INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

Department of Electrical and Electronics Engineering

QUESTION BANK

Course Name	:	**UTILIZATION OF ELECTRICAL ENERGY**
Course Code	:	**A70232**
Class	:	**IV B.Tech I Semester**
Branch	:	**Electrical and Electronics Engineering**
Year	:	**2018 - 2019**
Course Faculty	:	**Ms. Lekha Chandran, Assistant Professor, EEE**

OBJECTIVE:

This subject deals with power electronics equipments, different AC and DC machines speed control techniques.

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
	UNIT - I **ELECTRIC DRIVE**		
	Part - A (Short Answer Questions)		
1	What are different methods of modes of heat transfer?	Remember	1
2	State different types of drives and give three advantages and disadvantages of various drives?	Remember	1
3	Why electrical drives produces noise? How it is reduces?	Understand	1
4	What is load equalization? Why it is necessary? What are the speed control of?	Understand	1
5	Compare the slip ring and squirrel cage induction motors from the application.	Understand	1
6	Why and where is an individual drive recommended?	Understand	1
7	Discuss the various factors that govern the choice of a motor for a given.	Understand	1
8	Explain the starting characteristics of synchronous motor?	Remember	1
9	Explain the starting characteristics of D.C. motors?	Remember	1
10	Derive the equations of heat time curve and cool time curve?	Remember	1
11	State the criterions for selection of a motor.	Understand	1
12	Why is DC shunt motor preferred where precise speed control is needed?	Understand	1
13	What are advantages and disadvantages of group drive?	Understand	1
14	Explain speed torque characteristics of a DC shunt motor?	Remember	1
15	Explain speed torque characteristics of a DC series motor?	Remember	1
	Part - B (Long Answer Questions)		
1	Describe the selection of various types of motors for the following services. Rolling mills ii) cranes and lifts iii) Textile machinery iv) Printing machine and v) Household applications.	Understand	1
2	a) Compare the characteristics of DC series and shunt motor. b) Explain the different types of drives?	Understand	1
3	Discuss advantages and disadvantages of electric drive over other drives and also explain different types of drives.	understand	1
4	What is an electric drive? What are its advantages? Compare a group drive and an individual drive.	Remember	1
5	Explain what is mean by - individual drivel and Group drivel discuss their relative merits and demerits?	Understand	1
6	Through AC is superior to DC for electric drives, sometimes DC is preferred. Give the reasons and mention some of the applications	Understand	1

7	Discuss how different parameters of speed-Time curve will vary with the type of train service	Remember	1
8	Explain the various methods of speed control of AC motors.		
9	Explain what is meant by Load Equalization and how it is accomplished?	Understand	1
10	a) Discuss the various factors governing the choice of motors b) Explain the various factors that affect the final temperature rise of a motor on load?	Understand	1
11	a) Discuss the running characteristics of any two electric motors b) Discuss the selection criterion of a motor for a drive application.	Understand	1
12	By means of a block diagram explain the various components of a DC DRIVE.	Understand	1
13	By means of a block diagram explain the various components of an AC DRIVE.	Understand	1
14	Describe the characteristics of mechanical loads.	Remember	1
15	Explain why individual drive has superseded group drive?	Understand	1
16	Explain what is multi motor drive and why is it prevalent in modern industry?	Understand	1
Part – C (Analytical Questions)			
1	A 200V shunt motor has an armature resistance of 05 ohm it takes a current of 16A on full load and runs at 600 rpm if a resistance of 05ohm is placed in the armature circuit Find the ratio of the starting torque to the full load torque.	Remember	1
2	A 250V DC shunt motor with constant field excitation drives a load, the torque of which varies as the square of the speed. The armature current is 20A, when the motor is running at 500 rpm find the percentage reduction in the speed of the motor when a resistance of 20ohms is connected in series with the armature. Neglect the losses in the motor.	Remember	1
3	A 50-kVA, 400-V, 3-φ, and 50-Hz squires cage induction motor has full-load slip of 6%. Its standstill impedance is 0.866 Ω / phase. It is started using a tapped autotransformer. Calculate the tap position and the ratio of starting torque to full load. The maximum allowable supply current at the time of starting is 100 A. external resistance per phase that must be added to lower the speed to 1,300rpm.	Remember	1
4	A 300V shunt motor has an armature resistance of 04 ohm it takes a current of 16A on full load and runs at 500 rpm if a resistance of 04ohm is placed in the armature circuit Find the ratio of the starting torque to the full load torque.	Remember	1
5	Determine the new value of stator current if a 3-φ, 440-V and 1,200-rpm slip ring induction motor is operating with 3% slip and taking a stator current of 50-A speed of the motor is reduced at constant torque to 600 rpm using stator voltage control.	Remember	1
6	A 9.5-kW, 240-V, three-phase, star-connected, 50-Hz, and four-pole squirrel cage induction has its full-load internal torque at a slip of 0.05. The parameters of the motor are Rl = 0.4Ω/phase, R2 = 0.3Ω/phase X1 = X2 = 0.5Ω/phase Xm = 16Ω/phase. Assume that the shunt branch is connected across the supply terminals. Determine (a) maximum internal torque at rated voltage and frequency, (b) slip at maximum torque, and (c) internal starting torque at rated, voltage, and frequency.	Remember	1
7	A 30-HP, six-pole, 50-Hz, and three-phase induction motor has stator / rotor phase voltage ratio of 7/5. The stator and rotor impedances per phase are (0.35 + j0.65) Ω and (0.15 + j0.65) Ω, respectively. Find the starting torque exerted by the motor when an external resistance of 1.5 Ω is inserted in each phase; the motor being started directly on the 440-V supply system. Assume Y/Y connection.	Remember	1
8	A series motor with series field and armature resistance of 0.08 Ω and 0.025 Ω, respectively, is connected across 400-V mains. The armature takes 65 A and its speed is 900 rpm. Determine its speed when it takes 80 A from this very and the excitation is increased by 20%.	Remember	
9	A series motor with series field and armature resistance of 0.06 Ω and 0.02Ω, respectively, is connected across 440-V mains. The armature takes 60 A and its speed is 850 rpm. Determine its speed when it takes 85 A from this very and the excitation is increased by 20%.	Remember	1

