SUBJECT DETAILS

UTILIZATION OF ELECTRICAL ENERGY

Objective and Relevance

Scope

Prerequisites

Syllabus

i. JNTU

ii. GATE

iii. IES

Suggested Books

Websites

Experts' Details

Journals

Finding and Development

Session Plan

Student Seminar Topics

Question Bank

i. JNTU

ii. GATE

iii. IES

OBJECTIVE AND RELEVANCE

This subject covers topics like illumination engineering, welding, heating methods, electric traction, electric drives etc. It gives introduction to electric drives, steady state and transient characteristics of motor and various methods of speed controls and braking. Also deals with various methods of heating and welding, and some modern circuits for Induction and dielectric heating at high frequencies. It also covers the illumination levels in different places like office, factories and modern approach to electric traction.

SCOPE

The subject covers an extensive range of topics like illumination engineering, heating and welding, electrical drives and control and electric traction. As these topics concern with general day to day life in present times an electrical engineering student should familiarize himself with the subject. As this subject gives an overview of utilisation of electrical energy for various practical purposes it will provide the basic insight to the fresh engineers entering Electrical utility industry. Apart from the basic knowledge of fundamental principles the students will come to know different areas of utilisation of the electrical engineering. In view of the students thorough knowledge of Electric traction, they will have brighter chance of jobs in Indian railways.

PREREQUISITES

Basic fundamentals of machines, network theory and power electornics are essentialy necessary to understand this subject. In addition to this the basic concepts of light energy and fundamentals of mathematics are necessary.

JNTU SYLLABUS

UNIT-I

OBJECTIVE

This units covers electrical drives and their types, characteristic of electrical motors. On the completion of this unit the students gain knowledge on practical application of electrical drives, types of motors used for electrical drives, types of loads and load equalization

SYLLABUS

ELECTRIC DRIVES: Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load qualization.

UNIT-II

OBJECTIVE

This unit deals with electrical heating. It covers different types of electrical heating like resistance, induction and dielectric heating at the end of the unit student get familiar with practical implementation of electrical heating.
This unit deals with electrical welding process. It gives on idea about different types of electrical welding like arc and resistance welding. It also discuss about the electrical equipment requirement for both AC and DC welding.

SYLLABUS

ELECTRIC HEATING & WELDING : Advantages and methods of electric heating, resista nce heating induction heating and dielectric heating.
ELECTRIC WELDING: Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. welding.

UNIT-III

OBJECTIVE

This unit covers the illumination and laws of illumination. At the end of this unit student learn about illumination and its related terms, laws. They get familiar about photometry integrated sphere, polar curves and different sources of lighting.
This unit basically covers various illumination methods used for different applications. At the end of this unit student learn different types of lamps like discharge lamps, filament lamps, fluorescent lamp, and different types of lighting schemes depending upon the application area. This unit also involves problems related to different lighting schemes for better illumination which are useful in all areas.

SYLLABUS

ILLUMINATION FUNDAMENTALS: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

VARIOUS ILLUMINATION METHODS: Discharge lamps, MV and SV lamps, comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT-IV

OBJECTIVE

The units deals with introduction of electrical traction and electrical braking at the end of the unit student gained knowledge on different types of electrical traction in India and importance of track electrification. They also gain knowledge on special features of traction motors, electrical braking and its importance.

This unit deals with analysis of different types of traction systems with the help of speed time curves and the calculations required for different types of speed time curves. At the end of the unit the students learn about different speed time curves for urban, sub-urban areas selection of speed time curve for particular area and calculations related to trapezoidal and quadraleteral speed-time curve.

SYLLABUS

ELECTRIC TRACTION-I: System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking-plugging rheostatic braking and regenerative braking.

Mechanics of train movement. Speed-time curves for different services, trapezoidal and quadrilateral speed time curves.

UNIT-V

OBJECTIVE

This unit deals with different calculations involved in electrical traction for the movement of train over track. At the end of the unit students learn about terms like tractive effort, power, specific energy consumption, adhesive weight and coefficient of adhesion. This unit gives the mathematical formulae related to electrical traction

SYLLABUS

ELECTRIC TRACTION-II: Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation adhesive weight and coefficient of adhesion.

