**Graphical user interface, application

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| **Course Code** | **11EE209/12EE209/EE251** | **Duration** | **3hrs** |
| **Course Name** | **INDUCTION AND SYNCHRONOUS MACHINES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Indicate how armature winding in alternators differs from those used in a DC machine. | | CO1 | U | | 1 |
| 2. | Define fractional slip in Induction Motor. | | CO3 | R | | 1 |
| 3. | Indicate why the single-phase induction motor is not self-starting. | | CO2 | U | | 1 |
| 4. | Identify when is a synchronous motor said to be under-excited. | | CO2 | R | | 1 |
| 5. | Define pull-out torque in a synchronous motor. | | CO3 | R | | 1 |
| 6. | List the main parts of the synchronous motor. | | CO2 | R | | 1 |
| 7. | The synchronous motor always runs at synchronous speed -Justify. | | CO1 | E | | 1 |
| 8. | Define the term voltage regulation of an alternator. | | CO2 | R | | 1 |
| 9. | Name the factor that provides synchronous reactance. | | CO3 | U | | 1 |
| 10. | Sketch the power angle characteristic curve of a salient pole machine. | | CO3 | A | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | List the advantages of the repulsion motor. | | CO1 | | R | 3 |
| 12. | An induction motor having 8 poles runs on 50 Hz supply. If it operates at fullload at 720 rpm. Compute slip. | | CO3 | | A | 3 |
| 13. | Differentiate synchronous reluctance motor and hysteresis motor. | | CO2 | | U | 3 |
| 14. | List the applications of universal motors. | | CO1 | | R | 3 |
| 15. | Show the necessity for predetermination of voltage regulation. | | CO2 | | U | 3 |
| 16. | Sketch torque-slip characteristics. | | 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. |  | Explain the principle of operation, construction, and torque equation of three phase induction motor with the necessary diagrams. | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 18. |  | Explain the construction and working principle of a single-phase induction motor. Develop an equivalent circuit of a single-phase induction motor ignoring core losses. | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 19. |  | Express the EMF equation for the synchronous machines | CO3 | | U | 12 |
|  |  |  |  | |  |  |
| 20. |  | Describe with neat sketches the constructional details of a salient pole-type alternator.Discuss briefly the load characteristics of the alternator for different power factors. | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 21. |  | An over-excited synchronous motor is called a synchronous condenser. Explain. | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 22. |  | A 3300V, 3-phase synchronous motor running at 1500 rpm has its excitation kept constant corresponding to a no-load terminal voltage of 3000V. Determine the power input, power factor, and torque developed for an armature current of 250A if the synchronous reactance is 5 Ω per phase and armature resistance is neglected. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | A 3 phase, 4 pole 50 Hz induction motor at standstill has 180V induced across its star-connected terminals. The rotor resistance and standstill reactance per phase are 0.6Ω and 0.3Ω respectively. Calculate the speed when the rotor is drawing a current of 6A at a particular load. Also, calculate the speed at which the torque is maximum and the corresponding value of the rotor. | CO1 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Sketch neatly the phasor diagrams, V-curves, and inverted V-curves of synchronous motor and explain in detail | CO2 | | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Knowledge of selecting the suitable motor for an application and implement suitable control techniques for the selected motor. |
| CO2 | Ability to identify the various operation conditions of Synchronous motor and its impact. |
| CO3 | Ability to understand the importance of various parameter while synchronization. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 6 | 1 | 24 | - | 1 | - | 32 |
| CO2 | 3 | 67 | - | - | - | - | 70 |
| CO3 | 2 | 16 | 4 |  |  |  | 22 |
|  | | | | | | | **124** |

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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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the power device which is having highest switching frequency. | | CO1 | R | 1 |
| 2. | Identify any one power device which conducts current at both directions. | | CO1 | R | 1 |
| 3. | Define holding current. | | CO1 | U | 1 |
| 4. | Which type of ac-dc power converter works in four quadrants? | | CO2 | U | 1 |
| 5. | A power converter which converts input power at one frequency to output power at different frequency with one stage conversion is called \_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 6. | In a step down chopper, if Vs = 120 V and the chopper is operated at a duty cycle of 80 %. Find the output voltage. | | CO2 | A | 1 |
| 7. | Define Modulation index. | | CO2 | R | 1 |
| 8. | Voltage source Inverter has stiff ac source voltage at its terminals. Say True or False. | | CO2 | A | 1 |
| 9. | Identify the type of power supply required for a life support system. | | CO3 | A | 1 |
| 10. | Name the type of HVDC scheme uses only one conductor. | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MAR/KS)** | | | | | |
| 11. | Discuss the advantages and disadvantages of GTO. | | CO1 | U | 3 |
| 12. | Compare full converter and semi converter. | | CO1 | U | 3 |
| 13. | A step down chopper has Vdc = 100 V, R = 12 Ohms. If the duty cycle is 0.6, calculate average voltage Vavg and rms voltage Vrms | | CO2 | A | 3 |
| 14. | Brief out the control strategies of AC Voltage controllers. | | CO2 | U | 3 |
| 15. | Define PWM and its advantages. | | CO3 | U | 3 |
| 16. | List out few methods used to generate the gate pulse for ac-dc converter. | | 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. | a. | With neat diagrams describe the switching characteristics of Power MOSFET. | CO1 | U | 6 |
|  | b. | Elucidate the static characteristics of TRIAC. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. |  | Explain the static and switching characteristics of Thyristor in detail with neat diagrams. | CO1 | R | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the operation of a single phase half controlled bridge converter with RL load with neat diagram and waveform. Also drive expression for average output voltage. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Discuss the working of the single phase ac to ac full wave voltage controller with R Load with necessary circuit diagram and waveform. Also drive the expression for rms output voltage. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the working of the step down chopper with R load with neat circuit diagram and waveform. Also derive the expression for the average value of the load voltage and load current. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe the operation of single phase full bridge inverter with circuit diagram and waveform. | CO2 | A | 8 |
|  | b. | The single phase full bridge inverter has a resistive load R=2.4Ω and the dc input voltage is Vs=48V. Determine a) the rms output voltage at fundamental frequency, b) the output power. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 23. |  | Explain the operation of three phase bridge inverter in 120° mode conduction with relevant circuit diagram and waveform. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the working of HVDC systems with relevant circuit diagram. | CO3 | U | 6 |
|  | b. | With relevant circuit diagram, explain the working of UPS. | CO3 | U | 6 |

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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. | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 12 | 21 |  |  |  |  | 33 |
| CO2 | | 2 | 28 | 29 |  |  |  | 59 |
| CO3 | | 1 | 18 | 13 |  |  |  | 32 |
|  | | | | | | | | **124** |

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| **Course Code** | | **11EE215/ 12EE215/ EE253** | **Duration** | **3hrs** | |
| **Course Name** | | **GENERATION, TRANSMISSION AND DISTRIBUTION** | **Max. Marks** | **100** | |
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| **Q. No.** | **Questions** | **Marks** |
| **PART – A (10X1 = 10 MARKS)** | | |
| 1. | What is the function of super heater in a thermal electric power plant? | 1 |
| 2. | Define annual plant capacity factor | 1 |
| 3. | In a 3-phase, 4 wire ac system, if the loads are balanced, then the current in the neutral wire is \_\_\_\_\_. | 1 |
| 4. | Define skin effect. | 1 |
| 5. | What is GMD? | 1 |
| 6. | How capacitance is calculated in a long transmission line? | 1 |
| 7. | The metallic sheath is provided over the insulation to protect the cable from \_\_\_\_\_\_\_\_. | 1 |
| 8. | By using a guard ring, the string efficiency is \_\_\_\_\_\_\_\_\_\_\_\_\_. | 1 |
| 9. | Give any two advantages of ring main distributor. | 1 |
| 10. | Strain type insulators are used for voltages beyond \_\_\_\_\_\_\_\_\_. | 1 |

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| **PART – B(6X 3= 18 MARKS)** | | |
| 11. | Why is a condenser used in a steam power station ? | 3 |
| 12. | Mention the advantages of high transmission voltages. | 3 |
| 13. | Draw the diagram for short transmission line. | 3 |
| 14. | What are the factors affecting corona? | 3 |
| 15. | Define String Efficiency. | 3 |
| 16. | Classify the types of DC distributors. | 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. |  | With a neat diagram, the working principle of Thermal power plant. List the advantages and disadvantages. | 12 |
| 18. |  | With the help of neat sketch showing different circuits, explain the working of a nuclear power station. | 12 |
| 19. |  | Deduce an expression for line to neutral inductance for a 3-phase overhead transmission line when the conductors are (a) symmetrically placed(b) un symmetrically placed but transposed.power station. | 12 |
|  |  |  |  |
| 20. |  | Show how regulation and transmission efficiency are determined for medium lines using a nominal T&π methods. | 12 |
| 21. |  | In a three phase overhead system each line is suspended by a string of three insulators. The voltages at the top unit, near the tower and middle unit are 10kV and 11 kV respectively.  a.Evaluate the ratio of shunt capacitance to self capacitance of each insulator.  b.String Efficiency  c.Line Voltage. | 12 |
| 22. |  | Draw a cross sectional view, showing the constructional details of a single core low tension cable and explain the purpose of each material used. | 12 |
| 23. |  | Derive the expression for sag in the transmission line a. at equal levels b. at unequal levels. | 12 |
|  |  | **COMPULSORY QUESTION** |  |
| 24. |  | Sketch the different types of dc distribution systems and derive equations for the same. | 12 |

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Three equal resistors of 3 Ω are connected is delta. If the network is converted into an equivalent star network, identify the value of resistor in each arm of the network. | | CO1 | A | | 1 |
| 2. | In the circuit given below, find the current supplied by the voltage source. | | CO1 | An | | 1 |
| 3. | Define poles and zeros of a network function. | | CO2 | U | | 1 |
| 4. | \_\_\_\_\_\_\_ theorem states that in a linear bilateral network, the ratio of excitation to the response remains the same even if its positions are interchanged. | | CO1 | U | | 1 |
| 5. | Give an expression for the Band width of a series RLC circuit. | | CO2 | R | | 1 |
| 6. | Define the coefficient of coupling. | | CO1 | U | | 1 |
| 7. | In a balanced, 3 phase, star connected power system, Vph=\_\_\_\_\_\_\_\_ where Vph is the phase voltage and VL is the line voltage. | | CO1 | R | | 1 |
| 8. | Give an expression to find the time constant of RL circuit. | | CO2 | R | | 1 |
| 9. | If W1 and W2 are the wattmeter readings of a three phase power measurement using two wattmeter scheme, the power factor of the circuit will be \_\_\_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 10. | Define driving point impedance parameters. | | CO1 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Find the equivalent resistance with respect to terminals A and B. | | CO1 | | A | 3 |
| 12. | Determine the poles of the function | | CO2 | | An | 3 |
| 13. | Obtain the relation between the Thevinin’s equivalent circuit and Norton’s equivalent circuit of an electric circuit. | | CO1 | | A | 3 |
| 14. | An RLC series circuit is supplied with 50V AC supply. If R=10 ohm, L=5 henry and C=1 farad, determine the current through the circuit at resonance. | | CO1 | | An | 3 |
| 15. | Determine the time constant of an RC circuit with R=10 ohm and C=1 Farad. | | CO2 | | A | 3 |
| 16. | Obtain the design equations of a constant K, low pass, passive filter. | | CO3 | | C | 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. | Determine the equivalent resistance between terminals A and B in Figure | CO1 | | A | 8 |
|  | b. | Illustrate Voltage division rule with the help of an example. | CO1 | | U | 4 |
|  |  |  |  | |  |  |
| 18. | a. | In the circuit of Figure, find the current I using the mesh method if the resistors are in ohm.  . | CO1 | | An | 8 |
|  | b. | Illustrate the significance of Super nodal method with the help of an example. | CO1 | | U | 4 |
|  |  |  |  | |  |  |
| 19. | a. | Determine the Norton’s equivalent circuit across AB for the circuit shown in Figure. | CO1 | | A | 8 |
|  | b. | State and illustrate Millman’s theorem. | CO1 | | U | 4 |
|  |  |  |  | |  |  |
| 20. | a. | Each phase of a 3 phase Δ connected load consists of impedance Z = 10+j10Ω. The line voltage is 400V at 50Hz. Compute the power consumed by each phase impedance and total power. | CO1 | | An | 8 |
|  | b. | For the three coupled coils in fig., calculate the total inductance. | CO1 | | A | 4 |
|  |  |  |  | |  |  |
| 21. | a. | A series RLC circuit with R = 40 Ω, L = 60 mH and C = 60 µF has an applied voltage of 200 V, determine the value of (i) resonant frequency (ii) current at resonance (iii) Q-factor and (iv) Bandwidth. | CO2 | | An | 8 |
|  | b. | The number of turns in an ideal transformer are N1 = 10 and N2 = 50. Determine the primary impedance if the secondary load is 5 K Ω. | CO1 | | A | 4 |
|  |  |  |  | |  |  |
| 22. |  | In the RC circuit shown in figure, the switch S is closed initially on 1 at t = 0, then it is moved on to position 2. Find the complete current transient. | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 23. | a. | Write the mesh equations for the circuit shown in figure and hence determine the current through the 10 ohm resistor. | CO1 | | An | 8 |
|  | b. | Write down the conditions for various damping in series RLC circuit with DC excitation. | CO2 | | An | 4 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Find the impedance parameters of the two port network given below. | CO1 | | An | 12 |

