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| **Course Code** | **11EE212 / 12EE212 / EE254** | **Duration** | **3hrs** |
| **Course Name** | **POWER ELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Power MOSFET is a \_\_\_\_\_\_\_\_\_controlled device. | | CO1 | R | 1 |
| 2. | \_\_\_\_\_\_ is a bidirectional controlled device which has the terminals MT1, MT2 and Gate. | | CO1 | R | 1 |
| 3. | The angle at which the SCR is turned off is called \_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 4. | The latching current is \_\_\_\_\_\_\_\_\_than the holding current. | | CO2 | U | 1 |
| 5. | Four quadrant chopper ﻿is a \_\_\_\_\_\_ type/class of chopper. | | CO2 | U | 1 |
| 6. | A VSI is one in which the DC source has \_\_\_\_\_\_\_\_\_ impedance. | | CO2 | U | 1 |
| 7. | State any one application of current source inverter. | | CO3 | R | 1 |
| 8. | Inverters circuit uses natural commutation operation. (True or False). | | CO3 | R | 1 |
| 9. | Isolation is usually provided between gating circuits and power circuits for \_\_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 10. | In HVDC transmission lines, one acts as a converter and other as an inverter. (True or False) | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Draw the characteristics of TRIAC and mark the various regions of operation. | | CO1 | R | 3 |
| 12. | Compare single phase full converter with semi converter. | | CO1 | U | 3 |
| 13. | Define current limit control. | | CO2 | R | 3 |
| 14. | Compare 180° and 120° modes of operations of three phase inverter. | | CO2 | An | 3 |
| 15. | Describe pulse width modulation. | | CO3 | U | 3 |
| 16. | Sketch a single-phase semi converter bridge with DC motor load. | | CO3 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Designate the static and switching characteristics of Thyristor with necessary diagrams and waveforms. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Draw and explain the operation of single-phase full converter bridge rectifier with RLE load with necessary waveforms. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Describe the operation of the single-phase ac to ac full wave voltage controller for a resistive (R) load with necessary circuits and waveforms. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Illustrate the working and operation of a Four quadrant chopper. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Describe the 180° mode operation of a three-phase bridge inverter with an appropriate circuit diagram, waveforms, and equations. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the basic structure, characteristics and working principle of a Power MOSFET with necessary diagrams. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Elucidate the operation of any one gating signal generation circuit for single-phase full wave-controlled rectifier with firing angle control with necessary diagram and waveforms. | CO3 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the various types of UPS with necessary diagrams. | CO3 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Usage of electronics and solid-state power devices for the control, conversion, and  protection of electrical energy |
| CO2 | Ability to design criteria (power, efficiency, ripple voltage and current, harmonic  distortions, power factor). |
| CO3 | Ability to components; interpret terminal characteristics of the components for designing  the circuitry for power converters. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 40 | - | - | - | - | **45** |
| CO2 | 3 | 15 | - | 15 | - | - | **33** |
| CO3 | 3 | 31 | - | 12 | - | - | **46** |
|  | | | | | | | **124** |



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| **Course Code** | **14EE2001 / 17EE2001** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRICAL CIRCUITS AND NETWORKS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | If a 4 Ω resistor and a 3 Ω resistor are connected in parallel across two terminals, determine the value of a single equivalent resistor which can replace the above. | | CO1 | | A | 1 |
| 2. | In the circuit given below, find the current through the 4 Ω resistor. | | CO1 | | A | 1 |
| 3. | Poles of a network function is the frequencies at which the function becomes \_\_\_\_\_. | | CO2 | | U | 1 |
| 4. | Draw the Thevinin’s equivalent circuit of the circuit shown in figure. | | CO1 | | A | 1 |
| 5. | A series RLC circuit with R=2 Ω, L=1 milli henry and C=3 micro Farad, resonates at \_\_\_\_\_\_ frequency. | | CO2 | | A | 1 |
| 6. | Express coefficient of coupling in terms of Mutual Inductance and Self Inductances. | | CO2 | | R | 1 |
| 7. | For a balanced, 3 phase, star connected power system, express Vph in terms of VL . | | CO1 | | R | 1 |
| 8. | Give an expression to find the time constant of an RC circuit. | | CO2 | | R | 1 |
| 9. | If W1 and W2 are the wattmeter readings of a three phase power measurement using two wattmeter scheme, the reactive power of the circuit can be expressed as \_\_\_\_\_\_\_\_, in terms of W1 and W2. | | CO1 | | U | 1 |
| 10. | Define the transfer impedance of a two port network. | | CO2 | | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Write the equations to convert a star network into an equivalent delta network. | | CO1 | U | | 3 |
| 12. | Identify the zeroes of the network function given | | CO2 | U | | 3 |
| 13. | State the Superposition theorem and illustrate it with the help of an example. | | CO1 | R | | 3 |
| 14. | An RLC series circuit is supplied with 50V AC supply. If R=5 ohm, L=2 henry and C=1 farad, determine the voltage across the resistor at resonance. | | CO2 | A | | 3 |
| 15. | Determine the time constant of an RL circuit with R=5 ohm and L=0.5 henry. | | CO2 | A | | 3 |
| 16. | Differentiate between constant K and M derived filters. | | CO3 | An | | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. |  | Find the currents through the various resistors in the circuit given below using Kirchoff’s laws. | CO1 | A | | 12 |
|  |  |  |  |  | |  |
| 18. |  | Use mesh analysis technique to find the current through the 4 ohm resistor in the circuit. | CO1 | A | | 12 |
|  |  |  |  |  | |  |
| 19. |  | Find the current through the 5 ohm resistor using Thevinin’s theorem. | CO1 | A | | 12 |
|  |  |  |  |  | |  |
| 20. | a. | A series RLC circuit with R = 10 Ω, L = 50 mH and C = 40 µF has an applied voltage of 100 V, determine the value of (i) resonant frequency (ii) current at resonance (iii) Q-factor and (iv) Bandwidth. | CO2 | An | | 8 |
|  | b. | For the three coupled coils in fig., calculate the total inductance. | CO1 | An | | 4 |
|  |  |  |  |  | |  |
| 21. |  | Find the current through each of the impedances in the 3 Phase circuit given below. (Impedances are given in ohms) | CO1 | An | | 12 |
|  |  |  |  |  | |  |
| 22. |  | Determine the current through the inductance if the switch is moved from position 1 to 2 at time t=0. | CO2 | An | | 12 |
|  |  |  |  |  | |  |
| 23. |  | Derive an equation to find the transient response of a series RLC circuit if it is excited by a Sinusoidal voltage source. | CO2 | U | | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Find the open circuit impedance parameters and short circuit admittance parameters of the network given below. | CO2 | An | | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Analyze electrical circuits by applying circuit laws and theorems. |
| CO2 | Investigate the time domain and frequency domain behavior of electrical circuits. |
| CO3 | Design filters and attenuators for simple applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 4 | 4 | 39 | 16 | - | - | 63 |
| CO2 | 2 | 17 | 7 | 32 | - | - | 58 |
| CO3 | - | - | - | 3 | - | - | 3 |
|  | | | | | | | **124** |



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| **Course Code** | **14EE2009/17EE2005** | **Duration :** | **3hrs** |
| **Course Name** | **ELECTRICAL MACHINE DESIGN** | **Max. Marks :** | **100** |

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| **Q. No.** | **Questions** | **CO/BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | Classify the Transformer according to construction. | CO1/ R | 1 |
| 2. | Define Field Form Factor. | CO1/ R | 1 |
| 3. | The range of specific electric loading is \_\_\_\_\_\_\_\_\_\_\_\_\_. | CO1/ R | 1 |
| 4. | What are the advantages of higher number of poles in the number of poles selection procedure in DC machine? | CO5/ R | 1 |
| 5. | Distinguish between Core and Shell Type Transformer. | CO5/ R | 1 |
| 6. | Write the expression for output equation of a single phase transformer | CO5/ R | 1 |
| 7. | For a best power factor of a three-phase induction machine, τ is \_\_\_\_\_\_\_\_\_\_\_. | CO2/ R | 1 |
| 8. | Write the formula for length of mean turn of stator of induction motor. | CO3/ R | 1 |
| 9. | Write the range of Short circuit ratio of turbo alternators. | CO4/ R | 1 |
| 10. | What are the various losses in synchronous machine? | CO6/ R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Define specific electric loading. | CO1/ R | 3 |
| 12. | Mention the guiding factors for the selection of number of poles. | CO2/ R | 3 |
| 13. | Describe the necessity of cooling tubes in the transformer. | CO5/ R | 3 |
| 14. | List down the factors to be considered for estimating the length of air gap in Induction motor. | CO4/ U | 3 |
| 15. | Explain the phenomenon of cogging. | CO3/ R | 3 |
| 16. | Define dispersion coefficient. | CO4/ R | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is Compulsory)** | | | | |
| 17. |  | Discuss how the specific electric and magnetic loadings will be chosen for rotating machine. | CO1 / U | 12 |
|  |  |  |  |  |
| 18. |  | Write down the design procedures for the commutator of dc machine. | CO2 / U | 12 |
|  |  |  |  |  |
| 19. |  | Discuss the design of field system of a DC motor. | CO3 / A | 12 |
|  |  |  |  |  |
| 20. |  | Explain the design procedure for the squirrel caged induction motor. | CO 4/ U | 12 |
|  |  |  |  |  |
| 21. |  | Derive the output equation of single phase Transformer and three-phase transformer. | CO5 / U | 12 |
|  |  |  |  |  |
| 22. |  | The tank of 1250 KVA, natural oil cooled transformer has the dimensions of length, width and height as 1.55 X 0.65 X 1.85 m respectively. The full load loss = 13.1KW, loss dissipation due to radiations = 6 W/m2-0C, loss dissipation due to convection = 6.5 W/m2-0C, Improvement in convection due to provision to tubes = 40%, Temperature rise = 400C, Length of each tube =1m, diameter of tube = 50 mm. Find the number of tubes for this transformer. Neglect the top and bottom surface of the tank as regards the cooling. | CO4 / A | 12 |
|  |  |  |  |  |
| 23. |  | A1000 kVA, 3300V, 50Hz, 300rpm, 3phase alternator has 180 slots with 5 conductors per slot. Single layer winding with full pitch coil is used. The winding is star connected with one circuit per phase. Determine the specific electric and specific magnetic loadings, if the stator core is 2.0m and the core length is 0.4m. Using the same loadings, determine the corresponding data for a 1250 kVA, 330V, 50 Hz, 250 rpm, 3 phase star connected alternator having 2 circuits per phase. The machines have 60◦ phase spread. | CO5 / A | 12 |
|  |  | **COMPULSORY QUESTION** | | |
| 24. |  | Derive the output equation of an AC machines | CO6/ U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the importance of magnetic and electric loadings. |
| CO2 | Explain the design of main dimensions of DC and AC rotating machines. |
| CO3 | Calculate the system parameters for proper design of field coils and armature coils and DC and AC rotating machines. |
| CO4 | Select a proper winding design of armature coils and deduce the values of armature design parameters of DC and AC rotating machines. |
| CO5 | Design a transformer and its cooling systems. |
| CO6 | Predetermine the performances of the DC, AC rotating machines and transformers from the design data. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 6 | 12 |  |  | - | - | 18 |
| CO2 | 4 | 12 |  |  |  |  | 16 |
| CO3 | 4 |  | 12 |  | - | - | 16 |
| CO4 | 4 | 12 | 12 |  |  |  | 28 |
| CO5 | 9 | 12 | 12 |  | - | - | 33 |
| CO6 | 1 | 12 |  |  | - | - | 13 |
|  | | | | | | | **124** |



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| **Course Code** | **14EE2010 / 17EE2006 / 18EE2010** | **Duration** | **3hrs** |
| **Course Name** | **POWER ELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Power Semiconductor device \_\_\_\_\_\_\_ combines the advantages of BJT and MOSFET. | | CO1 | R | 1 |
| 2. | Name the terminals of GTO. | | CO1 | R | 1 |
| 3. | Mention any one type of commutation used in power converters. | | CO2 | U | 1 |
| 4. | When do you need freewheeling diode? | | CO2 | U | 1 |
| 5. | Another name of the variable frequency system is \_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | For a *f*/4 step down cycloconverter, if the supply frequency is 50Hz, then the frequency of the output voltage is\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO3 | U | 1 |
| 7. | Power MOSFET’s are preferred for D.C. Choppers because \_\_\_\_\_. | | CO4 | U | 1 |
| 8. | In a step-down chopper, if Vs = 200 V and the chopper is operated at a duty cycle of 65 %. Find the output voltage. | | CO4 | U | 1 |
| 9. | In \_\_\_\_\_\_\_\_\_\_\_\_\_\_pulse width modulation method, sinusoidal wave is compared with a triangular type of wave. | | CO5 | R | 1 |
| 10. | Forced commutation method used in inverters. [True or False] | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare Power MOSFET and Power BJT. | | CO1 | An | 3 |
| 12. | List the significance of free-wheeling diode. | | CO2 | U | 3 |
| 13. | Brief out the control strategies of AC Voltage controllers? | | CO3 | U | 3 |
| 14. | A type – A chopper has Vdc = 200 V, R = 10 Ohms. If the duty cycle is 0.4, calculate average voltage Vavg and rms voltage Vrms | | CO4 | An | 3 |
| 15. | Define Modulation index. | | CO5 | U | 3 |
| 16. | List out the types of HVDC links. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | With neat diagrams describe the switching characteristics of IGBT. | CO1 | U | 4 |
| b. | Elucidate the reverse recovery characteristics of a Power Diode with neat diagram. | CO1 | U | 8 |
|  |  |  |  |  |  |
| 18. |  | Draw and explain the operation of single-semi controlled bridge converter with RLE load with necessary waveforms. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Designate the operation of the single-phase ac to ac full wave voltage controller for a resistive (R) load with necessary circuits and waveforms. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | With relevant circuit diagram and waveforms explain the operation of the step-down chopper with R load and derive the expression for the average value of the load voltage, and load currents. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Describe the 120° mode operation of a three-phase bridge inverter with an appropriate circuit diagram, waveforms, and equations. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Determine the working and operation of a Four quadrant chopper. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the static and switching characteristics of Thyristor with necessary diagrams and waveforms. | CO1 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss the working of HVDC systems with relevant circuit diagram. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the switching characteristics of power devices and select a suitable power device for power conversion. |
| CO2 | Design a power converter with criteria (power, efficiency, ripple voltage and current, harmonic distortions, power factor). |
| CO3 | Implement and verify the performance characteristics of power converters. |
| CO4 | Interpret terminal characteristics of the components for designing the circuitry for power converters. |
| CO5 | Estimate the required converters for renewable based applications. |
| CO6 | Assess the quality of power by analyzing the factors such as harmonics, ripples, etc., |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 24 | - | 3 | - | - | **29** |
| CO2 | - | 17 | - | - | - | - | **17** |
| CO3 | 1 | 4 | - | 12 | - | - | **17** |
| CO4 | - | 26 | - | 3 | - | - | **29** |
| CO5 | 1 | 16 | - | - | - | - | **17** |
| CO6 | - | 15 | - | - | - | - | **15** |
|  | | | | | | | **124** |