GATE SYLLABUS

Not applicable

IES SYLLABUS

Not applicable

Session Plan

Sl. No.	JNTU Syllabus	Modules and Sub Modules	Lecture No.	Books referred	Remarks
UNIT-I					
1	Types of electrical drive	Introduction to Electrical drive and its importance. Group drives, Individual drives and multi motor drives	L1	T2-Ch3, R1-Ch5 R3-Ch2, R2-Ch4	
2	Choice of motor	Factors effecting selection of the motor	L2	T2-Ch3, R1-Ch5 R3-Ch2, R2-Ch4	
3	Starting and running characteristics Starting and running characteristics	Starting and running characteristics of different types of motors DC motors AC motors Induction motors	L3	T1-Ch1, T2-Ch3 R1-Ch5, R3-Ch2 R2-Ch4	
		AC motors Induction motors Synchronous motors	L4	T1-Ch1, T2-Ch3 R1-Ch5, R2-Ch4	
4	Speed control	Speed control of DC machines Field control Armature control Speed control of Induction motors Pole changing Rheostatic control Cascade control	L5	T1-Ch1, T2-Ch3 R1-Ch5, R3-Ch2 R2-Ch4	
		Problems related to speed control	L6	T1-Ch1, T2-Ch3 R1-Ch5, R3-Ch2 R2-Ch4	
5	Temperature rise, Practical applications of electrical drives	Temperature rise and practical applications of electrical drives	L7	T1-Ch1, T2-Ch3 R1-Ch5, R3-Ch2 R2-Ch4	
6	Types of industrial loads	Active and passive loads. Nature of mechanical load Variation with time Continuous load, intermittent loads and Variable and fluctuating loads.	L8	T1-Ch1, T2-Ch3 R1-Ch5, R3-Ch2 R2-Ch4	
7	Continuous intermittent and variable loads	Continuous load Intermittent loads Variable loads Fluctuating loads	L9	T1-Ch5, T2-Ch3 R1-Ch5, R3-Ch2 R2-Ch4	
8	Load equalization	Peak load condition Light load condition Load equalization Use of flywheels	L10	T1-Ch5, T2-Ch3 R1-Ch5, R3-Ch2 R2-Ch4	
9	Load Equalization	Problems	L11	T1-Ch5, T2-Ch3 R1-Ch5, R3-Ch2 R2-Ch4	

Sl. No.	JNTU Syllabus	Modules and Sub Modules	Lecture No.	Books referred	Remarks
		UNIT-II			
10	Advantages and methods of electrical heating	Advantages Methods of electrical heating Relative costs	L12	T1-Ch3, T2-Ch4 R1-Ch2, R2-Ch5 R3-Ch4	
11	Resistance heating	Resistance heating Resistance ovens Characteristic features of heating element Designing a heating element	L13	T1-Ch3, T2-Ch4 R1-Ch2, R2-Ch5 R3-Ch4	
12	Resistance heating	Temperature control Problem related to design of heat element	L14	T1-Ch3, T2-Ch4 R1-Ch2, R2-Ch5 R3-Ch4	
13	Induction heating	Core type furnace Ajax Wyatt furnace	L15	T1-Ch3, T2-Ch4 R2-Ch5, R3-Ch4	
		Core less induction furnace problems	L16	T1-Ch3, T2-Ch4 R1-Ch2, R2-Ch5 R3-Ch4.	
14	Dielectric heating	Dielectric heating Applications	L17	T1-Ch2, T2-Ch5 R1-Ch4, R2-Ch5 R3-Ch4	
		UNIT-III			
15	Electrical welding resistance welding	Electrical welding Resistance welding Spot welding Seam welding Butt welding	L18	T1-Ch3, T2-Ch5 R1-Ch2, R2-Ch5 R3-Ch5	
16	Arc welding	Resistance welding Projection welding Precrussion welding Flash Butt welding Electrical arc welding Carbon arc welding	L19	T1-Ch3, T2-Ch5 R1-Ch2, R2-Ch5 R3-Ch5	
		Shielded metal arc welding Gas metal arc welding Submerged arc welding	L20	T1-Ch3, T2-Ch5 R1-Ch2, R2-Ch5 R3-Ch5	
17	Electrical winding equipment	Electrical winding equipment	L21	T1-Ch3, T2-Ch5 R1-Ch2, R2-Ch5 R3-Ch5	
18	Comparison between AC and DC welding	Comparison between AC and DC welding Advantages	L22	T1-Ch3, T2-Ch5 R1-Ch2, R2-Ch5 R3-Ch5	
		Problems	L23	T1-Ch3, T2-Ch5 R1-Ch2, R2-Ch5 R3-Ch5	
		UNIT-IV			
19	Introduction, terms used in the illumination	Introduction Nature of light Definitions Plane angle Solid angle Luminous efficiency Maintenance factor	L24	T1-Ch5, R1-Ch1 R2-Ch6, R3-Ch6	