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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 | 1 | 16 | 31 | 40 | - | - | 88 |
| CO2 | 2 | 1 | 3 | 27 | - | - | 33 |
| 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** | | **Course Outcome** | | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | The specific \_\_\_\_\_\_\_\_ loading is defined as the total flux per unit area over the surface of the armature periphery. | | | CO1 | | U | 1 |
| 2. | Differentiate leakage magnetic flux and useful magnetic flux. | | | CO1 | | R | 1 |
| 3. | Define fringing. | | | CO2 | | R | 1 |
| 4. | Write the relation between the number of commutator segments and number of armature coils in a D.C generator. | | | CO3 | | R | 1 |
| 5. | Mention the ranges of specific magnetic loading in an induction motor. | | | CO4 | | U | 1 |
| 6. | Write the expression for the length of mean turn of stator winding. | | | CO4 | | R | 1 |
| 7. | \_\_\_\_\_\_\_\_\_\_ is a phenomenon in which the induction motor refuses to start. | | | CO4 | | U | 1 |
| 8. | Distinguish Core and Shell Type Transformer. | | | CO5 | | U | 1 |
| 9. | Define copper space factor. | | | CO5 | | R | 1 |
| 10. | \_\_\_\_\_\_\_\_\_winding is used to reduce the oscillations developed in the rotor of alternator when it is suddenly loaded. | | | CO6 | | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Derive the output equation of a DC Machine. | | | CO1 | | U | 3 |
| 12. | List the factors that influence the choice of commutator diameter. | | | CO2 | | U | 3 |
| 13. | Mention the guiding factors for the selection of number of poles. | | | CO3 | | R | 3 |
| 14. | List down the factors to be considered for estimating the length of air gap in Induction motor. | | | CO4 | | U | 3 |
| 15. | Write the steps involved in the design of single phase transformer. | | | CO5 | | U | 3 |
| 16. | Define critical speed of alternator. | | | 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. |  | Obtain the relationship between real and apparent flux density in the slots of rotating machine. | | CO1 | | U | 12 |
| 18. |  | A 350 KW, 500 V, 450 rpm, 6 pole dc generators is built with an armature diameter of 0.87m and core length of 0.32m. The lap wound armature has 660 conductors. Calculate the specific electric and magnetic loadings. | | CO2 | | An | 12 |
| 19. |  | Find the main dimensions and the number of poles of a 37kW, 230V, 1400rpm Shunt motor so that a square pole face is obtained. The average gap density is 0.5wb/m2 and the ampere conductors per meter are 22000. The ratio of pole arc to pole pitch is 0.7 and the full load efficiency is 90%. | | CO3 | | An | 12 |
| 20. |  | Determine the D and L of a 70HP, 415V, three phase, 50Hz, star connected, 6 pole induction motor for which ac = 30000 ampere conductor/m and Bav = 0.51wb/m2. Take efficiency = 90% and pf = 0.91. Assume τ = L. Estimate the number of stator conductors required for a winding in which the conductors are connected in two parallel paths. Choose a suitable number of conductors/slots so that the slot loading does not exceed 750ampere conductors. | | CO4 | | An | 12 |
| 21. |  | Explain the following in detail,  a. Rules for selecting rotor slots of squirrel cage Induction machines(4)  b. Design of rotor bars(4)  c. Design of stator(4) | | CO4 | | U | 12 |
| 22. |  | Derive the output equation of single phase Transformer and three phase transformer. | | CO5 | | R | 12 |
| 23. |  | Explain the design procedure to design a transformer tank and cooling tubes in a single phase transformer. | | CO5 | | U | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. |  | Write short notes on the following:  a. Short Circuit Ratio(6)  b. Design of turbo alternator.(6) | CO6 | | U | | 12 |

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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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 16 |  |  |  |  | 17 |
| CO2 | 1 | 3 |  | 12 |  |  | 16 |
| CO3 | 4 |  |  | 12 |  |  | 16 |
| CO4 | 1 | 17 |  | 12 |  |  | 30 |
| CO5 | 13 | 16 |  |  |  |  | 29 |
| CO6 |  | 16 |  |  |  |  | 16 |
|  | | | | | | | **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** | | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Power BJT is a \_\_\_\_\_\_\_\_\_\_ controlled device. | | | CO1 | R | 1 |
| 2. | Define Latching current. | | | CO1 | R | 1 |
| 3. | Define firing angle. | | | CO2 | U | 1 |
| 4. | Single phase fully controlled converter is \_\_\_\_\_\_\_\_\_\_\_ quadrant converter. | | | CO2 | U | 1 |
| 5. | Mention the type of dc-dc chopper used in reversible regenerative dc drives. | | | CO3 | R | 1 |
| 6. | A step down chopper is operated in the continuous conduction mode in steady state with a constant duty ratio D. If VO is the magnitude of the DC output voltage and if the VS is the magnitude of the DC input voltage, the ratio of VO / VS is given by \_\_\_\_\_\_\_\_\_\_. | | | CO3 | U | 1 |
| 7. | Voltage source Inverter has stiff dc source voltage at its terminals. Say True or False. | | | CO4 | R | 1 |
| 8. | Which conduction mode of three phase bridge inverter is preferred? | | | CO5 | An | 1 |
| 9. | A single phase half bridge inverter is supplied with DC voltage 300V. The rms output voltage is \_\_\_\_\_\_\_\_\_\_. | | | CO5 | A | 1 |
| 10. | For transmission of bulk power over long distances, high voltage direct current transmission is preferred. Say True or False | | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MAR/KS)** | | | | | | |
| 11. | List out the advantages of GTO over an SCR. | | | CO1 | U | 3 |
| 12. | Describe the functions of freewheeling diode in ac-dc converter circuits. | | | CO2 | U | 3 |
| 13. | Brief out the control strategies of AC Voltage controllers. | | | CO3 | U | 3 |
| 14. | Mention the type of power converter used in Electric vehicles. Justify your answer. | | | CO4 | U | 3 |
| 15. | Explain PWM and its advantages | | | CO5 | U | 3 |
| 16. | Draw the circuit diagram of Single phase multilevel inverter. | | | 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 | 8 |
|  | b. | Draw the reverse recovery characteristics of power diode. Explain. | | CO1 | U | 4 |
| 18. |  | Explain the static and switching characteristics of Thyristor in detail with neat diagram. | | CO2 | R | 12 |
| 19. |  | Explain the operation of a single phase semi controlled bridge converter with RL load with neat diagram and waveform. | | CO3 | U | 12 |
| 20. |  | Discuss the working of the single phase bridge type cyclo-converter with R Load, with necessary circuit and waveform. | | CO3 | A | 12 |
| 21. | a. | A step down chopper has Vdc = 100 V, R = 10Ω. If the duty cycle is 0.4, calculate the average voltage Vavg, rms voltage Vrms, average current Iavg and output power Po | | CO4 | An | 4 |
|  | b. | Draw the circuit diagram and waveform of step up DC-DC converter with R load. | | CO4 | A | 8 |
| 22. |  | Explain the operation of single phase full bridge inverter with RL load. Also drive the expression for the RMS output voltage. | | CO5 | U | 12 |
| 23. |  | With relevant circuit diagram and waveform explain the operation of three phase bridge inverter in 120° mode conduction. Derive the expression for the RMS value of phase voltage and line voltage. | | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | | Discuss the working of UPS with relevant circuit diagram. | CO6 | U | 6 |
|  | b. | | Draw the circuit diagram of Super lift Luo Converter and explain its working. | CO6 | U | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Identify to use the solid-state power devices for the control, conversion, and Protection of electrical energy |
| 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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 16 |  |  |  |  | 17 |
| CO2 | 12 | 5 |  |  |  |  | 17 |
| CO3 | 1 | 16 | 12 |  |  |  | 29 |
| CO4 | 1 | 3 | 4 | 8 |  |  | 16 |
| CO5 |  | 15 | 13 | 1 |  |  | 29 |
| CO6 | 1 | 15 |  |  |  |  | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **14EE2012** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRIC DRIVES AND CONTROL** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Give some examples of Electric Drives. | | CO1 | U | | 1 |
| 2. | Write the functions of power modulators. | | CO1 | R | | 1 |
| 3. | Give some example for multi motor electric drive. | | CO1 | R | | 1 |
| 4. | Define short time rating of motor. | | CO1 | R | | 1 |
| 5. | Write the types of braking used for DC motor. | | CO1 | U | | 1 |
| 6. | For a separately excited motor, the speed equation is given by\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 7. | In Induction motors with normal design, the ratio of breakdown to rated torque varies from \_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_. | | CO2 | U | | 1 |
| 8. | Controlled rectifier fed dc drive is also known as static \_\_\_\_\_\_\_\_\_\_\_ drive. | | CO2 | R | | 1 |
| 9. | Write the modes of variable frequency control of synchronous motor drives. | | CO3 | U | | 1 |
| 10. | Write any one application of stepper motor. | | CO3 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Mention the different factors taking into account for the selection of electric drives. | | CO1 | | R | 3 |
| 12. | Write the components of load torques. | | CO1 | | U | 3 |
| 13. | Compare VSI and CSI fed induction motor drives. | | CO2 | | U | 3 |
| 14. | Mention the different schemes involved in the slip power recovery system. | | CO2 | | U | 3 |
| 15. | How do we change the speed of three phase Induction motor using pole changing method? | | CO3 | | R | 3 |
| 16. | List the possible modes of operation, when a synchronous motor is fed from a voltage source. | | 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. |  | Construct the block diagram of the electric drive employed for Automotive Industry. Explain in detail. | CO1 | | R | 12 |
|  |  |  |  | |  |  |
| 18. |  | Classify the classes of motor duty according to IS: 4722-1968 and explain in detail with their applications. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 19. |  | Discuss the following closed-loop control of drives:   1. Closed Loop Torque Control. 2. Closed Loop Speed Control of Multi-motor Drives. | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 20. |  | Explain different methods of starting of Induction motor with necessary diagrams for electric vehicle applications. | CO2 | | R | 12 |
|  |  |  |  | |  |  |
| 21. |  | Elucidate single phase half controlled rectifier control of dc separately excited motor in continuous conduction and discontinuous conduction mode. | CO3 | | U | 12 |
|  |  |  |  | |  |  |
| 22. |  | Explain chopper fed dc drives with a neat sketch for Irrigation system. | CO3 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Explain the operation of voltage source inverter fed induction motor drive with neat sketch. | CO3 | | R | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Classify permanent magnet AC motor drives and explain in detail about the control techniques with neat diagrams and waveforms. | CO3 | | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Select the motors for a particular applications. |
| CO2 | Analyze the converter characteristic for drive applications. |
| CO3 | Choose suitable control techniques for drives. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 18 | 17 |  |  |  |  | 35 |
| CO2 | 14 | 19 |  |  |  |  | 33 |
| CO3 | 15 | 29 | 12 |  |  |  | 56 |
|  | | | | | | | **124** |

**Graphical user interface, application

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Mention the advantage of per unit method over percent method. | | CO1 | U | | 1 |
| 2. | For n bus power system size of Y bus matrix is \_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 3. | In which of the faults, all the sequence currents are equal? | | CO2 | R | | 1 |
| 4. | A 50 bus power system Ybus has 80% sparsity. The total number of transmission lines will be \_\_\_\_\_\_\_\_\_\_\_ | | CO2 | R | | 1 |
| 5. | What are the assumptions made in short circuit studies of a large power system network? | | CO3 | U | | 1 |
| 6. | A transformer is rated at 11kV/0.4kV, 500 KVA, 5% reactance. What is the short circuit MVA of the transformer when connected to an infinite bus? | | CO3 | R | | 1 |
| 7. | On slack bus \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_ are specified. | | CO4 | U | | 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 | R | | 1 |
| 9. | Economic distribution of loads between plants also know as \_\_\_\_\_\_. | | CO5 | U | | 1 |
| 10. | Define Power Quality Problem. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Determine the zero sequence components of unbalanced three phase currents:Ia=10∠0 A Ib= 12∠0 A and Ic= 10∠130A. | | CO1 | | An | 3 |
| 12. | Compare Type-2 and Type-3 modifications in Zbus building algorithm. | | CO2 | | U | 3 |
| 13. | Classify the different types of power system faults. | | CO3 | | U | 3 |
| 14. | Give the reason, NR load flow is preferred over Gauss-Seidal load flow in power industry. | | CO4 | | U | 3 |
| 15. | Write shorts notes on hydrothermal scheduling. | | 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 | | 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 100 MVA, 33 KV, three phase generator has a reactance of 20%. The generator is connected to motors through transmission lines and transformers. The motor has rated inputs of 30 MVA, 20 MVA and50 MVA at 30 KV with 15 % sub transient reactance. The three phase transformers are rated at 110 MVA, 32 KV Δ/110 KV Y with leakage reactance of 8 %. The line has a reactance of 45Ω. Selecting the generator rating as base quantities in generator circuit, determine base quantities in other parts of system and evaluate the p.u. values.  T2  T1  j45Ω  M1  M2  M3  100MVA,  33KV, | CO1 | | An | 12 |
|  |  |  |  | |  |  |
| 18. |  | Give a brief explanation of how the bus impedance matrix is formed. | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 19. |  | Starting from basic conditions for a double line to ground fault with fault impedance Zf . Obtain the expression for fault current. Show the connection of sequence network for this fault. A 30 MVA, 11 kV generator has Z1=Z2= j0.2 pu and Zo=j0.05 pu. A double line to ground fault occurs on the generator terminals. Find actual values of fault currents and line to line voltages during fault conditions. Assume that the generator neutral is solidly grounded and that the generator is operating at no load and at rated voltage at the occurrence of the fault. | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 20. |  | The following is the system data for a load flow problem.  Calculate the voltage at the end of the First iteration using  Gauss-Seidal method.   |  |  |  |  | | --- | --- | --- | --- | | Bus code | Real Power Injection (P) | Reactive Power Injection  (Q) | V | | 1 | - | - | 1.06 | | 2 | 0.5 | -0.2 | - | | 3 | -0.4 | -0.3 | - | | 4 | -0.3 | 0.1 | - | | CO4 | | An | 12 |
|  |  |  |  | |  |  |
| 21. |  | The heat-rate characteristics of three power plants are given by  H1=0.0412P12+7.21P1+510 MBtu/hr  H2=0.0194P22+7.85P2+310 MBtu/hr  H3=0.0480P32+7.97P3+78 MBtu/hr  The fuel cost and power generation limits are  Plant 1: 1.5 Rs/hr 150 ≤ P1≤600 MW  Plant 2: 1.8 Rs./hr 100≤ P2≤500 MW  Plant 3: 2 Rs./hr 50≤ P3≤200 MW  Find the ED schedule and the total fuel cost for a demand of 850MW. Instead of following the ED schedule if you divide the load as 400 MW, 300 MW and 150 MW among the generators, what will be the total fuel cost? | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 22. |  | The parameters of a 4-bus system are as follows. Draw the network and construct the bus admittance matrix. If the line connected between bus 1 and bus 3 is removed write the new Ybus.   |  |  |  | | --- | --- | --- | | Bus Code | Line Impedance (pu) | Charging Admittance (pu) (ypq/2) | | 1-2  2-3  2-4  3-4  1-3 | 0.2+j0.8  0.3+j0.9  0.25+j1  0.2+j0.8  0.1+j0.4 | j0.02  j0.03  j0.04  j0.02  j0.01 | | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 23. | a. | Illustrate in detail the need for system analysis in planning and operation of power system. | CO1 | | U | 8 |
|  | b. | Write the equality and inequality constraints for economic dispatch problem. | CO5 | | U | 4 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | How can we classify stability studies in power system? | CO6 | | U | 4 |
|  | b. | Derive swing equation for a single machine connected to infinite bus system. State the assumptions for damping is not to be neglected. | CO6 | | U | 8 |