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| **Course Code** | **14EE2014/17EE2008** | **Duration** | **3hrs** |
| **Course Name** | **POWER SYSTEM ANALYSIS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Given: Base voltage = 22,000V and Base power = 5 MVA. What is the value of base impedance? | | CO1 | U | 1 |
| 2. | 1+a+a 2 +a 3 = \_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | Number of tree in a branch is \_\_\_\_\_\_\_\_ number of node in the network. | | CO2 | R | 1 |
| 4. | In type 3 modification of Z-bus building algorithm, off diagonal elements are always----------- | | CO2 | U | 1 |
| 5. | One of the \_\_\_\_\_\_\_\_\_ bus is considered as slack bus in the power flow analysis. | | CO3 | U | 1 |
| 6. | On Generator bus \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_ are specified. | | CO3 | U | 1 |
| 7. | If the fuel cost of the power generating unit F=0.06P2+40P+120, the incremental fuel cost at 40 MW is given by \_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | A network containing 50 buses in which 10 are the voltage control buses, 6 are the generator buses. Find the size of the Jacobian matrix. | | CO4 | U | 1 |
| 9. | Economic distribution of loads between plants also known as \_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | Transient Limit is always\_\_\_\_\_\_\_\_\_\_than the steady state limit. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Prove that neutral current can flow only if zero –sequence current is present. | | CO1 | U | 3 |
| 12. | Ybus of a power system is sparse. Infer the reason by considering a real power system. | | CO2 | U | 3 |
| 13. | Mention the different unsymmetrical fault types are present in a power system? | | CO3 | U | 3 |
| 14. | Why is NR load flow preferred to Gauss-Seidal load flow in the power industry? | | CO4 | U | 3 |
| 15. | Give the elementary idea of optimal load scheduling of Hydro - Thermal plants. | | CO5 | U | 3 |
| 16. | Find the steady state power transfer limit of a system consisting of  generator equivalent reactance 0.4 p.u. connected to an infinite bus through a series reactance of 1.2 p.u. The terminal voltage of the generator is held at 1.20 p.u. and the voltage of infinite bus is 1 p.u. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the modeling of synchronous generator, transformer, transmission line and static and dynamic loads of the power system. | CO1 | U | 8 |
|  | b. | Mention the applications of impedance diagram and reactance diagram. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. |  | Construct the ZBus for the sample system shown in the figure using Zbus building algorithm. If a new transmission line is installed between bus 2 and bus 3, how will you modify Zbus.  . | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Starting from basic conditions for a single line to ground fault with fault impedance Zf, obtain the expression for fault current. Show the connection of sequence network for this fault. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Describe the Newton-Raphson load flow method with necessary mathematical equations and flow-chart. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | A power plant has three units with the following fuel cost equations:  Maximum and minimum loading on each unit is 150 MW and 40 MW, the demand is 275MW. Find the optimal scheduling. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Consider the 50 Hz power system the single-line diagram of which is shown in Fig.The system contains three generators, three transformers and three transmission lines. The system ratings are   |  |  | | --- | --- | | Generator  G1 | 200 MVA, 20 kV, *Xd*= 15% | | Generator  G2 | 300 MVA, 18 kV, *Xd*= 20% | | Generator  G3 | 300 MVA, 20 kV, *Xd*= 20% | | Transformer T 1 | 300 MVA, 220Y/22 kV, *Xd*= 10% | | Transformer T 2 | Three single-phase units each rated 100 MVA, 130Y/25 kV, *X*= 10% | | Transformer T 3 | 300 MVA, 220/22 kV, *X*= 10% |   The transmission line reactances are as indicated in the figure. Draw the reactance diagram choosing the Generator 3 as the base.http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/power-system/chapter_1/images/image320.jpg | CO1 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | The bus impedance matrix of a system is given by  Generators are connected to buses 1 and 3 and their sub transient reactances were included when finding bus impedance matrix. Find the fault current for a 3-phase fault in bus-3. Also calculate the voltages in all the buses. | CO3 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze the transient stability of a power system by second-order Runge-Kutta method. Use proper flow-chart. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate the power system components using single line diagram. |
| CO2 | Analyze the impact of a short-circuit on the power system network. |
| CO3 | Select the circuit breakers and protective devices. |
| CO4 | Perform load flow and stability analysis. |
| CO5 | Optimize the operation of power plants. |
| CO6 | Design of VAR compensator. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 | - | 12 | - | - | 29 |
| CO2 | 1 | 4 | 12 | 12 | - | - | 29 |
| CO3 | - | 17 | - | - | - | - | 17 |
| CO4 | 1 | 16 | - | - | - | - | 17 |
| CO5 | - | 4 | - | 12 | - | - | 16 |
| CO6 | 1 | 3 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EE2032 / 14EE2024** | **Duration** | **3hrs** |
| **Course Name** | **BASICS OF ELECTRIC AND HYBRID VEHICLE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | |
| 1. | \_\_\_\_\_\_\_ materials offer better thermal insulation than metallic ones, with corresponding lower heat transfer. | CO1 | R | 1 |
| 2. | The ratio of fuel consumption per unit time (in kg/hr) to power produced by engine (in kwh) is called \_\_\_\_\_\_. | CO1 | E | 1 |
| 3. | In the year \_\_\_\_ Porsche showed his first hybrid car at the Paris exposition. | CO2 | R | 1 |
| 4. | Carbon Dioxide (CO2) is a chief greenhouse gas – **True or False**. | CO2 | An | 1 |
| 5. | For DC Chopper operation the power electronics device \_\_\_\_\_\_\_\_ is preferred due to its high switching frequency and low power. | CO3 | U | 1 |
| 6. | In a BLDC Motor, the hall sensor is place after every \_\_\_\_ degree. | CO3 | An | 1 |
| 7. | In a hybrid drive train, steady (average) power has a \_\_\_\_\_\_ value. | CO4 | A | 1 |
| 8. | A hybrid vehicle drivetrain usually consists of no more than \_\_\_\_ power trains. | CO4 | U | 1 |
| 9. | Supercapacitors are also known as Electric Double Layer Capacitor (EDLC) – **True or False**. | CO5 | R | 1 |
| 10. | A fuel cell is an electrochemical cell that converts \_\_\_\_\_\_\_ energy of a fuel and a oxidizing agent through a pair of redox reactions. | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | Sketch the transmission of an automobile power train. | CO1 | U | 3 |
| 12. | List out any 3 modern electric vehicle’s model / make. | CO2 | R | 3 |
| 13. | A DC chopper operates from a 24V battery source in to a resistive load of 12 Ohms. The duty ratio is 0.4. Calculate the average output voltage during step-down and step-up mode. | CO3 | E | 3 |
| 14. | Sketch the load power waveforms of a vehicle that varies randomly in real operation of hybrid configuration. | CO4 | U | 3 |
| 15. | Find the total amount of energy stored flywheel, when the moment of inertia is 5 kg/m2 and rotational speed is 10 r/s. If the speed is reduced to 6 r/s, obtain the change in kinetic energy storage. | CO5 | E | 3 |
| 16. | Define energy management system (EMS). | CO6 | U | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. |  | Describe the total tractive effort analysis in a vehicle with necessary diagrams and equations. | CO1 | A | 12 |
| 18. | a. | Describe the historical development of Hybrid Vehicles. | CO2 | U | 8 |
| b. | Discuss the social and environmental importance of hybrid and electric vehicles. | CO2 | U | 4 |
| 19. | a. | With neat diagrams and waveforms describe the 180-degree mode of operation in a VSI fed Induction motor drive. | CO3 | An | 8 |
| b. | Compare PMSM with BLDC Motor. | CO3 | U | 4 |
| 20. |  | With necessary equations and diagrams explain the power flow control in the series hybrid configuration of hybrid vehicle. | CO4 | An | 12 |
| 21. | a. | Illustrate the working of flywheel with necessary diagrams. | CO5 | U | 8 |
| b. | Compare Batteries and Supercapacitors. | CO5 | U | 4 |
| 22. | a. | Compare electric and hybrid vehicles. | CO2 | U | 6 |
| b. | List out the advantages & disadvantages of Li-Ion and Li-Pol batteries. | CO2 | U | 6 |
| 23. | a. | Analyze the major factors that decides the choice of electric propulsion system. | CO5 | An | 7 |
| b. | Sketch the functional block diagram of a typical electric propulsion system. | CO5 | U | 5 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the energy management system of hybrid electric vehicle with neat diagram. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the functioning of the propulsion system in vehicles |
| CO2 | Apply the knowledge for selecting suitable combinations of EHV propulsion system |
| CO3 | Analyze the effect on the characteristic behaviours of EHV |
| CO4 | Evaluate the performance of the propulsion system for a given scenario |
| CO5 | Design an Electric Hybrid Propulsion system for a specific application |
| CO6 | Develop an Energy Management system for Electric Vehicles. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 3 | 12 | - | 1 | - | **17** |
| CO2 | 4 | 24 | - | 1 | - | - | **29** |
| CO3 | - | 5 | - | 9 | 3 | - | **17** |
| CO4 | - | 4 | 1 | 12 | - | - | **17** |
| CO5 | 1 | 17 | - | 7 | 3 | - | **28** |
| CO6 | - | 16 | - | - | - | - | **16** |
|  | | | | | | | **124** |



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| **Course Code** | **14EE3034** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRIC VEHICLE BATTERY TECHNOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Analyze the condition under which a pure Electric Vehicle can be chosen as a better option compared to hybrid vehicles considering the impact on climate change. | CO1 | An | 10 |
|  | b. | Discuss the concept of vehicle power source characterization. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Generalize the energy efficiency and performance of electric vehicles. | CO1 | C | 20 |
|  |  |  |  |  |  |
| 3. | a. | Explain the dynamic equation of vehicle motion. | CO1 | U | 8 |
|  | b. | Categorize the different power flow control modes of a typical parallel hybrid system with the help of block diagrams. | CO1 | An | 12 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Appraise the purpose of battery modelling with suitable examples. | CO2 | An | 10 |
|  | b. | Trace the typical torque Vs speed envelope curves of drive train motors and show the continuous, intermittent and peak overload ratings. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. |  | Analyze the available methods of determining state of charge in electric vehicles. | CO2 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain fuel cell and flywheel as energy source elements in electric and hybrid electric vehicle. | CO2 | U | 10 |
|  | b. | Review the various methods used to predict the battery life. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 7. |  | Explain in detail the types of cell balancing and estimation of cell core temperature. | CO2 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | A 12V battery pack is connected to series RL load with L=100mH. The battery pack has rated capacity of 120Ah. At t=0 switch is closed and the battery begins to discharge. Calculate and plot battery discharge current i(t), if the steady state discharge is C/5.Neglect voltage drop. Calculate and plot SoC, assuming that t=0, the battery is charged to rated capacity. Calculate the time according to 70% DoD, assume t>>100ms. | CO3 | A | 12 |
|  | b. | Compare the different modes of battery charging. | CO3 | An | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Evaluate different energy management system and issues of energy management strategies of EHV. | CO3 | E | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Categorize various types of batteries for EV and analyze their performance. |
| CO2 | Model a battery based on the parameters of the battery and implement cell balancing. |
| CO3 | Know the functions of energy management system and deploying it in an EV. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 18 | - | 22 | - | 20 | 60 |
| CO2 | - | 50 | - | 30 | - | - | 80 |
| CO3 | - | - | 10 | 10 | 20 | - | 40 |
| CO4 | - | - | - | - | - | - | - |
| CO5 | - | - | - | - | - | - | - |
| CO6 | - | - | - | - | - | - | - |
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| **Course Code** | **17EE3026** | **Duration** | **3hrs** |
| **Course Name** | **EV ENERGY SOURCES AND ENERGY RECOVERY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain in detail the conversion and power systems from the perspective of HEV propulsion systems. | CO1 | U | 12 |
|  | b. | Comment on the Hybrid Power sources over the standalone type of power sources. | CO1 | An | 8 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss about the various schemes for energy management in an EV. | CO4 | U | 12 |
|  | b. | Sketch the various equivalent circuit models of battery. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | Discuss about battery aggregation method. | CO2 | U | 10 |
|  | b. | Analyze the performance of Nickel and Lithium based batteries. | CO2 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Elaborate about fuel cell system performance and its characteristics. | CO3 | U | 12 |
|  | b. | List out and compare the different types of the fuel cell with schematic diagram. | CO6 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | Explain proton exchange membrane fuel cell technologies with relevant diagrams. | CO6 | U | 15 |
|  | b. | Infer from the polarization curve of fuel cell. | CO5 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Show various elements of a PHEV and suggest a suitable model which can support regeneration mode of operation. | CO1 | An | 10 |
|  | b. | Discuss on series and parallel Hybrid Vehicle. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 7. | a. | Describe about energy consumption in braking. | CO4 | U | 12 |
|  | b. | Discuss on optimal fuel and optimal energy recovery. | CO3 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Calculate the Run-time Characterization of NiMH traction battery from the following Specification and comment on the performance   |  |  |  | | --- | --- | --- | |  |  |  |   i. What is the energy rating of battery in kWh?  ii. What will be time duration for fully charged battery at a maximum discharge rate of 100A and only 40% can be discharged?  iii. How long does it take to charge the battery to 80% SOC at a maximum charge rate of 90A and current SOC of 40%?  iv. What is the efficiency at maximum charge rate, if the battery internal resistance is 0.15Ω?  v. What is the efficiency at a maximum discharge rate, if the battery internal resistance is 0.1Ω?  vi. How much is the voltage drop by internal resistance at the maximum charge/discharge rate?  viii. How many days does it take to self-discharge the battery from 80% to 40% SOC, if the leakage current is 20mA? | CO2 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Discuss the multi-configuration of hybrid fuel cell energy storage systems with relevant diagrams. | CO3 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the usage of various storage devices used in electric vehicles. |
| CO2 | Interpret their characteristics and performance. |
| CO3 | Select a suitable storage device based on load requirement. |
| CO4 | Develop schemes for recovering energy in electric vehicle. |
| CO5 | Comprehend the functions of energy management system. |
| CO6 | Develop schemes for energy management in an EV. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 22 |  | 18 |  |  | 40 |
| CO2 |  | 10 | 8 | 30 |  |  | 48 |
| CO3 |  | 40 |  |  |  |  | 40 |
| CO4 |  | 24 |  |  |  |  | 24 |
| CO5 |  | 5 |  |  |  |  | 5 |
| CO6 |  | 15 | 8 |  |  |  | 23 |
|  | | | | | | | **180** |



