OBJECTIVE:

This subject deals with power electronics equipments , different a.c and d.c machines speed control techniques

GROUP-I (SHORT ANSWER TYPE QUESTIONS)

S.No	QUESTION	BLOOMS TAXONOMY	COURSE OUTCOME
	UNIT-I **ELECTRIC DRIVES**		
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 any one of	Remember	1
3	Why electrical drives produces noise? How it is reduces?	Analyze	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	Analyze	1
6	Why and where is an individual drive recommended?	Analyze	1
7	Discuss the various factors that groven 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?	evaluate	1
	UNIT-II **ELECTRIC HEATING**		
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 principal of dielectric heating and its applications?		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 furnance?	Understand	2
6	What is high-frequency eddy current heating?	Remember	2

7	What is the Stefan's formula for heat dissipation?	Analyze	2
8	a)What is pinch effect? b) What are the types of arc furnaces?	Understand	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 cm^2 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?	evaluate	2
	UNIT-III **ELECTRIC WELDING**		
1	Why only D.C. supply is used in case of carbon arc welding?	Analyze	3
2	What are the various methods of welding? What are the types of butt	Remember	3
3	What are the applications of the electrical welding?	Remember	3
4	What are the advantages of coated electrodes in welding process?	Remember	3
5	a)What is resistance welding?	Remember	3
6	Enlist the advantages of A.C arc welding process?	Remember	3
7	Name and describe various resistances welding process?	Understand	3
8	Describe: i) carbon Arc welding process ii) shielded metal Arc welding process?	Understand	3
9	a) What is meant by electrical welding? b) What are the advantages of electrical welding?	Remember	3
10	What is meant by spot welding? What is meant by seam welding?	Remember	3
	UNIT-1V **ILLUMINATION FUNDAMENTALS**		
1	a) Define following terms i)MSCP ii)MHCP	Understand	4
2	State Inverse square law and Lambert's cosine law of illumination?	Analyze	4
3	Explain how you will measure the candle power of a source of light	Analyze	4
4	Prove the relationship between the plane angle and solid angle?	evaluate	4
5	A 200V lamp takes a current of 1.2amp, it produces a total flux of 2,860lumens.calculate a) the MSCP of the lamp b) efficiency of the lamp?	evaluate	4
6	What is photometry?	Remember	4
7	Define: (a) Mean spherical candle power,(b) Mean horizontal candle power(c)	Understand	4
8	Write short notes on Bunsen photometer head.	Remember	4
9	Write the expression that shows the relation between solid angle and plane	Analyze	4
10	What is the need of polar curves?	Understand	4
	UNIT-V **VARIOUS ILLUMINATION METHODS**		
1	State at least four differences between Incandescent Lamp and Fluorescent	Understand	4
2	State four advantages of graphite electrode over carbon electrode in case of arc heating furnace.	Remember	4

3	Write the principle of electric incandescent lamp.	Understand	4
4	Compare the merits and demerits of filament lamp and fluorescent lamps?	Analyze	4
5	List out the properties should be possessed by the filament material.	Remember	4
6	Discuss about street lighting?	Understand	4
7	Compare the various features of industrial lighting and domestic lighting?	Analyze	4
8	Mention any two reasons why tungsten is preferred to carbon as filament	Remember	4
9	a) What is meant by aging effect? b) What is stroboscopic effect?	Understand	4
10	a) What is meant by floodlighting? b) What is the empirical formula for calculating the number of lamps	Understand	4
	UNIT-VI **ELECTRIC TRACTION-I**		
1	State advantages and disadvantages of electrical braking system over	Remember	5
2	Explain the electric braking by plugging?	Understand	5
3	Explain briefly the a.c motors used in traction.	Understand	5
4	Compare the various types of braking methods.	Analyze	5
5	Explain why a series motor is preferred for the electric traction.	Understand	5
6	Explain the methods of rheostatic bracking.	Understand	5
7	What are the requirements of good electric braking?	Remember	5
8	Briefly explain the a.c motors used in traction.	Remember	5
9	Explain why a DC series motor is ideally suited for traction purpose.	Analyze	5
10	What are the advantages and disadvantages of track electrification?	Remember	5
	UNIT-VII **ELECTRIC TRACTION-II**		
1	What are the various types of services?	Remember	6
2	What is meant by main line services?	Understand	6
3	Define crest speed	Remember	6
4	Define schedule speed	Remember	6
5	What is meant by urban services?	Understand	6
6	What is meant by suburban services?	Understand	6
7	Draw speed-Time curve of a main line service	Remember	6
8	Draw speed-Time curve of sub-urban service	Remember	6
9	Draw the trapezoidal speed-Time curve	Remember	6
10	What do you understand by speed-Time curve? What is its use in practice?	Analyze	6
	UNIT-VIII **ELECTRIC TRACTION-III**		
1	Define adhesive weight Define coefficient of adhesion	Understand	7
2	Define dead weight	Understand	7
3	Define tractive effort	Understand	7

