DEPARTMENT OF ELECTRICAL AND ELECTRONICS

ELECTRIC ENERGY GENERATION,UTILIZATION AND CONSERVATION

UNIT - I

PART – A

1. Give two examples of renewable energy sources.
2. What is the minimum wind velocity required for power generation through wind mill?
3. Give any two reasons to go for non conventional sources for power generation.
4. What is meant by geothermal energy?
5. Give the principle of working of geothermal power generation.
6. Compare nuclear power stations with thermal stations.
7. Indicate the difficulties in using Geothermal energy.
8. Give four sources of non-conventional energy.
9. Name the various semi conductors used for photovoltaic conversion.
10. what are the factors required to select the suitable site for hydro power station?
11. what is meant by distributed generation?
12. what is hydrograph?
13. mention the factors which determine the power in wind.
14. define the term cogeneration.
15. Why biomass energy generation is treated as renewable energy?

PART – B

1. Describe briefly the generation of electrical power by conventional methods.
2. Describe with a neat sketch the working of a wind energy conversion system.
3. Explain in detail about the electric energy generation by tidal and wind power.
4. Write about the concept of distributed generation and its effect on system operation.
5. (a) With A neat block diagram, explain the main parts and working of a wind electric system.
6. (b) (i) Write a note on distributed generation.
   (ii) Explain the main components and working of Tidal power plant.
7. (i) Explain the concept of distributed generation. (8)
   (ii) Explain the generation of electrical power by tidal generation. (8)
8. (i) What are the basic components of solar PV system?
   (ii) Explain the basic solar PV system used for power generation.
9. Give a brief review of generation of electric power by any two conventional methods.
10. Explain bio-mass and municipal wastes.
11. Explain the geothermal generation by a neat diagram(8)
12. (i) Draw the general layout of thermal power plant and explain the parts involved. (10)
    (ii) Write short notes on combined operation of power station. (6)
13. (i) Explain in detail about Nuclear power plant. (10)
    (ii)List the advantages and disadvantages of Nuclear power plant. (6)
14. (i) Describe the general layout of steam power plant with neat diagram. (10)
    (ii)Explain the principle and working of pumped storage hydel plant. (6)

15. (i)Describe with neat sketch the construction and principle of operation used for tidal power. (8)
    (ii)Explain the effect of distributed generation system in power system operation. (8)
16. (i) Compare the features of nuclear power plant with thermal power plant. (8)
    (ii) draw the block diagram of a standalone solar PV power generation system. Also explain the role of individual blocks. (8)
17. (i) Discuss the effect of distributed power generation on power system operation (8)
    (ii) Explain the method of producing power from municipal waste. (8)

UNIT – II

PART A

1. State a few methods of improving the power factor in the industry.
2. What are the different types of tariffs?
3. State the advantages of power factor improvement.
4. Draw a typical daily load curve.
5. Give any four objectives of tariff.
6. Define the term power quality.
7. What is a load curve? Draw the same.
8. List the methods to improve lagging power factor.
9. Define load factor.
10. What are the causes for low power factor?
11. List the disadvantages of low power factor.
12. Define load curve and load duration curve.
13. What do you mean by economics of generation?
14. What are the effects of energy conservation?
15. List the various power quality parameters.

PART B

1. Explain the load curve and load duration curve.
2. (i) Explain briefly about different energy auditing methods in use.
   (ii) Bring out the importance of energy conservation measures in electric energy consuming industry.
3. A generating station has the following daily loads.

0 to 6 hrs	4000 kW
6 to 8 hrs	3000 kW
8 to 12 hrs	8000 kW
12 to 14 hrs	2000 kW
14 to 18 hrs	7500 kW
18 to 20 hrs	3000 kW
20 to 24 hrs	4500 kW

   Sketch the load duration curve and determine the load factor assuming the capacity of plant 11,000 kW.
4. (i) Write a short note on the need for energy conservation.
   (ii) Discuss briefly about energy auditing.
5. (i) Discuss the various methods to improve power factor.

(ii) Define power quality and explain related terms.

6. (a) Write short notes on:
   (i) Need for electrical energy conservation
   (i) Energy management
   (i) Energy auditing.

   (b) Explain the different methods of power factor improvement.