10	A motor has the following load cycle. Load raising uniformly from 100 to 200 kW in 5s. Continuous load 50 kW for 10 s regenerative braking kW returned to the supply 50 kW to 0 kW for 3 s and idle for 2 s. Draw the load diagram neatly for one cycle. Find the size of continuously rated motor for the above duty. The load cycle is repeated indefinitely.	Remember	1
11	A DC shunt motor rated 250 V, 10 kW, 1500 rpm has a full load efficiency of 80 percent. Its field and armature resistances are 110 ohms and 0.25 ohms. Respectively. Determine the value of the resistance to be inserted in series with the armature and the power lost in the armature circuit to reduce the speed to 200 rpm. When (a) the load torque is independent of the speed. (b) the load torque si directly proportional to speed. (c) the load torque is proportional to square of the speed.	Remember	1
12	A 3 phase induction motor at rated voltage and frequency has a maximum torque of 275 percent and a starting torque of 125 percent of full load torque. Determine the slip (i) at maximum torque (ii) at full load. Assume constant rotor resistance and neglect starter resistance and rotational losses.	Remember	1
13	A 3 phase 50 Hz induction motor has equivalent stator and resistance of 0.05 ohms. Each. And reactance of 0.3 ohms each. The motor is to be operated at one half of its rated voltage. And one half of its rated frequency. Determine (i) maximum, torque at the reduced value of supply as a fraction of its normal value. (ii) the starting torque at the reduced value of supply as a fraction of its normal value.	Remember	1
14	A delta connected 400 V, 50 HP , 750 rpm squirrel cage motor takes a full load current of 50 A and has a full load slip of 4.5 percent. The impedance per phase is 2.5 ohms. Determine the starting torque and the starting current taken from the supply if the motor is started by (i) D.O.L starter (ii) Star Delta starter 9iii) An auto transformer starter with 70 percent tapping.	Remember	1
15	A 3 phase 400 V , 30 HP , 500 rpm squirrel cage induction motor has a full load efficiency of 0.85 and p.f o 0.88. The motor takes a short circuit current of 150 A at 0.25 lag p.f. The full load slip is 5 percent. Determine the minimum starting current drawn from the supply. If the starting torque required is at least ½ the full load torque and it is started by (i) an autotransformer. (ii) a series resistance in the stator circuit. Determine the value of tapping on the transformer and the magnitude of the resistance to be added to each phase.	Remember	1
	UNIT - II **ELECTRIC HEATING AND WELDING**		
	Part - A (Short Answer Questions)		
1	State causes of failure of heating element at least four.	Remember	2
2	State four applications of dielectrically heating.	Remember	2
3	Explain the principle of dielectric heating and its applications?	Remember	2
4	What are the characteristics of heating element? Explain the heating element in?	Remember	2
5	Give relative advantages and disadvantages of direct and indirect electric Arc furnace?	Understand	2
6	What is high-frequency eddy current heating?	Remember	2
7	What is the Stefan's formula for heat dissipation?	Understand	2
8	a) What is pinch effect? b) What are the types of arc furnaces?	Remember	2
9	What are the various methods of controlling the temperature of resistance	Understand	2
10	The power required for dielectric heating of a slab of resin 150 cm2 in area and 2-cm thick is 200 W, at a frequency of 30 MHz The material has a relative permittivity of 5 and power factor 0.05. Find the voltage necessary and the current flowing through the material. If the voltage is limited to 700 V, what will be the frequency to obtain the same heating?	Remember	2
11	Why electric heating is preferred over other forms of heating?	Understand	2
12	What are the different methods of heat transfer under what conditions heat transfer by radiation is efficient?	Remember	2
13	What are different methods of electric heating?	Understand	2