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| **Course Code** | **18EE2001** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRICAL CIRCUIT ANALYSIS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Write the expression for the number of mesh currents for the network with B branches and N nodes. | | CO1 | U | | 1 |
| 2. | Determine the current labeled I in the circuit given using Kirchhoff’s Current Law | | CO1 | An | | 1 |
| 3. | Super position theorem is applicable for Non-Linear networks. Say True or False | | CO2 | R | | 1 |
| 4. | A practical circuit is drawn as Thevenin’s equivalent circuit. The value of Thevenin’s equivalent resistance is 5Ω. Obtain the value of Load resistance for maximum power transfer between source to load. | | CO2 | U | | 1 |
| 5. | A series RLC circuit is behaves like an un-damped and oscillatory. Obtain the value of R in a series RLC circuit. | | CO3 | U | | 1 |
| 6. | A series RLC circuit is connected with the dc supply. Write the condition for under damped condition. | | CO3 | R | | 1 |
| 7. | The Laplace transform of impulse signal is \_\_\_\_\_\_\_\_\_\_ | | CO4 | U | | 1 |
| 8. | Define convolution integral. | | CO4 | R | | 1 |
| 9. | Write down the condiction for symmetrical netwoork interns of Y parameters. | | CO5 | U | | 1 |
| 10. | Mention any one application of ABCD parameters. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Determine *v*d in the circuit given. | | CO1 | | An | 3 |
| 12. | Define and explain Norton’s Theorem | | CO2 | | U | 3 |
| 13. | If R=10Ω, L=5H, C=2 mF, find damping factor, un-damped natural frequency, damped natural frequency. Also find the type of natural frequency? | | CO3 | | An | 3 |
| 14. | Find the amplitude, phase, period and frequency of the sinusoidal signal *v(t)=*300 sin (314t+600) | | CO4 | | A | 3 |
| 15. | Find the initial value and final value of the Laplace transformed function V(s)= | | CO5 | | An | 3 |
| 16. | Given Z parameters as [z]=. Determine ABCD parameters. | | CO6 | | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. |  | Use mesh current method to find   1. Power delivered by the 80V source to the circuit shown 2. Power dissipated in the 8Ω Resistance | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 18. | a. | In the figure shown, Find the value of the current I using superposition theorem. | CO2 | | An | 6 |
|  | b. | For the circuit shown in the figure, Obtain the Thevenin equivalent circuit and find the voltage across 2Ω Resistance. | CO2 | | An | 6 |
|  |  |  |  | |  |  |
| 19. |  | The switch in circuit shown was in position1 for a long time to establish a steady state. It is moved from position 1 to position 2 at time t = 0. Obtain the expression foe the voltage across the capacitor at both positions of the switch. | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 20. |  | In a series RLC circuit, R=5Ω, L=1H, C=1F, a DC source of 20V is applied at t > 0. Find the expression for the current | CO3 | | A | 12 |
|  |  |  |  | |  |  |
| 21. | a. | Obtain the average value, rms value, form factor, crest factor of a sine wave. | CO4 | | A | 6 |
|  | b. | A series RLC circuit containing a resistance of 12Ω, an inductance of 0.15H and a capacitor of 100uF are connected in series across a 100V, 50Hz supply. Calculate the total circuit impedance, current, power factor and draw the voltage phasor diagram. | CO4 | | A | 6 |
|  |  |  |  | |  |  |
| 22. | a. | Obtain the frequency response (both magnitude and phase response) of RC series circuit. Assume R=5Ω and C=0.5F. | CO5 | | An | 7 |
|  | b. | Obtain the expression for the impedance, current flowing through the circuit, power factor, real power, reactive power, apparent power, voltage across the resistance and inductance of RL series circuit supplied with ac sinusoidal supply. | CO5 | | An | 5 |
|  |  |  |  | |  |  |
| 23. |  | Find the Nodal Voltages? Also find the current flowing through various resistances? | CO1 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Determine the impedance parameters of the network given in figure. | CO6 | | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Name the various circuit elements, explain the behavior of circuit elements and circuits and analyze the circuits using KVL, KCL, Mesh analysis and Nodal analysis techniques. |
| CO2 | State various network theorems explain it and use it for solving the problems of electric circuits and networks |
| CO3 | Relate first order and second order differential equations to electric circuits and networks, explain it, solve it for obtaining the transient responses of RL, RC and RLC networks and categorize RLC Networks. |
| CO4 | Describe fundamental concepts used in single phase and three phase AC circuits and coupled circuits, explain these concepts, and solve problems pertaining to these circuits |
| CO5 | Explain the Laplace transform technique, transformed networks and resonance in electric circuits use the Laplace transform technique for transforming a network to S domain and analyzing it, and examine the behavior of resonant circuits and assess the performance of tuned coupled circuits |
| CO6 | Calculate the network parameters, explain the network parameters and identify (analyze) the network parameters for a two-port network and construct interconnected networks. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 1 | 24 | 4 |  |  | 29 |
| CO2 | 1 | 4 |  | 12 |  |  | 17 |
| CO3 | 1 | 1 | 12 | 15 |  |  | 29 |
| CO4 | 1 | 1 | 15 |  |  |  | 17 |
| CO5 |  | 1 |  | 15 |  |  | 16 |
| CO6 |  | 1 | 3 | 12 |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18EE2002** | **Duration** | **3hrs** |
| **Course Name** | **NETWORK THEORY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Calculate the value of current *i* by applying KCL.  question | | CO1 | A | 1 |
| 2. | Predict the number of mesh equations that can be formed for the circuit shown.  network-theory-questions-answers-mesh-analysis-q3 | | CO1 | U | 1 |
| 3. | Identify the condition for maximum power transfer from a source to the load. | | CO2 | U | 1 |
| 4. | “The response in a linear circuit having more than one independent source can be obtained by adding the responses caused by the sources each acting one at a time”. Recall the above statement and tell the network theorem. | | CO2 | R | 1 |
| 5. | State the relation between line voltage and phase voltage in a 3 phase star connected system. | | CO3 | R | 1 |
| 6. | A balanced mesh load of 10∠30⁰ is connected across a 440V, 3 – Ø balanced supply. Calculate the power factor. | | CO3 | A | 1 |
| 7. | Identify the Transform impedance of the Inductor. | | CO5 | R | 1 |
| 8. | State the Laplace transform of . | | CO4 | R | 1 |
| 9. | What is the scale factor for the network functions? | | CO6 | R | 1 |
| 10. | Choose a filter that passes frequencies between two designated cut-off frequencies and attenuates all other frequencies | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | A connection is made consisting of resistance ‘A’ in series with a parallel combination of resistances ‘B’ and ‘C’. Three resistors of value 10 Ω, 5 Ω, 2 Ω are provided. Consider all possible permutations of the given resistors into the positions A, B, C, and identify the configurations with maximum possible overall resistance, and also the ones with minimum possible overall resistance. Calculate the ratio of maximum to minimum values of the resistances. | | CO1 | A | 3 |
| 12. | Estimate the Thevenin’s equivalent resistance across the terminal AB for the following circuit.  basic-electrical-engineering-questions-answers-thevenins-theorem-q1 | | CO2 | E | 3 |
| 13. | A three phase balanced delta connected load of (2+j4)Ω is connected across 400V, 3-phase balanced supply. Determine the phase currents. | | CO3 | A | 3 |
| 14. | Recall the three properties of Laplace Transform. | | CO4 | R | 3 |
| 15. | Identify the poles and zeros for the network function | | CO5 | U | 3 |
| 16. | Solve the given network to find the driving point impedance.  network-theory-questions-answers-network-function-one-port-q4 | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Determine the mesh currents in the circuit using mesh analysis. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Determine the equivalent resistance across AB of the circuit. | CO1 | A | 8 |
|  | b. | Given Ra=10 ohm, Rb=5 ohm, Rc=20 ohm. Compute the delta connection resistance Rab, Rbc, Rac. | CO1 | A | 4 |
|  |  | Construct the dual network of the following circuit |  |  |  |
| 19. | a. | Calculate the phase currents, line currents, power drawn by the load and power factor for the following: A three phase balanced delta connected load of (2+j3) Ω is connected across a 400V, 3Ø balanced supply. Assume the phase sequence to be RYB. | CO3 | An | 10 |
|  | b. | Construct the dual network of the following circuit. | CO3 | E | 2 |
|  |  |  |  |  |  |
| 20. | a. | Evaluate the Norton’s current (IN) and Norton’s equivalent circuit for the circuit shown in the figure. | CO2 | E | 10 |
|  | b. | Recall Thevenin’s theorem . | CO2 | R | 2 |
|  |  |  |  |  |  |
| 21. |  | Apply superposition theorem to determine the current through 3Ω resistor in the circuit shown. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | |  | | --- | | Estimate the resonant frequency, Q factor, lower cut off frequency, upper cut off frequency and bandwidth of the following circuit specification. A series RLC circuit consists of 50 Ω resistor 0.2 H inductance and 10 μF capacitor with an applied voltage of 20V. | | CO5 | An | 10 |
|  | b. | |  | | --- | | Express the value of impedance at resonance in the given circuit. | | CO5 | U | 2 |
|  |  |  |  |  |  |
| 23. |  | Express the steady state response of series RL and series RC circuit using Laplace transform | CO4 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Determine the open circuit impedance parameters of the network given below.  C:\Users\ALFRED KIRUBARAJ\Desktop\ECA_CBCS\p_2\3_4.png | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand basics electrical circuits with nodal and mesh analysis. |
| CO2 | Apply the various electrical network theorems to analyze the circuits and networks. |
| CO3 | Analyze three phase circuits. |
| CO4 | Apply Laplace Transform for steady state and transient analysis. |
| CO5 | Analyze the frequency domain techniques. |
| CO6 | Determine different network functions and Design filter circuits to satisfy design specifications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 1 | 28 | - | - | - | 29 |
| CO2 | 3 | 1 | 12 | - | 13 | - | 29 |
| CO3 | 1 | - | 4 | 10 | 2 | - | 17 |
| CO4 | 4 | 12 | - | - | - | - | 16 |
| CO5 | 1 | 5 | - | 10 | - | - | 16 |
| CO6 | 1 | - | 16 | - | - | - | 17 |
|  | | | | | | | **124** |



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| **Course Code** | **18EE2014** | **Duration** | **3hrs** |
| **Course Name** | **POWER SYSTEMS II** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | For n bus power system size of Y bus matrix is--------------. | | CO1 | U | 1 |
| 2. | How a primitive network is mapped with the actual network? | | CO1 | R | 1 |
| 3. | Write the expression for reactive power from single machine to infinite bus. | | CO2 | R | 1 |
| 4. | Draw the power angle curve of a single machine supplying power to infinite bus. | | CO2 | U | 1 |
| 5. | The ALFC loop will main control only during normal changes in ------and---------. | | CO3 | U | 1 |
| 6. | Name the controller used in AGC to bring back the static frequency error to zero. | | CO3 | U | 1 |
| 7. | SCADA systems encompass the transfer of data between a central host computer and a number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_and/or Programmable Logic Controllers (PLCs), and the central host and the operator terminals. | | CO4 | R | 1 |
| 8. | Define wide area measurement system. | | CO4 | U | 1 |
| 9. | ------------------is a specialised type of transformer, typically used to control the flow of active power on three-phase electric transmission networks. | | CO5 | U | 1 |
| 10. | A ---------------may refer to the entity that operates an electricity market at which electricity is traded. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the properties of the bus admittance matrix. | | CO1 | U | 3 |
| 12. | Sort the various categories of stability. | | CO2 | U | 3 |
| 13. | Justify the need for speed governor and its droop setting. | | CO3 | U | 3 |
| 14. | State estimation definition. Mention how it is used in power systems. | | CO4 | U | 3 |
| 15. | Find out the minimum value of open loop gain of the AVR loop to get 1% static accuracy limit. | | CO5 | U | 3 |
| 16. | What is spot pricing? Mention the benefits. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | In the network as shown below, the marked parameters are pu impedances. The bus admittance matrix of the network is  https://gradeup-question-images.grdp.co/liveData/PROJ61906/1601360323908734.jpg | CO1 | An | 8 |
|  | b. | Ybus of a power system is sparse. Infer the reason by considering a real power system. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. |  | Analyze the transient stability of a power system by second-order Runge-Kutta method. Use proper flow-chart. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Describe how the AGC system works using a block diagram. Also, calculate the AGC's overall transfer function. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Draw the phasor measuring unit block diagram and describe. Mention the phasor measurements made by the device. | CO4 | U | 6 |
|  | b. | Enlighten the use of SCADA for power system monitoring and control using a schematic illustration. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. |  | Make a block diagram to depict the AVR loop. Explain the requirement for stability adjustment using root loci. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the step by step computational procedure for the Gauss-Seidel method in load flow studies with appropriate expressions. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Describe the equal area criterion for transient stability analysis of a power system when a fault occurs in the TL. | CO2 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Describe the whole-sale competition and vertically integrated power market models. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Use numerical methods to analyze a power system in steady state. |
| CO2 | Classify the state of operating equilibrium after being subjected to a physical disturbance. |
| CO3 | Implement the voltage, frequency and power flow control. |
| CO4 | Monitoring and control the transmission and distribution power system. |
| CO5 | Design various compensators for to control the power system parameters. |
| CO6 | Optimize the operation of power plant. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 8 | 12 | 8 | - | - | 29 |
| CO2 | 1 | 4 | 24 | - | - | - | 29 |
| CO3 | - | 17 | - | - | - | - | 17 |
| CO4 | 1 | 16 | - | - | - | - | 17 |
| CO5 | - | 4 | - | 12 | - | - | 16 |
| CO6 | 1 | 15 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **18EE2019** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRICAL MACHINES AND DRIVES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | A DC motor is an electrical machine that converts \_\_\_\_\_\_\_\_\_\_ into \_\_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | An Induction motor is also called as \_\_\_\_\_\_\_\_\_\_ motor. | | CO1 | R | 1 |
| 3. | The speed control of DC motor below rated speed in Ward-Leonard system is achieved by \_\_\_\_\_\_\_\_\_\_ control method. | | CO2 | R | 1 |
| 4. | \_\_\_\_\_\_\_\_\_\_ restrict the current to an acceptable level. | | CO2 | U | 1 |
| 5. | An \_\_\_\_\_\_\_\_\_\_ is often referred to as an electronic controller. | | CO3 | U | 1 |
| 6. | In \_\_\_\_\_\_\_\_\_\_ drive each operation of the mechanism is taken care of by a separate drive motor. | | CO3 | R | 1 |
| 7. | IGBT is a \_\_\_\_\_\_\_\_\_\_ controlled device. | | CO4 | U | 1 |
| 8. | \_\_\_\_\_\_\_\_\_\_ is universally referred to as thyristor. | | CO4 | R | 1 |
| 9. | Name any one commonly used semiconductor switch. | | CO5 | R | 1 |
| 10. | \_\_\_\_\_\_\_\_\_\_ of DC motor is very good in Ward-Leonard system. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Calculate the synchronous speed of a 4 pole Induction motor which operates at 60Hz. | | CO1 | E | 3 |
| 12. | Cite the three main methods to control the speed of dc motor. | | CO2 | U | 3 |
| 13. | Sketch the block diagram of an electric drive. | | CO3 | A | 3 |
| 14. | Summarize the various other names of IGBT. | | CO4 | A | 3 |
| 15. | List the applications of cycloconverter. | | CO5 | A | 3 |
| 16. | Point out the advantages of solid state control. | | CO6 | An | 3 |
| PART – C (6 X 12 = 72 MARKS)  (Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory) | | | | | |
| 17. | a. | A four pole DC machine having wave wound armature winding has 25 slots, each slot containing 25 conductors. What will be the back emf generated in the machine when driven at 1000 rpm, assuming the flux per pole to be 5 mWb? Calculate the back emf generated when the DC machine has lap wound armature winding. | CO1 | E | 6 |
|  | b. | Explain the speed torque characteristics of a stepper motor with a neat diagram. | CO1 | An | 6 |
| 18. | a. | What is the necessity of starters for DC motors? List the damages caused due to high starting current in a DC motor. | CO2 | An | 4 |
|  | b. | Describe in detail the construction and working principle of Ward Leonard system for the speed control of DC motors. | CO2 | An | 8 |
| 19. | a. | What are the factors governing the selection of electric drives for any particular application? | CO3 | A | 8 |
|  | b. | Define load equalization. Write the expression for moment of inertia of the flywheel required for load equalization. | CO3 | An | 4 |
| 20. | a. | Discuss the two basic forms of MOSFET with a neat sketch of their symbolic representation. | CO4 | A | 4 |
|  | b. | Sketch the MOSFET switching characteristics and explain how the turn ON and OFF times get affected by the internal capacitance and impedance of the gate drive circuit. | CO4 | An | 8 |
| 21. | a. | Examine the operation of Type E chopper when four semiconductor switches and diodes arranged in antiparallel. | CO5 | An | 8 |
|  | b. | List the advantages and disadvantages of Current Source Inverters. | CO5 | A | 4 |
| 22. | a. | Explain the methods of speed control of three phase induction motor using inverters. | CO6 | An | 8 |
|  | b. | Describe Kramer slip power recovery system of 3-phase induction motor with a neat diagram. | CO6 | A | 4 |
| 23. | a. | Analyze and derive an expression for the heating curve of electric drives. | CO3 | An | 10 |
|  | b. | List the factors affecting the selection of motor power rating. | CO3 | A | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain how the speed control of DC drive is achieved using fully controlled rectifiers. | CO6 | An | 8 |
|  | b. | Point out the advantages and disadvantages of Ward Leonard system. | CO6 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the operating principles of DC and AC motors. |
| CO2 | Explain the various method of speed control of DC and AC motors. |
| CO3 | Describe the factors for selection of drive, various load patterns and determine their power rating. |
| CO4 | Discuss the working of various power semiconductor devices. |
| CO5 | Demonstrate the working of various power converters and inverters. |
| CO6 | Apply and Analyze the control of DC and AC motors with solid state power converters and inverters. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | - | 6 | 9 | - | 17 |
| CO2 | 1 | 4 | - | 12 | - | - | 17 |
| CO3 | 1 | 1 | 13 | 14 | - | - | 29 |
| CO4 | 1 | 1 | 7 | 8 | - | - | 16 |
| CO5 | 1 | - | 7 | 8 | - | - | 17 |
| CO6 | - | 1 | 8 | 19 | - | - | 28 |
|  | | | | | | | **124** |