7. Write short notes on the following:
   (i) Energy management (8)
   (ii) Need for electrical energy conservation. (8)

8. (i) Discuss the design for improvement of power factor using power capacitors. (10)
   (ii) Write short notes on power quality. (6)

9 .The maximum demand of power plant is 40 MW. The capacity factor is 0.5 and the utilization factor is 0.8. Find

1. Load factor
2. Plant capacity factor
3. Reserve capacity.

10. Discuss the following types of tariffs :
    1. Two part tariff or Hopkinson demand rate
    2. Three part tariff
    3. Flat demand tariff
    4. Straight meter rate tariff

11. (i) What are the desired characteristics of tariff?
    (ii) A generating station has a maximum demand of 20 MW, a load factor of 60%, a plant capacity factor of 48% and a plant use factor of 80%. Calculate
    (1) The daily energy produced
    (2) The reserve capacity of the plant
    (3) The maximum energy that could be produced daily if the plant was running all the time
    (4) The maximum energy that could be produced daily if the plant was running fully loaded and operating as per schedule. (12)

12. (i) A consumer has an annual comsumption of 2×10^5 units. The tariff is Rs. 250 per kVA of maximum demand plus Rs.3 per kWh.
    (1) Find the annual bill and the overall cost per kWh if the load factor is 35%
    (2) What is the overall cost per kWh if the annual consumption is reduced by 25% with the same load factor?
    (3) What is the overall cost per kWh if the load factor is 25% and the same consumption as (i)? (9)

13. (i) Explain two part tariff. Also explain how the total cost is reduced in this type. (10)
    (ii) Write a note on the importance of energy audit. (6)

14. (i) Explain how power factor improvement is done by using static capacitors. (6)
    (ii) A generating station has the following load cycle.

Time	0-6	6-10	10-12	12-16	16-20	20-24
Load	40	50	60	50	70	40

    Draw the load curve and find maximum demand, units generated per day, average load, load factor and plant capacity factor. (10)

15. (i) Explain the design improvements in energy efficient induction motors, when compared to standard induction motor. (8)
    (ii) A 4 pole, 3 phase, 300 HP squirrel cage induction motor draws an input poer of 165 kW at 0.88 p.f. lagging from a 415 V 3-phase power supply. Calculate the kVA rating of power factor improvement capacitor to be connected in parallel to the motor to improve the existing power factor to unity. Also calculate the reduction in kVA demand due to power factor improvement of the motor from o.88 lagging to unity. (8)
16. (i) Discuss the importance of size and number of power generation units on the aspects of economy and efficiency. (8)
    (ii) The monthly energy reading of an industrial consumer is as follows:

Actual M.D	Energy consumption	Apparent power consumption
2600 kVA	1344408 kWh	1445600 kVARh

    If the tariff is Rs. 300 per kVA of actual maximum demand reached and unit rate is Rs.5.50 per kWh of consumption plus power factor penalty for every 0.01 drop in power factor below 0.95 is 1% of sum of demand and energy charges. Calculate the monthly energy bill of the above spinning mill consumer. (8)

UNIT – III

PARTA

1. Define illumination.
2. State the laws of illumination.
3. What is meant by energy efficient lamp?
4. Define the term Lux.
5. What is photometry
6. What are the types of lamps?
7. Define the following terms:
   (i) Luminous flux (ii) Lumen (iii)lamp efficiency (iv)luminous intensity
8. What is a solid angle?
9. What are the various types of lighting schemes?
10. W hat are the requirements of good lighting?
11. Define the term MSCP and lamp efficiency.
12. Define luminous efficacy.
13. Specify any four energy efficient lamps.
14. Why tungsten is selected as the filament material?

PARTB

1. State and explain the laws of illumination.(8)
2. Explain the working of high pressure mercury vapour lamp with a neat diagram.
3. Explain the working of fluorescent lamp (low pressure mercury vapour lamp) with the neat diagram.
4. State and describe the various types of lighting schemes.
5. What are the requirements of a good street lighting?

