# SRM VALLIAMMAI ENGINEERING COLLEGE

**(An Autonomous Institution)**

SRM Nagar, Kattankulathur – 603 203

## DEPARTMENT OF

## ELECTRICAL AND ELECTRONICS ENGINEERING

## QUESTION BANK

**VIII SEMESTER**

**1905805- Electric Energy Generation, Utilization and Conservation**

**Regulation – 2019**

**Academic Year 2022 – 2023 (EVEN)**

*Prepared by*

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**SUBJECT: 1905805- Electric Energy Generation, Utilization and Conservation**

**SEM / YEAR: VIII / IV**

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| **UNIT I - ILLUMINATION** | | | | |
|---|---|---|---|---|
| Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting – LED lighting and energy efficient lamps. | | | | |
| **PART-A** | | | | |
| **Q.No** | **Questions** | **BT Level** | **Competence** | **COs** |
| 1 | Define Light. | 1 | Remember | CO 1 |
| 2 | Define luminous efficiency. | 1 | Remember | CO 1 |
| 3 | If the total lumens required are 7200 and coefficient of utilization is 0.3, calculate lamp lumens required | 5 | Evaluate | CO1 |
| 4 | List the types of lighting system. | 4 | Analyze | CO1 |
| 5 | What are the two laws of illumination? | 3 | Apply | CO1 |
| 6 | State inverse square law. | 2 | Understand | CO1 |
| 7 | State Lambert's law. | 2 | Understand | CO1 |
| 8 | Define luminous flux | 1 | Remember | CO1 |
| 9 | Define Illumination or Illuminance or Degree of Illumination. | 1 | Remember | CO1 |
| 10 | Define lumen. | 1 | Remember | CO1 |
| 11 | What are the properties of heating materials? | 2 | Understand | CO1 |
| 12 | State the different types of electrical lamps used for illumination? | 4 | Analysis | CO1 |
| 13 | Why tungsten is selected as the filament material? | 5 | Evaluate | CO1 |
| 14 | Point out the various factors for designing the lightning scheme. | 4 | Analyze | CO1 |
| 15 | Mention any two uses of flood lighting. | 6 | Create | CO1 |
| 16 | What is flood lighting and where is it generally used? | 3 | Apply | CO1 |
| 17 | List the importance of street lighting system | 4 | Analyze | CO1 |
| 18 | Define the term MSCP and lamp efficiency. | 1 | Remember | CO1 |

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| 19 | Define solid angle | 1 | Remember | CO1 |
| 20 | Generalize plane angle. | 2 | Understand | CO1 |
| 21 | What do you understand by polar curves as applied to light source? | 2 | Understand | CO1 |
| 22 | Deduce why sodium vapour lamps are not preferred for indoor lighting. | 5 | Evaluate | CO1 |
| 23 | Define Waste Light Factor. | 2 | Understand | CO1 |
| 24 | Define Utilization Factor in the design of the lighting scheme. | 3 | Apply | CO1 |
| | **PART-B** | | | |
| 1 | (i) Compare the output lumen of LED, CFL and Incandescent wattage. (7)<br>(ii) Discuss in detail about the street or road lighting with neat sketches. (6) | 3 | Apply | CO1 |
| 2 | (i) Discuss laws of illumination. (6)<br>(ii)A workshop measuring 5.25m by 36.6m is illuminated by 20lamps of 500W each. The luminous efficacy of each lamp is 15lumens/Watt. Allowing a depreciation factor of 0.7 and the coefficient of utilization of 0.5, determine the illumination on the working plane. (7) | 4 | Analyze | CO1 |
| 3 | A hall 30m long and 12m wide is to be illuminated and the illumination required is 50 m candles. Deduce the number of fitting required, taking depreciation factor of 1.3 and utilization factor of 0.5.Given that the outputs of different types of lamp are given below:<br>Watts 100 200 300 500 1000<br>Lumens 1615 3650 4700 9950 21500<br>(13) | 5 | Evaluate | CO1 |
| 4 | A hall of 30 × 20 m area with a ceiling height of 6 m is to be provided with a general illumination of 200 lumens/$m^2$, taking a coefficient of utilization of 0.6 and depreciation factor of 1.6. Determine the number of fluorescent tubes required, their spacing, mounting height, and total wattage. Take luminous efficiency of fluorescent tube as 25 lumens/W for 300- W tube.(13) | 4 | Analyze | CO1 |
| 5 | In a street lighting, two lamps are having luminous intensity of 300 candela, which are mounted at a height of 6 and 10 m. The distance between lamp posts is 12 m. Find the illumination, just below the two lamps. (13) | 3 | Apply | CO1 |
| 6 | Discuss about photometry in detail. (13) | 2 | Understand | CO1 |
| 7 | What is Arc lamps and explain its types. (13) | 1 | Remember | CO1 |
| 8. | Explain types of incandescent lamp with neat diagram. (13) | 2 | Understand | CO1 |
| 9. | Explain about the following lamps with neat diagram.<br>(i) Mercury Vapour lamp (6)<br>(ii) Sodium Vapour lamp (7) | 1 | Remember | CO1 |
| 10 | (i)Compare tungsten filament lamps and fluorescent lamp. (6) | 2 | Understand | CO1 |