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| **Course Code** | **18EE3016** | **Duration** | **3hrs** |
| **Course Name** | **DATA MINING FOR RENEWABLE ENERGY SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | You are given a data set of renewable energy consisting of variables with missing values. Identify the methods for filling in missing values and list the best practices for data cleaning. | CO1 | U | 10 |
|  | b. | Detail the variations and similarities between data warehouse and a database. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Determine the mean, median, mode, range, variance and standard deviation for the given solar radiation data in MJ/m2/day.  {21, 22, 23, 22, 20, 16, 15, 15, 17, 17, 17,18} | CO2 | An | 10 |
|  | b. | Construct a box plot using the five number summary for the given data.  18, 27, 34, 52, 54, 59, 61, 68, 78, 82, 85, 87, 91, 93, 100 | CO2 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Compare the advantages and disadvantages of associative classification versus classical decision tree method. | CO3 | A | 10 |
|  | b. | Establish a distinction between classification and prediction**.** Also describe **the issues regarding classification and prediction.** | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Present conditions under which density-based clustering is more suitable than partitioning-based clustering and hierarchical clustering. Give some application examples to support your argument. | CO4 | A | 10 |
|  | b. | Outliers are often discarded as noise. Propose two methods that can be used to detect outliers and discuss which one is more reliable. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Describe how ensemble approach improves the predictive task for time series data? | CO5 | U | 10 |
|  | b. | Explain how to evaluate the efficiency of different forecasting methods in very small-scale networks? | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain data warehouse architecture and its components. Write the advantages and disadvantages of the data warehouse components. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 7. | a. | Illustrate the different challenges that motivated the development of Data Mining. Why preprocessing of the data is required before applying data mining techniques? | CO2 | An | 10 |
|  | b. | Brief about the following.   1. Dimensionality reduction 2. Feature selection 3. Variable transformation | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Compare agglomerative and divisive algorithm. With a neat flow diagram, write the main steps involved in k-means clustering. | CO3 | A | 10 |
|  | b. | Briefly outline the major steps of Bayesian classification. | CO3 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Outline the major research challenges of data mining in one specific application domain, such as renewable energy system. | CO6 | A | 10 |
|  | b. | Analyze how wind power forecasting enhances the performance of the power system while taking into account the various difficulties experienced by wind power generation. | CO6 | An | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the importance of data-driven performance optimization of renewable energy system. |
| CO2 | Exploit the vast data base available in the renewable energy sector and devise ways to make renewable energy a competitive source of supply. |
| CO3 | Classify and analysis the different type of data. |
| CO4 | Prediction of data with error measures. |
| CO5 | Apply data mining for the prediction of power from renewable energy sources. |
| CO6 | Find the various research opportunities provided by this field. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 40 | - | - | - | - | 40 |
| CO2 | 10 | - | 10 | 20 | - | - | 40 |
| CO3 | - | 10 | 30 | - | - | - | 40 |
| CO4 | - | - | 20 | - | - | - | 20 |
| CO5 | - | 20 | - | - | - | - | 20 |
| CO6 | - | - | 10 | 10 | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **18EE3018** | **Duration** | **3hrs** |
| **Course Name** | **POWER QUALITY ISSUES AND MITIGATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Illustrate the following with a waveform sketch related to Power quality events  a) Voltage imbalance  b) Flicker.  c) Sag with harmonics  d) Frequency variation | CO1 | U | 10 |
|  | b. | Give outlines on IEEE and IEC power quality standards. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Give explanation the different types of sag with a relevant vector diagram with proper equations. | CO2 | U | 10 |
|  | b. | Elucidate capacitor switching transient and magnification of capacitor switching transient. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain in detail about general procedure for harmonic distortion evaluation at the point of coupling, utility systems, customer facility and industrial facility | CO3 | U | 10 |
|  | b. | Discuss the construction and working principle of active filters for harmonic mitigation. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | A three-phase AC supply has a line voltage of 415 V at 50 Hz and a feeder (source) impedance of 1.0 Ω resistance and 3.0 Ω inductive reactance per phase after which an unbalanced isolated star configured load having ZLa=10 Ω, ZLb =20 Ω, and ZLc=40 Ω is connected, as shown in Figure.    If a three- leg PWM-based DSTATCOM is used to balance and maintain the voltage equal to the input voltage (415 V), calculate (a) the DSTATCOM line currents, (b) the kVA rating of the DSTATCOM, (c) the voltage drop across the source impedance, and (d) equivalent per-phase resistance (in ohms) of the compensated load. | CO4 | An | 10 |
|  | b. | Illustrate the principle of DVR operation used for sag mitigation. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Briefly describe the Instatenous Reactive Power (IRP) theory how extract the harmonic component with the suitable equations. | CO5 | A | 10 |
|  | b. | Briefly describe the Synchronous reference frame how extract the harmonic component with the suitable equations. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Examine the source and effects of different categories of Long duration voltage Variations. | CO2 | U | 10 |
|  | b. | Draw the CBEMA & ITI curve and explain about events described in the curves. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the following causes of sags.   1. Voltage sag due to motor sag 2. Voltage sag due to single line to ground fault. 3. Voltage sag due to transformer energizing. | CO2 | U | 10 |
|  | b. | Briefly Describe the FFT Theory for harmonic extraction process. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | The converter circuit is shown the below fig. Calculate the following quantities (a)THD of AC mains current (b) DIN (c) TDD of AC mains current (d) DF (e)DPF (f) PF | CO3 | An | 10 |
|  | b. | What are the various classifications of harmonic sources and explain briefly about it. | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Describe the steps needed to monitor power quality. What conclusions can be drawn from monitoring site surveys? | CO6 | U | 10 |
|  | b. | Elucidate the following  a. Harmonic Analyser  b. Flicker Meter | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the cause and source of power system disturbances. |
| CO2 | Calculate harmonic voltages and currents by analyzing all types of electrical systems loads and their power quality considerations. |
| CO3 | Suggest suitable mitigation scheme for some of the power quality issues. |
| CO4 | Examine the methods of reducing excessive harmonics using advanced modeling technique. |
| CO5 | Analyze the power quality issues using the Power quality indices. |
| CO6 | Design load compensators useful for mitigating power quality problems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 30 |  |  |  |  | 30 |
| CO2 |  | 40 |  |  |  |  | 40 |
| CO3 |  | 20 |  | 10 |  |  | 30 |
| CO4 |  |  | 10 | 10 |  |  | 20 |
| CO5 |  | 20 | 20 |  |  |  | 40 |
| CO6 |  | 20 |  |  |  |  | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **18EE3019** | **Duration** | **3hrs** |
| **Course Name** | **DISTRIBUTED GENERATION AND MICRO GRID** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Analyze the impacts of integrating DG to a well-established distribution system. | CO1 | An | 10 |
|  | b. | Draw the functional schematic of distributed energy sources (DES) interconnection system. Describe the various components of the system. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the hydrogen storage methods for fuel cell applications. | CO2 | U | 10 |
|  | b. | Illustrate any two types of concentrating solar power plants. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | A PV power plant has to be integrated with utility grid. Draw the schematic of power electronic interface with maximum power point tracking and power control. | CO3 | A | 10 |
|  | b. | For overcoming the slow dynamic response of the fuel cell, power electronic interface can be utilized. Justify with different schemes | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe different current distortions caused by the power electronic interface of DG. | CO4 | U | 10 |
|  | b. | Differentiate between active and passive anti-islanding schemes and describe one active scheme. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Evaluate the impact of capacitor switching on the DG enhanced distribution system. | CO5 | An | 10 |
|  | b. | List the effects of light flicker and explain how flicker reduction methods are implemented in a system with DG. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the generalized power electronics interface and control of a microturbine system. | CO3 | U | 10 |
|  | b. | DFIG interface is more convenient scheme in wind power integration. Justify. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Compare five key technologies deployed in Combined Heat and Power Systems. | CO2 | A | 10 |
|  | b. | Describe different types of micro turbines. List their applications. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Present different case studies to investigate the impact of the presence of DG on reclosing. | CO5 | A | 10 |
|  | b. | Draw the architecture of a microgrid and summarize its characteristics. Also compare traditional grid with microgrid. | CO6 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Draw a typical microgrid management structure and mention the role of each component. | CO6 | A | 10 |
|  | b. | Explain the Control Strategy for DC Microgrids. | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Define the concept of distributed generation and impact of DG on transmission system. |
| CO2 | Classify the various distributed generation sources and energy storage. |
| CO3 | Outline the general and the power electronic topologies for distributed generation and its interface. |
| CO4 | Describe various distributed generation protection scheme. |
| CO5 | Analyze the power quality issues of distributed generation. |
| CO6 | Compare the different microgrid architectures and discuss on the risks of the Smart Grid and its protective measures. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | - | - | 10 | - | - | 20 |
| CO2 | 10 | 20 | 10 | - | - | - | 40 |
| CO3 | - | 10 | 30 | - | - | - | 40 |
| CO4 | - | 10 | - | 10 | - | - | 20 |
| CO5 | - | 10 | 10 | 10 | - | - | 30 |
| CO6 | - | 10 | 20 | - | - | - | 30 |
|  | | | | | | | **180** |