Sl. No.	JNTU Syllabus	Modules and Sub Modules	Lecture No.	Books referred	Remarks
		Space height ratio Reflection factor			
20	Terms used in the illumination	MSCP MHSCP Luminance Brightness Glare Coefficient of utilization.	L25	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
21	Laws of Illumination	Illumination Effect of intensity of source Lamberts cosine law Inverse square law	L26	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
22	Polar curves	The Roussea diagram	L27	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
23	Photometry	Photometry Photo voltaic cell Photo emmissive cell Distribution photometry	L28	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
24	Integrating sphere	Integrating sphere Luminance measurement Flux method of calculation.	L29	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
25	Sources of light	Sources of light	L30	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
UNIT-V					
26	Discharge lamps, MV and SV lamps	Natural sources Artificial sources Non electric sources Electric sources Incandescent lamps Arc lamps	L31	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
		Gaseousdischargelamps Fluorescent tube Sodium vapourlamp	L32	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
27	Comparison between tungsten filament lamp and fluorescent tube	Mercury vapour lamp Comparison between filament lamp and fluorescent tube	L33	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
Sl. No.	JNTU Syllabus	Modules and Sub Modules	Lecture No.	Books referred	Remarks
28	Types and design of lightning	Design of indoor lighting scheme Design of factory lighting Design of outdoor lighting	L34	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
29	Flood lighting	Method and operation	L35	T1-Ch5, T2-Ch6 R1-Ch1, R2-Ch6 R3-Ch6	
UNIT-VI					

Sl. No.	JNTU Syllabus	Modules and Sub Modules	Lecture No.	Books referred	Remarks
30	System of electric traction and track electrification	Introduction Requirements of electric traction Advantages Systems DC system 1-□ low frequency ACsystem	L36	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
		3 phase system Composite system	L37	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
31	Review of existing electrical traction system in India	Review	L38	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
32	Special features of traction motor	Electrical feature Mechanical features DC motors	L39	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
		AC series motor 3 phase induction motor	L40	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
		Induction motors Related problems	L41	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
33	Methods of electrical breaking Plugging	Different types of Braking. Plugging or reverse current braking DC series motor 3 phase Induction motor Synchronous motor Induction motor	L42	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
34	Rheostatic braking	Rheostatic breaking of DC shunt motor Series motor Synchronous motor Induction motor	L43	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
35	Regenerative breaking	Regenerative braking of DC series motors Induction motors DC shunt motors	L44	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
		Comparison Problems	L45 L46	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
UNIT-VII					
36	Mechanics of train movement	Introduction and operation	L47	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
37	Speed time curves for different services	Typical speed time curves Urban services Rural services	L48	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
38	Trapezoidal and quadrilateral speed time curves	Simplified speed time curve Quadrilateral Trapezoidal	L49	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
		Average speed Rated speed Related problems	L50	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	

Sl. No.	JNTU Syllabus	Modules and Sub Modules	Lecture No.	Books referred	Remarks
		UNIT-VIII			
39	Calculation of Tractive effort, power	Tractive effort for acceleration Tractive effort to overcome gravitational pull Tractive effort to overcome train resistance Tractive effort to overcome curve resistance	L51	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
		Problems	L52	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
40	Specific energy consumption for a given run	Specific energy consumption consumption of driving axles to accelerate train Energy required to overcome gradient Energy required to overcome train resistance	L53	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
41	Effect of varying acceleration and braking retardation	Factors affecting specific energy consumption Acceleration Distance between stops Retardation	L54	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
		Type of equipment used Nature of track Related problems	L55	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
42	Adhesive weight breaking retardation and coefficient of adhesion.	Definitions Related formulae Factors affecting coefficient of adhesion	L56	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	
		Problems	L57	T1-Ch2, T2-Ch8 R1-Ch5, R2-Ch7 R3-Ch9	

SUGGESTED BOOKS

TEXT BOOKS

T1 Utilization of electrical energy, E. Open Shaw, Taylor, Longman.

T2 Art and science of electrical energy, Partab, DhanpatRai and sons Publications

REFERENCE BOOKS

R1 Utilization of electrical power including electrical drives and electrical traction, N.V. Suryanarayana, New Age International (P) Ltd.

R2 Generation Distribution and utilization of Electrical Energy, C.L.Wadwa, New Age International Ltd.

R3 Utilization of Electric power and Electrical Traction - G.C.Gargkhanna Publication.