14	What are the various reasons of heating element failure?		2
15	What are the advantages of radiant heating?	Understand	2
	Part - B (Long Answer Questions)		
1	Describe the selection of various types of motors for the following services. i)Rolling mills ii)cranes and lifts iii)Textile machinery iv) Printing machine and v) Household applications.	Remember	2
2	a) Discuss the various modes of heat dissipation b) Briefly explain the different methods of electric heating?	Remember	2
3	What is electric heating? What are the advantages over other methods of heating?	Understand	2
4	a) Explain the theory of dielectric heating and state its applications. what are the advantages of dielectric heating? b) Explain the principal of operation of induction heating and state and explain different type‘s induction heating methods?	Remember	2
5	Describe briefly the methods of direct and indirect resistance heating and list the applications of these two methods?	Understand	2
6	a) What are the various types of induction furnace? b) A high-frequency induction furnace that takes 20 min to melt 1.9 kg of aluminum, the input to the furnace being 3 kW, and the initial temperature is 25°C. Then, determine the efficiency of the furnace.	Remember	2
7	a) How will you control most efficiently the heat of resistance furnace? b) What advantages does graphite electrode process over carbon electrode?	Understand	2
8	A 4.5-kW, 200-V, and 1-φ resistance oven is to have nichrome wire heating elements. If the wire temperature is to be 1,000°C and that of the charge 500°C. Estimate the diameter and length of the wire. The resistivity of the nichrome alloy is 42.5 μΩ-m. Assume the radiating efficiency and the emissivity of the element as 1.0 and 0.9, respectively.	Remember	2
9	Explain in brief how heating is done in the following cases? Resistance heating, ii)Induction heating iii) Dielectric heating.	Understand	2
10	A 100-kW Ajax Wyatt furnace works at a secondary voltage of 12 V at power Factor 0.6 when fully charged. If the reactance presented by the charge remains constant but the resistance varies invert as the charge depth in the furnace; calculate the charge depth that produces maximum heating effect when the furnace is fully charged.	Remember	2
11	What are the special applications of dielectric heating?	Understand	2
12	What are the advantages of dielectric heating.	Remember	2
13	What are the factors which limit the choice of high frequency in induction and dielectric heating	Understand	2
14	On what factors dielectric loss depends?	Remember	2
15	How high frequency supply frequency supply is obtained?	Understand	2
	Part – C (Analytical Questions)		
1	A20-kW, 230-V, and single-phase resistance oven employs nickel-chrome strip 25-mm thick is used, for its heating elements. If the wire temperature is not to exceed 1,200°C and the temperature of the charge is to be 700°C.Calculate the width and length of the wire. Assume the radiating efficiency as 0.6 and emissivity as 0.9. Determine also the temperature of the wire when the charge is cold	Remember	2
2	Six resistances, each of 60 ohms, are used in a resistance; how much power is drawn for the following connections. (a) Supply is 400 V, AC, and single phase and the connections are: i) Three groups in parallel, each of two resistance units in series. ii) Six groups are in parallel, each of one resistance unit. (b) With the same three-phase supply, they are connected in delta fashion. i) Two resistance units in parallel in each branch. ii) Two resistance units in series in each branch. (c) Supply is 400 V and three-phase while the connection is a star combination of: i) Two resistance elements in series in each phase.	Remember	2