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| --- | --- | --- | --- |
| **Course Code** | **18EE3021** | **Duration** | **3hrs** |
| **Course Name** | **SMART POWER GRID RENEWABLE ENERGY SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Define smart grid according to different agencies. Also list the need for smart grids. | CO1 | U | 10 |
|  | b. | Compare traditional and smart grids with respect to key technical aspects. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Draw the layout of a smart substation. Analyze how it can be automated effectively. | CO4 | An | 10 |
|  | b. | Justify the need for FACTS devices with smart grid context. | CO4 | E | 10 |
|  |  |  |  |  |  |
| 3. | a. | Draw the structure a DMS. Indicate the main components and tools. | CO4 | U | 10 |
|  | b. | Justify the presence of EMS in smart grid. | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write the steps involved in RSA Algorithm to maintain information security in smart grids. Analyze the process with numerical data. | CO2 | An | 10 |
|  | b. | Analyze the functioning of on-line transient stability controller in Wide Area Monitoring, Protection and Control. | CO3 | An | 10 |
|  |  |  |  |  |  |
| 5. |  | Explain the communication infrastructure and protocols for smart grids including HAN, LAN and WAN. Design a HAN model for a typical home. | CO3 | C | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | List the benefits of advanced metering infrastructure for various stakeholders of smart grid. | CO1 | U | 10 |
|  | b. | Draw the functional block diagram of a smart meter. Analyze different technical possibilities to achieve the functions of each block. | CO1 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Draw the block diagram of phasor measurement unit. Analyze the mathematical concepts behind the phasor measurement. | CO3 | An | 10 |
|  | b. | Explain the importance of intelligent electronic devices in the automation of smart grids. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | With a single line diagram and phasor diagram, explain series compensation in the power grid. | CO5 | U | 10 |
|  | b. | Justify the need for anti-islanding scheme in smart grid. Apply your knowledge in power grid and power electronics to design an anti-islanding scheme. | CO5 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | The functionality of smart grid can be enhanced by integrating renewable energy sources and energy storage. Justify. | CO6 | An | 10 |
|  | b. | Analyze the technical difficulties faced by a distribution network if EV is integrated with it. | CO6 | An | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Differentiate the information exchange in traditional grid and smart grid. |
| CO2 | Assess the importance of the information security for smart grid. |
| CO3 | Demonstrate different smart grid communication technologies. |
| CO4 | Design the prototype model of the smart grid. |
| CO5 | Evaluate the role of power electronic devices in the network. |
| CO6 | Analyze the grid integration issues of renewable energy sources. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | -- | 20 | -- | 20 | -- | -- | 40 |
| CO2 | -- | -- | -- | 10 | -- | -- | 10 |
| CO3 | -- | -- | 10 | 20 | -- | 20 | 50 |
| CO4 | -- | 10 | -- | 10 | 20 | -- | 40 |
| CO5 | -- | 10 | 10 | -- | -- | -- | 20 |
| CO6 | -- | -- | -- | 20 | -- | -- | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **18EE3022** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRIC AND HYBRID VEHICLES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Sketch a general layout of an EV and discuss the transmission characteristics. | CO1 | A | 10 |
|  | b. | Explain flywheel as energy source element in electric and hybrid electric vehicle. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Compare conventional vehicle with hybrid electric vehicle. | CO1 | U | 10 |
|  | b. | Dissect the configuration and control of Switched reluctance motor | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Summarize the various parameters and their typical values for induction motors used in HEV applications. | CO2 | E | 10 |
|  | b. | Discuss on the constant power speed ratio as applied to an electric motor. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain rolling resistance and aerodynamic drag in vehicles. | CO3 | U | 10 |
|  | b. | Write the design considerations of electric vehicle chassis and body design. | CO3 | C | 10 |
|  |  |  |  |  |  |
| 5. | a. | Discuss in detail the performance analysis and control of BLDC Motor based EVs. | CO2 | U | 10 |
|  | b. | Explain about the importance of IC Engine for Hybrid vehicle modelling. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | A hybrid electric vehicle has two sources- an ICE with output power of 80kW and battery storage. The battery storage is a 150 Ah, Cio battery at 120V. (i) Calculate the battery energy capacity (ii). Without de-rating the Attr capacity, what is the maximum power that can be supported by the battery? (iii). What is the electrical motor power output if the total efficiency of power converter and motor combination is 98%. (iv). what is the maximum power that can be transmitted to the wheels if the transmission efficiency is 95%? | CO4 | A | 10 |
|  | b. | Explain the techniques used in modelling DC motor drive and controller. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. |  | Write short notes on terms of technical specifications of the Mitsubishi MiEV, Honda Insight, Toyota Prius, Chevrolet Volt, Audi A3 E Tron passenger cars available in the market. | CO5 | C | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Discuss the Torque–slip characteristics of an induction motor with fixed stator frequency and voltage. Also explain the constant V/F control of Induction Motor. | CO6 | U | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Devise a step-by-step procedure considered for importing, creating driving cycles and range estimation of electric car in any simulation environment. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Realize the need of Hybrid Vehicles and Electric vehicles. |
| CO2 | State different types of drives used in Electric & Hybrid Vehicles. |
| CO3 | Use the energy on-board optimally. |
| CO4 | Understand the merits and demerits of various mathematical models of Electric and hybrid Vehicle. |
| CO5 | Design the EHV using the mathematical Model. |
| CO6 | Simulate and observe the behavior of the EHV. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 20 | 10 | - | - | - | 30 |
| CO2 | - | 20 | - | 10 | 10 | - | 40 |
| CO3 | - | 10 | - | - | - | 10 | 20 |
| CO4 | - | 10 | 20 | - | - | - | 30 |
| CO5 | - | - | - | - | - | 20 | 20 |
| CO6 | - | 20 | - | 20 | - | - | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **19EE2003** | **Duration** | **3hrs** |
| **Course Name** | **RENEWABLE ENERGY SOURCES FOR HEALTH CARE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | \_\_\_\_\_\_ nm to \_\_\_\_\_nm range of the electromagnetic radiation is the visible light. | | CO1 | U | 1 |
| 2. | The complimentary angle of sun’s altitude angle is called \_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | The constant frequency time- ratio control is also called as \_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 4. | If the application is solar cooling, the optimum installation angle of solar panel is \_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | \_\_\_\_\_\_\_ are capable of transforming hazardous waste chemicals to non-toxic products and can be harvested from microorganisms grown in mass culture. | | CO3 | U | 1 |
| 6. | NFPA 99 is associated with \_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 7. | Define an impulsive transient. | | CO4 | U | 1 |
| 8. | Sterilization of equipment by air requires a high temperature up to \_\_\_\_\_◦C for around two hours. | | CO5 | U | 1 |
| 9. | Suggest any two offgrid energy sources for a hospital. | | CO5 | R | 1 |
| 10. | Name any benefit of Biomass water heater. | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | State any three advantages of Polycrystalline solar cell. | | CO2 | R | 3 |
| 12. | Define the duty cycle of a power electronic voltage controller and indicate its role in controlling the voltage. | | CO1 | U | 3 |
| 13. | Discuss the various factors that involved in the land treatment operation of waste. | | CO3 | U | 3 |
| 14. | Write the importance NFPA 101 code. | | CO4 | R | 3 |
| 15. | Describe the factors to be considered while considering electric supply options to a hospital. | | CO5 | U | 3 |
| 16. | Discuss the compressor options available for a solar powered compressor type vaccine generator. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Classify solar cells and examine the constructional details and features of each type. | CO2 | A | 8 |
|  | b. | Draw the single diode model of a PV cell and explain. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the strategies used in the time- ratio control and current limit control. | CO1 | U | 8 |
|  | b. | Compare solar air heaters and solar water heaters. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 19. | a. | Recommend suitable disposal techniques for the biomedical wastes of different categories. | CO3 | E | 4 |
|  | b. | Explain the techniques used for biological treatment of hazardous waste. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 20. | a. | Explain the Significance of NFP 780 standard. | CO4 | An | 8 |
|  | b. | Describe the IEEE Standard C62.41-2002 | CO4 | R | 4 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the working of a solar powered operation theatre. | CO5 | A | 8 |
|  | b. | Discuss the use of thermal energy for health care applications. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. |  | Solve the problem of maximum power point tracking with the help of a suitable algorithm and give all the details about the algorithm. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Describe the principle of Flat plate solar collectors with relevant diagrams. | CO2 | R | 6 |
|  | b. | Give an overview of Incineration technology. | CO2 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Investigate the possibility of hybrid power for mobile hospital. | CO6 | An | 6 |
|  | b. | Discuss about auxiliaries for turbine generation plant with solar thermal plants. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the basic physics of solar power generation. |
| CO2 | Summarize the solar thermal power generation technologies |
| CO3 | Explain the bio and clinical waste to energy generation. |
| CO4 | Describe the various electrical codes for Power station in a hospital. |
| CO5 | Explain the various applications of Solar Power for a hospital. |
| CO6 | Plan for the Emergency Power units for a hospital using Renewable Energy Sources. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 12 | - | - | - | - | 14 |
| CO2 | 10 | 6 | 20 | 8 | - | - | 44 |
| CO3 | 1 | 4 | - | 8 | 4 | - | 17 |
| CO4 | 8 | 1 |  | 8 | -- | - | 17 |
| CO5 | 1 | 11 | 8 | - | - | - | 20 |
| CO6 | - | 6 | - | 6 | - | - | 12 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

**SUPPLEMENTARY EXAMINATION – JUNE 2023**

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| --- | --- | --- | --- |
| **Course Code** | **19EE2003** | **Duration** | **3hrs** |
| **Course Name** | **RENEWABLE ENERGY SOURCES FOR HEALTH CARE** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | The solar constant is rated at a solar minimum of \_\_\_\_\_\_ kW/m2 and a solar maximum of \_\_\_\_\_kW/m2. | | CO1 | U | 1 |
| 2. | The angle between a line extending from center of sun to the center of earth and the projection of this line on to equatorial plane is called \_\_\_\_\_\_. | | CO1 | U | 1 |
| 3. | The variable frequency time- ratio control is also called as \_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 4. | If the application is solar heating, the optimum installation angle of solar panel is \_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | Name the processin which suspended solid particles less than 100 ppm (parts per million) concentration are removed from an aqueous stream. | | CO3 | R | 1 |
| 6. | NFPA 110 is associated with \_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 7. | Name any one reason for poor electrical power quality. | | CO4 | R | 1 |
| 8. | Sterilization of equipment by steam autoclaves requires a temperature of \_\_\_\_\_\_◦C. | | CO5 | U | 1 |
| 9. | Name any two renewable energy sources suitable for hospitals. | | CO6 | R | 1 |
| 10. | Name any drawback of Biomass water heater. | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | State any three advantages of Monocrystalline solar cell. | | CO2 | R | 3 |
| 12. | List any three drawbacks of variable frequency time-ratio controller. | | CO1 | R | 3 |
| 13. | Discuss the importance of chemical precipitation process. | | CO3 | U | 3 |
| 14. | Write the importance NFPA 99 code. | | CO4 | R | 3 |
| 15. | Describe a Solar Autoclave. | | CO5 | U | 3 |
| 16. | Discuss about the sterilization process in a hospital. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the operation of Buck-Boost converters with suitable diagrams. | CO1 | An | 8 |
|  | b. | With a neat diagram explain the Grid interactive type solar PV system. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 18. | a. | Discuss about the various techniques used for the storage of thermal energy. | CO2 | U | 6 |
|  | b. | Investigate on different concentrating type solar collectors. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe about the color code used for the segregation of different category of biomedical wastes. | CO3 | R | 4 |
|  | b. | Explain the various physical and chemical treatment methods used for hazardous wastes. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the importance of Power quality. Examine the standard used to ensure good quality power. | CO4 | An | 8 |
|  | b. | Compare NFPA 101 and NFPA 110 | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the stepwise approach to electrify a health center with the following loads. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Use Perturb and Observation algorithm to track the maximum power point of a solar panel and describe all the details. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the operation of a charge controller which is designed to maximize its efficiency | CO1 | U | 6 |
|  | b | Write short note on secured land fill. | CO3 | R | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | With a neat diagram, explain the power generation from an incineration plant. | CO6 | An | 9 |
|  | b. | Examine the working of a water heating system which works with biomass as its fuel | CO3 | An | 3 |

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the basic physics of solar power generation. |
| CO2 | Summarize the solar thermal power generation technologies |
| CO3 | Explain the bio and clinical waste to energy generation. |
| CO4 | Describe the various electrical codes for Power station in a hospital. |
| CO5 | Explain the various applications of Solar Power for a hospital. |
| CO6 | Plan for the Emergency Power units for a hospital using Renewable Energy Sources. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 8 | - | 8 | - | - | 20 |
| CO2 | 4 | 6 | 12 | 10 | - | - | 32 |
| CO3 | 12 | 3 | - | 11 | - | - | 26 |
| CO4 | 5 | 4 | - | 8 | - | - | 17 |
| CO5 | - | 7 | - | - | - | - | 7 |
| CO6 | 1 | - | 12 | 9 | - | - | 22 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **19EE2006** | **Duration** | **3hrs** |
| **Course Name** | **COMPUTER SIMULATION OF ELECTRICAL SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | MATLAB stands for \_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 2. | Identify the following MATLAB/Simulink block? | | CO1 | U | 1 |
| 3. | MATLAB is used to store the complex number in \_\_\_\_\_ class. | | CO2 | R | 1 |
| 4. | The output at scope 1 is? | | CO2 | An | 1 |
| 5. | The value of the time constant in the R-L circuit is? | | CO3 | U | 1 |
| 6. | The three terminals of the Power BJT are | | CO3 | R | 1 |
| 7. | In power system, the maximum number of buses are : load buses. – **True or False.** | | CO4 | R | 1 |
| 8. | The current in the R-L circuit at a time t = 0+ is? | | CO4 | U | 1 |
| 9. | \_\_\_\_\_ circuit is used across a power semiconductor device for protection against high dv/dt and high di/dt. | | CO5 | R | 1 |
| 10. | The networks in which the R, L, C parameters are individually concentrated or lumped at discrete points in the circuit are called \_\_\_\_\_. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | After executing the following script file in MATLAB  x= [2:4 ;‐1:1 ;1 2 3];  y=x(2,:);  size(y')  the displayed result will be \_\_\_\_\_ | | CO1 | An | 3 |
| 12. | List out the operators that MATLAB allows. | | CO2 | U | 3 |
| 13. | Discus the transient response of RL circuit with step input signals. | | CO3 | U | 3 |
| 14. | Appraise the methods available to form Y bus. | | CO4 | An | 3 |
| 15. | Describe significance of snubber circuit in power converters. | | CO5 | U | 3 |
| 16. | Differentiate integrator and differentiator circuits. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | List out the common tool boxes in MATLAB | CO1 | U | 4 |
| b. | Give a brief note about Array, Matrix and Scripts in MATLAB | CO1 | U | 8 |
|  |  |  |  |  |  |
| 18. |  | Obtain the root locus of the system using MATLAB whose transfer function is defined by | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | With an example mention the steps to verify circuit using Norton theorem with MATLAB. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Discuss the load Load flow studies using Newton-Raphson Technique using MATLAB. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Illustrate the simulation model of a single-phase inverter with necessary diagram and waveforms. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Analyse the performance of a solar PV simulation model with necessary diagram and waveforms. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Demonstrate the simulation model of a DC-DC buck converter with necessary diagram and waveforms. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the working of Op-amp based differentiator with necessary simulation diagrams | CO6 | U | 6 |
|  | b. | Describe the simulation models in steps of an Op-amp based integrator circuit | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the main features of the MATLAB programming environment. |
| CO2 | Apply working knowledge of MATLAB package to simulate and solve electrical, electronic circuits and applications. |
| CO3 | Solve, Simulate and Analyse various network theorems and electric circuits. |
| CO4 | Identify & formulate solutions to problems relevant to power system using software tools. |
| CO5 | Simulate various converter/inverter circuits. |
| CO6 | Solve, Simulate and Analyse various Analog Electronic circuits. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 13 | - | 3 | - | - | 17 |
| CO2 | 1 | 15 | - | 1 | - | - | 17 |
| CO3 | 1 | 4 | 12 | - | - | - | 17 |
| CO4 | 1 | 13 | - | 15 | - | - | 29 |
| CO5 | 1 | 16 | - | 12 | - | - | 29 |
| CO6 | - | 12 | 3 | - | - | - | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **19EE2008** | **Duration :** | **3hrs** |
| **Course Name** | **DIGITAL SIGNAL PROCESSING** | **Max. Marks :** | **100** |