WEB SITES

1. www.mit.edu
2. www.soe.stanford.edu
3. www.grad.gatech.edu

4. www.gsas.harward.edu
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11. www.irfca.com
12. www.railway.technical.com
13. www.eere.energy.gov
14. www.onesmartclick.com
15. www.advancedillumination.com

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JOURNALS

INTERNATIONAL

1. IEEE Transactions on Power Electronics
2. IEEE Transactions on Power Engineering Practice & Energy Management
3. IEEE Transactions on Power Systems
4. IEEE Transactions on Energy Conversion
5. IEEE Transactions on Computer Applications in Power
6. IEEE Transactions on Industrial Applications

NATIONAL

1. Electrical India
2. Power Engineering Journal, IEE
3. Electrical Engineering update
4. Journal of Institute of Engineers (India)

FINDINGS AND DEVELOPMENTS

1. A Modular Design of Asynchronous Traction Drive. G. Crawshaw, B.J.Cadwell, Brush electrical machines limited, U.K.
2. Diesel Hybrid Electric Busses, Field operates program, U.S. Dept. of Energy.
3. Traction Drive System for Electric Vehicles Method Converters, Juan W. Dixon, Michahortozar and teliperiods.
4. A New Adaptive Control System for Electrical Power Drive, Haude Li Shayan, Ming Chan, belizhang, Chanzi Shen.
5. LED's lights of coming days, Dr. Davind, MiruskaMilanovic, Electric India, Oct. 2004.
6. Fuzzy Logic Controller based high performance induction motor drive, Conference proceedings of IEE sponsored national conference on Power Engineering Practice and energy management S.B. Subudhi, S.P. Das & S.R. Doradla - 2005, TIET, Patiala, Page 51-54, Jan. 28-29, 2005
7. Organic Light Emitting Devices, Sheraton Sandieago and Marina Sandieago, USA.
8. Photonics, Palain De La Masique, Europe 26-30, April, 2004.

SESSION PLAN

STUDENT SEMINAR TOPICS

1. High Efficient Parallel Connected Induction Motor Speed Control with Unbalanced Load Condition using One Inverter I.Ando, IEEE transactions on Industry Applications, pp.162-167, 2003.
2. Control Methodology for SingleInverter, Parallel Connected Dual Induction Motor Drives for Electric Vehicles, Patric M. Kelecy and Robert D.Lorenz, IEEE transactions on Industry Applications,
pp.987-991, 1994.
3. New AC Traction Drive System with Transistor VVVF Inverter, Hiroshi Miki, IEEE transactions on Industry Applications, pp.291-297, 1991.
4. A Stator FluxBased Vector Control Method for Parallel Connected Multiple Induction Motors Fed by A Single Inverter, Yasushi Matsumoto, IEEE transactions on Industry Applications, pp.575-580, 1998
5. Modelling and Simulation of Electrical Drives using MATLAB/Simulink and Power System Blockset, IECON-2001, the 27th Annual Conference of the Hoang Le Huy, IEE E Industrial Electronics Society, pp. 1603-1611.
6. LED's lights of coming days, Dr. David, MiruskaMilanovic - Electric India, Oct. 2004.
7. Fibre optic lighting, The light of the coming days - Electric India, 15th Sep. 2001.

7.1.12 QUESTION

BANK UNIT-I

1. i. what is an electric drive? What are its advantages? Compare a group drive and an individual drive.

   ii. Explain the various methods of speed control of AC motors **(May 2013)**

2. i. Write short notes on Continuous rating motor.

   ii. Motor for intermittent loads cycle constituted as follows, 0 to 15 sec load rising from 0 to 1050 hp, 15 to 85 sec constant load of 600 hp, 85 to 95 sec regenerative braking with the hp returned falling uniformly from 200 to 0 hp, 95 to 120 sec. motor is at rest. Determine the continuous rating of the motor that would be suitable for the load cycle. Assume the rating to depend upon the:

i) rms value of loading. ii) Average value of loading. **(July-12)**

3. i. 2An induction motor has a short circuit current equal to 6 times the full load current at normal voltage. It has a slip of 5 % on full load. Calculate the starting torque in terms full load torque if started by:
   a) A star-delta starter.

An auto- transformer with 60% tapping. Ignore the magnetizing current **(Nov/Dec 2012)**

4. i. Discuss the advantages and disadvantages of electric drive over other drives.
   ii. A 220 V, 10 h.p. (metric) shunt motor has field and armature resistances of 120 Ohms and 0.25 Ohm, respectively. Calculate the resistance to be inserted in the armature circuit to reduce the speed to 700 r.p.m. from 950 r.p.m, if the full load efficiency is 80% and the torque varies as the square of the speed. **(Aug 07, May 07, 06)**
5. i. "If a high degree of speed control is required, d.c. is preferable to a.c. for an electric drive" -Justify.
   ii. A 200 V shunt motor has an armature resistance of 0.5 Ohm. It takes a current of 16 amps on full load and runs at 600 r.p.m. If a resistance of 0.5 Ohm is placed in the armature circuit, find the ratio of the stalling torque to the full load torque. **(Aug 07, May 07, 05, 03)**