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| | (ii)Discuss trouble shooting of fluorescent tubes. (7) | | | |
| 11 | Explain the operation of fluorescent lamp. (13) | 1 | Remember | CO1 |
| 12 | Evaluate the various steps involved in designing of illumination system. (13) | 5 | Evaluate | CO1 |
| 13 | Discuss about the types of lighting schemes. (13) | 2 | Understand | CO1 |
| 14 | Point out the various factors to be taken into account for designing street lighting and flood lighting. (13) | 4 | Analyze | CO1 |
| 15 | Illustrate best energy saving practices. (13) | 3 | Apply | CO1 |
| 16 | Explain the parts and principle of operation of LED.(13) | 1 | Remember | CO1 |
| 17 | In a photometric bench test balance is obtained when a standard lamp of 20 candela in the horizontal direction is 1.5m and the lamp being tested is 1.25m from the photometer screen (a) What is the luminous intensity of the test lamp (b)if the light from the test lamp is reduced by 15% ,What would be the respective distance of lamps from the screens? In this case the lamps are fixed 3.5m apart and the screen moves between them. (13) | 4 | Analyze | CO1 |
| | **PART-C** | | | |
| 1 | A drawing, with an area of 18 × 12 m, is to be illuminated with an average illumination of about 150 lux. The lamps are to be fitted at 6 m height. Find out the number and size of incandescent lamps required for an efficiency of 20 lumens/W. UF = 0.6, MF = 0.75. (15) | 5 | Evaluate | CO1 |
| 2 | Explain about the following<br>(i) Factory lighting (5)<br>(ii) Flood lighting (5)<br>(iii)Street lighting (5) | 5 | Evaluate | CO1 |
| 3 | A lamp having a candle power of 300 in all directions is provided with a reflector that directs 70% of total light uniformly on a circular area 40-m diameter. The lamp is hung at 15 m above the area.<br>i) Calculate the illumination. (5)<br>ii). Also calculate the illumination at the center. (5)<br>iii). The illumination at the edge of the surface. (5) | 5 | Evaluate | CO1 |
| 4 | Illustrate about photometry and explain different types of photocell used photometry measurement and also describe about distribution photometry. (15) | 5 | Evaluate | CO1 |
| 5 | A hall 40-m long and 16-m wide is to be illuminated and illumination required is 70-m candles. Five types of lamps having lumen outputs, as given below are available.<br>Watts 50 100 150 200 250<br>Lumens 1500 1830 2500 3200 4000<br>Taking a depreciation factor of 1.5 and a utilization coefficient of 0.7, calculate the number of lamps required in each case to produce required illumination. Out of above five types of lamps, select most suitable type and design, a suitable scheme, and make a sketch showing location of lamps. Assume a suitable mounting height and calculate space to height ratio of lamps. (15) | 6 | Create | CO1 |