4	Define specific energy consumption.	Understand	7
5	Define Acceleration and Retardation	Understand	7
6	Define Crest speed or Maximum speed	Understand	7
7	Explain tractive effort for propulsion of train	Remember	7
8	What are factors affecting specific consumption.	Remember	7
9	What are factors affecting schedule speed of a train?	Remember	7
10	Derive expression for the tractive effort for a train on a level track?	evaluate	7

GROUP-II (LONG ANSWER QUESTIONS)

S.No	QUESTION	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
	UNIT-I **ELECTRIC DRIVES**		
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.	Understand	1
2	a) Compare the characteristics of DC series and shunt motor. b) Explain the different types of drives?	Analyze	1
3	a) Discuss advantages and disadvantages of electric drive over other drives and also explain different types of drives. b) Explain the various methods of speed control of AC motors.	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 drive” and Group drive” discuss their relative merits and demerits?	Understand	1
6	Through a.c is superior to d.c for electric drives, sometimes d.c. is preferred. Give the reasons and mention some of the applications	Analyze	1
7	Discuss how different parameters of speed-Time curve will vary with the type of train service.	Remember	1
8	Explain what is mean by Load Equalization and how it is accomplished?	Understand	1
9	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?	Analyze	1
10	a) Discuss the running characteristics of any two electric motors b) Discuss the selection criterion of a motor for a drive application.	Analyze	1
	UNIT-II **ELECTRIC HEATING**		
1	a) Discuss the various modes of heat dissipation b) Briefly explain the different methods of electric heating?	Understand	2
2	a) Discuss the various modes of heat dissipation b) Briefly explain the different methods of electric heating?	Understand	2

3	What is electric heating? What are the advantages over other methods of heating?	Remember	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?	Understand	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.	evaluate	2
7	a)How will you control most efficiently the heat of resistance furnace? b) What advantages does graphite electrode process over carbon electrode?	Analyze	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 resistivy 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.	evaluate	2
9	Explain in brief how heating is done in the following cases? i)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.	evaluate	2
	UNIT-III **ELECTRIC WELDING**		
1	a) Define the following terms i) squeeze time ii)weld time iii)Hold time b) Define the following resistance welding process i)spot welding ii) seam welding iii) butt welding iv)projection welding	Understand	3
2	Compare between Resistances welding and are welding on following points. i) Types of supply used. ii) External filler material required. iii) External pressure required. iv) Temperature obtained	Analyze	3
3	Explain the difference between carbon and metallic arc weldings. Give their relative merits and demerits.	Understand	3
4	Explain the different methods of electric welding and their relative advantages?	Understand	3
5	a) What is the fundamental difference between the electric arc welding and the resistance welding?	Understand	3

	b) What is meant by electron beam welding? c) What is meant by laser beam welding?		
6	a) Compare flash and upset butt welding? b) Compare resistance and arc welding?	Analyze	3
7	a) Describe the various types of electric Arc welding process? b) Why AC is more suitable for the resistance welding?	Understand	3
8	b) What advantages does graphite electrode process over carbon electrode? c) Write a note on A.C welding set & D.C. welding set?	Remember	3
9	a)Describe the various methods of current flow control in welding transformers b) Describe butt welding and its various applications.	Understand	3
10	What are the types of electrodes used for welding operation? Give the advantages of coated electrodes.	Remember	3
	UNIT-IV **ILLUMINATION FUNDAMENTALS**		
1	Define the following :i)solid angle ii)candela iii)Luminous efficiency iv) M.S.C.P V) M.H.C.P	evaluate	4
2	Define the terms: i)Illumination ii) Glare iii)Luminance iv) Luminous efficiency.	evaluate	4
3	What are polar curves as applied to light sources/ show how these curves are used for finding in MHCP and MSCP.	Remember	4
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?	Remember	4
5	Define: i)Space to height ratio ii)Specific output iii)Coefficient of utilization iv)coefficient of reflection	Understand	4
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	4
7	What do you understand by polar curves as applicable to light source Explain?	Remember	4
8	State the laws of illumination. Explain the laws with the help of suitable diagrams, and derive an equation of the same.	Understand	4
9	Define i) Luminous flux ii)Illumination iii) Luminance iv) Luminous intensity	Remember	4
10	Explain how the determination of mean horizontal luminous intensity and polar curve is made.	Understand	4