	ii) Two resistance elements in parallel in each phase.		
3	A 100-kW Ajax Wyatt furnace works at a secondary voltage of 12 V at power factor 0.6 when fully charged. If the reactance presented by the charge remains constant but the resistance varies invert as the charge depth in the furnace; calculate the charge depth that produces maximum heating effect when the furnace is fully charged	Remember	2
4	Determine the amount of energy required to melt 2 ton of zinc in 1 hr, if it operates at an efficiency of 70% specific heat of zinc is equals to 0.1. The latent heat of zinc = 26.67 kcal/kg, the melting point is 480°C, and the initial temperature is 25°C.	Remember	2
5	A high-frequency induction furnace that takes 20 min to melt 1.9 kg of aluminum, the input to the furnace being 3 kW, and the initial temperature is 25°C. Then, determine the efficiency of the furnace.	Remember	2
6	A low-frequency induction furnace has a secondary voltage of 20 V and takes 600 kW at 0.5 pf when the hearth is full. If the secondary voltage is maintained at 20 V, determine the power absorbed and the power factor when the hearth is half-full. Assume the resistance of the secondary circuit to be doubled and the reactance to remain the same.	Remember	2
7	A piece of insulating material is to be heated by dielectric heating. The size of the piece is 10 × 10 × 3 cm3. A frequency of 30 mega cycles is used and the power absorbed is 400 W. Determine the voltage necessary for heating and the current that flows in the material. The material has a permittivity of 5 and a power factor of 0.05.	Remember	2
8	An electric arc furnace consuming 5KW takes 15 minutes to just melt 15kgs of aluminum, the initial temperature being 15oC Find the efficiency of the furnace Specific heat of aluminum is 0.212, melting point 658 ^{o}C and latent heat of fusion is 76.8 cal per gram.	Remember	2
9	Why only D.C. supply is used in case of carbon arc welding?	Remember	2
10	What are the various methods of welding? What are the types of butt?	Remember	2
11	What are the applications of the electrical welding?	Remember	2
12	What are the advantages of coated electrodes in welding process?	Remember	2
13	What is resistance welding?	Remember	2
UNIT - III ILLUMINATION			
Part - A (Short Answer Questions)			
1	a) Define following terms i)MSCP ii) MHCP	Remember	3
2	State Inverse square law and Lambert's cosine law of illumination?	Understand	3
3	Explain how you will measure the candle power of a source of light?	Remember	3
4	Prove the relationship between the plane angle and solid angle?	Understand	3
5	A 200V lamp takes a current of 1.2amp, it produces a total flux of 2,860 lumens calculate a) the MSCP of the lamp b) efficiency of the lamp?	Remember	3
6	What is photometry?	Understand	3
7	Define: (a) Mean spherical candle power,(b) Mean horizontal candle power (c)	Remember	3
8	Write short notes on Bunsen photometer head.	Understand	3
9	Write the expression that shows the relation between solid angle and plane	Remember	3
10	What is photometry?	Understand	3
11	Define: (a) Mean spherical candle power,(b) Mean horizontal candle power (c)	Remember	3
12	Write short notes on Bunsen photometer head.	Understand	3
13	Write the expression that shows the relation between solid angle and plane	Remember	3
14	Write the principle of electric incandescent lamp.	Understand	3
15	Compare the merits and demerits of filament lamp and fluorescent lamps?	Remember	3
Part - B (Long Answer Questions)			
1	Define the following :i) solid angle ii)candela iii)Luminous efficiency iv) M.S.C.P V) M.H.C.P	Remember	3
2	Define the terms: i) Illumination ii) Glare ii) Luminance	Understand	3

	iv) Luminous efficiency.		
3	What are polar curves as applied to light sources/ show how these curves are used for finding in MHCP and MSCP.	Remember	3
4	a) Explain why it is economical to use few large sources of light mounted high for industrial use than many sources of low output? b) What are drawbacks of direct lighting systems and how these are over come?	Understand	3
5	Define: i) Space to height ratio ii) Specific output iii) Coefficient of utilization iv) coefficient of reflection	Remember	3
6	Two similar lamps having uniform intensity 500 CP in all directions below the horizontal are mounted at a height of 4 m. What must be the maximum spacing between the lamps so that the illumination on the ground midway between the lamps shall be at least one-half the illuminations directly under the lamps?	Understand	3
7	What do you understand by polar curves as applicable to light source Explain?	Remember	3
8	State the laws of illumination. Explain the laws with the help of suitable diagrams, and derive an equation of the same.	Understand	3
9	Define i) Luminous flux ii)Illumination iii) Luminance iv) Luminous intensity	Remember	3
10	Explain how the determination of mean horizontal luminous intensity and polar curve is made.	Understand	3
11	With a neat diagram, explain the construction and working of Mercury vapour lamp.	Remember	3
12	With the help of a neat diagram, explain the principal of operation of Incandescent lamp?	Understand	3
13	What are the various types of lighting schemes? Explain with a neat sketch?	Remember	3
14	Explain with connection diagram the operation of the low pressure fluorescent lamp and state its advantages?	Understand	3
15	Write short notes on: a) High pressure mercury vapour lamp i) M.A Type ii) M.T.Type b) Mercury fluorescent lamp	Remember	3
	Part – C (Analytical Questions)		
1	A 200-V lamp takes a current of 1.2 A, it produces a total flux of 2,860 lumens. Calculate: 1. MSCP of the lamp and 2. Efficiency of the lamp	Remember	3
2	A room with an area of 6 × 9 m is illustrated by ten 80-W lamps. The luminous efficiency of the lamp is 80 lumens /W and the coefficient of utilization is 0.65. Find the average illumination.	Remember	3
3	The luminous intensity of a lamp is 600 CP. Find the flux given out. Also find the flux in the hemisphere containing the source of light and zero above the horizontal	Remember	3
4	A surface inclined at an angle 40° to the rays is kept 6 m away from 150 candle power lamp. Find the average intensity of illumination on the surface.	Remember	3
5	The illumination at a point on a working plane directly below the lamp is to be 60 lumens/m^2. The lamp gives 130 CP uniformly below the horizontal plane. Determine: i) The height at which lamp is suspended. ii) The illumination at a point on the working plane 2.8 m away from the vertical axis of the lamp	Remember	3