| UNIT II - REFRIGERATION AND AIR CONDITIONING | | | | |
|---|---|---|---|---|
| Refrigeration-Domestic refrigerator and water coolers - Air-Conditioning-Various types of air-conditioning system and their applications, smart air conditioning units - Energy Efficient motors: Standard motor efficiency, need for efficient motors, Motor life cycle, Direct Savings and payback analysis, efficiency evaluation factor. | | | | |
| **PART-A** | | | | |
| **Q.No** | **Questions** | **BT Level** | **Competence** | **COs** |
| 1 | List out the applications of refrigeration system. | 1 | Remember | CO4 |
| 2 | What ate the elements of refrigeration system? | 3 | Apply | CO4 |
| 3 | Define coefficient of performance. | 1 | Remember | CO4 |
| 4 | List out classification of Air-conditioning system. | 2 | Understand | CO4 |
| 5 | What are the two main parts in domestic refrigeration system? | 1 | Remember | CO4 |
| 6 | Point out different types of water cooler | 1 | Remember | CO4 |
| 7 | What is meant by refrigerant and list out classification? | 1 | Remember | CO4 |
| 8 | List out the desirable properties of ideal refrigerant. | 3 | Apply | CO4 |
| 9 | Define psychrometry. | 4 | Analysis | CO4 |
| 10 | What are the factors affecting comfort in air conditioning system? | 5 | Evaluate | CO4 |
| 11 | Differentiate Direct saving and pay back analysis. | 4 | Analyze | CO4 |
| 12 | What is meant by standard motor efficiency? | 1 | Remember | CO4 |
| 13 | What is the necessity of energy efficient motors? | 3 | Apply | CO4 |
| 14 | Show the properties of energy efficient motors. | 4 | Analysze | CO4 |
| 15 | State the factors affecting motor efficiency. | 4 | Analyze | CO4 |
| 16 | What is meant by NEMA? | 1 | Remember | CO4 |
| 17 | Show what is meant by apparent efficiency. | 2 | Understand | CO4 |
| 18 | How energy-efficient motor different than a standard motor? | 5 | Evaluate | CO4 |
| 19 | Evaluate the payback period for selecting energy efficient versus standard efficiency motors/\. | 5 | Evaluate | CO4 |
| 20 | Describe the efficiency of an energy efficient motor at different load points. | 2 | Understand | CO4 |
| 21 | What is air conditioning? | 1 | Remember | CO4 |
| 22 | List the properties of refrigeration. | 2 | Understand | CO4 |
| 23 | State refrigeration effect. | 2 | Understand | CO4 |
| 24 | Differentiate vapour compression and vapour absorption refrigeration system. | 4 | Analysze | CO4 |
| **PART-B** | | | | |
| 1 | Explain with neat diagram construction and working of domestic refrigerator. (13) | 2 | Understand | CO4 |
| 2 | What is meant by water cooler and explain different types of water cooler with neat diagram. (13) | 1 | Remember | CO4 |
| 3 | Enlist the main requirement of good refrigerant and explain various types of refrigerant used for refrigeration system. (13) | 1 | Remember | CO4 |
| 4 | Explain with neat diagram different methods of | | | CO4 |

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| | refrigeration systems. (13) | 2 | Understand | |
| 5 | What are the components used for air-conditioning systems and briefly explain Air-conditioning cycle. (13) | 4 | Analyze | CO4 |
| 6 | What is the working principle of Air-conditioning system and briefly explain classification of Air-conditioning systems. (13) | 1 | Remember | CO4 |
| 7 | Evaluate briefly load estimation of Air-conditioning system. (13) | 5 | Evaluate | CO4 |
| 8 | Explain briefly cost benefit analysis of Energy Efficient motors. (13) | 2 | Understand | CO4 |
| 9 | Explain briefly different losses occurred in the conventional motor components. (13) | 4 | Analyze | CO4 |
| 10 | Explain detail steps to calculate annual energy saving for energy efficient motors over standard motors. (13) | 3 | Apply | CO4 |
| 11 | What is energy efficient motors and briefly explain motor efficiency labelling. (13) | 5 | Evaluate | CO4 |
| 12 | Explain briefly energy efficiency of motors. (13) | 1 | Remember | CO4 |
| 13 | Explain briefly selection and application of energy efficient motors. (13) | 3 | Apply | CO4 |
| 14 | A 75 Hp motor operating at 75 percent of full rated load determine kilowatts saved, energy saved,, Annual cost saving and cost effectiveness<br>Standard motor efficiency =91.6% ,<br>energy efficient motor efficiency=94,9%<br>Hours of operation=8000<br>Monthly demand charge=5.35$/kW<br>Energy charge=0.03$/kWh<br>List price premium=1189$<br>Discount factor=0.75 (13) | 3 | Apply | CO4 |
| 15 | Explain the working of Window type air conditioner.(13) | 4 | Analyze | CO4 |
| 16 | Explain construction of Vapour compression refrigeration system. (13) | 5 | Evaluate | CO4 |
| 17 | Explain construction of Vapour Absorption refrigeration system. (13) | 2 | Understand | CO4 |
| | **PART-C** | | | |
| 1 | Evaluate briefly with diagram room type air conditioning system and list out advantages of the system. (15) | 5 | Evaluate | CO4 |
| 2 | Explain briefly power factor and its effects of energy consumption. (15) | 5 | Evaluate | CO4 |
| 3 | Explain briefly how energy efficient motors superior than standard motors with respect to electrical characteristics. (15) | 5 | Evaluate | CO4 |
| 4 | A 25-hp poly phase induction motor, 1800-rpm application with an average annual operating time of 4000 hr and a cost of electric power of 5 $/kWh and standard motor efficiency 88% and energy efficient motor efficiency 93%, Typical list price of standard | 6 | Create | CO4 |