UNIT-V **VARIOUS ILLUMINATION METHODS**			
1	With a neat diagram, explain the construction and working of Mercury vapour lamp.	Remember	4
2	With the help of a neat diagram, explain the principal of operation of Incandescent lamp?	Understand	4
3	What are the various types of lighting schemes? Explain with a neat sketch?	Remember	4
4	Explain with connection diagram the operation of the low pressure fluorescent lamp and state its advantages?	Understand	4
5	Write short notes on: a) High pressure mercury vapour lamp i) M.A Type ii) M.T.Type b) Mercury fluorescent lamp	Remember	4
6	State and describe various types of lighting schemes	Understand	4
7	Discuss the flood lighting with suitable diagrams.	Remember	4
8	Compare a tungsten filament lamp with fluorescent lamp in detail.	Analyze	4
9	Explain with a neat diagram the principle of operation of a sodium vapour lamp. Mention its applications.	Understand	4
10	Why is tungsten selected as the filament material and on what factors does its life depend?	Understand	4
UNIT-VI **ELECTRIC TRACTION-I**			
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	5
2	a) What are the requirements of good electric braking? b) What are the various electric traction systems in India? Compare them.	Remember	5
3	Explain the different methods of the electric braking of the three-phase induction motor.	Understand	5
4	Describe how plugging, rheostat braking, and regenerative braking are employed with DC series motor.	Understand	5
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	5
6	Why DC series motor is ideally suited for traction services? Review the existing electric traction systems in India.	Analyze	5
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.	Analyze	5

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?	Remember	5
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	5
10	Explain the following electric bracking methods. i) Plugging ii) Rheostatic bracking iii) Regenerative bracking.	Remember	5
	UNIT-VII **ELECTRIC TRACTION-II**		
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	6
2	Derive an expression for the distance traveled by an electric train using trapezoidal speed-time curve.	Analyze	6
3	Draw the speed-time curves for different services and explain them in detail.	Understand	6
4	Assuming a quadrilateral speed-time curve, develop a method of determining the specific energy consumption of a train.	Analyze	6
5	Discuss how different parameters of speed-time curve will vary with the type of train service.	Remember	6
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.	Analyze	6
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.	evaluate	6
8	Derive an expression for specific energy output on level track using a simplified speed–time curve.	evaluate	6
9	Derive the relationship between acceleration, retardation, maximum speed, running time and distance between two stops assuming a trapezoidal Speed-Time curve.	evaluate	6
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	6
	UNIT-VIII **ELECTRIC TRACTION-III**		
1	Derive expression for: (a) The tractive effort for propulsion of a train on level track (b) The tractive effort for propulsion of a train up and down a gradient.	evaluate	7

2	An electric train has quadrilateral speed–time curve as follows: i) Uniform acceleration from rest at 1.5 kmphps for 25 s. ii)Coasting for 45 s. iii)The duration of braking 20 s.	evaluate	7
3	(a) Explain characteristics of d.c series motors and why these are used in traction. (b) Describe the d.c series motor control with details of components used.	Understand	7
4	Explain dead weight, accelerating weight, and train resistant referred to traction	Understand	7
5	A train has schedule speed of 32 kmph over a level track distance between two stations being 2 km. The duration of stop is 25 s. Assuming the braking retardation of 3.2 kmphps and the maximum speed is 20% grater than the average speed. Determine the acceleration required to run the service.	evaluate	7
6	Explain briefly the tractive effort required, while the train is moving up the gradient and down the gradient.	Understand	7
7	How does the value of acceleration and retardation affect the specific energy consumption for a given schedule speed?	Analyze	7
8	Write short notes on the following i) Factors affecting energy consumption in propelling a train ii) Mechanism of train movement iii) Tractive efforts for propulsion of train	Remember	7
9	What is tractive effort of train and what are its functions? Derive an expression for the tractive effort developed by a train unit	Analyze	7
10	Describe the procedure of calculating the specific energy consumption of an electric train	Analyze	7

GROUP-III (ANALYTICAL QUESTIONS)