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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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 9 |  | 15 |  |  | 25 |
| CO2 | 2 | 15 |  | 12 |  |  | 29 |
| CO3 | 1 | 4 |  | 12 |  |  | 17 |
| CO4 | 1 | 4 |  | 12 |  |  | 17 |
| CO5 |  | 8 | 12 |  |  |  | 20 |
| CO6 |  | 13 |  | 3 |  |  | 16 |
|  | | | | | | | **124** |

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The \_\_\_\_\_\_\_\_\_ is used in a manual transmission to couple or decouple the gearbox to the power plant in a conventional IC engine vehicle. | | CO1 | A | 1 |
| 2. | The drag-coefficient (Cd) can be reduced by good vehicle design and its typical value is between \_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | In a \_\_\_\_\_\_\_\_\_ wheel drive, the power train, engine and transmission are at the front of the wheel. | | CO2 | U | 1 |
| 4. | Victor Wouk was nicknamed the ‘Godfather of the Hybrid”. – True or False. | | CO2 | An | 1 |
| 5. | \_\_\_\_\_\_\_\_\_motor is classified as shunt series and compound type. | | CO3 | R | 1 |
| 6. | The synchronous speed of an AC machine, if the no. of poles (P) is 6 and frequency (f) is 50Hz is \_\_\_\_\_\_\_\_\_ rpm. | | CO3 | E | 1 |
| 7. | Degree of hybridization (DoH) is defined as \_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | A hybrid vehicle drive train usually consists of two or more power trains – True or False. | | CO4 | An | 1 |
| 9. | Flywheel controls the \_\_\_\_\_\_\_\_\_ variation caused by the fluctuation of the engine turning moment during each cycle of operation. | | CO5 | R | 1 |
| 10. | In a battery management system, SOC means \_\_\_\_\_\_\_\_\_. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List out any three basic techniques for improving the engine performance, efficiency, and emissions. | | CO1 | U | 3 |
| 12. | Compare electric and hybrid vehicles. | | CO2 | An | 3 |
| 13. | List out the applications and advantages of PMSM. | | CO3 | R | 3 |
| 14. | Draw the diagram of series hybrid configuration. | | CO4 | U | 3 |
| 15. | Brief out: specific energy, energy density and specific power. | | CO5 | A | 3 |
| 16. | Classify the energy/power management techniques in EV/HEV. | | 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. |  | Analyze the various parameters of total tractive effort that influences the performance of a vehicle with necessary diagrams and equations. | CO1 | An | 12 |
| 18. | a. | Describe the historical development of Electric Vehicles. | CO2 | U | 8 |
| b. | Brief out multi-wheel drive power train. | CO2 | A | 4 |
| 19. | a. | Elucidate the four-quadrant operation of chopper-based DC Motor with necessary diagrams and waveforms. | CO3 | U | 8 |
| b. | Compare Brushed DC Motor with BLDC Motor. | CO3 | An | 4 |
| 20. |  | With necessary diagrams, explain the operation of parallel hybrid and series-parallel hybrid configuration of hybrid vehicle. | CO4 | U | 12 |
| 21. | a. | Explain the working of fuel cell with necessary diagrams. | CO5 | U | 6 |
| b. | Compare Lithium Ion and Lithium Polymer batteries. | CO5 | An | 6 |
| 22. |  | With neat diagrams, explain the working of Front and Rear wheel drive Power trains. | CO1 | U | 12 |
| 23. | a. | Find the total amount of energy stored flywheel, when the moment of inertia is 10 kg/m2 and rotational speed is 10 r/s. If the speed is reduced to 4 r/s, obtain the change in kinetic energy storage. | CO5 | E | 4 |
| b. | Compare batteries and super capacitors. | CO5 | An | 4 |
| c. | Sketch the Ragone plot with respect to various energy storage devices. | CO5 | U | 4 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | With neat diagram, analyze the Battery management – system level architecture. | CO6 | U | 12 |

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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 | 15 | 1 | 12 | - | - | **29** |
| CO2 | - | 9 | 4 | 4 | - | - | **17** |
| CO3 | 4 | 8 | - | 4 | 1 | - | **17** |
| CO4 | 1 | 15 | - | 1 | - | - | **17** |
| CO5 | 1 | 10 | 3 | 10 | 4 | - | **28** |
| CO6 | 3 | 13 | - | - | - | - | **16** |
|  | | | | | | | **124** |

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| **Course Code** | **14EE2036 / 19EE2002** | **Duration** | **3hrs** |
| **Course Name** | **SMART GRID** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | **Course Outcome / Pattern** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | Give technologies required for the Smart Grid. | CO 1/ R | 1 |
| 2. | List out the Stages on Evolution of Smart Grid. | CO 1/ U | 1 |
| 3. | What are the principle of Switching techniques? | CO 2 / R | 1 |
| 4. | Define encryption. | CO 2 / U | 1 |
| 5. | Mention the Key components of smart metering. | CO 3 / A | 1 |
| 6. | What is the significance of Signal condition? | CO 3 / U | 1 |
| 7. | Suggest the ultimate goal of a DMS? | CO 4 / R | 1 |
| 8. | What is the purpose of Customer information system? | CO 4 / U | 1 |
| 9. | What is the principle of operation of Flow battery? | CO5 / A | 1 |
| 10. | Give the Applications of energy storage batteries? | CO5 / R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | What is the Smart Grid? | CO1 / R | 3 |
| 12. | Give the need for Digital signatures. | CO2 / U | 3 |
| 13. | Define demand side management and demand side participation. | CO3 / R | 3 |
| 14. | Mention the applications of DMS. | CO4 / R | 3 |
| 15. | Why Wide-Area Measurement Systems is required? | CO5 / U | 3 |
| 16. | What is Series compensation? | CO6 / 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. | a. | Why Smart Grid is needed? | CO1 / U | 4 |
| b. | Compare smart grid with today’s grid. | CO1 / A | 4 |
| c. | What are the benefits of smart grid? | CO1 / R | 4 |
|  |  |  |  |  |
| 18. | a. | Describe the Multi-Protocol Label Switching. | CO2 / U | 4 |
| b. | Explain the basic smart metering architecture. | CO2 / R | 4 |
| c. | Write short notes on Modbus and DNP3. | CO2 / R | 4 |
|  |  |  |  |  |
| 19. | a. | Compare the conventional and smart metering methods. | CO3 / A | 4 |
| b. | Explain the communications architecture for smart metering with neat diagram. | CO3 / U | 4 |
| c. | Briefly explain the Price-based DSI implementations. | CO3 / R | 4 |
|  |  |  |  |  |
| 20. | a. | Draw the structure and explain the main components of a DMS Data Management systems. | CO4 / R | 4 |
| b. | Explain in detail the attributes of SCADA. | CO4 / U | 4 |
| c. | Briefly list the applications of CIS. | CO4 / R | 4 |
|  |  |  |  |  |
| 21. | a. | Explain the Phasor measurement units. | CO5 / U | 4 |
| b. | With an example, describe a typical energy management systems. | CO5 / A | 4 |
| c. | Discuss about any one techniques used for visualisation. | CO5 / R | 4 |
|  |  |  |  |  |
| 22. | a. | With neat diagram, explain the Structure of the IEC 61850. | CO2 / R | 4 |
| b. | List out IEEE 1686: IEEE Standards. | CO2 / U | 4 |
| c. | Why Authentication is needed? Explain. | CO2 / A | 4 |
|  |  |  |  |  |
| 23. | a. | Draw the block diagram of Smart meters hardware and explain. | CO3 / R | 4 |
| b. | Mention the Important factors for assessment of smart metering communication protocols. | CO3 / A | 4 |
| c. | How the demand side resources are used to give energy efficient improvements? | CO3 / U | 4 |
|  |  | **Compulsory:** | | |
| 24. | a. | List out the different FACTS devices and their applications. | CO6 / E | 4 |
| b. | Write short notes on D STATCOM. | CO6 / R | 4 |
| c. | Give the need for energy storage devices. | CO6 / U | 4 |

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|  | **COURSE OUTCOMES** |
| CO1 | Smart grid introduction |
| CO2 | Communication technologies &information security for smart grid |
| CO3 | Smart metering and demand side integration |
| CO4 | Distribution management systems |
| CO5 | Transmission system operation |
| CO6 | Renewable energy resources interconnection issues |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 8 | 5 | 4 |  | - | - | 17 |
| CO2 | 9 | 8 |  |  |  |  | 17 |
| CO3 | 11 | 9 | 9 |  | - | - | 29 |
| CO4 | 12 | 5 | - | - |  |  | 17 |
| CO5 | 5 | 7 | - | 5 | - | - | 17 |
| CO6 | 7 | 4 | - | - | 4 | - | 15 |
|  | | | | | | | **112** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **15EE2005** | **Duration** | **3hrs** |
| **Course Name** | **TESTING AND INSTALLATION OF POWER SYSTEM APPARATUS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | The minimum distance between two conducting points separated by air or gas is referred to as \_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 2. | The severity of electric shock depends on \_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 3. | \_\_\_\_\_\_ tests are conducted to identify and analyze the principles and to establish cause and effect relationship in nature. | | CO1 | U | | 1 |
| 4. | Device used to measure the vibration is \_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 5. | \_\_\_\_\_\_\_\_\_\_\_ test is also known as bell and battery test. | | CO2 | U | | 1 |
| 6. | The open-circuit test on a transformer is used to measure its\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 7. | The phenomenon in which change in dimensions takes place when a ferromagnetic substance is magnetized is called \_\_\_\_\_\_\_\_\_\_\_. | | CO2 | U | | 1 |
| 8. | Skin effect is more predominant at \_\_\_\_\_\_\_\_\_\_\_ frequency. | | CO3 | R | | 1 |
| 9. | Parameter that defines the quality of power is\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | U | | 1 |
| 10. | For distances more than \_\_\_\_\_\_\_\_\_\_\_, high voltage direct current transmission lines are preferred. | | CO3 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Compare research test and development test. | | CO1 | | R | 3 |
| 12. | Identify suitable measures for reducing the temperature rise on the motors. | | CO1 | | U | 3 |
| 13. | Explain why synchronization is required for a synchronous motor? | | CO2 | | U | 3 |
| 14. | Enumerate the advantages of AC transmission lines. | | CO2 | | R | 3 |
| 15. | Classify bus bars. | | CO3 | | R | 3 |
| 16. | Define power quality. | | 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. |  | List the safety precautions against electric shocks in small buildings, shops and small LV installations. | CO1 | | R | 12 |
|  |  |  |  | |  |  |
| 18. |  | Explain the objectives, principles and importance of safety management. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 19. |  | Evaluate the various types of sub-stations for rated voltages of 12kV, 36kV, 66kV and above. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 20. | a. | Summarize the principle of DC insulation resistance measurements. Discuss its merits and demerits. | CO2 | | R | 6 |
|  | b. | Describe the test associated with the commissioning of a power transformer. | CO2 | | R | 6 |
|  |  |  |  | |  |  |
| 21. |  | Establish an expression for dielectric absorption ratio and also present the circuit diagram of volt-amp method for DC resistance measurement for testing a conducting path. | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 22. |  | Examine the causes of disturbances in power quality and discuss the power quality improvement facilities for each variable of electric power supply. | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Illustrate the various variables the tolerance range that would decide the quality of power as per IEEE Std. 446,1987 and list the power quality improvement facilities for each variable of the electric power supply. | CO3 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Develop the procedure of high voltage tests on rotating machine with the help of a schematic. | CO3 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | To analyze the testing of equipments. |
| CO2 | To analyze the commissioning of machine and transmission line. |
| CO3 | To assess the quality of Power. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 16 | 17 | 12 | - | - | - | 45 |
| CO2 | 17 | 17 | 12 | - | - | - | 46 |
| CO3 | 5 | 4 | 24 | - | - | - | 33 |
|  | | | | | | | **124** |



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

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| **Q. No.** | **Questions** | **Course Outcome / Pattern** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | What is the other name for Dependent sources?  a) Uncontrolled sources b) Time response elements  c) Steady state elements d) Controlled sources | CO1/R | 1 |
| 2. | Mesh analysis is generally used to determine \_\_\_\_\_\_\_\_\_.  a) Voltage b) Current c) Resistance d) Power | CO1/U | 1 |
| 3. | Superposition theorem is valid for \_\_\_\_\_\_\_\_\_.  a) Linear systems b) Non-linear systems  c) Both linear and non-linear systems  d) Neither linear nor non-linear systems | CO2/R | 1 |
| 4. | While considering Reciprocity theorem, we consider ratio of response to excitation as ratio of?  a) voltage to voltage b) current to current c) voltage to current  d) No ratio is considered | CO2/U | 1 |
| 5. | If the roots of an equation are real and equal, then the response will be \_\_\_\_\_\_.  a) over damped b) damped c) critically damped d) under damped | CO3/U | 1 |
| 6. | The time constant of an R-C circuit is?  a) RC b) R/C c) R d) C | CO3/A | 1 |
| 7. | P = 269 W, Q = 150 VAR (capacitive). The power in the complex form is a) 150 – j269 VA b) 150 + j269 VA c) 269 – j150 VA d) 269 + j150 VA | CO4/A | 1 |
| 8. | What is the type of current obtained by finding the square of the currents and then finding their average and then fining the square root?  a) RMS current b) Average current c) Instantaneous current  d) Total current | CO4/U | 1 |
| 9. | The relation between current and voltage in the case of inductor is?  a) v=Ldt/di b) v=Ldi/dt c) v=dt/di d) v=di/dt | CO5/U | 1 |
| 10. | The transfer function of a system having the input as X(s) and output as Y(s) is?  a) Y(s)/X(s) b) Y(s) \* X(s) c) Y(s) + X(s) d) Y(s) – X(s) | CO5/U | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Summarize the concept of duality and dual networks in network analysis. Also list out any four dual pairs used in electrical networks. | CO1/R | 3 |
| 12. | State the principle of maximum power transfer theorem along with its expression. | CO2/U | 3 |
| 13. | Distinguish transient response and steady state response of a circuit. | CO3/A | 3 |
| 14. | A series RLC circuit has a resonance frequency of 1 kHz and a quality factor Q = 100. If each of R, L and C is doubled from its original value. Find the new Q of the circuit. | CO4/A | 3 |
| 15. | Draw the frequency response of RLC series circuit along with mathematical expression. | CO5/A | 3 |
| 16. | Define two port networks. List out the different types of two-port network. | CO6/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. | a. | Find the Loop currents I1, I2 and I3 by Mesh loop analysis as shown in Fig. | CO1/A | 6 |
| b. | Apply nodal analysis to find the node voltage V in the following circuit. | CO1/A | 6 |
|  |  |  |  |  |
| 18. | a. | Find the Thevenin equivalent resistance Rth of the circuit shown below. | CO2/A | 6 |
| b. | By applying the Norton’s theorem, Draw the Norton equivalent circuit representation and find the current with respect to terminal ‘a’ and ‘b’ of the following circuit shown below. | CO2/A | 6 |
|  |  |  |  |  |
| 19. |  | Derive the expression for the Transient Response of Series RL Circuit having DC Source Excitation. | CO3/U | 12 |
|  |  |  |  |  |
| 20. |  | Explain in detail the three phase 3-wire circuits with (i) Star connected balanced loads (ii) Delta balanced Loads. | CO4/U | 12 |
|  |  |  |  |  |
| 21. | a. | Express the Laplace Transform for the following Functions (i) Step Function (ii) Exponential Function (iii) Sine Function (iv) Cosine Function. | CO5/A | 4 |
| b. | A series L–R–C circuit has a sinusoidal input voltage of maximum value 12 V. If inductance, L = 20 mH, resistance, R = 80 Ω, and capacitance, C = 400 nF, determine (a) the resonant frequency, (b) the value of the p.d. across the capacitor at the resonant frequency, (c) the frequency at which the p.d. across the capacitor is a maximum, and (d) the value of the maximum voltage across the capacitor. | CO5/A | 6 |
| c. | Differentiate active and reactive power in electrical circuits. | CO5/A | 2 |
|  |  |  |  |  |
| 22. |  | Find the current flowing through 20 Ω resistor of the following circuit using superposition theorem. | CO2/A | 12 |
|  |  |  |  |  |
| 23. |  | Analyze Sinusoidal Response of RLC series circuit along with suitable mathematical expressions. | CO4/An | 12 |
|  |  | **Compulsory:** | | |
| 24. |  | Discuss in detail the following interconnection of two port networks along with the equivalent circuit representation.   1. Series Connection 2. Parallel Connection 3. Series and Parallel Connection 4. Cascade Connection | CO6/U | 12 |