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| **Q. No.** | **Questions** | **CO/BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | Define impulse response. | CO1 / R | 1 |
| 2. | Give any one example for energy signal. | CO1 / R | 1 |
| 3. | Define convolution. | CO2 / R | 1 |
| 4. | Give any one application of DFT. | CO2 / R | 1 |
| 5. | The poles of butter worth filter lie on \_\_\_\_\_\_\_\_\_\_\_. | CO3 / R | 1 |
| 6. | State the condition for linear phase filter. | CO4 / R | 1 |
| 7. | Mention the methods of Quantization. | CO5 / R | 1 |
| 8. | List out the types of limit cycle oscillations. | CO5 / R | 1 |
| 9. | Mention the generations of TMS320 family DSP Processors. | CO6 / R | 1 |
| 10. | Define Pipelining. | CO6 / R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Find whether the signal x(n)=(-0.25)n u(n) is an energy signal or power signal. | CO1 / U | 3 |
| 12. | Find the circular convolution of x(n)=[1,3,5,7] and h(n)=[2,4,6,8] | CO2 /U | 3 |
| 13. | Compare DIT and DFT algorithms used to find DFT. | CO3 / U | 3 |
| 14. | Compare IIR and FIR filter. | CO4 / U | 3 |
| 15. | What are the quantization errors due to finite word length registers in digital filters? | CO5 / U | 3 |
| 16. | Explain any 5 instructions used to program TMS320 series DSP processors. | CO6 / U | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is Compulsory)** | | | | |
| 17. | a. | Check if the following system linear, shift invariant and causal.  y(n)=3y2(n-1)-nx(n)+4x(n-1)-2x(n+1) | CO1 /An | 9 |
| b. | Check whether following Discrete Time systems are stable or not.  y(n)=a.x(n) | CO1 / A | 3 |
|  |  |  |  |  |
| 18. |  | For the given specifications, design an analog Butterworth filter.  0.9 ≤ | H (ejω) | ≤ 1, 0 ≤ Ω≤ 0.2π;  | H (ejω) | ≤ 0.2, 0.4π ≤ Ω ≤ π. | CO3/An | 12 |
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| 19. |  | Determine the output of linear FIR filter whose impulse response is h(n)={1,-1} and input signal x(n)={1,2,3,4,4,3,2,1} using Overlap save method. | CO2 / A | 12 |
|  |  |  |  |  |
| 20. |  | Compute 8 point DFT using decimation in time (DIT) of a sequence  x(n)={1,1,1,1,0,1,1,1} | CO2 /An | 12 |
|  |  |  |  |  |
| 21. |  | Consider the first order transfer function  H(z) =   1. Draw its product quantization noise model 2. Find the steady state noise power due to product round-off 3. Assume a=0.4 find output round-off noise power | CO5 / A | 12 |
|  |  |  |  |  |
| 22. |  | Design an Low Pass Filter using rectangular window if N=9 whose desired frequency response is | CO4 /An | 12 |
|  |  |  |  |  |
| 23. | a. | Apply bilinear transformation to Ha(s)= with T=1 sec and  find H(z). | CO3 / A | 6 |
|  | b. | For the analog transfer function Ha(s)= Determine the H(z) using impulse invariance method. T=1 sec | CO3 /A | 6 |
| **Compulsory Question** | | | | |
| 24. |  | Explain in detail about Von Newmann architecture. | CO6 / R | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the digital signal processing concepts. |
| CO2 | Analyze the discrete time signals for DSPapplications. |
| CO3 | Apply various transformations for Digital (IIR and FIR) filter design procedures. |
| CO4 | Relate the signal processing concepts practically with the help of finite word length effects and PDSPs. |
| CO5 | Compare and select the DSP processor suitable for a specific application. |
| CO6 | Design and develop algorithms for signal processing applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 3 | 9 |  |  | 17 |
| CO2 | 2 | 3 | 12 | 12 |  |  | 29 |
| CO3 | 1 | 3 | 12 | 12 |  |  | 28 |
| CO4 | 1 | 3 |  | 12 |  |  | 16 |
| CO5 | 2 | 3 | 12 |  |  |  | 17 |
| CO6 | 14 | 3 |  |  |  |  | 17 |
|  | | | | | | | **124** |



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| **Course Code** | **19EE2010** | **Duration** | **3hrs** |
| **Course Name** | **SPECIAL ELECTRICAL MACHINES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | A **\_\_\_\_\_\_** motor is a brushless, synchronous electric motor that converts digital pulses into mechanical shaft rotation. | | | CO2 | R | 1 |
| 2. | In a unipolar stepper motor, torque will be maximum in \_\_\_\_ mode of excitation. | | | CO2 | U | 1 |
| 3. | Switched reluctance motor works based on \_\_\_\_\_\_ principle. | | | CO1 | U | 1 |
| 4. | Give any one disadvantage of a switched reluctance motor. | | | CO1 | An | 1 |
| 5. | For a permanent magnet brushless DC motor, Permanent magnet is used in the \_\_\_\_\_ or \_\_\_\_\_\_ quadrant of hysteresis loop. | | | CO4 | U | 1 |
| 6. | Write any one advantage of BLDC motor. | | | CO3 | An | 1 |
| 7. | \_\_\_\_\_ motors have sinusoidal bak e.m.f. | | | CO3 | U | 1 |
| 8. | Torque equation of \_\_\_\_\_\_ motor is given by . | | | CO4 | R | 1 |
| 9. | Give any one reason why DC series motor cannot be used as an AC series motor without any modification. | | | CO6 | An | 1 |
| 10. | Linear motors often use [\_\_\_\_\_\_\_\_\_](http://www.explainthatstuff.com/superconductors.html) magnets, which are cooled to low temperatures to reduce power consumption. | | | CO5 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Define the pullout torque and holding torque of stepper motors. | | | CO2 | R | 3 |
| 12. | Describe the main three features of Synchronous Reluctance motors. | | | CO3 | U | 3 |
| 13. | Give any three features of ALNICO magnets. | | | CO4 | An | 3 |
| 14. | Compare Permanent Magnet Brushless DC Motors with Permanent Magnet Synchronous Motors. | | | CO1 | An | 3 |
| 15. | Compare Linear and Rotary Induction Motors. | | | CO5 | An | 3 |
| 16. | Give any three advantages of Axial Flux Motors. | | | CO4 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | | a. | Illustrate the working of Permanent Magnet Stepper Motor. | CO1 | A | 8 |
|  | | b. | Classify the Variable Reluctance Stepper Motors and explain about each. | CO1 | An | 4 |
| 18. | | a. | Explain about different types of control scheme used in stepper motors. | CO2 | A | 6 |
|  | | b. | List the types of excitation used in stepper motors and explain each. | CO3 | R | 6 |
| 19. | |  | Discuss about different types of switched reluctance motor. | CO4 | U | 12 |
| 20. | |  | Discuss the constructional details and working principle of Synchronous Reluctance Motors. | CO5 | U | 12 |
| 21. | | a. | Draw the circuit diagram of 3 phase unipolar driven PMBLDC Motor and 3 phase bipolar driven PMBLDC Motor and explain the controlling mechanism of both. | CO3 | A | 8 |
|  | | b. | Draw the magnetic equivalent circuit of PMBLDC Motor and justify this diagram. | CO3 | E | 4 |
| 22. | | a. | Obtain the E.M.F. equation of a Permanent Magnet Synchronous Motor. | CO4 | A | 7 |
|  | | b. | Plot the circle diagram of a Permanent Magnet Synchronous Motor and justify it | CO3 | E | 5 |
| 23. | | a. | Judge the various modifications done in AC series motor compared to a DC series motor. | CO6 | A | 8 |
|  | | b. | Describe the advantages and disadvantages of DC series motors. | CO6 | R | 4 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | |  | Explain about different types of magnetic circuits used in Axial flux motors. | CO4 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Select an energy efficient linear or rotary motor based on the characteristics of the load & applications. |
| CO2 | Incorporate the correct control technique to the machine for efficient operation. |
| CO3 | Analyze the behavior of the machine for the applied control technique. |
| CO4 | Improve the performance of the motor by enhancing the operating conditions. |
| CO5 | Explain the theory of travelling magnetic field and applications of linear motors. |
| CO6 | Explain the significance of electrical motors for traction drives. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 1 | 8 | 8 | - | - | 17 |
| CO2 | 4 | 1 | 6 | - | - | - | 11 |
| CO3 | 6 | 4 | 8 | 1 | - | - | 19 |
| CO4 | 1 | 13 | 7 | 18 | 9 | - | 48 |
| CO5 | - | 12 | 1 | 3 | - | - | 16 |
| CO6 | 4 | - | 8 | 1 | - | - | 13 |
|  | | | | | | | **124** |



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| **Course Code** | **19EE2023** | **Duration** | **3hrs** |
| **Course Name** | **SUBSTATION DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the elements of ITAP. | | CO1 | U | 1 |
| 2. | Those sub-stations which change the supply ----------are known as frequency changer sub-stations. | | CO1 | R | 1 |
| 3. | -----------diagram of a pipe system or items of equipment which includes miniature alarm lights or operating buttons for the relevant point or item in the system. | | CO2 | R | 1 |
| 4. | SF6 is ------------ times as dense as air. | | CO2 | R | 1 |
| 5. | Electric shock is greatly reduced by -------------fault clearing time. | | CO3 | U | 1 |
| 6. | The ------------network contains the conductors responsible for offering a low impedance path between the equipment frames or metallic structures and the connection to the earth. | | CO3 | R | 1 |
| 7. | SCADA protocols were created using electromechanical phone switching technology. (True/ False) | | CO4 | U | 1 |
| 8. | Open Loop Hall Sensors Price and -------is Low. | | CO4 | R | 1 |
| 9. | Abreviate AAA in Cyber Security. | | CO5 | U | 1 |
| 10. | High levels of ------------noise and transients are generated by the operation of power equipment and their controls. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | What is called Mobile Substation? | | CO1 | U | 3 |
| 12. | Give a list of the benefits of gas-insulated substations. | | CO2 | U | 3 |
| 13. | Write the short notes on Permissible Body Current Limits. | | CO3 | U | 3 |
| 14. | Define protocol. | | CO4 | U | 3 |
| 15. | Mention the types of hackers. | | CO5 | U | 3 |
| 16. | Comment the role of Substations in Smart Grids. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | Compare Indoor and Outdoor Substations. | CO1 | U | 4 |
|  | b. | Suggest the suitable main types of equipment and accessories used for 66kV step up Substation? And explain briefly. | CO1 | Ap | 8 |
| 18. | a. | Gas Insulated Substation is employed where? Justify. | CO2 | Ap | 4 |
|  | b. | Illustrate the design, Construction and Commissioning Process  in the indoor substation. | CO2 | An | 8 |
| 19. | a. | Define Intentional ground and Accidental ground. | CO3 | U | 4 |
|  | b. | Explicate the Two classical design methods have historically been employed to protect substations from direct lightning strokes. | CO3 | An | 8 |
| 20. | a. | Classify the different types of sensors used in substation automation. | CO4 | U | 4 |
|  | b. | Explain the following terms related to substation protocols   1. DNP3 2. UCA 1.0 3. ICCP 4. TCP/IP | CO4 | Ap | 8 |
| 21. | a. | Mention the SA security challenges. | CO5 | U | 4 |
|  | b. | Explain the following System analysis in SA system.  a. Criticality assessment  b. Vulnerability assessment  c. Risk assessment | CO5 | An | 8 |
| 22. | a. | Define bus bar and mention the types. | CO1 | U | 4 |
|  | b. | Illustrate the Structure of a SCADA Communication Protocol with examples | CO4 | An | 8 |
| 23. | a. | Explain the Interconnecting Bus and Air Connection in GIS system. | CO2 | U | 4 |
|  | b. | Illustrate the design criteria for a substation grounding system. | CO3 | An | 8 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Briefly explain the Communication Networks inside the Substation. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Develop Substation Layouts. |
| CO2 | Select Switching Configuration. |
| CO3 | Design Air Insulated and Gas Insulated Substation. |
| CO4 | Interface Communication Techniques. |
| CO5 | Monitor and Control the Substation Operation. |
| CO6 | Adopt Substation Technology Advances in future. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 12 | 8 |  |  |  | 21 |
| CO2 | 2 | 7 | 4 | 8 |  |  | 21 |
| CO3 | 1 | 8 |  | 16 |  |  | 25 |
| CO4 | 1 | 8 | 8 | 8 |  |  | 25 |
| CO5 |  | 8 |  | 8 |  |  | 16 |
| CO6 |  | 4 |  | 12 |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EE2025** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRICAL ESTIMATION AND COSTING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Recall the offer made by the supplier in reply to the letter of quotation for supply of material on the basis of certain terms and conditions. | | CO1 | R | 1 |
| 2. | Name the process used by electricians, construction managers and engineers to determine the amount and cost of electricity required for a specific location or process. | | CO1 | R | 1 |
| 3. | Predict the maximum load that can be connected in one sub-circuit (in watts) as per recommendation of ISI. | | CO2 | U | 1 |
| 4. | Estimate the socket outlet (in amps) provided in building for the use of domestic appliances such as AC, water cooler. | | CO2 | U | 1 |
| 5. | Name the overhead line or cable connecting the supplier’s distributing line to the consumer premises. | | CO3 | R | 1 |
| 6. | Identify the distribution system that is not normally used.  A. 3 phase, 3-wire  B. 3 phase, 4-wire  C. .Single phase, 3-wire  D. single phase, 2-wire | | CO3 | R | 1 |
| 7. | Interpret the rating of fuse is dependent/not on the load of the circuit. | | CO4 | U | 1 |
| 8. | Record the maximum efficiency of motor in % of rated load. | | CO4 | A | 1 |
| 9. | Recall in the continuity test of wiring, whether a dry cell is connected with an electric bell in series or not | | CO5 | R | 1 |
| 10. | Name the material used for making solar cell | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write the points while classifying the Overhead charges. | | CO1 | A | 3 |
| 12. | Determine permissible voltage drop for a two-core cable required to carry the maximum current of 30 amps. It is given that length of cable is 60 metres and declared supply voltage is 240 volts. | | CO2 | A | 3 |
| 13. | Sketch the single line diagram of bus bar arrangement. | | CO3 | A | 3 |
| 14. | Write the types of service connections. | | CO4 | A | 3 |
| 15. | Classify the types of MCB based on poles. | | CO5 | U | 3 |
| 16. | List the Components of Solar Photovoltaic Plant. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | List the objective of I.E rules and explain any seven Indian electricity rules. | CO1 | R | 7 |
|  | b. | Relate the procedure of purchasing and briefly explain each one of them. | CO1 | U | 5 |
| 18. |  | Justify the requirement for earthing and explain the following briefly   1. System earthing 2. Equipment earthing 3. Earthing accessories 4. Application of Earthing | CO2 | E | 12 |
| 19. | a. | Interpret the fundamental considerations for planning of an electrical installation for commercial building. | CO3 | A | 8 |
|  | b. | Briefly explain the following:   1. Selection of Earth electrode and Earth conductor 2. Size of bus-bar chamber 3. The basis on which the total load in a commercial building is calculated. | CO3 | A | 4 |
| 20. |  | List the various methods of installation of Overhead service lines and explain them briefly. | CO4 | R | 12 |
| 21. | a. | Define ELCB and Explain types of ELCB with neat diagrams. | CO5 | R | 9 |
|  | b. | In a house there are 40 load points, calculate the insulation resistance indicated in the test in megohm. | CO5 | A | 3 |
| 22. |  | Explain the following :   1. Polarity test of switches 2. Earth continuity test 3. Insulation test between the conductors 4. Insulation test between the conductors and earth | CO5 | U | 12 |
| 23. | a. | Describe the advantages and disadvantages of Current operated ELCB. | CO5 | U | 6 |
|  | b. | Write the difference between MCB and MCCB. | CO3 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | With neat diagram explain different types of solar panels connection | CO6 | U | 6 |
|  | b. | Explain the following briefly:   1. PIR Sensor 2. LDR Sensor | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the concept of IE rules, contracts, tender and tender document and its related procedures. |
| CO2 | Describe the basic terms, general rules, circuit design procedure, wiring design and design considerations of residential and commercial Electrical Installations. |
| CO3 | Define different types of Electrical Installation and interpret the Electrical Engineering Drawing. |
| CO4 | Identify the types of service connection and installation of power circuits. |
| CO5 | Inspect and test an electrical installation in residential and commercial buildings and suggest protective methods. |
| CO6 | Design and selection of suitable size of conductor for wiring and estimation of smart home and industry. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 9 | 5 | 3 |  |  |  | 17 |
| CO2 |  | 2 | 3 |  | 12 |  | 17 |
| CO3 | 2 | 6 | 15 |  |  |  | 23 |
| CO4 | 12 | 1 | 4 |  |  |  | 17 |
| CO5 | 10 | 21 | 3 |  |  |  | 34 |
| CO6 | 4 | 12 |  |  |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EE2027** | **Duration** | **3hrs** |
| **Course Name** | **FUNDAMENTALS OF ELECTRICAL SAFETY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | --------------- is the total amount of energy delivered by the power system  to the arc. | | CO1 | U | 1 |
| 2. | Which is the “Can’t Let Go” range of current flow? | | CO1 | R | 1 |
| 3. | Abbreviate OSHA. | | CO2 | R | 1 |
| 4. | Name any two circuit protection devices. | | CO2 | U | 1 |
| 5. | -------- measurement can mean the difference between life and death. | | CO3 | U | 1 |
| 6. | All circuits and components to which employees may be exposed should  be ---------------before work begins. | | CO3 | U | 1 |
| 7. | Define insulator. | | CO4 | R | 1 |
| 8. | What is equipotential bonding conductor? | | CO4 | U | 1 |
| 9. | List the NESC depending factors. | | CO5 | U | 1 |
| 10. | The voltmeter must have very high internal resistance so as to drain a negligible test current. (True/False) | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Give outlines of Permissible Body Current Limits. | | CO1 | U | 3 |
| 12. | List the common causes of Electrical Accidents. | | CO2 | U | 3 |
| 13. | What does ampacity mean exactly? | | CO3 | U | 3 |
| 14. | Write short notes on Protective conductors. | | CO4 | U | 3 |
| 15. | Mention any four types of Electrical Safety-Related Organizations. | | CO5 | U | 3 |
| 16. | What is an Insulation Resistance test? | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | A hemispherical electrode is embedded in a soil with resistivity of 200 ohm-m (e.g., poorly graded gravel). Calculate the size of the electrode’s radius in order to achieve an earth resistance not exceeding 10 ohm . | CO1 | An | 6 |
|  | b. | Briefly describe the effect of electric current passing through the human body and also suggest suitable safety practice. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the Arc Flash PPE Categories based on article 130.7 of the NFPA 70E standard. | CO2 | A | 6 |
|  | b. | Write any four factors that affect the amount of trauma caused by an electric arc and explain. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Demonstrate the different types of grounding in the power system. | CO3 | U | 6 |
|  | b. | Briefly explain the different categories of Energy control programs. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Classify the different types of conductor and suggest suitable conductor for power Transformer and circuit breaker with suitable justification. | CO4 | U | 6 |
|  | b. | Describe the Safety against static electricity in brief. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain briefly the standards adopted by NEC during safe installation of electrical wiring and equipment. | CO5 | U | 6 |
|  | b. | List the requirements and purpose of NESC. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Elucidate the class-1 and class-2 equipment for safety mathematical representation. | CO1 | An | 6 |
|  | b. | Illustrate the determining safe approach distance from Electrical  Hazards. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Determine the minimum approach distances for employees for shock hazard purposes. | CO3 | An | 6 |
|  | b. | Illustrate on earth electrode and the different types of earth electrode. | CO4 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze earth resistance and classify the different methods that are available to measure the earth resistance. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the effects of electrical hazards on human body. |
| CO2 | Discover the potential of electrical hazard in the workplace. |
| CO3 | Identify the right safety procedure/method for the electrical accident that happened. |
| CO4 | Comprehend on the function of electrical safety equipment. |
| CO5 | Apply the appropriate electrical safety code prescribed by the regulatory bodies. |
| CO6 | Test the electrical safety systems and apply them in real-time applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 10 | - | 12 | - | - | 23 |
| CO2 | 1 | 16 | 6 | - | - | - | 23 |
| CO3 | - | 17 | - | 6 | - | - | 23 |
| CO4 | 1 | 22 | - | - | - | - | 23 |
| CO5 | - | 16 | - | - | - | - | 16 |
| CO6 | 1 | 3 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |



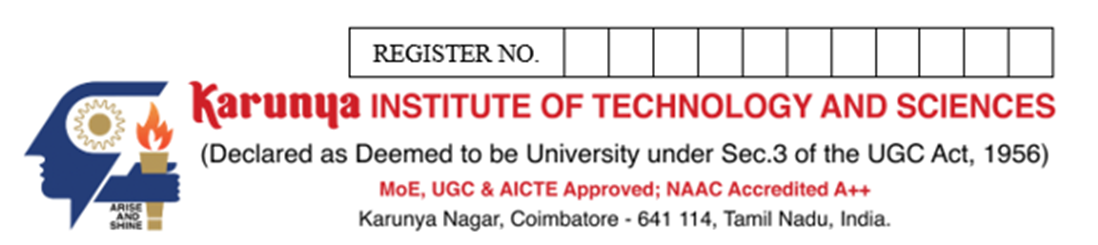
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| **Course Code** | **19EE2029** | **Duration** | **3hrs** |
| **Course Name** | **EMBEDDED SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name the mode of operation of ARM7 under which most of the applications and OS tasks run. | | CO1 | R | 1 |
| 2. | Undef mode of operation of ARM7 is used to handle memory violations.  True/False. | | CO1 | R | 1 |
| 3. | Communication from network server or application via gateway to the end device is known as\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | Define humidity sensor. | | CO2 | R | 1 |
| 5. | Mention the sensor used in touch screen of devices. | | CO3 | U | 1 |
| 6. | The \_\_\_\_\_\_\_\_\_ LPWAN technology has licensed spectrum | | CO3 | U | 1 |
| 7. | Smart Lighting is an example of \_\_\_\_\_\_\_\_\_\_\_ device. | | CO4 | A | 1 |
| 8. | \_\_\_\_\_ is a python framework with a code library used for common web development operations. | | CO4 | R | 1 |
| 9. | The IoT communication method that has both long range and long battery life is \_\_\_\_\_\_\_ | | CO5 | U | 1 |
| 10. | MQTT supports message binary large objects (BLOBs) up to \_\_\_\_\_\_ MB in size. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate M2M and IoT. | | CO1 | U | 3 |
| 12. | Paraphrase a Private Cloud. | | CO2 | U | 3 |
| 13. | List an application of prescriptive analytics. | | CO3 | R | 3 |
| 14. | Annotate the AWS that is five times faster than standard MySQL databases. | | CO4 | A | 3 |
| 15. | Summarize the features of PaaS. | | CO5 | U | 3 |
| 16. | Identify three characteristics of I2C protocol. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Compare and contrast the characteristics of microprocessor and microcontroller with a block diagram each. | CO1 | U | 6 |
|  | b. | With a block diagram explicate the application of IoT in efficient online shopping scenario. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Mention 8 applications of Stream Processing in various fields. | CO2 | A | 6 |
|  | b. | Differentiate a Data Lake and Data Warehouse with respect to a Big Data application. | CO2 | An | 3 |
|  | c. | Illustrate the lifecycle of IoT with an example each. | CO2 | U | 3 |
|  |  |  |  |  |  |
| 19. |  | With the necessary block diagram explain the Registers of Advanced RISC Machine 7 processor. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Explicate a device protocol that communicates in full duplex mode using a master-slave architecture with one master. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Choose top two suitable use cases for the following IoT sensors.   1. Temperature sensor 2. Proximity sensor 3. Pressure sensor 4. Chemical sensor | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Differentiate PaaS and IaaS with respect to its advantages and disadvantages. | CO5 | An | 6 |
|  | b. | Categorize the ecommerce and non-ecommerce application of Software as a Service (SaaS). | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Paraphrase the IoT Level 1, Level 2 and Level 3 with necessary block diagram and identify one application for each level of IoT. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Interpret Message Queuing Telemetry Transport (MQTT) protocol and its Quality of Service (QoS). | CO6 | U | 8 |
|  | b. | CoAP is different from HTTP – Justify. | CO6 | An | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Explain the basics of embedded systems and IoT using modular design and abstraction. |
| CO2 | Comprehend the major architectures and advanced features of ARM 32-Bit Microprocessor. |
| CO3 | Employ the usage of Internal and External Embedded Peripheral Components. |
| CO4 | Recognize the application of Protocols in designing an Embedded and IoT system. |
| CO5 | Implement an architectural design for Embedded IoT. |
| CO6 | Choose between available technologies and devices to solve the given societal challenge using IoT. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 9 | 6 |  |  |  | 17 |
| CO2 | 2 | 18 | 6 | 3 |  |  | 29 |
| CO3 | 3 | 2 |  | 12 |  |  | 17 |
| CO4 | 1 |  | 16 |  |  |  | 17 |
| CO5 |  | 4 | 6 | 6 |  |  | 16 |
| CO6 | 1 | 23 |  | 4 |  |  | 28 |
|  | | | | | | | **124** |