S.No	QUESTIONS	BLOOMS TAXONOMY LEVEL	PROGRAM OUTCOME
	UNIT-I **ELECTRIC DRIVES**		
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.	Evaluate	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.	Evaluate	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.	Evaluate	1
4	The rotor of four-pole and 50-Hz slip ring induction motor has a resistance of 0.25 Ω per phase and runs at 1,440 rpm at full load. Determine the	Evaluate	1

	external resistance per phase that must be added to lower the speed to 1,300 rpm.		
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.	Evaluate	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 $R_1 = 0.4\Omega$/phase, $R_2 = 0.3\Omega$/phase $X_1 = X_2 = 0.5\Omega$/phase, $X_m = 16\Omega$/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.	Evaluate	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 $(0.35 + j0.65)\ \Omega$ and $(0.15 + j0.65)\ \Omega$, 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.	Evaluate	1
8	A motor operates continuously on the following load cycle. 20 kW for 10 sec,10 kW for 15 sec, 30 kW for 5 sec, 50 kW for 20 sec, 40 kW for 10 sec, and idle for 5 sec.	Evaluate	1
9	A series motor with series field and armature resistance of 0.06 Ω and 0.02 Ω, 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%.	Evaluate	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.	Evaluate	1
	UNIT-II **ELECTRIC HEATING**		
1	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 resistivy 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	Evaluate	2
2	Determine the diameter and length of the wire, if a 17-kW, 220-V, and 1-φresistance oven employs nickel-chrome wire for its heating elements. The temperature is not exceeding to 1,100°C and the temperature of the charge is to be 500°C. Assume the radiating efficiency as 0.5 and the emissivity as 0.9, respectively.	Evaluate	2

3	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	Evaluate	2
4	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. ii) Two resistance elements in parallel in each phase.	Evaluate	2
5	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.	Evaluate	2
6	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.	Evaluate	2
7	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.	Evaluate	2
8	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.	Evaluate	2
9	A piece of insulating material is to be heated by dielectric heating. The size of the piece is $10 \times 10 \times 3$ cm^3. 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.	Evaluate	2
10	An electric arc furnace consuming 5KW takes 15 minutes to just melt 15kgs of aluminum, the initial temperature being 15^oC Find the efficiency of the furnace Specific heat of aluminum is 0.212, melting point 658 ^oC and latent heat of fusion is 76.8 cal per gram.	Evaluate	2

UNIT-IV

ILLUMINATION FUNDAMENTALS

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.	Evaluate	4
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	Evaluate	4
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.	Evaluate	4
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.	Evaluate	4
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.	Evaluate	4
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.	Evaluate	4
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.	Evaluate	4
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	Evaluate	4
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*?	Evaluate	4
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	Evaluate	4

UNIT-V VARIOUS ILLUMINATION METHODS			
1	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.	Evaluate	4
2	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.	Evaluate	4
3	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	Evaluate	4
4	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.	Evaluate	4
5	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.	Evaluate	4
6	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.	Evaluate	4
7	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. Watts: 50 100 150 200 250 Lumens: 1,500 1,830 2,500 3,200 4,000 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.	Evaluate	4
8	An illumination on the working plane of 100 lux is required in a room 45 × 25 m in size. The lamps are required to be hung 3 m above the plane. Assuming a suitable space–height ratio, a utilization factor of 0.8, a lamp efficiency of 18 lumens/W, and a candle power depreciation of 30%, estimate the number, rating, and disposition of lamps.	Evaluate	4
9	A lamp of 50 W operates at 220 V and power factor 0.8. Its power factor is to be corrected to be unity. Determine the capacitance required for the condenser	Evaluate	4
10	A room 40 × 24 m is illuminated by indirect lighting. An average illumination of 50 lux is required to illuminate the working plane. Eighty-watt filament lamps having luminous efficiency of 16 lumens/W are to be used. The coefficient of utilization is 0.75 and depreciation factor is 0.85. Calculate the following:	Evaluate	4

	1. Gross lumens required. 2. Power required for illumination. 3. Number of lamps. 4. Find the saving in power if instead of 80-W filament lamps, 30-W fluorescent tubes are used having efficiency of 40 lumens/W. Also find the number of tube lights required.		
	UNIT-VI **ELECTRIC TRACTION-I**		
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.	Evaluate	5
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	Evaluate	5
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	Evaluate	5
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	Evaluate	5
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	Evaluate	5
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 reduce the speed by 20%, assuming the torque remains constant. The efficiency of the motor is 90%.	Evaluate	5
7	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.	Evaluate	5
8	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?	Evaluate	5
9	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	Evaluate	5
10	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%.	Evaluate	5