6	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. 1. Calculate the illumination. 2. Also calculate the illumination at the center. 3. The illumination at the edge of the surface without reflector.	Remember	3
7	Two sources of candle power or luminous intensity 200 candela and 250 candela are mounted at 8 and 10 m, respectively. The horizontal distance between the lamps posts is 40 m, calculate the illumination in the middle of the posts.	Remember	3
8	Two sources of having luminous intensity 400 candela are hung at a height of 10 m. The distance between the two lamp posts is 20 m. Find the illumination (i) beneath the lamp and (ii) in the middle of the posts.	Remember	3
9	A light source with an intensity uniform in all direction is mounted at a height of 20 ms above a horizontal surface. Two points *'A'* and *_B'*both lie on the surface with point *A* directly beneath the source. How far is *B* from *A* if the illumination at *_B'* is only 1/15th as great as *A*?	Remember	3
10	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	Remember	3
11	A room 20 × 10 m is illuminated by 60 W incandescent lamps of lumen output of 1,600 lumens. The average illumination required at the workplace is 300 lux. Calculate the number of lamps required to be fitted in the room. Assume utilization and depreciation factors as 0.5 and 1, respectively	Remember	3
12	The front of a building 35 × 18 m is illuminated by 15 lamps; the wattage of each lamp is 80 W. The lamps are arranged so that uniform illumination on the surface is obtained. Assuming a luminous efficiency of 20 lumens/W, the coefficient of utilization is 0.8, the waste light factor is 1.25, DF = 0.9. Determine the illumination on the surface.	Remember	3
13	A room of size 10 × 4 m is to be illuminated by ten 150-W lamps. The MSCP of each lamp is 300. Assuming a depreciation factor of 0.8 and a utilization factor of 0.5. Find the average illumination produced on the floor.	Remember	3
14	The front of a building 25 × 12 m is illuminated by 20 1,200-W lamps arranged so that uniform illumination on the surface is obtained. Assuming a luminous efficiency of 30 lumens / W and a coefficient of utilization of 0.75. Determine the illumination on the surface. Assume DF = 1.3 and waste light factor 1.2.	Remember	3
15	An illumination of 40 lux is to be produced on the floor of a room 16 × 12 m. 15 lamps are required to produce this illumination in the room; 40% of the emitted light falls on the floor. Determine the power of the lamp in candela. Assume maintenance factor as unity.	Remember	3
UNIT - IV ELECTRIC TRACTION-1			
Part - A (Short Answer Questions)			
1	State advantages and disadvantages of electrical braking system over.	Understand	4
2	Explain the electric braking by plugging?	Remember	4
3	Explain briefly the A.C motors used in traction?	Understand	4
4	Compare the various types of braking methods.	Remember	4
5	Explain why a series motor is preferred for the electric traction?	Understand	4
6	Explain the methods of rheostatic bracking?	Remember	4
7	What are the requirements of good electric braking?	Understand	4
8	Briefly explain the A.C motors used in traction?	Understand	4
9	Explain why a DC series motor is ideally suited for traction purpose?	Remember	4
10	What are the advantages and disadvantages of track electrification?	Understand	4
11	What are the various traction systems you know of?	Remember	4
12	Discuss merits and demerits of steam engine drive?	Understand	4
13	What are various factors on which choice of traction system depends?	Remember	4
14	What are different systems of track electrification?	Understand	4
15	What is the advantage of flywheel drive?	Understand	4