6. i. Explain what you mean by Load Equalization and how it is accomplished.
   ii. A motor fitted with a flywheel supplies a load torque of 150 Kg-m for 15 sec. During the no load period the flywheel regains its original speed. The motor torque is required to be limited to 85 Kg-m. Determine the moments of inertia of the flywheel. The no load speed of the motor is 500 r.p.m and it has a slip of 10% on full load. **(Aug 07, 06, Apr 05, 03)**

7. i. Compare and contrast the slip ring and squirrel cage induction motors from the application point of view.
   ii. A series motor working on 500 V d.c supply runs at a speed of 1000 r.p.m. When The load current is 120 amps. The resistance of the motor 0.15 Ohm, of which 0.04 Ohm is the resistance of the field. Calculate the speed of the motor when the torque is half of the full load torque and the field winding is connected in parallel with a diverter of resistance 0.08 Ohm, assuming an unsaturated magnetic circuit. **(May 07, Aug 06, May 06,05, 04)**

8. i. Discuss the various factors that govern the size and the rating of a motor for a particular service.
   ii. A motor has to deliver a load rising uniformly from zero to a maximum of1500 Kw in 20 sec during the acceleration period, 1,000 Kw for 50 sec during the full load period and during the deceleration period of 10 sec when regenerative braking takes place the Kw returned to the supply falls from an initial value of 500 to zero uniformly. The interval for decking before the next load cycle starts is 20 sec.

Estimate the rating of the motor. **(Aug, May 06, Apr 03)**

9. i. Though a.c. is superior to d.c. for electric drives, sometimes d.c. is preferred. Give the reasons and mention some of the applications.
   ii. A d.c. series motor drives a load, the torque of which varies as the square of the speed. The motor takes current of 30 amps, when the speed is 600 r.p.m. Determine the speed and current when the field winding is shunted by a diverter, the resistance of which is 1.5 times that of the field winding. The losses may be neglected. **(May 06, 04, Nov 03)**

10. i. Where is the use of Individual drive recommended and why?
    ii. The speed of a 15 h.p. (Metric) 400 V d.c. Shunt motor is to be reduced by 25% by the use of a controller. The field current is 2.5 amps and the armature resistance is 0.5 Ohm. Calculate the resistance of the controller, if the torque remains constant and the efficiency is 82%. **(May 06, Nov 03)**

11. A motor driving a load has to deliver a load rising uniformly from zero to a maximum of 2000 h.p. in 20 sec during the acceleration period, 1000 h.p. for 40 sec during the full speed period and during the deceleration period of 10 sec when regenerating braking is taking place the h.p. returned to the supply falls from 330 to zero. The interval for decking before the next load cycle starts is 20 sec. Estimate the horse power rating of the motor. **(May 06,05)**

12. Explain the characteristics of D.C. compound motors and explain its advantage over the series motor. **(May 06)**

13. A 60 h.p. motor has a final temperature rise of 45 degrees C on continuous full load. Its heating and cooling time constants are 100 and 150 minutes, respectively. The load cycle is as follows: 20 minutes at a certain load and 40 minutes on no-load. Find the rating of the motor. **(May 06)**

14. i. Derive an expression for the temperature rise of an equipment in terms of the heating time constant.
    ii. At full load of 10 h.p., the temperature rise of a motor is 25 degrees C after one hour, and 40 degrees C after 2 hours. Find the final temperature rise on full load. Assume that the iron losses are 80% of full load copper losses. **(Apr 05, 03)**

15. A 220 V, 10 h.p. (metric) shunt motor has field and armature resistances of 120 Ohms and 0.25 Ohm, respectively. Calculate the resistance to be inserted in the armature circuit to reduce the speed to 700 r.p.m. from 950 r.p.m, if the full load efficiency is 80% and the torque varies as the square of the speed. **(Apr 05, 04, Nov 03)**

16. i. Derive an expression for the time-dependent temperature as the electrical Apparatus cools, in terms of the cooling time constant.
    ii. A 60 h.p. Motor has a final temperature rise of 45 degrees C on continuous full load. Its heating and cooling time constants are 100 and 150 minutes, Respectively. The load cycle is as follows: 20 minutes at a certain load and 40 minutes on no-load. Find the rating of the motor. **(Apr 04)**

17. i. Discuss the current-speed and current-torque characteristics of d.c. series motors.
    ii. The full voltage starting current of a 400 V, 50 Hz, delta connected induction motor is 4 times the full load line current and the starting torque is 2 times the full load Torque. Determine the starting torque when the motor is started by an auto Transformer with 60% tapping. **(Apr 04)**