UNIT-VII **ELECTRIC TRACTION-II**			
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.	Evaluate	6
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.	Evaluate	6
3	The distance between two stops is 5 km. A train has schedule speed of 50 kmph. The train accelerates at 2.5 kmphps and retards 3.5 kmphps and the duration of stop is 55 s. Determine the crest speed over the run assuming trapezoidal speed–time curve.	Evaluate	6
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.	Evaluate	6
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 eachAssume trapezoidal speed-time curve.	Evaluate	6
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.	Evaluate	6
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.	Evaluate	6
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.	Evaluate	6
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.	Evaluate	6
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.	Evaluate	6
UNIT-VIII **ELECTRIC TRACTION-III**			

1	An electric train is to have the acceleration and braking retardation of 0.6 km/hr/sec and 3 km/hr/sec, respectively. If the ratio of the maximum speed to the average speed is 1.3 and time for stop is 25 s. Then determine the schedule speed for a run of 1.6 km. Assume the simplified trapezoidal speed–time curve.	Evaluate	7
2	A train is required to run between two stations 1.5 km apart at an average speed of 42 kmph. The run is to be made to a simplified quadrilateral speed–time curve. If the maximum speed is limited to 65 kmph, the acceleration to 2.5, kmphps, and the casting and braking retardation to 0.15 kmphs and 3 kmphs, respectively. Determine the duration of acceleration, costing, and braking periods	Evaluate	7
3	A train has schedule speed of 32 kmph over a level track distance between two stations being 2 km. The duration of stop is 25 s. Assuming the braking retardation of 3.2 kmphps and the maximum speed is 20% grater than the average speed. Determine the acceleration required to run the service	Evaluate	7
4	A suburban electric train has a maximum speed of 75 kmph. The schedule speed including a station stop of 25 s is 48 kmph. If the acceleration is 2 kmphps, the average distance between two stops is 4 km. Determine the value of retardation.	Evaluate	7
5	An electric train is accelerated at 2 kmphps and is braked at 3 kmphps. The train has an average speed of 50 kmph on a level track of 2,000 min between the two stations. Determine the following: 1. Actual time of run. 2. Maximum speed. 3. The distance travelled before applying brakes 4. Schedule speed. Assume time for stop as 12 s. And, run according to trapezoidal	Evaluate	7
6	An electric train has quadrilateral speed–time curve as follows: 1. Uniform acceleration from rest at 1.5 kmphps for 25 s. 2. Coasting for 45 s. 3. The duration of braking 20 s. If the train is moving a uniform up gradient of 1.5%, the reactive resistance is 45 N/ton, the rotational inertia effect is 10% of dead weight, the duration of stop is 15 s, and the overall efficiency of transmission gear and motor is 80%. Find schedule speed.	Evaluate	7
7	A 250-ton motor coach having four motors each developing 6,000 N-m torque during acceleration, starts from rest. If the gradient is 40 in 1,000, gear ration is 4, gear transmission efficiency is 87%, wheel radius is 40 cm, train resistance is 50 N/ton, the addition of rotational inertia is 12%. Calculate the time taken to attain a speed of 50 kmph. If the line voltage is 3,000-V DC and the efficiency of motors is 85%. Find the current during notching period.	Evaluate	7
8	An electric train of weight 250 ton has eight motors geared to driving wheels, each is 85 cm diameter. The tractive resistance is of 50/ton. The effect of rotational inertia is 8% of the train weight, the gear ratio is 4–1, and the gearing efficiency is 85% determine. The torque developed by each motor to accelerate the train to a speed of 50 kmph in 30 s up a gradient of 1 in 200.	Evaluate	7
9	A train weighing 450 ton is going down a gradient of 20 in 1,000, it is desired to maintain train speed at 50 kmph by regenerative braking. Calculate the power fed into the line and allow rotational inertia of 12% and the efficiency of conversion is 80%. Traction resistance is 50 N/ton.	Evaluate	7

10	The speed–time curve of an electric train on a uniform raising gradient of 10 in 1,000 comprise of: 1. Uniform acceleration from rest at 2.2 kmphps for 30 s. 2. Wasting with power off for 30 s. 3. Braking at 3.2 kmphps to standstill the weight of the train is 200 ton. The tractive resistance of level track being 4 kg/ton and the allowance for rotary inertia 10%. Calculate the maximum power developed by traction motors and the total distance travelled by the train. Assume the transmission efficiency as 85%.	Evaluate	7