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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 Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 4 | 1 | 12 | - | - | - | 17 |
| CO2 | 1 | 4 | 12 | - | - | - | 17 |
| CO3 | - | 13 | 4 | - | - | - | 17 |
| CO4 | - | 13 | 4 | 12 | - | - | 29 |
| CO5 | - | 2 | 15 | - | - | - | 17 |
| CO6 | 3 | 12 | - | - | - | - | 15 |
|  | | | | | | | **112** |

**Graphical user interface, application

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

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | | **Marks** | |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | | | |
| 1. | A series circuit consists of 3.6 KΩ, 6 KΩ and 8.8 KΩ resistor. Indicate the resistor which has more voltage across it. | | | CO1 | U | | | 1 | |
| 2. | Find the power, if a resistor has 7.5 V across it and 3mA current flowing through it. | | | CO1 | R | | | 1 | |
| 3. | Tell the condition for maximum power transfer from a source to the load. | | | CO2 | R | | | 1 | |
| 4. | Name the dual term of inductance. | | | CO2 | R | | | 1 | |
| 5. | Report the power factor of a 3Ø system if (1+j2)Ω impedance is connected in balanced star load. | | | CO3 | U | | | 1 | |
| 6. | List the advantages of 3 phase system. | | | CO3 | R | | | 1 | |
| 7. | Convert the following time domain voltage to phasor domain voltage  V(t)=50 sin(1000t+48o) . | | | CO4 | U | | | 1 | |
| 8. | Find the poles and of the network function  . | | | CO4 | R | | | 1 | |
| 9. | Define bandwidth. | | | CO5 | R | | | 1 | |
| 10. | Define driving point admittance. | | | CO6 | R | | | 1 | |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | | |
| 11. | Write the node equation for the circuit. | | | CO1 | | A | | 3 | |
| 12. | Explain Compensation Theorem with neat diagram. | | | CO2 | | U | | 3 | |
| 13. | Construct the dual network of the following circuit. | | | CO3 | | A | | 3 | |
| 14. | List the properties of Laplace Transform used in network theory. | | | CO4 | | R | | 3 | |
| 15. | Determine the quality factor and resonant frequency of a coil for the series RLC circuit consisting of R=15 Ω, L=0.01H, C=100µF. | | | CO5 | | A | | 3 | |
| 16. | Summarize the frequency selective filters with its characteristic diagrams. | | | 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. |  | | Calculate the current delivered by the source in the circuit shown in below | CO1 | | | An | | 12 |
|  |  | |  |  | | |  | |  |
| 18. |  | | Apply superposition theorem to determine the current through 3Ω resistor in the circuit shown. | CO2 | | | A | | 12 |
|  |  | |  |  | | |  | |  |
| 19. |  | | Estimate 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 | | 12 |
|  |  | |  |  | | |  | |  |
| 20. |  | | Determine the steady state response of series RL and series RC circuit using Laplace transform. | CO4 | | | A | | 12 |
|  |  | |  |  | | |  | |  |
| 21. | a. | | Estimate the steady state response using phasor method. | CO5 | | | An | | 8 |
|  | b. | | Compute 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 | | | A | | 4 |
|  |  | |  |  | | |  | |  |
| 22. |  | | Examine the reciprocity theorem for the circuit shown in figure. The units of all resistors are in ohm. | CO2 | | | A | | 12 |
|  |  | |  |  | | |  | |  |
| 23. |  | | Make use of the mesh analysis technique to determine the current flowing through the branch CD. | CO1 | | | A | | 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 |

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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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 15 | 12 | - | - | 29 |
| CO2 | 2 | 3 | 24 | - | - | - | 29 |
| CO3 | 1 | 1 | 3 | 12 | - | - | 17 |
| CO4 | 4 | 1 | 12 | - | - | - | 17 |
| CO5 | 1 | - | 7 | 8 | - | - | 16 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

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| **Course Code** | **18EE2012** | **Duration** | **3hrs** |
| **Course Name** | **POWER SYSTEMS I** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | The calorific value of a solid fuel is expressed in \_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 2. | The basic unit of energy is \_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 3. | The value of demand factor is \_\_\_\_\_\_\_\_ than 1. | | CO2 | R | | 1 |
| 4. | The running cost is directly proportional to \_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 5. | The current ratings are not required for isolator (True/False). | | CO3 | U | | 1 |
| 6. | What is the use to Short circuit studies in power system? | | CO3 | R | | 1 |
| 7. | Capacity of simple Microgrid. | | CO4 | U | | 1 |
| 8. | What are the important challenges faced during the implementation of micro-grids? | | CO4 | R | | 1 |
| 9. | Flywheels are example for Energy Storage (True/False). | | CO5 | U | | 1 |
| 10. | Lightning arresters consisted of \_\_\_\_\_\_\_ discs. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | How does a circuit breaker different from switch? | | CO1 | | A | 3 |
| 12. | List the different types of overhead conductor. | | CO2 | | U | 3 |
| 13. | Briefly write about ACSR | | CO3 | | An | 3 |
| 14. | Write the expression for a capacitance of a single phase transmission line. | | CO4 | | U | 3 |
| 15. | What is the difference between low voltage circuit breakers and high voltage circuit breakers? | | CO5 | | A | 3 |
| 16. | State skin effect in transmission line. Mention its effects on the resistance of the line. | | 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 causes of low power factor of the supply system. | CO1 | | U | 6 |
|  | b. | Discuss the various methods for power factor improvement. | CO1 | | An | 6 |
| 18. | a. | What is electric power supply system? Draw a single line diagram of a typical a.c power supply scheme. | CO2 | | R | 6 |
|  | b. | What are the advantages and disadvantages of d.c. transmission over a.c. transmission? | CO2 | | U | 6 |
| 19. |  | A string of 5 insulators is connected across a 100 kV line. If the capacitance of each disc to earth is 0·1 of the capacitance of the insulator, calculate (i) the distribution of voltage on the insulator discs and (ii) the string efficiency. | CO3 | | A | 12 |
| 20. | a. | Brief about Per unit System and per unit calculations | CO4 | | R | 6 |
|  | b. | Describe about the consequences of the electrical machine when it is connected to infinite bus in power system | CO4 | | R | 6 |
| 21. |  | A single phase overhead transmission line delivers 1100 kW at 33 kV at 0·8 p.f. lagging. The total resistance and inductive reactance of the line are 10 Ω and 15 Ω respectively. Determine : (i) sending end voltage (ii) sending end power factor and  (iii) transmission efficiency. | CO3 | | U | 12 |
| 22. |  | Draw with neat sketches and explanation of pin and suspension type insulators. Compare their merits and dements. | CO4 | | U | 12 |
| 23. |  | Write short notes on Over current relays and Microprocessor based relay used in power system. | CO5 | | R | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Explain the various types of A.C and D.C distributors system in power system network. | CO6 | | U | 6 |
|  | b. | Draw the Typical structure of Microgrid and describe about its configuration. | CO6 | | A | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Investigate the state of a power system of any size and be in a position to analyze a practical system both under steady state and fault conditions. |
| CO2 | Do calculation in transmission lines, select the protective components, planning and analysis. |
| CO3 | Mathematically model the various over voltages and analyze different situations. They will be aware of the preliminary design aspects of protection equipment needed. |
| CO4 | Analyze the electromagnetic and electromechanical phenomena taking place around the synchronous generator. |
| CO5 | Analyze the various electrical faults and use of switchgears. |
| CO6 | Explain the various structures and configurations of a Microgrids. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 7 | 3 | 6 |  |  | 17 |
| CO2 | 8 | 9 |  |  |  |  | 17 |
| CO3 | 1 | 13 | 12 | 3 |  |  | 29 |
| CO4 | 13 | 16 |  |  |  |  | 29 |
| CO5 | 13 |  | 3 |  |  |  | 16 |
| CO6 | 1 | 9 | 6 |  |  |  | 16 |
|  | | | | | | | **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** | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | |
| 1. | How a primitive network is mapped with the actual network? | CO1 | U | 1 |
| 2. | Write the performance equation of a power system network in impedance form. | CO1 | A | 1 |
| 3. | Define dynamic stability. | CO2 | U | 1 |
| 4. | Write the expression for reactive power from single machine to infinite bus. | CO2 | U | 1 |
| 5. | Name the controller used in AGC to bring back the static frequency error to zero. | CO3 | U | 1 |
| 6. | Write the expression power system time constant. | CO3 | R | 1 |
| 7. | Voltage control can be implemented in a local manner. Justify. | CO5 | U | 1 |
| 8. | State the application of tap-changing transformer in distribution system. | CO5 | U | 1 |
| 9. | What is the role of RTU in SCADA? | CO4 | U | 1 |
| 10. | Define wide area measurement system. | CO4 | U | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | List the applications of power system analysis. | CO1 | R | 3 |
| 12. | Differentiate between steady state stability and transient stability. | CO2 | A | 3 |
| 13. | List the feedback mechanisms used in AGC. | CO3 | U | 3 |
| 14. | What is the role of embedded DC link in AC transmission system? | CO5 | An | 3 |
| 15. | List the functions of ECC. | CO4 | U | 3 |
| 16. | Draw the heat-rate curve of thermal generators. | CO6 | U | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23)** | | | | | |
| 17. |  | For the Given Network i) Draw the Oriented Graph ii) Draw one tree and the corresponding co-tree ii) Write the element – node incidence matrix. Find Ybus by direct inspection.  (elements’ impedance are marked). | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | How will you analyze the transient behavior and find the transient stability of a power system by second-order Runge-Kutta method. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | With block diagram, explain the operation of AGC system. Also, derive the overall transfer function of AGC. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Perform root locus analysis of AVR loop under  i) uncompensated case ii) compensated case. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | With the help of state transition diagram explain different operating states of a power system. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | From basic principles deduce the equations for Gauss-Seidel load flow studies. How will you treat PV buses? | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | From basic principles of mechanics, derive swing equation. | CO2 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the terms Power Exchange (PX) and spot pricing related to electricity markets. | CO6 | U | 12 |