18. i. Discuss in detail how the maximum torque can be obtained at the time of starting a 3 phase slip ring induction motor.
    ii. A 250 V d.c. shunt motor with constant field excitation drives a load, the torque of which varies as the square of the speed. The armature current is 20 amps, when the motor is running at 500 r.p.m. Find the percentage reduction in the speed of the motor when a resistance of 20 Ohms is connected in series

with the armature. Neglect the losses in the motor. **(Apr 04)**

19. i. A flywheel is not used with a synchronous motor for load equalization - Discuss.
ii. A 25 h.p. 3-phase 10 pole, 50 Hz induction motor fitted with flywheel has to supply a load torque of 750 Nw-m for 12 sec followed by a no load period during which the flywheel regains its original speed. Full load slip of the motor is 4% and the torque-speed curve is linear. Find the moment of inertia of the flywheel if the motor torque is not to exceed 2 times the full load torque. **(Apr 04)**

20. i. Derive an expression for the motor torque at any instant in terms of the load torque, moment of inertia of the flywheel and the slip of the motor
ii. A 500 h.p. induction motor is fitted with a flywheel and has the following data:
No load speed 40 r.p.m. Slip at full load 12%. Load torque during actual rolling 41,500 Kg-m. Duration of each rolling period is 10 sec.
Determine the inertia of the flywheel to limit the motor torque to 2 times its full load value. Neglect no load losses and assume that the rolling mill torque falls to zero between each rolling period. Assume a linear torque-slip characteristic. **(Apr 04)**

21. If a high degree of speed control is required, D.C. is preferable to A.C. for an electric drives - Justify and mention other application. **(Apr 04, 03, Nov 03)**

22. What is meant by load equalization. Explain how this is achieved in electric industry. **(Apr 04, 03, 02, Dec 02)**

23. "A fly wheel is not used with synchronous motor for load equalization" discuss. **(Nov 03)**

24. Discuss the advantages & disadvantages of electric drives over other drives. **(Nov 03)**

25. Discuss the various losses that occurs in insulating materials and how they could be reduced. **(Nov 03)**

26. Draw and explain the output (vs) time characteristics of any three types of loads. **(Nov 03)**

27. i. Explain what you mean by "Individual drive" and" Group drive ". Discuss their relative merits and demerits.
ii. A 500 V d.c. series motor runs at 500 r.p.m. and takes 60 amps. The resistances of the field and the armature are 0.3 and 0.2 Ohms, respectively. Calculate the value of the resistance to be shunted with the series field winding in order that the speed may be increased to 600 r.p.m., if the torque were to remain constant. Saturation may be neglected. **(Nov 03)**

28. i. Draw and explain the output vs. time characteristics of any three types of loads.
ii. A motor has the following duty cycle:
Load rising from 200 to 400 h.p. --- 4 minutes
Uniform load 300 h.p. --- 2 minutes
Regenerative braking h.p. Returned to supply from 50 to zero ---1 minute.
Remains idle for 1 minute.
Estimate the h.p. of the motor. **(Nov 03)**

29. A motor has the following load cycle:
Accelerating period 0 -15 sec Load rising uniformly from 0 to 1000 h.p
Full speed period 15-85 sec Load constant at 600 h.p.
Decelerating period 85-100 sec h.p. returned to line falls uniformly from 200 to zero
Decking period 100-120 sec Motor stationary.

Estimate the size of the motor. **(Nov 03)**

30. What are the advantages & disadvantages of group drives and individual drives. **(Nov, Apr 03, Dec 02)**

31. Enumerate the various points which govern's the choice of a motor for a particular industrial drive. **(Apr 03, 02, Dec 02)**

32. What is meant by cooling time constant of motor. **(Apr 03)**

33. Write short notes on Temperature rise in electric drive **(Apr 03, Dec 02)**

34. Explain with the help of diagram, 4-Quadrant speed torque characteristics of an induction motor when running
    i. Forward direction
    ii. Reverse direction

35. Torque in shunt motor varier with armature current - Justify. **(Apr 03)**

36. A 6 pole, 50 Hz slip ring induction motor with a rotor resistance per phase of 0.2 Ohm and a standstill reactance of 1.0 Ohm per phase runs at 960 r.p.m. at full load. Calculate the resistance to be inserted in the rotor circuit to reduce the speed to 800 r.p.m., if the torque remains unaltered. **(Apr 03)**

37. i. " Torque in a shunt motor varies with the armature current" -Justify.
    ii. A squirrel cage induction motor takes twice full load current and develops half full load torque when started by a star delta starter. If started by an auto transformer with a 50% tapping, fined the starting current and starting torque in terms of the full load values. **(Apr 03)**

38. i. Discuss the various losses that occur in magnetic conductors which cause the temperature rise in any electrical apparatus and suggest how they can be reduced.
    ii. The outside of a 12 h.p. (metric) motor is equivalent to a cylinder of 65 cms diameter and 1 metre length. The motor weighs 400 Kg and has a specific heat of 700 Joules per kg per degree C. The outer surface is capable of heat dissipation of 12 W per meter square per degree C. Find the final temperature rise and thermal constant of the motor when operating at full load with an efficiency of 90%. **(Apr 03)**