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| | motor $993 and typical list price of energy efficient motor $1226.To find annual power cost saving and time to recover initial cost. (15) | | | |
| 5 | Discuss in detail the different methods of refrigeration systems. (15) | 5 | Evaluate | CO4 |

**UNIT III - HEATING AND WELDING**

Role of electric heating for industrial applications – resistance heating – induction heating – dielectric heating - electric arc furnaces. Brief introduction to electric welding – welding generator, welding transformer and the characteristics. Power supply for radiation welding.

**PART-A**

| Q.No | Questions | BT Level | Competence | COs |
|---|---|---|---|---|
| 1. | What are the advantages of electric heating? | 4 | Analyze | CO2 |
| 2. | Classify the methods of electric heating. | 3 | Apply | CO2 |
| 3. | List the properties of heating element material. | 2 | Understand | CO2 |
| 4. | What is the basic principle of induction heating? | 1 | Remember | CO2 |
| 5. | State direct resistance heating. | 1 | Remember | CO2 |
| 6. | What is the principle of arc furnace? | 2 | Understand | CO2 |
| 7. | Differentiate core type and coreless type induction furnaces | 4 | Analyze | CO2 |
| 8. | Point out advantages of electric heating. | 4 | Analyze | CO2 |
| 9. | What is meant by welding? | 1 | Remember | CO2 |
| 10. | Compare DC welding and AC welding. | 4 | Analyze | CO2 |
| 11. | List the different types of welding. | 3 | Apply | CO2 |
| 12. | What are the modern welding techniques? | 2 | Understand | CO2 |
| 13 | What is LASER welding? | 1 | Remember | CO2 |
| 14 | Define quenching. | 2 | Understand | CO2 |
| 15 | Evaluate causes of failure of heating element. | 5 | Evaluate | CO2 |
| 16 | List the types of arc welding. | 2 | Understand | CO2 |
| 17 | What are the methods used to control the current flow in welding transformers? | 3 | Apply | CO2 |
| 18 | Discuss power supply requirements for welding equipments. | 2 | Understand | CO2 |
| 19 | List the factors for the selection of the welding process. | 3 | Apply | CO2 |
| 20 | What are the drawbacks of convention welding methods? | 2 | Understand | CO2 |
| 21 | What are the causes of failure of heating elements? | 2 | Understand | CO2 |
| 22 | Define electric heating. | 1 | Remember | CO2 |
| 23 | State Newton’s law of cooling. | 1 | Remember | CO2 |