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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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 3 | 1 | 13 | 12 | - | - | 29 |
| CO2 | - | 2 | 3 | 24 | - | - | 29 |
| CO3 | 1 | 4 | - | 12 | - | - | 17 |
| CO4 | - | 5 | - | 12 | - | - | 17 |
| CO5 | - | 2 | - | 15 | - | - | 17 |
| CO6 | - | 15 | - | - | - | - | 15 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **18EE2016** | **Duration** | **3hrs** |
| **Course Name** | **WIND AND SOLAR ENERGY SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | The factor 16/27 (0.593) is known as \_\_\_\_\_\_\_\_\_\_\_\_ coefficient. | | CO1 | U | | 1 |
| 2. | A wind turbine has blades 1m long. The blades are rotating at 15 rpm. The tip speed is \_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 3. | Permanent magnet \_\_\_\_\_\_\_\_\_\_\_\_ speed generator can produce power up to 4.25 MW and can withstand overpower for limited periods of time. | | CO2 | R | | 1 |
| 4. | Which generator is used in variable speed WECS? | | CO2 | R | | 1 |
| 5. | In what form is solar energy radiated from the sun? | | CO3 | U | | 1 |
| 6. | Solar \_\_\_\_\_\_\_\_\_\_\_\_ angle is defined as the angle of the projection of beam radiation on the horizontal plane. | | CO3 | R | | 1 |
| 7. | Solar cell is the photovoltaic device that convert the \_\_\_\_\_\_\_\_\_\_\_\_ energy into \_\_\_\_\_\_\_\_\_\_\_\_ energy. | | CO4 | U | | 1 |
| 8. | Suggest suitable inverters to 0.4–2 kW range for small roof-top plants with panels connected in one string. | | CO4 | A | | 1 |
| 9. | \_\_\_\_\_\_\_\_\_\_\_\_ is the short time reduction in the rms voltage between 0.1 to 0.9 p.u for a duration of 0.5 cycle to 1 minute. | | CO5 | U | | 1 |
| 10. | Define solar pond. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Show how to calculate the kinetic energy of wind. | | CO1 | | An | 3 |
| 12. | List the factors that determine the power in the wind. | | CO2 | | U | 3 |
| 13. | Consider the earth to be a blackbody with average surface temperature 15 ◦ C and area equal to 5.1 × 1014 m2. Find the rate at which energy is radiated by the earth and the wavelength at which maximum power is radiated. | | CO3 | | An | 3 |
| 14. | Mention the different types of solar cell and compare the efficiency of the cell. | | CO4 | | U | 3 |
| 15. | Demonstrate the Frequency limits according to Hydro-Quebec and AESO grid codes. | | CO5 | | U | 3 |
| 16. | State two advantages and disadvantages flate plate collectors. | | 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. | Discuss how the weibull distribution relates to the real wind speed distribution in a typical region. | CO1 | | An | 8 |
|  | b | Consider a turbine with rotor diameter = 1 m and power rating of 2 KW at 15 m/s. Check if this turbine will pass the Betz limit test at 15 m/s wind speed. | CO1 | | An | 4 |
| 18. |  | Give a brief description of the power electronic converters used to convert wind energy. Describe the converter control as well. | CO2 | | U | 12 |
| 19. |  | Discuss the procedure of estimating the solar energy availability. | CO3 | | U | 12 |
| 20. |  | Describe in detail the PV module equivalent circuit and its I-V characteristics. | CO4 | | An | 12 |
| 21. |  | What are the power quality issues in the interconnected systems of solar PV and wind systems? Elaborate. | CO5 | | A | 12 |
| 22. | a. | A 40-m, three-bladed wind turbine produces 600 kW at a wind speed of 14 m/s. Air density is the standard 1.225 kg/m3. Under these conditions,  a. At what rpm does the rotor turn when it operates with a TSR of 4.0?  b. What is the tip speed of the rotor?  c. If the generator needs to turn at 1800 rpm, what gear ratio is needed to match the rotor speed to the generator speed?  d. What is the efficiency of the complete wind turbine (blades, gear box, generator) under these conditions? | CO2 | | An | 8 |
|  | b. | Find the optimum tilt angle for a South-facing photovoltaic module in Tucson (latitude 32.1◦) at solar noon on March 1. | CO3 | | An | 4 |
| 23. | a. | Write short notes on Fault ride-through for wind farms. | CO5 | | U | 4 |
|  | b. | Summarize the maximum power point tracking in the Solar Photo voltaic system and discuss the advantages and disadvantages | CO4 | | U | 8 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Explain in detail the solar furnaces with a neat sketch. Give its advantages and disadvantages. | CO6 | | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the need for technologies pertaining to renewable energy sources in the current  energy scenario. |
| CO2 | Describe the basic physics of wind and solar power generation. |
| CO3 | Outline the power electronic interfaces for wind and solar generation. |
| CO4 | Illustrate the technologies in Solar PV power generation. |
| CO5 | Interpret the issues related to the grid-integration of solar and wind energy systems. |
| CO6 | Summarize the solar thermal power generation technologies. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 |  | 15 |  |  | 17 |
| CO2 | 2 | 15 |  | 8 |  |  | 25 |
| CO3 | 1 | 13 |  | 7 |  |  | 21 |
| CO4 |  | 12 | 1 | 12 |  |  | 25 |
| CO5 |  | 20 |  |  |  |  | 20 |
| CO6 |  | 16 |  |  |  |  | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Identify the relation between the synchronous speed, frequency and poles of a single phase Induction Motor. | | CO1 | U | | 1 |
| 2. | Reluctance of ferromagnetic material is \_\_\_\_\_\_\_\_ than air. | | CO1 | R | | 1 |
| 3. | Excessive starting current in a motor leads to \_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 4. | A motor is said to operate on electrical braking if the direction of rotation and the direction of developed torque are \_\_\_\_\_\_\_\_ to each other. | | CO2 | U | | 1 |
| 5. | An \_\_\_\_\_\_\_\_ includes both an electric motor and a speed control unit. | | CO3 | U | | 1 |
| 6. | An \_\_\_\_\_\_\_\_ is often referred to as an electronic controller. | | CO3 | R | | 1 |
| 7. | SCR is a \_\_\_\_\_\_\_\_ controlled device. | | CO4 | U | | 1 |
| 8. | \_\_\_\_\_\_\_\_ is a combination of BJT and MOSFET. | | CO4 | R | | 1 |
| 9. | If the semiconductor devices are arranged appropriately, a chopper can work in any of the \_\_\_\_\_\_\_\_ quadrants. | | CO5 | R | | 1 |
| 10. | The \_\_\_\_\_\_\_\_ of the controlling system in a solid state control is faster. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Define Fleming’s left hand rule. | | CO1 | | R | 3 |
| 12. | List the advantages of autotransformer starting method. | | CO2 | | A | 3 |
| 13. | Classify the various duty cycles from the point of view of motor rating. | | CO3 | | An | 3 |
| 14. | Mention the four terminals of a MOSFET. | | CO4 | | A | 3 |
| 15. | Classify the types of inverters according to the input source. | | CO5 | | An | 3 |
| 16. | Point out the applications of Ward Leonard system. | | 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. | Explain the principle of operation of synchronous motor with a neat diagram. | CO1 | | A | 6 |
|  | b. | A four pole DC machine having wave wound armature winding has 50 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 10 mWb? Calculate the back emf generated when the DC machine has lap wound armature winding. | CO1 | | E | 6 |
|  |  |  |  | |  |  |
| 18. | a. | Describe the Direct online starting method of a 3-phase Induction Motor with a neat diagram. | CO2 | | A | 4 |
|  | b. | Elucidate the methods of braking of three phase Induction Motor with a neat sketch. | CO2 | | An | 8 |
|  |  |  |  | |  |  |
| 19. | a. | A motor equipped with a Flywheel is to supply a load torque of  1000 Nm for 10 sec, followed by a light load period of 200 Nm long enough for the flywheel to regain its steady state speed. It is desired to limit the motor torque to 700 Nm. What should be the moment of inertia of Flywheel? Motor has an inertia of 10 kgm2. Its no load speed is 500 rpm and the Slip at a torque of 500 Nm is 5%. Assume Speed-torque characteristics of the motor to be a straight line in the region of interest. | CO3 | | E | 8 |
|  | b. | Discuss the various types of electric drives based on their development. | CO3 | | An | 4 |
|  |  |  |  | |  |  |
| 20. | a. | Discuss the two basic forms of IGBT with a neat sketch. | CO4 | | An | 4 |
|  | b. | Explain the working principle and VI characteristics of IGBT with a neat diagram. | CO4 | | A | 8 |
|  |  |  |  | |  |  |
| 21. | a. | Describe the operation of Two quadrant Type A and Type B chopper with a neat sketch | CO5 | | An | 8 |
|  | b. | Mention the advantages and disadvantages of Current Source Inverters. | CO5 | | A | 4 |
|  |  |  |  | |  |  |
| 22. | a. | Explain the Ward Leonard method of speed control of DC drives using converters. | CO6 | | An | 8 |
|  | b. | Point out the advantages and disadvantages of Ward Leonard system. | CO6 | | A | 4 |
|  |  |  |  | |  |  |
| 23. | a. | Analyze and derive an expression for the cooling curve of electric drives. | CO3 | | An | 10 |
|  | b. | List the four commonly used methods adopted for the determination of motor power rating. | CO3 | | A | 2 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Explain the methods of speed control of three phase induction motor using stator voltage control and variable frequency control method. | CO6 | | An | 8 |
|  | b. | Describe Static Scherbius slip power recovery system of 3-phase induction motor with a neat diagram. | CO6 | | A | 4 |

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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 | 4 | 1 | - | 6 | 6 | - | 17 |
| CO2 | 1 | 1 | 7 | 8 | - | - | 17 |
| CO3 | 1 | 1 | 2 | 17 | 8 | - | 29 |
| CO4 | 1 | 1 | 11 | 4 | - | - | 17 |
| CO5 | 1 | - | 4 | 11 | - | - | 16 |
| CO6 | - | 1 | 11 | 16 | - | - | 28 |
|  | | | | | | | **124** |



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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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | What is Single Line Diagram (SLD)? Draw the SLD for residential system. | CO1 | U | 10 |
|  | b. | Give examples of how DG has an impact on the transmission system and central generation. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Discuss about the following (a) Micro grid (b) Smart grid  (c) Power grid (d) Distributed Generation. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 3. |  | Write Short Notes on the Following   1. Photovoltaic Generators (ii) Fuel Cells 2. Combined Heat and Power Generation 3. Energy Storage | CO2 | R | 5  5  5  5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | A short description of the many Power Electronics Topologies for Wind Energy Systems | CO3 | U | 10 |
|  | b. | Give specifics on the various Power Electronics Topologies used in PV Systems. | CO3 | U | 10 |
|  |  |  |  | U |  |
| 5. | a. | Explain in Detail about different IEEE 1547 Standards for DG. | CO1 | A | 10 |
|  | b. | Sketch and explain different current injection method for DG systems. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | What is mean by Grid Unbalance with suitable example explain its consequences. | CO4 | U | 10 |
|  | b. | Brief about various Power quality mitigation techniques. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Assume any two case studies and analyze about its voltage regulation. | CO5 | A | 10 |
|  | b. | Explain about different types of Radial test Feeders. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Point up the Transient Response and Fault Behaviors in Distribution Generation systems. | CO5 | R | 10 |
|  | b. | Illustrate the Power Electronics Topologies for the Battery Energy Storage Systems. | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Describe the general structure of Microgrid control Architecture. | CO6 | U | 10 |
|  | b. | Enumerate the operation of Centralized Control method in Microgrid. | CO6 | A | 10 |

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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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 20 | 10 |  |  |  | 40 |
| CO2 | 20 |  |  |  |  |  | 20 |
| CO3 |  | 40 |  |  |  |  | 40 |
| CO4 |  | 20 | 10 |  |  |  | 30 |
| CO5 |  | 10 | 20 |  |  |  | 30 |
| CO6 | 10 | 10 |  |  |  |  | 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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Discuss about the merits and demerits of the various configurations of HEV in terms performance, starting power requirement and traction. | CO2 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | With a detailed block, discuss about the performance analysis and control of BLDC Motor based EVs. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 3. |  | With a detailed block, discuss about the control of SRM Motor based Hybrid EVs. | CO2 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | With supporting sketches and equation, discuss about the constant current discharge approach of battery modeling. | CO3 | A | 20 |
|  |  |  |  |  |  |
| 5. |  | Discuss about the Torque–slip characteristics of an induction motor with fixed stator frequency and voltage. Also explain about constant V/F control of Induction Motor. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Write short notes in terms of technical specifications of the following passenger cars available in the market.   1. FreeGo Hawk electric cycle 2. Honda FCX clarity 3. Toyota Prius 4. Chevrolet Volt | CO6 | U | 20 |
|  |  |  |  |  |  |
| 7. |  | With neat sketch explain the principle and working along with supporting chemical reaction equation of Lithium batteries. | CO3 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | A1540 Kg (Curb weight) EV vehicle has a payload of 560 kg, wheel diameter of 0.7m. The vehicle reaches a maximum speed of 55Km/hr in 6 secs. Let the aerodynamic coefficient be 0.38, air density be 1.3kg/m3, frontal area of 2.4m2, Let the gear ratio of the transmission system be 4.1 and g=9.81m/s2.fr=0.02. Calculate the total tractive power required. | CO4,5 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Give the step-by-step procedure for Range Estimation of Electric car using MATLAB. | CO6 | U | 20 |

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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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 20 |  |  |  |  | 20 |
| CO2 |  |  | 20 | 40 |  |  | 60 |
| CO3 |  | 20 | 20 |  |  |  | 40 |
| CO4 |  |  | 10 |  |  |  | 10 |
| CO5 |  |  | 10 |  |  |  | 10 |
| CO6 |  | 40 |  |  |  |  | 40 |
|  | | | | | | | **180** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Mention the value of the solar constant. | | CO1 | R | 1 |
| 2. | Define solar azimuth angle. | | CO1 | R | 1 |
| 3. | Identify the type of collectors that work at a lower temperature in a solar thermal power plant. | | CO2 | U | 1 |
| 4. | List different components of a flat plate collector. | | CO2 | R | 1 |
| 5. | Name the process of burning medical solid wastes under suitable temperatures and conditions in a specific furnace. | | CO3 | R | 1 |
| 6. | Give an example of a waste treatment method not applicable to biomedical wastes. | | CO3 | U | 1 |
| 7. | State the implication of the NFPA 70 code. | | CO4 | R | 1 |
| 8. | Show the significance of FGI guidelines for the design of power systems for hospitals and health care. | | CO4 | U | 1 |
| 9. | Indicate the saturated steam used by the steam sterilizer. | | CO5 | U | 1 |
| 10. | Identify whether biomass energy is as efficient as fossil fuels. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate time ratio control and current limit control. | | CO1 | U | 3 |
| 12. | Write short notes on solar ponds. | | CO2 | A | 3 |
| 13. | Differentiate bio and clinical waste. | | CO3 | U | 3 |
| 14. | Define IEEE 519 standard. | | CO4 | R | 3 |
| 15. | Summarize pasteurization used in hospitals. | | CO5 | U | 3 |
| 16. | Illustrate power generation from the incineration plant. | | 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. |  | Sketch the equivalent circuit and explain the electrical characteristics of the solar cell in detail. | CO1 | A | 12 |
| 18. |  | Sketch neatly flowchart of the maximum power point tracking (MPPT) algorithm and explain it in detail. | CO2 | A | 12 |
| 19. |  | Describe secured landfills and incinerators. | CO3 | U | 12 |
| 20. | a. | List the IEEE C62.41 guidelines for power quality in critical facilities. | CO4 | R | 4 |
|  | b. | Show the functionalities of national electrical codes NFPA 101, and NFPA 99. | CO4 | U | 4 |
|  | c. | Indicate the purpose of national electrical codes and IEEE codes used in critical facilities. | CO4 | U | 4 |
| 21. |  | Design a solar-powered Health clinic by considering the following critical loads.   |  |  |  |  | | --- | --- | --- | --- | | **S. No** | **EQUIPMENT** | **POWER RATING(Watts)** | **No of hours used** | | 1 | Computer | 100 | 8 | | 2 | Lights | 50 | 12 | | 3 | Fans | 55 | 12 | | 4 | Microscope | 10 | 6 | | 5 | Centrifuge nebulizer | 100 | 2 | | 6 | Vaporizer | 50 | 3 | | 7 | Oxygen concentrator | 250 | 5 | | CO5 | C | 12 |
| 22. |  | Indicate the steps involved in the biomedical waste management process. Discuss each step in detail with the necessary diagrams. | CO3 | U | 12 |
| 23. |  | Discuss the working of a solar-powered compressor-type vaccine refrigerator. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the water heating system using biomass with the necessary diagrams. | CO6 | U | 12 |

