | - | 2 | 3 | - | - | 3 | - | 2 | 3 | 2 |  |
|  |