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**SUPPLEMENTARY EXAMINATION - JUNE 2023**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19EE2032** | **Duration** | **3hrs** |
| **Course Name** | **BASICS OF ELECTRIC AND HYBRID VEHICLE** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Represent the type of hybrid vehicle which is either propelled by ICE or battery. | | CO1 | U | 1 |
| 2. | List the benefits of hybrid car. | | CO1 | R | 1 |
| 3. | Report the main components of hybrid electric vehicle. | | CO2 | U | 1 |
| 4. | "In this system, the engine is used to supply electrical power to the motor, which then turns the wheels". Select the type of Hybrid System according to above description. | | CO2 | An | 1 |
| 5. | Represent the speed of the motor when the stator poles of the switch reluctance motor are increased. | | CO3 | U | 1 |
| 6. | Write the applications of DC Series Motor. | | CO3 | A | 1 |
| 7. | Record the form in which the energy is stored in a flywheel. | | CO4 | R | 1 |
| 8. | Indicate the battery that is not suitable for electric vehicle. | | CO5 | U | 1 |
| 9. | Name the commonly used battery in EVs. | | CO5 | R | 1 |
| 10. | Summarize about the term ‘SOC’ in battery management system. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the disadvantages of series hybrid vehicle. | | CO1 | R | 3 |
| 12. | Classify the types of DC motors. | | CO2 | U | 3 |
| 13. | Discuss about the need for Regenerative braking. | | CO3 | U | 3 |
| 14. | Explain rolling resistance and aerodynamic drag in vehicles. | | CO4 | U | 3 |
| 15. | Indicate the advantages and disadvantages of Ni-Cd batteries. | | CO5 | U | 3 |
| 16. | Enumerate the Amp- hr measurement of SOC in battery. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Compare and Contrast electric vehicle with IC engine vehicles. | CO1 | U | 6 |
|  | b. | Explain in brief about all wheel drive, front wheel drive and rear wheel drive. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discuss about the historical development of hybrid vehicle. | CO2 | U | 6 |
|  | b. | Criticize on the main components of an electric drive train. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the principle of operation, construction used in BLDC motors. Compare BLDC with brushed DC motors. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Describe various hybrid drive-train topologies. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the construction and working of hydrogen fuel cells. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Discuss on the mathematic modelling of vehicles and how the tractive force is calculated. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain in detail the super capacitor as alternate source of fuel for EV. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Deduce the requirement of an energy management control system in an HEV? Also, explain energy management strategies used in hybrid and electric vehicles. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the functioning of the propulsion system in vehicles. |
| CO2 | Apply the knowledge for selecting suitable combinations of EHV propulsion system. |
| CO3 | Analyze the effect on the characteristic behaviours of EHV. |
| CO4 | Evaluate the performance of the propulsion system for a given scenario. |
| CO5 | Design an Electric Hybrid Propulsion system for a specific application. |
| CO6 | Develop an Energy Management system for Electric Vehicles. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 19 | - | 6 | - | - | 29 |
| CO2 | - | 10 | - | 7 | - | - | 17 |
| CO3 | - | 16 | 1 | - | - | - | 17 |
| CO4 | 1 | 15 | - | - | - | - | 16 |
| CO5 | 1 | 28 | - | - | - | - | 29 |
| CO6 | 3 | 1 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EE2051** | **Duration** | **3hrs** |
| **Course Name** | **IOT AND ITS APPLICATIONS IN ELECTRICAL ENGINEERING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Ability of a system to work with or use the parts or equipment of another is called \_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 2. | Global Sensor Network works under \_\_\_\_\_\_\_ environment. | | CO1 | A | 1 |
| 3. | \_\_\_\_\_\_\_\_ protocol is lightweight. | | CO2 | U | 1 |
| 4. | Frequency band of low power Wifi is \_\_\_\_\_\_\_\_\_. | | CO2 | U | 1 |
| 5. | MQTT is Machine to Machine and Internet of Things protocol ( True/False). | | CO3 | R | 1 |
| 6. | \_\_\_\_\_\_\_ protocol is used in GSN. | | CO3 | R | 1 |
| 7. | In Touch screen devices \_\_\_\_\_\_\_\_\_\_ sensor is used. | | CO4 | U | 1 |
| 8. | In home automation \_\_\_\_\_\_\_\_\_\_\_\_ sensor is used to detect the movements. | | CO4 | R | 1 |
| 9. | ICT stands for \_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | \_\_\_\_\_ will convert any form of signal in to electrical signal. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List out the characteristics of IoT. | | CO1 | R | 3 |
| 12. | Draw the basic architecture of IoT. | | CO2 | An | 3 |
| 13. | Differentiate between sensors and actuators. | | CO3 | R | 3 |
| 14. | Name any four tools used in big data analytics. | | CO4 | U | 3 |
| 15. | Define the term safety security and reliability in IoT. | | CO5 | A | 3 |
| 16. | List out any 3 sensors used to monitor environment. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate about Real Time Operating System (RTOS) used in industries. | CO1 | An | 6 |
|  | b. | Write down any one hardware and software requirements for Internet of Things. | CO1 | R | 6 |
| 18. | a. | Write short notes on MQTTS and CoAP. | CO2 | U | 6 |
|  | b. | Compare Sigfox and LoRA protocol used in IoT. | CO2 | R | 6 |
| 19. | a. | Brief about Infrared and Thermal Sensors used in Food industries. | CO3 | R | 6 |
|  | b | Describe about the operating principle and application of any two type of actuators used in industries. | CO3 | R | 6 |
| 20. | a. | Draw the architecture of Cloud of Things and examine its function. | CO3 | A | 6 |
|  | b. | Illustrate the significance of Saas, Paas, and Iaas used in cloud service. | CO3 | R | 6 |
| 21. | a. | Illustrate the HARD and MODBUS protocol. | CO4 | A | 6 |
|  | b | Describe pressure sensor and temperature sensor used in industries. | CO4 | R | 6 |
| 22. | a. | Explain about Real time Monitoring system with suitable example. | CO4 | A | 6 |
|  | b | Write short notes on Smart Factories. | CO5 | U | 6 |
| 23. | a. | Illustrate about Industry 4.0. | CO5 | A | 6 |
|  | b | Mention various benefits and challenges of Internet of Things in Supply Chain Management (SCM). | CO5 | R | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Brief about Inter and intra vehicular communication. | CO6 | U | 6 |
|  | b. | Describe about the weather monitoring system using cloud computing. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the architecture framework of IoT. |
| CO2 | Explain IoT Standards and Protocols. |
| CO3 | Select suitable Smart Sensors depending on the applications. |
| CO4 | Apply IoT for Smart and Digital Factories. |
| CO5 | Design and develop smart homes. |
| CO6 | Develop applications of IoT in Transportation |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 8 |  | 1 | 9 |  |  | 18 |
| CO2 | 7 | 10 |  |  |  |  | 17 |
| CO3 | 6 | 3 | 10 |  |  |  | 19 |
| CO4 | 13 | 1 | 15 |  |  |  | 29 |
| CO5 | 5 | 3 | 20 |  |  |  | 28 |
| CO6 |  | 7 | 6 |  |  |  | 13 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20EE1001** | **Duration** | **3hrs** |
| **Course Name** | **BASIC ELECTRICAL AND COMPUTER ENGINEERING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name few tools used for electrical wiring. | | CO1 | U | 1 |
| 2. | The star label indicates the \_\_\_\_\_\_\_\_\_\_\_ level of the device. | | CO1 | R | 1 |
| 3. | Single Phase Induction motor is a self-starting motor: (True or False) | | CO2 | R | 1 |
| 4. | Write the any two Limitations of Brushless DC motor. | | CO2 | R | 1 |
| 5. | Name the types of ROM. | | CO3 | U | 1 |
| 6. | \_\_\_\_\_\_\_\_\_\_\_ is used to hold the contents of data being manipulated. | | CO3 | R | 1 |
| 7. | Suggest suitable sensor for Water level controller. | | CO4 | U | 1 |
| 8. | \_\_\_\_\_\_\_\_\_\_\_ consists of two different metals connected at two points. | | CO4 | R | 1 |
| 9. | \_\_\_\_\_\_\_\_\_\_\_ is a decentralized ledger of all transactions across a peer-to-peer network. | | CO5 | U | 1 |
| 10. | Define IOT. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Justify why LED lighting is superior to other lighting. | | CO1 | U | 3 |
| 12. | Summarize the advantages of three phase induction motor. | | CO2 | U | 3 |
| 13. | Draw the symbol of the following devices.   1. Zener diode 2. LED 3. UJT | | CO3 | U | 3 |
| 14. | List any four essential technologies of Industry-4.0. | | CO4 | U | 3 |
| 15. | Write short notes about Modem. | | CO5 | U | 3 |
| 16. | Mention the characteristics of Big data analysis. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | Distinguish between Conventional and non-conventional sources of energy. | CO1 | U | 4 |
|  | b. | Calculate the energy consumed per month by the following electrical appliances.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | [s.no](http://s.no/) | Name of the load | Quantity | Wattage | Operating hours | | 1 | Fluorescent lamp | 7 | 40W | 5 | | 2 | Ceiling Fan | 3 | 60W | 10 | | 3 | Refrigerator(165L) | 1 | 100W | 24 | | 4 | Air Conditioner | 1 | 1500W | 6 | | 5 | Mixer | 1 | 450W | 1 | | 6 | LED Television | 1 | 100W | 8 | | CO1 | U | 8 |
| 18. |  | Describe the construction and working principle of DC motor with the help of a neat diagram. | CO2 | U | 12 |
| 19. | a. | Discuss the operation of the AND, OR, NOT, NOR gates using the truth table. | CO3 | U | 08 |
|  | b. | Explain the operation of PN junction diode under forward bias condition with its characteristics curve. | CO3 | U | 04 |
| 20. |  | With the relevant schematic, describe a water level controller for a multi-storage building and list its advantages. | CO4 | A | 12 |
| 21. | a. | Briefly describe the various functions of operating system in computer. | CO5 | U | 8 |
|  | b. | Compare MAC and IP address. | CO5 | U | 4 |
| 22. | a. | Draw the circuit diagram of Staircase wiring and explain its operation. | CO1 | U | 6 |
|  | b. | Explain the piezo electric pressure sensor working with suitable diagram. | CO4 | U | 6 |
| 23. | a. | Suggest suitable motor for the following applications   1. Home Fans 2. Mixer 3. Grinder 4. Air conditioner 5. Washing machine 6. Pumps | CO2 | A | 6 |
|  | b. | Describe the operation of photo diode and list the applications. | CO3 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the concept of Cloud computing and list the various types and advantages. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Identify the basics and usage of electric grids, power supply, wiring and safety in domestic and commercial electrical areas. | | | | | | | |
| CO2 | Apply the working of electrical machines in daily life and other applications. | | | | | | | |
| CO3 | Recognize the need of electronic circuits in digital circuits and devices. | | | | | | | |
| CO4 | Identify the characteristics and applications of sensors and transducers. | | | | | | | |
| CO5 | Classify the role of computers in daily and commercial applications. | | | | | | | |
| CO6 | Understand the latest concepts in the computer and electrical trends. | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 1 | 22 |  |  |  |  | 23 |
| CO2 | | 2 | 21 |  |  |  |  | 23 |
| CO3 | | 1 | 22 |  |  |  |  | 23 |
| CO4 | | 1 | 10 | 12 |  |  |  | 23 |
| CO5 | |  | 16 |  |  |  |  | 16 |
| CO6 | |  | 16 |  |  |  |  | 16 |
|  | | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20EE1003** | **Duration** | **3hrs** |
| **Course Name** | **SENSORS AND MEASUREMENT TECHNIQUES IN BIOTECHNOLOGY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define Lenz’s Law. | | CO1 | R | 1 |
| 2. | Find the voltage across an electric bulb of resistance 100Ω through which passes a current of 2 A. | | CO1 | A | 1 |
| 3. | **A string of Christmas lights is an example of ————- circuit.** | | CO2 | A | 1 |
| 4. | State any one advantage of MI instruments over PMMC instruments. | | CO2 | R | 1 |
| 5. | Write the function of ADC. | | CO3 | U | 1 |
| 6. | Elucidate the role of delay line circuit in CRO. | | CO3 | U | 1 |
| 7. | List the applications of e-nose. | | CO4 | R | 1 |
| 8. | How transducers are classified according to the basis of transduction? | | CO4 | R | 1 |
| 9. | What are the basic parts of LVDT? | | CO5 | R | 1 |
| 10. | Give some examples of commercially available biosensors. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate active and passive elements. Give examples for each. | | CO1 | U | 3 |
| 12. | The ratio arms of a Wheatstone bridge are 500 Ω and 50 Ω respectively. If the bridge is balanced when the adjustable resistor is set to 22.8 Ω, calculate the value of the unknown resistor. | | CO2 | A | 3 |
| 13. | Write the role of liquid crystals in LCD display. | | CO3 | U | 3 |
| 14. | Compare e-nose with biological nose. | | CO4 | U | 3 |
| 15. | Describe the working principle of the thermocouple. | | CO5 | U | 3 |
| 16. | List the components of biosensor. Mention the role of each component. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | Three resistors of 2 Ω, 3 Ω and 5 Ω are connected in series across 20V supply. Find the equivalent resistance, current and voltage across each resistor. | CO1 | A | 6 |
|  | b. | Apply KCL for the circuit to find current through all the resistors. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Discuss about the different torques required for the operation of instruments and also the methods to implement all the torques. | CO2 | U | 12 |
| 19. | a. | Draw the block diagram of DSO. Write about the reconstruction mechanisms used to display the waveforms. | CO3 | R | 8 |
|  | b. | List the advantages of DSO over CRO. | CO3 | R | 4 |
| 20. |  | Explain the working principle of pyranometer with a neat diagram. Mention the applications. | CO4 | U | 12 |
| 21. |  | What is a strain gauge? How do they work? Give real-life examples of the use of strain gauges. | CO5 | U | 12 |
| 22. | a. | State and explain Kirchhoff’s current and voltage laws with suitable examples. | CO1 | R | 6 |
|  | b. | Draw the block diagram of Digital Multi-meter. Mention the role of each block. | CO1 | R | 6 |
| 23. |  | With neat diagram explain the construction and working principle of Permanent Magnet Moving Coil (PMMC) Instrument. | CO2 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Draw the block diagram of smart sensor. Mention the role of each block. Write the application of smart sensors in health care and agriculture. | CO6 | R | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Understand the basic circuit components. | | | | | | | |
| CO2 | Describe working of the electronic measuring instruments. | | | | | | | |
| CO3 | Know the different display and recording devices. | | | | | | | |
| CO4 | Identify sensors and instruments needed for measurement and control. | | | | | | | |
| CO5 | Know the working principle and the characteristics of different transducers. | | | | | | | |
| CO6 | Choose suitable smart sensors for various biotechnology applications. | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 13 | 3 | 13 | - | - | - | 29 |
| CO2 | | 1 | 24 | 4 | - | - | - | 29 |
| CO3 | | 12 | 5 | - | - | - | - | 17 |
| CO4 | | 2 | 15 | - | - | - | - | 17 |
| CO5 | | 1 | 15 | - | - | - | - | 16 |
| CO6 | | 16 | - | - | - | - | - | 16 |
|  | | | | | | | | **124** |



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| **Course Code** | **20EE2001** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRIC VEHICLE DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Porsche showed his first hybrid car at the Paris exposition in the year \_\_\_\_. | | CO1 | U | 1 |
| 2. | A fuel cell is an electrochemical cell that converts \_\_\_\_\_ energy of a fuel and an oxidizing agent through a pair of redox reactions. | | CO1 | R | 1 |
| 3. | Regenerative braking is not possible in a series motor – **True or False**. | | CO2 | An | 1 |
| 4. | The synchronous speed of an AC machine, if the no. of poles (P) is 6 and frequency (f) is 50Hz is \_\_\_\_\_ rpm. | | CO2 | E | 1 |
| 5. | A \_\_\_\_ arrangement with one driven wheel at the back could also help in the production of a near-teardrop shape with its associated low aerodynamic drag. | | CO3 | U | 1 |
| 6. | Aerodynamic drag and rolling resistance minimization are particularly important to design EVs with \_\_\_\_\_\_ efficiencies in order to reduce the mass of expensive batteries required. | | CO3 | R | 1 |
| 7. | The Popular Driving Cycle ‘FUDS’ stands for \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | The force at the rims or the outer edges of the driving wheels of moving trains is called \_\_\_\_\_\_\_\_\_ effort. | | CO4 | U | 1 |
| 9. | A device which gives an electrical output by detecting the changes in quantities or events can be defined as a \_\_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | \_\_\_\_\_ is a technique which enables machines to mimic human behavior. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare Lithium ion and Lithium Polymer Batteries. | | CO1 | An | 3 |
| 12. | Distinguish BLDC Motor with Induction Motor. | | CO2 | An | 3 |
| 13. | Demonstrate the stick controller with respect to design of controls. | | CO3 | U | 3 |
| 14. | For an Electric Vehicle (EV), if the gear ratio (G) is 10, total tractive effort is 50N and radius of the tyre is 10 m, find the motor torque. | | CO4 | E | 3 |
| 15. | Name any three sensors used in self-driving cars. | | CO5 | U | 3 |
| 16. | Brief out Honda FCX Clarity. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Deliberate the parallel hybrid and series-parallel hybrid configuration of hybrid vehicle with necessary diagrams. | CO1 | U | 8 |
| b. | Fuel cell an alternative for batteries – Discuss. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Explain the Converter for Switched Reluctance Motor (SRM) with neat diagram and waveforms. | CO2 | U | 8 |
| b. | Sketch the Torque-speed Characteristics of SRM. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 19. |  | Deliberate the transmission efficiency and consideration of vehicle mass of Electric Vehicle necessary diagrams. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Discuss the modelling of Battery with respect to an EV. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the benefits of AI based EV compared to conventional PI control of EV with necessary diagrams. | CO5 | U | 8 |
| b. | Brief out self-healing sensors. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. |  | Towards the EV performance, designate the effect of Vehicle Chassis and Body Design necessary diagrams and equations. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Deliberate the case study on Honda Insight. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss the case study on GM EV1. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Realize the need of Electric vehicles. |
| CO2 | State different types of Electric & Hybrid Vehicles. |
| CO3 | Use the energy on-board optimally. |
| CO4 | Understand the design and mathematical modelling of EV and drives. |
| CO5 | Analyze the latest control techniques for vehicle control. |
| CO6 | Simulate and observe the behaviour of the EV. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 9 | 4 | 3 | - | - | 17 |
| CO2 | 4 | 8 | - | 4 | 1 | - | 17 |
| CO3 | 1 | 4 | 24 | - | - | - | 29 |
| CO4 | 1 | 13 | - | - | 3 | - | 17 |
| CO5 | - | 17 | - | - | - | - | 17 |
| CO6 | - | 12 | 3 | 12 | - | - | 27 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20EE3001** | **Duration** | **3hrs** |
| **Course Name** | **IOT FOR FOOD INDUSTRIES** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Designate the time-line evolution of IoT. | CO1 | R | 6 |
| b. | With a block diagram explain a simple communication model. | CO1 | U | 6 |
| c. | Sketch the generic block diagram of IoT device. | CO1 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 2. |  | With necessary diagram elaborate a real time diagnostics system using IoT. | CO2 | An | 20 |
| 3. | a. | Draw the hardware architecture of an embedded system. | CO3 | U | 6 |
| b. | Compare Arduino and Raspberry Pi Microcontrollers. | CO3 | R | 6 |
| c. | Suggest an energy-efficient design for battery-powered embedded systems. | CO3 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | List out the challenges of smart object networks. | CO4 | U | 6 |
| b. | Analyse the network level challenges of IoT. | CO4 | An | 14 |
| 5. | a. | Sketch the diagram for usage of future internet enables for smart agri-food logistics. | CO5 | U | 6 |
| b. | Discuss the Architecture of IoT-based tracking and tracing platform with neat diagram. | CO5 | An | 14 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Describe the features, advantages, applications and seven guiding principles of Service-oriented Architecture. | CO2 | A | 20 |
| 7. | a. | Describe the IoT-based Smart Farming Cycle. | CO6 | A | 10 |
| b. | Discourse impact of the upcoming 5G network on smart farming. | CO6 | An | 10 |
|  |  | **(OR)** |  |  |  |

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| --- | --- | --- | --- | --- | --- |
| 8. | a. | Examine the need of Quality Assurance (QA) in process of delivery of a truly end-to-end production level IoT system. | CO5 | An | 10 |
| b. | Compare cloud, edge cloud and edge computing. | CO3 | A | 10 |
|  | | | | | |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | With necessary block diagrams and schematics deliberate the need of Nano sensors applications in agriculture and food industry. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the concepts of Internet of Things. |
| CO2 | Understand the design architecture of IoT and its concepts. |
| CO3 | Select appropriate components for developing IoT hardware. |
| CO4 | Choose suitable protocols and deployment in solutions. |
| CO5 | Learn the concepts of food supply chain. |
| CO6 | Understand the IoT based Monitoring system. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 6 | 14 | - | - | - | - | **20** |
| CO2 | - | - | 20 | 20 | - | - | **40** |
| CO3 | 6 | 6 | 18 | - | - | - | **30** |
| CO4 | - | 6 | - | 14 | - | - | **20** |
| CO5 | - | 6 | - | 24 | - | - | **30** |
| CO6 | - | - | 10 | 30 | - | - | **40** |
|  | | | | | | | **180** |