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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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 12 | - | - | - | 17 |
| CO2 | 1 | 1 | 15 | - | - | - | 17 |
| CO3 | 1 | 28 |  | - | - | - | 29 |
| CO4 | 8 | 9 | - | - | - | - | 17 |
| CO5 | - | 16 | - | - | - | 12 | 28 |
| CO6 | - | 16 | - | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Command used to display the value of variable x is \_\_\_\_\_\_\_. | CO1 | R | | 1 |
| 2. | Identify the following MATLAB/Simulink block? | CO1 | A | | 1 |
| 3. | MATLAB is used to store the complex number in \_\_\_\_\_ class. | CO2 | R | | 1 |
| 4. | The limits of the axes drawn are only specified in the command used to plot the graph itself – **True or False** | CO2 | U | | 1 |
| 5. | The default Laplace transform, of functions, computed by MATLAB is \_\_\_\_\_\_\_\_\_\_. | CO3 | R | | 1 |
| 6. | The three terminals of the Power MOSFET are | CO3 | U | | 1 |
| 7. | Snubber circuit is used across a power semiconductor device for protection against high \_\_\_\_\_\_\_\_ and high \_\_\_\_\_\_\_\_. | CO4 | R | | 1 |
| 8. | The current in the R-L circuit at a time t = 0+ is? | CO4 | U | | 1 |
| 9. | The Norton current is the \_\_\_\_\_\_\_circuit current. | CO5 | U | | 1 |
| 10. | Slew rate of an ideal op-amp is zero– **True or False** | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Obtain the output of the following code.  for i=1:4  for j=1:4  a=5;a=a+5;  end  end | CO1 | | E | 3 |
| 12. | The output of the following code (in editor window) is ?  A = [1 0 2] ; b = [3 0 7] ; c=a.\*b; | CO2 | | E | 3 |
| 13. | Discuss the transient response of RL circuit with step input signals. | CO3 | | U | 3 |
| 14. | Brief out load flow studies using Newton-Raphson Technique. | CO4 | | An | 3 |
| 15. | Describe the need of pulse width modulation in inverters. | CO5 | | A | 3 |
| 16. | Differentiate integrator and differentiator circuits. | 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. | Define MATLAB and its applications. | CO1 | U | 4 |
| b. | List out the operators that MATLAB allows. | CO1 | R | 4 |
| c. | Mention the common tool boxes in MATLAB. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Designate the steps for Plotting the root locus in MATLAB | CO2 | A | 6 |
| b. | Describe the bode plot in determining phase margin,gain margin, determination of k value,gain and phase cross over frequency in MATLAB. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | With an example mention the steps to verify Thevenin theorem using MATLAB. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Discuss the fault analysis with Power system tool box with an example. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Illustrate the simulation model of a single-phase ac voltage controller with necessary diagram and waveforms. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the Simulation of Solar PV Model with necessary diagram and waveforms. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Demonstrate the simulation model of a single-phase full bridge inverter with necessary diagram and waveforms. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Describe the Simulink model of Op-amp based differentiator and integrator circuits with necessary diagrams. | CO6 | An | 12 |

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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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 8 | 1 | - | 3 | - | **17** |
| CO2 | 1 | 1 | 12 | - | 3 | - | **17** |
| CO3 | 1 | 4 | - | 12 | - | - | **17** |
| CO4 | 1 | 1 | 12 | 15 | - | - | **29** |
| CO5 | - | 1 | 3,12 | 12 | - | - | **28** |
| CO6 | 1 | 3 | - | 12 | - | - | **16** |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Obtain unit impulse sequence using unit step sequence. | | CO1 | R | | 1 |
| 2. | Give any one example for power signal. | | CO1 | R | | 1 |
| 3. | Define convolution. | | CO2 | R | | 1 |
| 4. | Give any one application of DFT. | | CO2 | R | | 1 |
| 5. | The poles of Chebyshev filter lie on \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 6. | In general, phase response of FIR filter is linear. Say True or False. | | CO4 | R | | 1 |
| 7. | Define Quantization. | | CO5 | R | | 1 |
| 8. | List out the types of limit cycle oscillations. | | CO5 | R | | 1 |
| 9. | Mention the function of EDMA controller in DSP Processors. | | CO6 | R | | 1 |
| 10. | Define Pipelining. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Find whether the signal x(n)=(0.5)n u(n) is an energy signal or power signal. | | CO1 | | U | 3 |
| 12. | Find the circular convolution of x(n)=[1,2, 4,2] and h(n)=[1,1,1] . | | CO2 | | U | 3 |
| 13. | Let x(n) is DT signal and X(k) is its DFT signal. Write down the procedure to find DFT and inverse DFT. | | CO3 | | U | 3 |
| 14. | Write down the advantages and disadvantages of FIR filter | | CO4 | | U | 3 |
| 15. | Draw the quantization noise model for the system given.  y(n)=a1y(n-1)+x(n) | | CO5 | | U | 3 |
| 16. | List out the three major characteristics of DSP processors. | | 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. | 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)=n.u(n) | CO1 | | A | 3 |
|  |  |  |  | |  |  |
| 18. |  | Design an analog Butterworth filter that has a -2dB pass-band attenuation at a frequency of 20 rad/sec and atleast -10dB stop-band attenuation at 30 rad/sec. | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 19. |  | Determine the output of linear FIR filter whose impulse response is h(n)={1,-3,5} and input signal x(n)={-1,4,7,3,-2,9,10,12,-5,8} using Overlap save method. | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 20. |  | Compute 8 point DFT using decimation in time (DIT) of a sequence x(n)={1,1,1,1,1,1,1,0} | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 21. |  | Using a rectangular window technique design a LPF with PB gain unity, cutoff frequency of 1000Hz and working at a sampling frequency of 5kHz. The length of impulse 7. | CO4 | | An | 12 |
|  |  |  |  | |  |  |
| 22. |  | Consider the transfer function H(z)=H1(z).H2(z)  H1(z) = , H2(z) =  Find the output round-off noise power, Assume a1=0.5, a2=0.6. | CO5 | | A | 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 |

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the digital signal processing concepts. |
| CO2 | Analyze the discrete time signals for DSP applications. |
| 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** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | \_\_\_\_\_\_\_ torque of a stepper motor is the torque at which motor loses synchronicity with the incoming pulses and stalls. | | CO1 | U | | 1 |
| 2. | A3 phase, permanent magnet stepper motor has 4 rotor poles. The step size of the motor will be \_\_\_\_\_\_\_\_\_\_\_\_\_ degree. | | CO1 | An | | 1 |
| 3. | The angular difference with which the respective phase of a switched reluctance motor is powered, is called \_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 4. | Give the advantage of an (n+1) switch mode of a switched reluctance motor. | | CO2 | R | | 1 |
| 5. | Stabilization is done in a permanent magnet to \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | A | | 1 |
| 6. | \_\_\_\_\_\_\_ magnets have high remnant flux density and low coercive force. | | CO4 | U | | 1 |
| 7. | In \_\_\_\_\_\_\_\_\_ Motor, back e.m.f will be Sinusoidal. | | CO4 | An | | 1 |
| 8. | State the reason for using short pitched windings in a Permanent Magnet Synchronous Motor. | | CO2 | A | | 1 |
| 9. | The secondary of a Linear Induction Motor is usually made of \_\_\_\_\_\_\_\_. | | CO5 | R | | 1 |
| 10. | AFPM brushless generators can be used both as high speed and low speed generators because of \_\_\_\_\_\_\_\_. | | CO2 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Differentiate unifilar and bifilar windings of stepper motors. | | CO1 | | An | 3 |
| 12. | Explain the principle of hall effect sensors. | | CO3 | | U | 3 |
| 13. | Plot the magnetic equivalent circuit of Permanent Magnet Brush Less DC Motors. | | CO4 | | A | 3 |
| 14. | Plot the phasor diagram of AC series motors and explain. | | CO6 | | A | 3 |
| 15. | List the key characteristics of permanent magnet synchronous motors | | CO3 | | U | 3 |
| 16. | State the advantages of axial flux motors. | | CO2 | | 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. | Compare and contrast the different types of permanent magnet stepper motors. | CO1 | | An | 6 |
|  | b. | Explain the constructional details and working of variable reluctance stepper motors. | CO1 | | U | 6 |
|  |  |  |  | |  |  |
| 18. | a. | Differentiate switched reluctance motor and conventional reluctance motor. | CO2 | | An | 6 |
|  | b. | Discuss the switching circuit of switched reluctance motor with two switching devices and two diodes per phase. | CO2 | | A | 6 |
|  |  |  |  | |  |  |
| 19. | a. | Explain the working principle of brushless DC motors. | CO4 | | U | 6 |
|  | b | Explain the commutation process in a brush less DC motor. | CO4 | | An | 6 |
|  |  |  |  | |  |  |
| 20. | a. | Assess various types of vector controllers used in a permanent magnet synchronous motor. | CO2 | | An | 6 |
|  | b. | Explain the constructional features of permanent magnet synchronous motors. | CO3 | | U | 6 |
|  |  |  |  | |  |  |
| 21. | a. | Explain, how the drawbacks of a DC series motor when it is run with AC supply is overcome while designing an AC series motor. | CO6 | | A | 6 |
|  | b. | Compare linear induction motors with rotary induction motors. | CO5 | | An | 6 |
|  |  |  |  | |  |  |
| 22. | a. | Compare the features of ALNICO, Ferrite and Samarium-cobalt magnets. | CO4 | | An | 6 |
|  | b. | Write an assembly language program to control the operation of a stepper motor. | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 23. | a. | List the merits and demerits of (n+1) switching circuit used to operate switched reluctance motors. | CO2 | | U | 6 |
|  | b. | Explain about the various techniques that can be used to determine incremental inductance. | CO4 | | A | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Discuss the advantages of axial flux motors. | CO2 | | U | 6 |
|  | b. | Classify axial flux machines based on magnetic circuits. | CO2 | | A | 6 |

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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 | - | 7 | - | 10 | - | - | 17 |
| CO2 | 1 | 13 | 13 | 15 | - | - | 42 |
| CO3 | 1 | 12 | 7 | - | - | - | 20 |
| CO4 | - | 7 | 9 | 13 | - | - | 29 |
| CO5 | 1 | - | - | 6 | - | - | 7 |
| CO6 | - | - | 9 | - | - | - | 9 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| --- | --- | --- | --- |
| **Course Code** | **19EE2020** | **Duration** | **3hrs** |
| **Course Name** | **POWER ELECTRONICS FOR RENEWABLE ENERGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | \_\_\_\_\_\_\_\_\_\_\_is the long-term heating of Earth's climate system observed since the pre-industrial period. | | | CO1 | U | | 1 |
| 2. | Total capacity of wind energy in India is \_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO1 | R | | 1 |
| 3. | The International Agreement that aimed to reduce CO2 is called as \_\_\_\_\_\_\_\_\_\_\_\_ Protocol | | | CO2 | R | | 1 |
| 4. | The percentage of duty ratio for the buck converter to reduce the solar panel output voltage from 100V to 25 V is \_\_\_\_\_\_\_\_\_\_%. | | | CO2 | R | | 1 |
| 5. | In which converter, the energy is transferred to the load during on time of the power switch \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO3 | U | | 1 |
| 6. | Write any two disadvantages of Neutral point clamped half bridge inverter. | | | CO3 | R | | 1 |
| 7. | The PV inverter market is driven by \_\_\_\_\_\_rather than cost. | | | CO4 | U | | 1 |
| 8. | List down few components available in standalone PV system | | | CO4 | R | | 1 |
| 9. | A grid-connected power converter perfectly matches the\_\_\_’s philosophy since it should work in harmony with the grid. | | | CO5 | U | | 1 |
| 10. | An\_\_\_\_\_\_\_\_\_ technique is therefore used to maintain the PV array’s operating point at its maximum power point. | | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Give any two environmental aspects of electric energy conversion. | | | CO1 | | U | 3 |
| 12. | Write short notes on line commutated inverter. | | | CO2 | | U | 3 |
| 13. | List down the advantages and disadvantages of HERIC converter. | | | CO3 | | R | 3 |
| 14. | Differentiate bipolar and unipolar PWM control technique in grid connected inverters. | | | CO4 | | U | 3 |
| 15. | Write short notes on active power feeding to the grid in grid connected PV system. | | | CO5 | | U | 3 |
| 16. | Draw the neat block diagram for the modern wind energy conversion system. | | | 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. |  | | Discuss the following:   1. Necessity of using renewable energy sources. 2. Renewable energy-based power generation. | CO1 | | U | 12 |
| 18. |  | | Design a DC-DC buck converter to charge a 12V battery form a 24 V solar panel with required circuit diagram and equations. | CO2 | | A | 12 |
| 19. |  | | Explain the concept of active and reactive power control in grid connected systems with neat phasor diagram. | CO3 | | U | 12 |
| 20. |  | | Explain the working principle of the following converters  a) Matrix inverter (6).  b) Uncontrolled rectifier (6). | CO4 | | U | 12 |
| 21. |  | | Explain the grid interactive inverters for wind energy conversion system with neat diagram. | CO4 | | A | 12 |
| 22. |  | | With appropriate circuit, explain how grid integration is done for Permanent Magnet Synchronous Generator based wind energy conversion system. | CO5 | | U | 12 |
| 23. |  | | Discuss the stand alone operation of fixed speed wind energy conversion system with neat diagram for food industries. | CO5 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. |  | Develop a neat block diagram of hybrid PV system which should be able to supply the power to the load for 10 hours without interruption using solar radiation, diesel and wind as the source of energy. | | CO6 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the basics of different renewable energy resources. |
| CO2 | Describe the power converters for solar PV systems. |
| CO3 | Integrate the renewable energy sources to the grid. |
| CO4 | Understand the power converters for wind energy conversion systems. |
| CO5 | Analyze the wind and Photo Voltaic systems. |
| CO6 | Develop hybrid renewable energy systems and maximum power point tracking algorithms. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 16 |  |  |  |  | 17 |
| CO2 | 2 | 3 | 12 |  |  |  | 17 |
| CO3 | 4 | 13 |  |  |  |  | 17 |
| CO4 | 1 | 16 | 12 |  |  |  | 29 |
| CO5 |  | 17 | 12 |  |  |  | 29 |
| CO6 | 3 |  | 12 |  |  |  | 15 |
|  | | | | | | | **124** |