39. Explain the characteristics of D.C. compound motor and explain its advantages over the series motor. **(Apr 03)**

40. Discuss the various losses that occur in magnetic conductors & which causes the terms rise in any electrical appanatus & suggest how they can be reduced. **(Apr 03)**

41. What are the factors to be considered while selecting an electric drive for a particular application. **(Dec 02)**

42. i. What is an electric drive? Classify various types of electric drives and discuss their merits and demerits .
    ii. Suggest, with reasons the electric drive used for the following applications.
    (i) Rolling mills (ii) Tex tile mills (iii) Cement mills (iv) Paper mills (v) Coal mining (vi) Lift, Cranes, Lathes and pumps. **(Dec 02)**

43. i. Explain with the help of a diagram, the four quadrant speed-torque characteristic of an induction motor when running in (i) forward direction (ii) reverse direction.
    ii. A 100 hp, 500 rpm d.c. shunt motor is driving a grinding mill through gears. Themoment of inertia of the mill is 1265 kg m^2. If the current taken by the motormust not exceed twice full load current during

- Ronald Reagan

starting, estimate the minimum time taken to run the mill upto full speed. **(Dec 02)**

44. A 250 V, d.c. shunt motor with constant field excitation drives a load whose torque varies as square of speed. The armature current is 20 A when the motor is running at 500 r.p.m. Find the speed of the motor when running with 25 ohm resistance connected in series with armature. **(Dec 02)**

45. Suggest, with reasons the electric drive used for following application.
   i. Rolling mills
   ii. Textile mills
   iii. Cement mills
   iv. Paper mills
   v. Coal mining
   vi. Lift, Cranes, Lather, Pump **(Apr 02)**

UNIT-II

1. **i** Explain the theory of dielectric heating and state its applications. What are the advantages of dielectric heating? **(May 13)**
   ii Explain the principle of operation of induction heating. State and explain different types induction heating methods. **(May 13)**
2. What are different methods of heat transfer? Explain in brief. **(July-12)**

3. i AExplain the principle of dielectric heating and its applications
   ii the power required for dielectric heating of a slab of resin 150sq cm in area and 2 cm thick is 200 watts at a frequency of 30 MHz. The material has relative permittivity of 5 and a pf 0.05. determine the voltage necessary and current flowing through the material. If the voltage is limited to 600V, what will be the value of the frequency to obtain the same heating? **(Nov/Dec-12)**

4. What are the applications of high frequency eddy current heating? Also explain the principle of high frequency eddy current heating. **(Aug 07, 06, May 06)**

5. i. What are different methods of heat transfer? Explain in brief.
   ii. What are the advantages of radiant heating?
   iii. Describe various types of electric heating equipment. **(Aug 07, Apr 03)**

6. A motor has the following load cycle: Accelerating period 0 -15 sec Load rising uniformly from 0 to 1000 h.p Full speed period 15-85 sec Load constant at 600 h.p. Decelerating period 85-100 sec H.p. returned to line falls uniformly from 200 to zero Decking period 100-120 sec Motor is stationary. Estimate the size of the motor. **(May 07, Aug, May 06)**

7. i. What are the causes of failure in heating elements?
   ii. Six resistances each of 40 ohms are used as heating elements in furnace. Find the power of the furnace for various connections to a three phase 230V supply. **(May 07, Aug, May 06, Apr 03, 02)**

8. i. Explain with a neat sketch the principle of coreless type induction furnace.
   ii. 100Kg of tin is to be smelt in one hour in a smelting furnace. Determine the suitable rating of furnace if smelting temperature of tin is 235^0C; specific heat is 0.055, latent heat of liquidification 13.3 Kcal/Kg. Take initial temperature of metal as 35^0C. **(May 07, 06)**

9. Discuss the various modes of heat dissipation. **(May 06,05)**

10. i. What is skin effect? How this effect is made use of in heating?
ii. Write the expression for skin depth. What are the applications of heating? **(May 06, 05, 04)**

11. Derive an expression for the time-dependent temperature as the electrical apparatus cools, in terms of the cooling time constant. **(May 06)**

12. i. Give relative advantages and disadvantages of direct and indirect electric arc furnaces.
ii. An electric arc furnace consuming 5KW takes 15 minutes to just melt 1.5Kgs of aluminum, the initial temperature being 15^{0}C. Find the eciency of the furnace. Specific heat of aluminum is 0.212, melting point 658^{0}C and latent heat of fusion is76.8Cal per gram. **(May 06)**