6. What is flood lighting and where it is used?
7. Discuss about the various factors that affect the design of lighting system.
8. (i) With a neat diagram explain the working of high pressure sodium vapour lamp.
   (ii) A lamp of 500 c.p. is placed at the centre of a room (20 x10 x 5) m^3. Calculate the illumination in each corner of the room.
9. (i) With a neat diagram explain the working of a low pressure mercury vapour lamp.
   (ii) A lamp of 500 c.p. is hung at the centre of a room 8 x 6 m^2 at a height of 3m from the floor. Calculate the maximum and minimum illumination produced and mention the places where it occurs.
10. (i) Discuss the various steps involved in the design of illumination system. (8)
    (ii) Discuss the various aspects of residential lighting and street lighting. (8)
11. List the different types of lamps. Explain any two with neat diagrams.
12. (i) Explain the working of low pressure mercury vapour lamp with necessary circuit diagram.
    (ii) Two street lamps are 20 m apart and fitted with 500 C.P. lamp at a height of 8 m above the ground. Find the illumination at a point under the lamp post and midway between the lamps.
13. (i) State and prove laws of illumination. (8)
    (ii) A drawing hall 30 X 15 X 5 m is to be provided with a general illumination of 120 Lux. Taking coefficient of utilization as 0.5, depreciation factor as 1.4, determine the number of fluorescent tubes required, their space-height, mounting height and total wattage. Take luminous efficacy of fluorescent tubes as 40 Lumen/watt for 80 watts tube. (8)
14. (i) With neat diagram explain the construction and working of sodium lamp.(8)
    (ii) Two lamp posts are 14m apart and are fitted with 200 CP lamp each at a height of 5m above the ground. Calculate illumination midway between them and illumination under each lamp. (8)
15. (i) Explain the factors affecting the design of lighting system. (6)
    (ii) A hall 30 m long and 12 m wide is to be illuminated and the illumination required is 50 lumens/ m^2. Calculate 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: (10)

Watts	100	200	300	500	1000
Lumens	1615	3650	4700	9950	21500

16. (i) Explain the operation of fluorescent lamp in details. (8)
    (ii) A lamp of uniform intensity of 200 C.P. is enclosed in dins glass globe. 25% of the light emitted by lamp is absorbed by the globe. Determine
    (1) Brightness of globe.
    (2) CP of globe if diameter of globe is 30 cm. (8)

UNIT – IV
PART-A

1. State the advantages of electric heating.
2. What are the modes of heat transfer?
3. Define the term ‘welding’.

4. What is resistance welding?
5. What are the properties of heating element materials?
6. Enumerate the qualities of good weld.
7. List the four merits of electrically produced heat.
8. Draw the voltage versus current characteristics of welding transformer.
9. List the advantages of electric heating.
10. Mention the applications of dielectric heating.
11. What is meant by resistance arc welding?

PARTB

1. (i) Derive the expressions for distance 'd' and length 'l' of a heating element.
   (ii) Explain the construction and operating principle of welding transformer and its characteristics.
2. A 30 kW, 3 phase, 440 V resistance oven is to employ nichrome strip 0.025 cm thick for the three star connected heating elements. If the wire temperature is to be 1100^0C and that of the charge is to be 700^0C. Estimate a suitable width for the strip. Assume resistivity as 1.016×10^{-6} ohm-m, emissivity 0.9 and radiating efficiency 0.5.
3. (a) (i) With necessary equations, describe the design of heating element. (10)
   (ii) Write about welding transformer and its characteristics. (6)
4. (i) Describe in detail design of the heating element. (10)
   (ii) Write a technical note on welding transformer. (6)
5. A 30 kW, three phase, 400 V oven is to employ nickel-chrome strip 0.254 mm thick for the three star-connected heating elements. If the wire temperature is to be 1100 C and that of the charge to be 700 C. Estimate a suitable width for the strip. Assume conductivity of 0.9 and radiating efficiency to be 0.5. What would be the temperature of the wire if the charge were cold? (16)
6. A 22kw,single phase 220v resistance oven employs circular Nichrome wire for its heating element. The wire temp is not to exceed 1230^0C and the temp of the charges is 500^0C.Calculate the size and the length of the wire required. Take radiant efficiency=0.6 and specific resistance of the wire is $101 \times 10^{-6}\Omega$Cm,ϵ=0.9.
7. Write about welding generator and its characteristics.
8. Explain the working principle of arc furnace and describe with the help of a sketch the construction and working of any one type of arc furnace.
9. What is dielectric heating? mention the advantage of it.
10. Describe with the diagram the working principle of vertical core type furnace(Ajax wyatt furnace)
11. What is induction heating? Explain any one type with a neat diagram.
12. (i) Explain the method of controlling temperature in resistance heating. (8)
    (ii) Calculate the time taken to melt 2 tonnes of steel in a three phase electric arc furnace having the following data:

Current	=	9000 A
Arc voltage	=	90 V
Resistance of transformer	=	0.002 Ω
Reactance of transformer	=	0.004 Ω
Latent heat of steel	=	8.89 Kcal/Kg
Specific heat of steel	=	0.12 C