**Graphical user interface, application

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | In the substation, stones are available for \_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | An indoor sub-station is \_\_\_\_\_\_\_\_\_ expensive than outdoor sub-station. | | CO1 | R | 1 |
| 3. | Where is Gas Insulated Substation employed? | | CO2 | R | 1 |
| 4. | SF6 is \_\_\_\_\_\_\_\_\_ times as dense as air. | | CO2 | R | 1 |
| 5. | The earthing electrode should be placed in \_\_\_\_\_\_\_\_\_ position. | | CO3 | U | 1 |
| 6. | Earthing conductivity in a substation is affected by \_\_\_\_\_\_\_\_\_ content in the soil. | | CO3 | R | 1 |
| 7. | \_\_\_\_\_\_\_\_\_ information was sent using current loops, which could provide constant current independent of circuit impedance. | | CO4 | U | 1 |
| 8. | Denial-of-service attacks are attacks in which an \_\_\_\_\_\_\_\_\_ consumes a critical system resource with the result that legitimate users are denied service. | | CO4 | R | 1 |
| 9. | The fault is the threat, while the age and operating condition of the transformer is the \_\_\_\_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | State monitoring can be subject to a certain degree of \_\_\_\_\_\_\_\_\_. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Classify the substations according to the design. | | CO1 | U | 3 |
| 12. | Match the devices with proper operation   |  |  | | --- | --- | | Load break switch | continuously carry load currents | | Disconnect switch | discharge the charging capacitance to ground | | Grounding switch | breaking and making of specified currents | | | CO2 | U | 3 |
| 13. | Bring out the factors that affect the resistance of earth system. | | CO3 | An | 3 |
| 14. | Match the following   |  |  | | --- | --- | | IED | Standards | | IEC | Antivirus | | NAC | electronic multifunction meters | | | CO4 | U | 3 |
| 15. | Define intruder. | | CO5 | U | 3 |
| 16. | Mention the IEEE standard for electrical environmental testing requirements for protective devices. | | 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. | Write short notes on Load Break Switches. | CO1 | U | 4 |
|  | b. | Define bus bar and mention the types. Recommend the suitable bus bar arrangement to Electrical Machines lab and explain with an appropriate diagram. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 18. | a. | Bring out the System requirements on substation design. | CO2 | U | 4 |
|  | b. | Explain the following components belongs to GIS  i) Interconnecting Bus. ii) Air Connection.  iii) Power Cable Connections  iv) Direct Transformer Connections. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 19. | a. | Sketch the equivalent circuit of touch potential and Step Potential. | CO3 | U | 4 |
|  | b. | Explain the following related with substation protection.  i) GPR ii) Strike distance iii) Keraunic Level iv) GFD. | CO3 | U | 8 |
|  |  |  |  |  |  |
| 20. | a. | Write the operations of hall effect sensors in substations. | CO4 | An | 4 |
|  | b. | Give a brief explanation of the SCADA communication needs for the 66 kV step up substation. | CO4 | Ap | 8 |
|  |  |  |  |  |  |
| 21. | a. | List the measures to enhance SA Cyber Security. | CO5 | An | 4 |
|  | b. | Briefly explain the thorough system analysis of the Substation automation system for the purpose of physical security. | CO5 | An | 8 |
|  |  |  |  |  |  |
| 22. | a. | Write short notes on NERC security guidelines. | CO5 | U | 4 |
|  | b. | Describe the specifications for the design of a substation grounding system. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 23. | a. | List the SCADA Functional Requirements. | CO4 | U | 4 |
|  | b. | Illustrate the design, Construction and Commissioning Process  in the indoor substation. | CO1 | An | 8 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Describe three concepts and solutions provided by IEC 61850 based on.  a. Interfaces within a substation automation system.  b. The engineering approach in IEC 61850. | CO6 | An | 12 |

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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 | 8 | 8 | 8 | - | - | 25 |
| CO2 | 2 | 15 | - | - | - | - | 17 |
| CO3 | 1 | 13 | - | 11 | - | - | 25 |
| CO4 | 1 | 8 | 4 | 8 | - | - | 21 |
| CO5 | - | 8 | - | 12 | - | - | 20 |
| CO6 | - | 4 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **19EE2024** | **Duration** | **3hrs** |
| **Course Name** | **TESTING AND COMMISSIONING OF ELECTRICAL EQUIPMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | The \_\_\_\_circuit test is carried out with the terminals of the machine connected from any external circuit. | | | CO1 | U | | 1 |
| 2. | In the \_\_\_\_\_\_ testing of transformer the standard impulse is produced by a rod gap with a chopping time of 3 to 6 microseconds. | | | CO1 | U | | 1 |
| 3. | \_\_\_\_\_\_\_\_\_\_refers to assembly on foundation at site, making electrical terminal connections of main circuits and auxiliary circuits, and to make the equipment, plant and auxiliaries ready for testing and commissioning. | | | CO1 | R | | 1 |
| 4. | Tests on lubricating system fall under the classification of the \_\_\_\_\_\_ tests on machines. | | | CO2 | R | | 1 |
| 5. | \_\_\_\_\_\_\_ is originated within the power system during the switching by the circuit breaker. | | | CO2 | R | | 1 |
| 6. | The polarization Index is the ratio of the insulation resistance at \_\_\_ to the insulation resistance at \_\_\_\_. | | | CO2 | U | | 1 |
| 7. | The space occupied by S"F" \_6, installations is only about \_\_\_ of that of a conventional outdoor substation. | | | CO2 | R | | 1 |
| 8. | During the installation of switchgears, the recommended spacing in the front is \_\_\_ meters and \_\_\_\_ m at the rear of 11 kV draw-out switchgear. | | | CO3 | R | | 1 |
| 9. | During the earth resistance test the earth resistance should be less than \_\_\_\_ for power stations. | | | CO5 | R | | 1 |
| 10. | All new completed electrical installation should be tested before connection to the supply, to ensure that the installation is technically sound and free from any possible \_\_\_\_\_\_\_. | | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | List down the types of maintenance under the operation and maintenance of the site management. | | | CO1 | | R | 3 |
| 12. | Discuss the value of the total current (It) in a DC voltage test. | | | CO2 | | U | 3 |
| 13. | Summarize the causes of high temperature rise and remedies. | | | CO3 | | U | 3 |
| 14. | List the various types of tests performed on a high voltage a.c circuit breakers. | | | CO4 | | R | 3 |
| 15. | Illustrate the CT/PT connections of the energy meter. | | | CO5 | | U | 3 |
| 16. | Enumerate the steps involved in the maintenance of a DG set. | | | 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. | Write a detailed note on the causes of disturbance, effects and remedies of the power quality in substations. | CO1 | | A | 6 |
|  | | b. | Explain the power supply waveforms during typical power quality disturbances with the aid of a neat sketch. | CO1 | | A | 6 |
|  | |  |  |  | |  |  |
| 18. | | a. | Describe the lightning impulse and switching impulse test in detail with the help of an experimental setup. | CO2 | | A | 6 |
|  | | b. | Examine the dielectric absorption test along with its test conditions. | CO2 | | A | 6 |
|  | |  |  |  | |  |  |
| 19. | | a. | Express the mathematical form of open circuit voltage test and short circuit test to find circuit parameters of a motor. | CO3 | | U | 6 |
|  | | b. | Discuss the performance test of a synchronous machine which includes the factory and field test. | CO3 | | U | 6 |
|  | |  |  |  | |  |  |
| 20. | | a. | Enumerate the salient features of the application of high voltage a.c circuit breakers and low voltage a.c circuit breakers. | CO4 | | R | 6 |
|  | | b. | Describe the contactor starter with the HRC fuse. | CO4 | | R | 6 |
|  | |  |  |  | |  |  |
| 21. | | a. | Explain the various over voltage tests that are conducted for insulators and bushings along with the creepage distance. | CO4 | | A | 6 |
|  | | b. | Construct the basic elements of a short circuit testing of isolators and circuit breakers and write a brief note about them. | CO4 | | A | 6 |
|  | |  |  |  | |  |  |
| 22. | | a. | Explain the concept of charging current, leakage current and absorption current through a dielectric with application of DC voltages. | CO3 | | U | 6 |
|  | | b. | Compare various AC and DC test under the insulation test and high voltage test in electrical equipment. | CO3 | | U | 6 |
|  | |  |  |  | |  |  |
| 23. | | a. | Discuss the construction of a typical draw out type metal clad switchgear with a neat sketch. | CO5 | | U | 6 |
|  | | b. | Represent the equivalent circuit of the cables for discharge and explain the high voltage test on cables. | CO5 | | U | 6 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | | a. | Articulate on the maintenance schedule and engine storage amongst the various application of testing methods. | CO6 | | A | 6 |
|  | | b. | Choose the procedure to be adopted for the maintenance of a diesel generator set. | CO6 | | A | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Gain knowledge on testing standards and site management. |
| CO2 | Commission various plants and electrical equipment. |
| CO3 | Demonstrate testing of electrical machines. |
| CO4 | Analyze various testing procedures for protection switchgear equipment. |
| CO5 | Suggest suitable method for testing of domestic wiring. |
| CO6 | Apply various testing methods in industry and residential equipment. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 4 | 2 | 12 | - | - | - | 18 |
| CO2 | 3 | 4 | 12 | - | - | - | 19 |
| CO3 | 1 | 27 | - | - | - | - | 28 |
| CO4 | 15 | - | 12 | - | - | - | 27 |
| CO5 | 1 | 15 | - | - | - | - | 16 |
| CO6 | 3 | 1 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | State whether the electrical load schedule is an estimate of the instantaneous electrical loads operating in a facility, in terms of active, reactive and apparent power. | | CO1 | R | | 1 |
| 2. | Recall the head under which the amount is provided to cover extra costs on account of delays in delivery and minor accidents. | | CO1 | R | | 1 |
| 3. | Predict the maximum load that can be connected in one power sub-circuit (in watts). | | CO2 | U | | 1 |
| 4. | Identify the factor based on which size of conductor is determined.  a. Maximum size for mechanical reason b. Current carrying capacity.  c. Structure of the tower. d. Wiring capacity. | | CO2 | U | | 1 |
| 5. | Name the collection of the switching devices required for a low, medium or high voltage electrical circuit. | | CO3 | R | | 1 |
| 6. | Recall whether the GI pipe is bent at the upper end with opening face downward in order to prevent the entry of rain water into the pipe. | | CO3 | R | | 1 |
| 7. | Record the maximum efficiency of motor in % of rated load. | | CO4 | A | | 1 |
| 8. | State whether the consumers are provided power supply by tapping connections from distributing lines. | | CO4 | R | | 1 |
| 9. | Identify the condition for which ELCB is designed.  a. Short circuit condition b. Ground fault condition.  c. Open circuit condition. d. Over load condition. | | CO5 | U | | 1 |
| 10. | Name the Series and parallel combination of the solar cell. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Classify the different modes of tendering. | | CO1 | | An | 3 |
| 12. | Write the factors to be considered while determining the size of the conductor for internal wiring of a given circuit. | | CO2 | | A | 3 |
| 13. | Illustrate the need for bus bar in the power station. | | CO3 | | A | 3 |
| 14. | List the points to be considered during the wiring of Electric motors. | | CO4 | | R | 3 |
| 15. | Interpret the points that should be checked while carrying out the inspection of internal wiring. | | CO5 | | A | 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. |  | Interpret the following terms:   1. Contingencies. Guidelines for inviting tender. 2. Overhead charges. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 18. | a. | List the points to be considering while determining the size of conductor and explain them. | CO2 | | R | 8 |
|  | b. | Sketch the earthing arrangement using TT system. | CO2 | | A | 4 |
|  |  |  |  | |  |  |
| 19. | a. | Briefly explain the following:   1. Selection of Earth electrode and Earth conductor. 2. Purpose of Bus bar iii) Switchgears and switchboards. | CO3 | | U | 6 |
|  | b. | Differentiate MCB and MCCB. | CO3 | | U | 6 |
|  |  |  |  | |  |  |
| 20. | a. | Illustrate the following:   1. List the types of service connections. 2. Single line diagram of service line to main switch connection. 3. The factors involved with fuse selection. | CO4 | | U | 9 |
|  | b. | List any three methods of installation of Overhead service lines. | CO4 | | R | 3 |
|  |  |  |  | |  |  |
| 21. | a. | Interpret the reasons for excess recording of energy consumption by energy meter. | CO5 | | A | 8 |
|  | b. | Write the advantages and disadvantages of ELCB. | CO5 | | A | 4 |
|  |  |  |  | |  |  |
| 22. |  | Classify the tests which are generally conducted on the wiring installation before it is actually connected to the main supply with neat diagrams. | CO5 | | An | 12 |
|  |  |  |  | |  |  |
| 23. | a. | Illustrate on any six Indian electricity rules. | CO1 | | A | 6 |
|  | b. | Describe the advantages and disadvantages of voltage operated ELCB. | CO5 | | U | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Sketch and elaborate the series and parallel connection of solar panels. | CO6 | | A | 6 |
|  | b. | Explain the following briefly:  i. PIR Sensor ii. LDR Sensor. | CO6 | | U | 6 |

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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 | 2 | 12 | 6 | 3 |  |  | 23 |
| CO2 | 8 | 2 | 7 |  |  |  | 17 |
| CO3 | 2 | 12 | 3 |  |  |  | 17 |
| CO4 | 7 | 9 | 1 |  |  |  | 17 |
| CO5 |  | 7 | 15 | 12 |  |  | 34 |
| CO6 | 4 | 6 | 6 |  |  |  | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

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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** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | Mention the types of house wiring. | | | CO1 | R | | 1 |
| 2. | Suggest a suitable motor for a table fan. | | | CO1 | A | | 1 |
| 3. | Write the limitations of Brushless DC motor. | | | CO2 | U | | 1 |
| 4. | Three Phase Induction motor is a self-starting motor: (True or False) | | | CO2 | U | | 1 |
| 5. | Sketch the symbol of UJT. | | | CO3 | R | | 1 |
| 6. | What is a microcontroller? | | | CO3 | R | | 1 |
| 7. | Mention the types of sensors. | | | CO4 | U | | 1 |
| 8. | List the advantages of Industry 4.0. | | | CO4 | U | | 1 |
| 9. | What is Local Area Network? | | | CO5 | R | | 1 |
| 10. | Name few applications of blue tooth. | | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Describe the working of fluorescent lamp with a neat wiring diagram. | | | CO1 | | U | 3 |
| 12. | List the components of electric vehicles. | | | CO2 | | R | 3 |
| 13. | Draw and explain the VI characteristics of a PN junction diode. | | | CO3 | | U | 3 |
| 14. | What are the types of transducers? | | | CO4 | | R | 3 |
| 15. | Define LAN, MAN and WAN. | | | CO5 | | R | 3 |
| 16. | Write the characteristics and challenges of big data. | | | 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. | Distinguish conventional and non-conventional sources of energy. | CO1 | | U | 6 |
|  | | b. | Draw the block diagram of digital energy meter. Mention the role of each block. | CO1 | | R | 6 |
|  | |  |  |  | |  |  |
| 18. | | a. | Describe the construction and working principle of 3-phase Induction motor with the help of a neat diagram. | CO2 | | U | 8 |
|  | | b. | Compare BLDC Motor with Brushed DC motor and Induction motor. | CO2 | | U | 4 |
|  | |  |  |  | |  |  |
| 19. | |  | Discuss the operation of the AND, OR, NOT, NOR, and EXNOR gates using the truth table. | CO3 | | A | 12 |
|  | |  |  |  | |  |  |
| 20. | |  | Draw the block diagram of automatic irrigation system. Explain the role of each block. | CO4 | | U | 12 |
|  | |  |  |  | |  |  |
| 21. | |  | What are the different types of computer networks? Write the features of each network along with the advantages and disadvantages of the network. | CO5 | | R | 12 |
|  | |  |  |  | |  |  |
| 22. | |  | Calculate the energy consumed per month by the following electrical appliances.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | S.N | 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 | | A | 12 |
|  | |  |  |  | |  |  |
| 23. | | a. | Describe the NPN transistor operation using the appropriate diagram. | CO2 | | U | 6 |
|  | | b. | Discuss the future of electric vehicles. | CO2 | | A | 6 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | | a. | Discuss the role of cloud computing and big data in IoT. | CO6 | | U | 6 |
|  | | b. | Give differences between artificial intelligence and machine learning. Also write some real-world applications of AI. | CO6 | | U | 6 |