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| 24 | List the advantages of coreless induction furnace. | 5 | Evaluate | CO2 |
| | **PART-B** | | | |
| 1 | What are the modes of heat transfer and explain each. (13) | 1 | Remember | CO2 |
| 2. | Explain the resistance heating methods with schematic diagrams. (13) | 2 | Understand | CO2 |
| 3 | Explain<br>i)Induction heating (8)<br>ii)Dielectric heating (7) | 2 | Understand | CO2 |
| 4 | Define arc. Describe the types of arc furnaces. (13) | 1 | Remember | CO2 |
| 5 | Discuss in detail about any two types of resistance welding. (13) | 5 | Evaluate | CO2 |
| 6 | With neat diagram describe the different type of arc welding. (13) | 1 | Remember | CO2 |
| 7 | Discuss the principle of arc welding and the difference between carbon and metal arc welding and their relative merits and demerits. (13) | 3 | Apply | CO2 |
| 8 | Explain the principle, working and characteristics of welding transformer. (13) | 2 | Understand | CO2 |
| 9. | What is radiation welding? Explain its types in detail. (13) | 1 | Remember | CO2 |
| 10 | Discuss modern welding techniques. (13) | 4 | Analyze | CO2 |
| 11 | Estimate the efficiency of a high frequency induction furnace which takes 15 minutes to melt 2kg of Aluminium. The input to the furnace being 5kW and the initial temperature is 15$^{o}$C.Take specific heat of aluminium is 880J/Kg/$^{o}$C, melting point of Al is 660$^{o}$C and latent heat of fusion of Al is 32KJ/Kg. (13) | 3 | Apply | CO2 |
| 12 | i) Compare DC welding and AC welding. (8)<br>ii)Compare resistance and arc welding. (7) | 4 | Analyze | CO2 |
| 13 | i) Explain the working of coreless induction furnace and list its merits. (8)<br>ii) A 105 kg of tin is to be melt during an hour in a melting furnace. Determine a suitable rating of the furnace if melting temperature of tin is 240$^{o}$ C. Take initial temperature of metal as 35$^{o}$C. (7) | 3 | Apply | CO2 |
| 14 | Explain<br>i)Projection welding (8)<br>ii)Spot welding (7) | 1 | Remember | CO2 |
| 15 | Explain<br>i)Butt welding (5)<br>ii)Upset welding (4)<br>iii)Flash-Butt welding (4) | 2 | Understand | CO2 |
| 16 | Discuss electric arc welding equipment and Power supply. (13) | 4 | Analyze | CO2 |
| 17 | Calculate the energy required to melt one metric ton of brass in a single phase induction furnace. If the time taken is 1.5hr, find the power input to the furnace.<br>Specific heat of brass = 0.094<br>Latent heat of fusion of brass = 38kcal/kg<br>Melting point of brass = 920$^{o}$ C | 6 | Create | CO2 |

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| | Temperature of charge=20$^{o}$C<br>Furnace efficiency =80%. (13) | | | |
| **PART-C** | | | | |
| 1 | Explain the types of induction furnaces. (15) | 5 | Evaluate | CO2 |
| 2 | A laminated plywood board 40cm * 25cm * 1.8cm is to be heated from 25$^{o}$C to 160$^{o}$C in 12 minutes, using 25MHz supply, specific heat of wood is to be taken as 0.32, density is 0.6 g/cm$^{3}$,relative permittivity of wood is 6 and power factor 0.05.Find the supply voltage, power required and current drawn. Take the efficiency of the process as 75%. (15) | 5 | Evaluate | CO2 |
| 3 | A 10 KW 200V single phase resistance oven employs Nickel-chrome strip 0.25mm thick as its heating element .If the strip temperature is not to exceed 1000$^{o}$C and temperature of charge is to be 600$^{o}$C, calculate the width and length of the strip. Assume radiating efficiency as 0.6 and emissivity as 0.9.Take resistivity of Nickel-chrome as1.016*10$^{-6}$ ohm-metre. (15) | 6 | Create | CO2 |
| 4 | Discuss the types of resistance welding. (15) | 5 | Evaluate | CO2 |
| 5 | Explain in detail the types of arc welding. (15) | 5 | Evaluate | CO2 |
| **UNIT IV - TRACTION** | | | | |
| Merits of electric traction – requirements of electric traction system – supply systems – mechanics of train movement – traction motors and control – braking – recent trends in electric traction. Systems of railway electrification. Traction motors and its characteristics. | | | | |
| **PART-A** | | | | |
| **Q.No** | **Questions** | **BT Level** | **Competence** | **COs** |
| 1 | Draw the speed torque characteristics of an ideal traction system drives | 3 | Apply | CO5 |
| 2 | Analysis the features of electric traction. | 4 | Analyze | CO5 |
| 3 | Name the type of motor used for electric traction. Why? | 3 | Apply | CO5 |
| 4 | List the factors affecting scheduled speed of a train. | 5 | Evaluate | CO5 |
| 5 | Sketch the speed-time curve for a sub-urban railway system. | 5 | Evaluate | CO5 |
| 6 | Discuss the requirements of an ideal traction system. | 2 | Understand | CO5 |
| 7 | State the use of speed time curve. | 3 | Apply | CO5 |
| 8 | List four advantages of AC series motor used as traction motor. | 4 | Analyze | CO5 |
| 9 | With respect to traction system, express the term “free running”. | 4 | Analyze | CO5 |
| 10 | Deduce the factor affecting schedule speed. | 2 | Understand | CO5 |
| 11 | What are the merits and demerits of D.C. system of | 2 | Understand | CO5 |