Melting point of steel = 1370 C
Initial temperature of steel = 30
Assume overall efficiency of furnace is 85%. Also calculate the energy consumed to melt 2 tonnes of steel. (8)

13. (i) What are the requirements of good welding? (8)
    (ii) In a resistance oven, 4 Nos. of 120 ohms resistances are used as heating element. Calculate the power drawn by the 4 Nos. of resistance when all are connected in parallel across a 230 V 50 Hz power supply. (8)
14. Explain the process and various methods of electric arc welding. (16)
15. (i) What are the differences of AC welding and DC welding? (6)
    (ii) A furnace consuming 5 kW takes 15 minutes to just melt 2.5 Kg of Al, the nitial temperature being 15 C. Find the efficiency of the furnace when the specific heat of Al is 0.212 cal/gm/ C, Melting point is 658 C and latent heat of fusion is 320 J/gm. (10)
16. (i) Explain the various types of resistance heating. (8)
    (ii) An insulating material 2 cm thick and 150 sq.cm. in area is to be heated by dielectric heating. The material has permittivity of 4 and p.f. as 0.04. Power required is 200 watts and frequency of 30 MHz. Determine the voltage and the current that flows through the material. If the voltage were limited to 600 V what will be the frequency to get the same loss. (8)
17. With neat diagram explain the working of the different types of arc welding. (16)

UNIT – V

PARTA

1. List two merits of series-parallel starting of traction motors.
2. What are the factors affecting specific energy consumption.
3. Explain the terms dead weight and adhesive weight as applied to a locomotive.
4. What is scheduled speed of train ?
5. What type of motor is used for electric traction? why?
6. Give any two advantages of electric traction.
7. Sketch the speed-time curve for a sub-urban service.
8. Define tractive effort.
9. What is meant by specific energy consumption?
10. What are the features of electric traction?
11. Specify the few advantages of electric traction systems.
12. What are the disadvantages of electric traction?
13. What are the recent trends in electric traction?

PARTB

1. (i) Draw a typical speed-time curve and explain its salient features.

(ii) An electric train is accelerated at 1.5 kmphps and is braked at 3 kmphps. The train has an average speed of 45 kmphps on a level track of 1500 m between stations. Determine the maximum speed and distance travelled before applying brakes.

2. A locomotive accelerates a 350 tonnes train up a gradient of 1 in 100 at 0.8 kmphps. Assuming coefficient of adhesion to be 0.25, determine the minimum adhesive weight of the locomotive. Assume train resistance 44.5 Newton / tonnes and allow 10 % for rotational inertia.
3. A train runs at an average speed of 45 km per hour between stations 2.5 km apart. The train accelerated at 2 kmphps and retards at 3 kmphps. Find its crest speed assuming trapezoidal speed time curve. Calculate also the distance travelled before the brakes were applied.
4. (i) Explain different methods of traction motor control. (10)
   (ii) Write in detail about mechanics of train movement. (6)
5. Describe in detail the recent trends available in electric traction system. (16)
6. (i) Discuss the recent trends in electric traction. (8)
   (ii) Describe the different types of supply systems used for railway electrification. (8)
7. (i) Write about mechanics of train movement. (8)
   (ii) Discuss the working of D.C. series motor control in detail. (8)
8. Discuss the different methods of traction motor control and explain.
9. Discuss the recent trends in electric traction.
10. A train runs at an average speed of 45 km per hour between stations 2.5 km apart. The train accelerated at 2 kmphps and retards at 3 kmphps. Find its crest speed assuming trapezoidal speed time curve. Calculate also the distance travelled before the brakes were applied. (16)
11. (i) What are the merits of electric braking?
    (ii) Describe briefly about regenerative braking and how this can be applied to D.C. series traction motors.
12. (i) Discuss and compare various arrangements of current collection used in traction. (8)
    (ii) What are the various types of electric braking used in traction? Discuss in detail. (8)
13. (i) Explain about multimotor speed control. (8)
    (ii) The maximum torque of a 440 V, three phase four pole 60 c/s IM is 400 N-m at a slip of 0.1. If the motor works at 50 c/s, 400 V supply, find the maximum torque, slip and the speed at which it occurs. Neglect stator impedance. (8)
14. (i) A suburban electric train has a maximum speed of 65 km/hr. The scheduled time including a station stop of 30 sec is 43.5 km/hr. If the acceleration is 1.3 kmphps, find the value of retardation when the average distance between stops is 3 km. (10)
    (ii) Write short notes on Trolley bus. (6)