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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. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 7 | 9 | 13 | - | - | - | 29 |
| CO2 | 3 | 20 | 6 | - | - | - | 29 |
| CO3 | 1 | 4 | 12 | - | - | - | 17 |
| CO4 | 3 | 14 | - | - | - | - | 17 |
| CO5 | 16 | - | - | - | - | - | 16 |
| CO6 | - | 13 | 3 | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

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

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| **Q. No.** | **Questions** | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | 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 |
| 2. | Porsche showed his first hybrid car at the Paris exposition in the year \_\_\_\_\_\_\_. | CO1 | R | | 1 |
| 3. | Regenerative braking is not possible in a shunt motor – True or False. | CO2 | R | | 1 |
| 4. | The synchronous speed of an AC machine, if the no. of poles (P) is 4 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 | U | | 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. | Define a sensor. | CO5 | R | | 1 |
| 10. | \_\_\_\_\_ is a subset of AI technique which used statistical methods to enable machines to improve with experience. | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare Lithium ion and Lithium Polymer Batteries. | CO1 | | U | 3 |
| 12. | Distinguish BLDC Motor with Induction Motor. | CO2 | | A | 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 6, total tractive effort is 30N and radius of the tyre is 10 m, find the motor torque. | CO4 | | E | 3 |
| 15. | Mention any three optimization methods used in AI. | CO5 | | A | 3 |
| 16. | Brief out Honda FCX Clarity. | 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. |  | Discuss the parallel hybrid and series-parallel hybrid configuration of hybrid vehicle with necessary diagrams. | CO1 | An | 12 |
| 18. | a. | Explicate the operation of C-Dump Converter for Switched Reluctance Motor (SRM) with neat diagram and waveforms | CO2 | An | 8 |
| b. | Mention the applications and advantages of BLDC motor. | CO2 | U | 4 |
| 19. |  | Determine the aero dynamic and rolling resistance design consideration of vehicle with necessary equations and diagrams | CO3 | An | 12 |
| 20. |  | With necessary diagrams explain the total forces acting in the EV for analyzing the vehicle performance modelling. | CO4 | An | 12 |
| 21. |  | Deliberate the history, system model and various level of the self-driving cars. | CO5 | An | 12 |
| 22. | a. | Describe the historical development of Hybrid Electric Vehicle. | CO1 | U | 8 |
| b. | Brief out flywheel operation. | CO1 | An | 4 |
| 23. | a. | With necessary diagrams and explanation, describe the benefits of AI based EV compared to conventional PI control of EV. | CO5 | A | 8 |
| b. | Brief out self-healing sensors. | CO5 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss the electric vehicle Nissan Leaf with a case study. | CO6 | A | 12 |

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|  | **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 behavior of the EV. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 11 | - | 16 | - | - | **29** |
| CO2 | 1 | 4 | 3 | 8 | 1 | - | **17** |
| CO3 | - | 9 | - | 8 | - | - | **17** |
| CO4 | 1 | 1 | - | 12 | 3 | - | **17** |
| CO5 | 1 | 4 | 11 | 12 | - | - | **28** |
| CO6 | - | 4 | 12 | - | - | - | **16** |
|  | | | | | | | **124** |

Graphical user interface, application

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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** | | | | **Course Outcome** | | **Bloom’s Level** | | **Marks** | |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | | | | | | |
| 1. | a. | | Draw the functional blocks of IoT. | | CO1 | | R | | 6 | |
| b. | | Differentiate the physical and logical design of IoT. | | CO1 | | U | | 6 | |
| c. | | Explain the human in loop concept in IoT | | CO1 | | An | | 8 | |
|  |  | | **(OR)** | |  | |  | |  | |
| 2. |  | | Discuss the Service-oriented Architecture of IoT in detail. | | CO2 | | A | | 20 | |
|  |  | |  | |  | |  | |  | |
| 3. | a. | | Sketch the circuit diagram of Arduino based moisture measurement system. | | CO3 | | U | | 6 | |
| b. | | Mention any six commonly used sensors in food industry. | | CO3 | | R | | 6 | |
| c. | | Categorize the embedded systems based on performance and functional requirements. | | CO3 | | An | | 8 | |
|  |  | | **(OR)** | |  | |  | |  | |
| 4. | a. | | Compare TCP and UDP. | | CO4 | | U | | 6 | |
| b. | | Illustrate the ability of IPv6 using the hourglass model. | | CO4 | | A | | 14 | |
|  |  | |  | |  | |  | |  | |
| 5. | a. | | List out key challenges concerning ICT for agri-food logistics. | | CO5 | | An | | 6 | |
| b. | | Explain the Smart prepackaged food lifecycle management service with neat diagram. | | CO5 | | U | | 14 | |
|  |  | | **(OR)** | |  | |  | |  | |
| 6. |  | | Analyze the three communication models in IoT. | | CO2 | | An | | 20 | |
|  |  | |  | |  | |  | |  | |
| 7. | a. | | Analyze the smart farming using remote sensing technique. | | CO6 | | An | | 10 | |
| b. | | Discuss the role of 5G network on smart farming. | | CO6 | | A | | 10 | |
|  |  | | **(OR)** | |  | |  | |  | |
| 8. | a. | | Investigate the IoT communication API’s. | | CO4 | | An | | 10 | |
| b. | | Describe the features of edge computing, cloud computing and edge cloud computing. | | CO3 | | A | | 10 | |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | | | | | |
| 9. | |  | | Discuss the role of Nano sensors in agriculture and food industry with necessary block diagrams and schematics. | | CO6 | | An | | 20 |

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|  | **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 | 6 | - | 8 | - | - | 20 |
| CO2 | - | - | 20 | 20 | - | - | 40 |
| CO3 | 6 | 6 | 10 | 8 | - | - | 30 |
| CO4 | - | 6 | 14 | 10 | - | - | 30 |
| CO5 | - | 14 | - | 6 | - | - | 20 |
| CO6 | - | - | 10 | 30 | - | - | 40 |
|  | | | | | | | 180 |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Name any two types of wiring found in homes. | | CO1 | U | | 1 |
| 2. | What is earthing? | | CO1 | R | | 1 |
| 3. | Three Phase Induction motor is a self-starting motor: (True or False) | | CO2 | R | | 1 |
| 4. | Suggest suitable motor for table fan. | | CO2 | R | | 1 |
| 5. | The forward biased characteristics of a zener diode are the same as those of a diode: (True or False) | | CO3 | U | | 1 |
| 6. | Name the types of ROM. | | CO3 | R | | 1 |
| 7. | A \_\_\_\_\_\_\_\_ is thermally sensitive resistor that exhibits a large change in resistance. | | CO4 | U | | 1 |
| 8. | Suggest suitable sensor for Water level controller. | | CO4 | R | | 1 |
| 9. | Bluetooth is used to form a wireless Personal Area Network.(True/False ) | | CO5 | U | | 1 |
| 10. | Mention any two applications of ML. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | An alternating sinusoidal current equation is given by i = 200 sin 314𝑡. Obtain Iavg and Irms. | | CO1 | | An | 3 |
| 12. | Which motor is most suitable mixer operation? Justify. | | CO2 | | U | 3 |
| 13. | Compare the Arduino Uno and Raspberry pi. | | CO3 | | U | 3 |
| 14. | Write the disadvantages of automatic irrigation systems. | | CO4 | | U | 3 |
| 15. | Compare WLAN and Bluetooth. | | CO5 | | U | 3 |
| 16. | Differentiate existing grid and smart grid. | | 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 working principle of induction type Energy meter with a neat diagram. | CO1 | | U | 8 |
|  | b. | Describe the working of fluorescent lamp with a neat wiring diagram. | CO1 | | U | 4 |
| 18. | a. | Elucidate the construction and working principle of 3-phase Induction motor with the help of a neat diagram. | CO2 | | U | 10 |
|  | b. | Compare BLDC Motor with Brushed DC motor | CO2 | | U | 2 |
| 19. | a. | Articulate the operation of PN junction diode using the suitable circuit diagram. | CO3 | | U | 6 |
|  | b. | Describe the NPN transistor operation using the appropriate diagram. | CO3 | | U | 6 |
| 20. | a. | Describe the advantages of an appropriate circuit and a soil moisture measurement approach for home gardening. | CO4 | | A | 8 |
|  | b. | Comment the benefits of automatic irrigation system. | CO4 | | U | 4 |
| 21. |  | Name the three basic network topologies and explain them giving all the relevant features. | CO5 | | U | 12 |
| 22. | a. | A household uses the following electric appliance  a. Refrigerator of rating 400w for 10hrs.  b. Two electric fans of rating 80w each for 12hrs each day.  c. 6 electric bulbs of rating 18w each for 6hrs each day.  Calculate the electric bill of the house for the month of June if the cost of per unit electrical energy isR3.0 | CO1 | | An | 8 |
|  | b. | Compare MAC and IP address. | CO5 | | U | 4 |
| 23. |  | Discuss the operation of the AND, OR, NOT, NOR, EXOR and EXNOR gates using the truth table. | CO3 | | U | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Elucidate the IOT components and working of IOT.List its applications. | CO6 | | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the basics and usage of electric grids, power supply, wiring and safety indomestic 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. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 13 |  | 11 |  |  | 25 |
| CO2 | 2 | 15 |  |  |  |  | 17 |
| CO3 | 1 | 28 |  |  |  |  | 29 |
| CO4 | 1 | 8 | 8 |  |  |  | 17 |
| CO5 |  | 20 |  |  |  |  | 20 |
| CO6 |  | 16 |  |  |  |  | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | **A string of Christmas lights is an example of ———— circuits.** | | | CO1 | R | 1 |
| 2. | One coulomb of charge particle contains\_\_\_\_\_\_\_\_\_\_\_ amount of electrons. | | | CO1 | R | 1 |
| 3. | Controlling torque opposes the \_\_\_\_\_\_\_\_\_\_\_\_\_ torque in measuring instruments. | | | CO2 | R | 1 |
| 4. | The digital \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an instrument which is capable of measuring a.c voltage, d.c voltage, a.c and d.c currents and resistances over several ranges. | | | CO2 | R | 1 |
| 5. | Write the types of digital recorders. | | | CO3 | R | 1 |
| 6. | \_\_\_\_\_\_\_\_\_ is the ratio of change in output of the sensor to unit change in input value. | | | CO4 | U | 1 |
| 7. | Say True or False: A strain gauge is also termed as Load cell . | | | CO4 | U | 1 |
| 8. | Capacitive transducers are useful for converting one form of energy into another form of energy by taking the \_\_\_\_\_\_\_\_\_\_\_value. | | | CO5 | R | 1 |
| 9. | Write any one advantage of WSN based smart power monitoring system. | | | CO6 | R | 1 |
| 10. | \_\_\_\_\_\_\_\_\_\_\_\_ has become popular in rural INDIA which saves crops from animals such as elephants. | | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Find out the unknown currents using KCL. | | | CO1 | U | 3 |
| 12. | Draw the basic block diagram of digital voltmeter. | | | CO2 | U | 3 |
| 13. | With simple diagram, explain the working of capacitive touch screen display. | | | CO3 | U | 3 |
| 14. | List the applications of Biosensors. | | | CO4 | U | 3 |
| 15. | What is the working principle of a metal detector? | | | CO5 | U | 3 |
| 16. | Define wireless sensor network and list its main components. | | | 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. | Four resistors of 5 Ω, 4 Ω, 5 Ω and 6 Ω are connected in series across 20V supply. Find the equivalent resistance, current and voltage across each resistor. | CO1 | A | 6 |
|  | | b | Define the following Laws with proper equation,   1. Ohm’s Law. 2. Faraday’s Law of Electromagnetic Induction. 3. Lenz’s Law. | CO1 | R | 6 |
| 18. | | a. | With neat diagram, explain the construction and working principle of Permanent Magnet Moving Iron Instrument. | CO2 | U | 8 |
|  | | b | Draw the constructional diagram of Induction type Energy Meter. Mark the various parts clearly. | CO2 | U | 4 |
| 19. | | a. | With neat functional diagram explain the working principle of Cathode Ray Oscilloscope. (CRO). | CO3 | U | 8 |
|  | | b | Write short notes on Graphic Recorders. | CO3 | R | 4 |
| 20. | | a. | Write about different classifications of transducer with definition and example. | CO4 | U | 8 |
|  | | b | Explain the necessity of E-nose and E-tongue. | CO4 | U | 4 |
| 21. | | a. | With neat block diagram, explain the working principle of Biotechnology sensor for Healthcare application. | CO4 | A | 8 |
|  | | b | Write short notes on LDR. | CO4 | U | 4 |
| 22. | |  | With neat diagram, explain the construction and working principle of Pyronometer. | CO4 | U | 12 |
| 23. | |  | Identify a sensor/transducer whose resistance varies with applied force. Prove it with an appropriate equation and explain its construction and working principle. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | |  | With a neat block diagram describe the architecture of a smart sensor and demonstrate the role of Smart Sensor in Agriculture. | CO6 | A | 12 |

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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. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 8 | 3 | 6 |  |  |  | 17 |
| CO2 | 2 | 15 |  |  |  |  | 17 |
| CO3 | 5 | 11 |  |  |  |  | 16 |
| CO4 |  | 33 | 8 |  |  |  | 41 |
| CO5 | 1 | 15 |  |  |  |  | 16 |
| CO6 | 1 | 16 |  |  |  |  | 17 |
|  | | | | | | | **124** |