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| | track electrification? | | | |
| 12 | Mention different methods of track electrification. | 1 | Remember | CO5 |
| 13 | What are the factors affecting schedule speed in electric traction? | 3 | Apply | CO5 |
| 14 | What is meant by coefficient of adhesion? | 1 | Remember | CO5 |
| 15 | What is meant by tractive effort? | 1 | Remember | CO5 |
| 16 | List out the factors affecting specific energy consumption of an electric train operation on a given schedules. | 4 | Analyze | CO5 |
| 17 | Differentiate dead, accelerating and adhesive weight | 5 | Evaluate | CO5 |
| 18 | Why are the ac single phase series motors not suitable for urban and sub urban service? | 5 | Evaluate | CO5 |
| 19 | What are the desirable requirements of braking in electric traction? | 2 | Understand | CO5 |
| 20 | Define plugging. | 1 | Remember | CO5 |
| 21 | Compare DC and AC traction. | 2 | Understand | CO5 |
| 22 | Define scheduled speed. | 1 | Remember | CO5 |
| 23 | List the methods for controlling the speed of dc series motor. | 2 | Understand | CO5 |
| 24 | Define crest speed. | 1 | Remember | CO5 |
| | **PART-B** | | | |
| 1 | Describe the different methods of traction motor control and explain (13) | 1 | Remember | CO5 |
| 2 | (i)Describe the series- parallel control of electric traction motor. Also specify the advantages. (6)<br>(ii)A train runs with an average speed of 50 kmph. Distance between stations is 2.5 km. Values of acceleration and retardation are 1.8 kmphs and 2.4 kmphps respectively. Calculate the maximum speed of the train assuming a trapezoidal speed time curve. (7) | 2 | Understand | CO5 |
| 3 | (i)Explain Buck Boost method in electric traction systems. (6)<br>(ii) A sub urban electric train has a maximum speed of 65kmph.The schedule speed including a station stop of 30seconds is 43.5kmph.If the acceleration is 1.3kmphps, find the value of retardation when the distance between stops is 3km. (7) | 2 | Understand | CO5 |
| 4 | (i) Explain about the types of supply system used in traction system. (6)<br>(ii) A 250 tonnes train with 10% rotational inertia effect is started with uniform acceleration and reaches a speed of 50 kmph in 265 seconds on level road. Calculate the specific energy consumption if the journey is to be made according to trapezoidal speed- time curve. Acceleration = 2 kmphps; Tracking retardation = 3 kmphps ; Distance between the stations = 2.4 km ; efficiency = 0.9; Track resistance=5kg/tones. (7) | 3 | Apply | CO5 |
| 5 | (i)With the aid of transmission of tractive effort, describe the mechanism of train movement. (6) | 2 | | |

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| | (ii) Describe clearly regenerative braking when used for Dc series traction motors. Also discuss the requirements for ideal traction. (7) | | Understand | CO5 |
| 6 | (i) A scheduled speed of 45km per hour is required between two stops 1.5km apart. Find the maximum speed over the run, if the stop is of 20 second duration. The values of acceleration and retardation are 2.4 kmphps and 3.2kmphps respectively. Assume a simplified trapezoidal speed-time curve. (7)<br>(ii)Discuss short notes on Trolley bus. (6) | 4 | Analyze | CO5 |
| 7 | (i) Draw the speed – Time curve of a traction system. Also explain various periods and the action. (6)<br>(ii)A train has a scheduled speed of 50 kmph over a level track, distance between stations being 1.8 kms. Station stopping time is 30 seconds. Assuming braking retardation of 3 kmphps and maximum speed 50% greater than average speed. Estimate acceleration to run the service. (7) | 4 | Analyze | CO5 |
| 8 | What are the various types of electric braking used in traction? Discuss any two types in detail. (13) | 1 | Remember | CO5 |
| 9 | A train weighing 203 tonnes accelerates uniforms from the rest to a speed of 45kmph up a gradient of 1 in 500, the time taken being 30 seconds. The power is then cut off the coasts down as uniform gradient of 1 in 1000 for a period of 40 seconds when brakes are applied for period of 15 seconds so as to bring the train uniformly to the rest on this gradient. Estimate<br>(i)The maximum power output from the driving axle.<br>(ii)The energy taken from the conductor rails in Kwh. Assume efficiency of 60%, traction resistance to be 44 Newton/tonne at all speed, rotational inertia is 10%. (13) | 5 | Evaluate | CO5 |
| 10 | (i) Explain and compare the various arrangements of current collection in traction. (6)<br>(ii) The maximum torque of a400v, three phase four pole 60c/s IM is 100NM at a slip of 0.1.If the motor works at 50c/s 400v supply. Evaluate the maximum torque, slip and the speed at which it occurs. Neglect stator impedance. (7) | 3 | Apply | CO5 |
| 11 | The distance between two stations is 1 km and the average speed of the train is 30 kmph. Station stopping time is 20 sec.Assume braking retardation 3 kmphps and maximum speed 1.25 times average speed .Calculate acceleration required to run the service if the speed time curve is approximated by a trapezoidal curve. (13) | 5 | Evaluate | CO5 |
| 12 | (i)Compare dc and ac systems of railway electrification from the point of main line and suburban line railway service (7)<br>(ii)What is coefficient of adhesion? How does it affect slipping of driving wheels of the traction unit? (6) | 4 | Analyze | CO5 |