Part - B (Long Answer Questions)			
1	Discuss various factors which are taken into account while deciding the changeover from existing system of electrification to a new system of electrification	Understand	4
2	a) What are the requirements of good electric braking? b) What are the various electric traction systems in India? Compare them?	Remember	4
3	Explain the different methods of the electric braking of the three-phase induction motor.	Understand	4
4	Describe how plugging, rheostat braking, and regenerative braking are employed with DC series motor	Remember	4
5	a) Explain how rheostat braking is done in DC shunt motors and series motors. b) Briefly explain the AC motors used in traction	Understand	4
6	Why DC series motor is ideally suited for traction services? Review the existing electric traction systems in India?	Remember	4
7	Derive expression for: a) The tractive effort for propulsion of train on level track. b) The tractive effort for propulsion of train up and down a gradient	Understand	4
8	a) What is electric traction? b) Mention a few advantages of electric traction c) What are the disadvantages of electric braking? d) What are the advantages of self-contained locomotives?	Understand	4
9	State the condition under which regenerative bracking with d.c series motor is possible and explain with the help of circuit diagram. Also explain the various methods of providing regeneration	Remember	4
10	Explain the following electric bracking methods? i) Plugging ii) Rheostatic bracking iii) Regenerative bracking.	Understand	4
11	What are the characteristics that a traction motor should possess?	Remember	4
12	What are the dis advantages of a bow collector?	Understand	4
13	What are the different current collection gears?	Remember	4
14	What precautions are taken in connection with location of neutral section?	Understand	4
15	What are advantages of weight tensioning?	Remember	4
Part – C (Analytical Questions)			
1	A 230-V DC shunt motor takes a current of 20 A on a certain load. The armature resistance is 0.8 Ω and the field circuit resistance is 250 Ω. Find the resistance to be inserted in series with the armature to have the speed is half if the load torque is constant.	Remember	4
2	A series motor having a resistance of 0.8 Ω between its terminal drives. The torque of a fan is proportional to the square of the speed. At 220 V, its speed is 350 rpm and takes 12 A. The speed of the fan is to be raised to 400 rpm by supply voltage control. Estimate the supply voltage required.	Remember	4
3	A 230-V, 10-HP, and DC shunt motor with R_a = 0.2 Ω and R_{sh} = 80 Ω, runs at 1000 rpm on full load. The efficiency on the full load is 80%. If the speed is to be raised to 1200 rpm keeping load constant, determine extra resistance to be added in the field ckt. Assume 1 HP = 736 W.	Remember	4
4	Two DC traction motors, each takes a current of 45 from 450 V mains and runs at the speed of 600 and 625 rpm, respectively. Each motor has an effective resistance of 0.4 Ω. Calculate the speed and voltage across each machine when mechanically coupled and electrically connected in series and taking a current of 45 A from 450 V mains the resistance of each motor being unchanged.	Remember	4
5	A DC series motor drives a load. The motor takes a current of 13 A and the speed is 620 rpm. The torque of the motor varies as the square of speed. The field winding is shunted by a diverter of the same resistance as that of the field winding, then determine the motor speed and current. Neglect all motor losses and assume that the magnetic circuit is unsaturated	Remember	4
6	A 230-V, and 12-HP motor has shunt and armature resistance of 120 and 0.3 Ω, respectively. Calculate the resistance to be inserted in the armature circuit to	Remember	4

	reduce the speed by 20%, assuming the torque remains constant. The efficiency of the motor is 90%.		
7	A200V, 500 rpm d.c shunt motor with an armature resistance of 0.08ohm and full load armature current of 150A is to be braked by plugging. Estimate the value of resistance which is to be placed in series with the armature to limit the initial braking current to 200A what would be the speed at which the electric braking torque is 75% of its initial value?	Remember	4
8	An electric train has an average speed of 42 km/hr on a level track between stops1400 m apart. It is accelerated at 1.7 km/hr/sec and it is braked at 3.3km/hr/sec.Draw the speed-Time curve and estimate the specific energy consumption. Assume tractive resistance as 50 NW/tonnes and allow 10% rotational inertia	Remember	4
9	A train weighing 500 tonnes is going down a gradient of 20 in 1000. It is desired to maintain train speed out 40 KMP by regenerative braking calculate the power fed into the line. Tractive resistance is 40 N/tone and allow rotational intertia of 10% and efficiency of conversion of 75%.	Remember	4
10	A 40H.P, 400V,3-phase, 4 pole, 50Hz 1m has full load slip of 5s. If ratio of standstill reactance resistance per rotor phase is 4. Estimate the plugging torque at full speed.	Remember	4
11	A train has schedule speed of 30 Kmph over a level track, distance between stations being 1 km. Station stopping time is 20 seconds. Assuming braking retardation of 3 Kmph and maximum speed of 25 percent greater than average speed, calculate acceleration required to run the service.	Remember	4
12	A 200Tonne motor each having 4 motors, each developing b6000 Nm torque during acceleration, starts from rest. If up gradient is 30 in 1000, gear ratio 4, gear transmission efficiency 90 percent, wheel radius 45 cm, train resistance 50 N/tone, addition of rotational inertia 10 %, calculate time taken to attain speed of 50 Kmph.	Remember	4
13	An electric train has quadrilateral speed time characteristic as follows: 1. Uniform acceleration from rest ast 2 kmphs for 30 s. 2. 2. Coasting for 50 s. 3. Duration of braking 50 s. If train is moving a uniform gradient of 10 % of dead weight, duration of station stop 15s, and overall efficiency of transmission gear and motor as 75 % , find the schedule speed and specific energy consumption.	Remember	4
14	An electric train weighing 300 Tonnes runs 10 percent up gradient with following speed time curve: 1. A uniform acceleration of 1.5 Kmph for 30 s. 2. Constant speed for 40s. 3. Coasting for 30s. 4. Braking at 2.5 Kmphs to rest. Calculate the specific energy consumption if tractive resistance is 45 N/Tonne, rotational inertia effect 10 %, overall efficiency of transmission and motor 75% .	Remember	4
15	400 T goods train is to be hauled by a locomotive up a gradient of 20 percent with acceleration of 1 kmphs. Coefficient of adhesion is 20 %, Track resistance 40 N/tone and effective rotating masses 10% of dead weight. Find the weight opf locomotive and number of axles, if axle load is not to increase beyond 22 T.	Remember	4
UNIT - V ELECTRIC TRACTION - 2			
Part - A (Short Answer Questions)			
1	With the help of a complete Speed-Time curve, discuss how different parameters. Of this curve change with the type of train service.	Understand	5
2	Deriven expression for the distance traveled by an electric train using trapezoidal speed-time curve.	Remember	5
3	Draw the speed-time curves for different services and explain them in detail.	Understand	5
4	Assuming a quadrilateral speed-time curve, develop a method of determining	Remember	5

	the specific energy consumption of a train.		
5	Discuss how different parameters of speed-time curve will vary with the type of train service.	Understand	5
6	With the help of trapezoidal speed-time curve, derive an expression for the maximum speed and hence estimate the values of acceleration and retardation.	Remember	5
7	Derive the expressions for the speed-Torque characteristics of dc shunt motor under the following conditions: a)Without control b) External resistance in the armature circuit c) External resistance in the field circuit d) Armature shunted with resistance R Draw the typical characteristics for all the conditions	Understand	5
8	Derive an expression for specific energy output on level track using a simplified speed–time curve.	Understand	5
9	Derive the relationship between acceleration, retardation, maximum speed, running time and distance between two stops assuming a trapezoidal Speed-Time curve.	Remember	5
10	What are the different methods of approximation of speed-Time curves? Derive expression for distance travelled using quadrilateral approximation method of V (t) curve	Understand	5
11	What steps are taken to reduce the interference in the telecommunication circuits?	Remember	5
12	Compare Ac and DC systems of traction?	Understand	5
13	What types of train services railways have to cater for and what are their distinguishing features?	Remember	5
14	What are the factors affecting the schedule speed of a train?	Understand	5
15	What are the different types of functions performed by the tractive effort developed by traction unit?	Remember	5
	Part - B (Long Answer Questions)		
1	With the help of a complete Speed-Time curve, discuss how different parameters. Of this curve change with the type of train service.	Understand	5
2	Derivean expression for the distance traveled by an electric train using trapezoidal speed-time curve.	Remember	5
3	Draw the speed-time curves for different services and explain them in detail.	Understand	5
4	Assuming a quadrilateral speed-time curve, develop a method of determining the specific energy consumption of a train.	Remember	5
5	Discuss how different parameters of speed-time curve will vary with the type of train service.	Understand	5
6	With the help of trapezoidal speed-time curve, derive an expression for the maximum speed and hence estimate the values of acceleration and retardation	Remember	5
7	Derive the expressions for the speed-Torque characteristics of dc shunt motor under the following conditions: a) Without control b) External resistance in the armature circuit c) External resistance in the field circuit d) Armature shunted with resistance R Draw the typical characteristics for all the conditions.	Understand	5
8	Derive an expression for specific energy output on level track using a simplified speed–time curve.	Understand	5
9	Derive the relationship between acceleration, retardation, maximum speed, running time and distance between two stops assuming a trapezoidal Speed-Time curve.	Remember	5
10	What are the different methods of approximation of speed-Time curves? Derive expression for distance travelled using quadrilateral approximation method of V (t) curve.	Understand	5
11	What are the major equipments of a DC substation?	Remember	5
12	What are the different systems of current collection and give their merits and demerits?	Understand	5