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| 13 | What is tractive effort of a train and what are its function? Derive an expression for the tractive effort developed by train motion. How does the train resistance play its part in the mechanics of train motion? (13) | 3 | Apply | CO5 |
| 14 | (i)Derive crest speed using trapezoidal speed time curve for main line service. (6)<br>(ii)An electric train has an average speed of 42kmph on a level track between stops 1400 rpm apart, It is accelerated at 1.7 kmphs and is braked at 3.3 kmphs. Draw the speed-time curve for run. (7) | 4 | Analyze | CO5 |
| 15 | Explain the mechanics of train movement. (13) | 1 | Remember | CO5 |
| 16 | Discuss in detail track equipment and current collecting system. (13) | 2 | Understand | CO5 |
| 17 | Explain overhead equipment (OHE). (13) | 1 | Remember | CO5 |
| | **PART-C** | | | |
| 1 | A train has schedule speed 60 Km/hr between stops which are 6 Kms apart .Determine the crest speed over the run, Assuming trapezoidal speed time curve. The train accelerates at 2 Km/hr/sec. The duration of stop is 60 seconds. (15) | 5 | Evaluate | CO5 |
| 2 | A 200 tonne motor coach train has four motors each developing a shaft torque of 6000 NM during the accelerating period, Calculate the time taken by a train to attain a speed of 50Km/hr, starting from rest on a gradient of 30 in 1000 .The motors have the gear ratio of 4, gear efficiency 90 %, wheel radius 45cm. Assume train resistance 50 Newton per tonne addition of rotational inertia 10%. If the line voltage is 3000V dc and efficiency of motors 85%, find the current during notching period. (15) | 5 | Evaluate | CO5 |
| 3 | Evaluate electric braking in detail. (15) | 5 | Evaluate | CO5 |
| 4 | (i)Explain briefly sag and tension calculation for trolley wire. (7)<br>(ii) A trolley wire of a tramway is suspended from two poles 40m apart. If the tension applied is 500kg, find the total length of wire required. (8) | 5 | Evaluate | CO5 |
| 5 | Explain traction motor control. (15) | 5 | Evaluate | CO5 |
| | **UNIT V - DOMESTIC UTILIZATION OF ELECTRICAL ENERGY** | | | |
| | Domestic utilization of electrical energy – House wiring. Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads – Eart,hing – Domestic, Industrial and Substation | | | |
| | **PART-A** | | | |
| **Q.No** | **Questions** | **BT Level** | **Competence** | **COs** |
| 1 | What are the different types of house wiring? | 2 | Understand | CO1 |