13	What are the advantages of automatic weight tensioning and temperature compensation arrangements in the OHE?	Remember	5
14	What are the advantages and disadvantages of linear induction motor?	Understand	5
15	What is the function of a motor starter?	Understand	5
	Part – C (Analytical Questions)		
1	The distance between two stops is 1.2 km. A schedule speed of 40 kmph is required to cover that distance. The stop is of 18-s duration. The values of the acceleration and retardation are 2 kmphp and 3 kmphp, respectively. Then, determine the maximum speed over the run. Assume a simplified trapezoidal speed–time curve.	Remember	5
2	The speed–time curve of train carries of the following parameters: 1. Free running for 12 min. 2. Uniform acceleration of 6.5 kmphp for 20 s. 3. Uniform deceleration of 6.5 kmphp to stop the train. 4. A stop of 7 min. Then, determine the distance between two stations, the average, and the schedule speeds	Remember	5
3	The distance between two stops is 5 km. A train has schedule speed of 50 kmph. The train accelerates at 2.5 kmp hps and retards 3.5 kmp hps and the duration of stop is 55 s. Determine the crest speed over the run assuming trapezoidal speed–time curve.	Remember	5
4	An electric train has an average speed of 40 kmph on a level track between stops 1,500 m apart. It is accelerated at 2 kmphps and is braked at 3 kmphps. Draw the speed–time curve for the run.	Remember	5
5	A train has a schedule speed of 40 km/hr between two stops which are 4kmps apart Determine the crest speed over the run, if the duration of stops is 60 sec and acceleration and retardation both are 2km/hr each Assume trapezoidal speed-time curve.	Remember	5
6	The maximum speed of sub-urban electric train is 60km/hr and its schedule speed is 40km/hr and duration of stop is 30 sec. If acceleration is 2km/hr and distance between two stops is 2kms. Determine the retardation.	Remember	5
7	A train has a schedule speed of 30kmph over a level track. Distance between stations being 1km. Station stopping time is 20 seconds. Assuming braking retardation of 3 kmphps and maximum speed 25% greater than average speed calculate acceleration required to run the service.	Remember	5
8	A section of tramway ABC is 6km long and earthed at A. Its resistance is 001ohm/km and loading of 200 A/Km uniformly distributed. Negative feeder with booster is taken off from point B, 4km from A. If potential of B is 4 volts above earth, calculate the rating of booster, negative feeder resistance being 0.02 ohm.	Remember	5
9	A mail is to be run between two stations 5kms apart at an average speed of 50 km/hr If maximum speed is to be limited to 70 km/hr acceleration to 2 kmphps, breaking retardation to 4 kmphps and coasting retardation to 01 kmphps Determine the speed at the end of coasting duration of coasting period and braking period.	Remember	5
10	A train is required to run between stations 1.6kms apart at an average speed of 40 kmph. The run is to be made from a quadrilateral speed-time curve. The acceleration is 2km/hr. The coasting and braking retardations are 0.16km/hr and 3.2 km/hr respectively. Determine the duration of acceleration, coasting and braking and distance covered in the each period.	Remember	5
11	A train runs at an average speed of 50 kmph between stations situated at 25 km apart. Train accelerates at 2 kmphps and retards at 3kmphs. Find its maximum speed assuming simplified trapezoidal speed time characteristic. Calculate distance travelled by the train.	Remember	5
12	An electric train is to have braking retardation of Two 600V motors are started by series parallel control. Each motor takes 400 A. During starting time of 200s and has 0.1 ohms resistance. Calculate (a) energy ost in starting rheostat (b) energy lost in motor.(c) motor output (d) Total energy input from line. (e) efficiency of starting	Remember	5

13	An electric train has an average speed of 50 kmph on a level track between stops 1,600 m apart. It is accelerated at 4 kmphps and is braked at 4 kmphps. Draw the speed–time curve for the run.	Remember	5
14	Two motors each of 1500V and armature resistance of 0.2 ohms take 500A during starting. If effective resistance of 50N/tone, tractive effort/motor 40,000N, speed at end of starting period v40Kmph, find (a) duration of starting period (b) speed of train at transition (c) rheostatic loss	Remember	5
15	A motor coach is being driven by two similar motors taking supply at 650V. If first motor is geared to driving wheel having diameter of 90cm. and other motor to driving wheel having diameters of 86 cm. If speed of first motor is 400 rpm when connected in parallel with other motors across 650V supply .Find out the speed of motors when connected in series. Assume armature current to remain same and armature voltage drop of 10% at this current.	Remember	5

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