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| 2 | Generalize the advantages of conduit wiring. | 4 | Analyze | CO1 |
| 3 | What is electric wiring? | 1 | Remember | CO1 |
| 4 | How does the induction cooking work? | 1 | Remember | CO1 |
| 5 | What is the difference between induction and convention ovens? | 1 | Remember | CO1 |
| 6 | List out the advantages and advantages of induction cooktop. | 3 | Apply | CO1 |
| 7 | Point out the induction bases appliances used in homes. | 3 | Apply | CO1 |
| 8 | Compare online and offline UPS. | 4 | Analyze | CO1 |
| 9 | Illustrate the advantages of online UPS over offline UPS. | 5 | Evaluate | CO1 |
| 10 | How does online UPS work? | 2 | Understand | CO1 |
| 11 | Which types of batteries normally used for UPS. | 3 | Apply | CO4 |
| 12 | Show the main characterises of UPS batteries. | | | CO1 |
| 13 | List the power quality problems due to domestic loads. | 4 | Analyze | CO1 |
| 14 | How can improve power quality in distribution system? | 2 | Understand | CO1 |
| 15 | Why do non-linear loads cause harmonics? | 2 | Understand | CO1 |
| 16 | Write out the difference between linear and nonlinear loads. | 5 | Evaluate | CO1 |
| 17 | What is battery lifespan? | 1 | Remember | CO1 |
| 18 | Illustrate the purpose of earthing. | 3 | Apply | CO1 |
| 19 | List out the different methods of earthing. | 5 | Evaluate | CO1 |
| 20 | How Earthing system differ from grounding system? | 2 | Understand | CO1 |
| 21 | Define Electrical wiring with its General requirements. | 1 | Remember | CO1 |
| 22 | What is the concept behind “On-line” and “Off-line” UPS? | 1 | Remember | CO4 |
| 23 | List the main types of Lithium -ion Batteries. | 5 | Evaluate | CO4 |
| 24 | Define Earthing. | 1 | Remember | CO1 |
| | **PART-B** | | | |
| 1 | Explain with neat diagram different types of the house wiring. (13) | 1 | Remember | CO1 |
| 2 | A 230kV 3 phase 50Hz 200km transmission line has a capacitance to earth of 0.02μF/km per phase. Calculate the inductance and kVA rating of the Peterson coil used for earthing the above system. (13) | 6 | Create | CO1 |
| 3 | Explain briefly with neat diagram working of Online & Offline uninterrupted power supply. (13) | 1 | Remember | CO1 |

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| 4 | Compare briefly different types of house of wiring systems. (13) | 2 | Understand | CO1 |
| 5 | Explain briefly different power quality problems due to home appliances. (13) | 4 | Analyze | CO1 |
| 6 | Explain suitable methods to mitigate power quality issues in distribution system. (13) | 5 | Evaluate | CO1 |
| 7 | Explain with suitable example the effects of linear and nonlinear loads in power system. (13) | 4 | Analyze | CO1 |
| 8 | How power quality of power system affects due to non-linear loads and explain different methods to overcome the power quality issues. (13) | 5 | Evaluate | CO1 |
| 9 | Explain with neat diagram different types of domestic earthing. (13) | 1 | Remember | CO1 |
| 10 | Explain briefly equipment and system grounding in substation. (13) | 2 | Understand | CO1 |
| 11 | Explain in detail different types of substation earthing. (13) | 1 | Remember | CO1 |
| 12 | What are the advantages of neutral grounding and explain briefly different methods of neutral grounding. (13) | 4 | Analyze | CO1 |
| 13 | Explain briefly different types of batteries used for uninterrupted power supply. (13) | 3 | Apply | CO4 |
| 14 | Explain in detail design criteria for substation grounding system. (13) | 3 | Apply | CO1 |
| 15 | What is UPS? Explain with schematic about Online and Offline Mode. (13) | 1 | Remember | CO1 |
| 16 | Discuss in detail about linear and non-linear loads in domestic utilization. (13) | 2 | Understand | CO1 |
| 17 | Explain about the purpose and types of earthing. (13) | 2 | Understand | CO1 |
| | **PART-C** | | | |
| 1 | Explain briefly how induction heating used for different domestic appliance and mention advantages of induction heating over conventional heating method. (15) | 5 | Evaluate | CO1 |
| 2 | What is meant by Uninterrupted power supply and | 5 | Evaluate | |

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| | explain various uninterrupted power supply used for electrical appliance. (15) | | | CO4 |
| 3 | Evaluate the design procedure of substation grounding system to limit the fault current. (15) | 5 | Evaluate | CO1 |
| 4 | Explain in detail Domestic Induction based appliances and its impacts in Power quality. (15) | 5 | Evaluate | CO1 |
| 5 | Narrate in detail about domestic utilization of Energy with source and loading conditions. (15) | 5 | Evaluate | CO1 |

**Course Outcomes:**

| COs | Course Outcome |
|---|---|
| CO1 | Ability to understand the main aspects of generation, utilization and conservation |
| CO2 | Ability to identify an appropriate method of heating for any particular industrial application |
| CO3 | Ability to handle domestic wiring connection and debug any faults occurred. |
| CO4 | Ability to construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application. |
| CO5 | Able to understand the concept of electric traction system. |