13. Discuss the various losses that occur in insulating materials and how they can be reduced. **(May 06)**

14. Estimate the energy required to melt one ton of brass in a single phase induction furnace. If the melt is to be carried out in 11/4 hrs, what must be the average power input to the furnace? Specific heat of brass = 0.094, Latent heat of fusion = 38.88Kcal/Kg, Melting point of brass = 9200C, Furnace efficiency = 70%. **(May 06)**

15. i. Explain in brief how heating is done in the following cases?
a. Resistance heating,
b. Induction heating
c. Dielectric heating.
ii. 90Kg of tin is to smelt during an hour in smelting furnace. Determine the suitable rating of the furnace, it's melting temperature = 230^{0}C, specific heat = 0.055, latent heat of liquidification is 13.3 Kcal/Kg. Take the initial temperature of the metal as 35^{0}C. **(Apr 05, Nov 03)**

16. With a neat sketch explain the working principle of coreless type induction furnace. **(Apr 05, Nov 03)**

17. What are the advantages of electrically produced heat? What are the proper ties to be possessed by the element used in resistance oven? What are properties element must possess. **(Apr 05, 02, Nov 03)**

18. i. What are the factors to be considered for inductor design in induction heating?
ii. Give some applications of induction heating. **(Apr 04)**

19. i. What are the advantages and disadvantages of high frequency heating?
ii. What are various reasons of heating element failure? **(Apr 04)**

20. i. With a neat sketch explain the construction and principle of indirect core type induction furnace.
ii. How the defects of above furnaces can be removed Discuss about such formulae. **(Apr 04)**

21. Explain the principal of Induction heating ? What are the applications of induction heating and what are the factors considered to design induction heating ? **(Apr 04, Nov 03)**

22. Discuss the different methods of electric heating, heat transfer and their relative merits. **(Nov, Apr 03, Dec 02)**

23. A 20KW single-Phase, 220V resistance oven employs circular nichrome wire for its heating element, if the wire temperature is not to exceed 1227^{0} and the temperature of the charge is to be 427^{0}C, calculate the size and length of the wirerequired. Assume emissivity = 0.9, radiating efficiency = 0.6 and specific resistance of wire = 1.09 X 10^{-6} Ohm-m. **(Apr**

03)

24. A low frequency Induction Furnace whose secondary voltage is maintained constant at 12 Volts takes 300 Kw at 0.65p.f.when the heat of the charge and reactance to remain constant, find the height upto which the hearth should be filled to obtain maximum heat. **(Apr 03)**

25. An electric arc furnace consuming 5KW takes 15 minutes to just melt 1.5Kgs of aluminum, the initial temperature being 15°C. Find the efficiency of the furnace. Specific heat of aluminum is 0.212, melting point 658°C and latent heat of fusion is76.8Cal per gram. **(Apr 03)**

26. Explain why very high frequency arc not used for dielectric heating. **(Dec 02)**

27. Short notes on Ajax watt furnace. **(Dec 02)**

28. Give the relative advantages and disadvantages of direct and indirect electric arc furnaces. **(Dec 02)**

29. What are the advantages of high frequency induction furnace ? **(Apr 02)**

30. Explain the principal of high frequency capacitance heating. What are its practical limitations? Mention two applications. **(Apr 02)**

31. Write short notes on 'Electrodes and power supply controls in arc furnaces'. **(Apr 02)**

32. A 40 KW, 3-phase, 400 V resistance oven is to employed Ni-cr strip of 0.3 mm thickness. The heating elements are star connected. If the wire temperature is to be 1127^0C and that of charge is 727^0C estimate the suitable width and length of wire required. Radiation efficiency = 0.6. Specific resistance of Ni-cr = 1.03 x 10^{-6} Ohm-mtr. Emissivity = 0.9. **(May 02)**

33. What is dielectric heating ? How temperature is controlled in direct arc furnace.

34. Explain the operation of
    i. Indirect arc furnace
    ii. High frequency induction furance

35. Estimate the efficiency of induction furnace which takes 16 min. to melt 2 kg of aluminium, the inpurt being 5 KW and initial temperature 20^0C.
    Specific heat of aluminium : 880 J/kg/^{0}C Melting Point : 660^0C Latent heat : 32 KJ/kg.

36. A plywood board of 0.5 x 0.25 x 0.02 mtrs is to be heated from 25^0C to 125^0C in 10 min. by dielectric heating employing a frequency of 30 Mhz. Determine power required in this heating process. Assume specific heat of wood 1500/J/Kg/^{0}C. Weight of wood 600 kg/m^3 and efficiency of the process 50%.

37. A low frequency induction furnace whose secondary voltage is maintained constant at 10V tones, 400 KW at 0.6 p.f. when the hearth is full. Assume the resistance of the secondary circuit to vary inversely as the height of the charge and reactance remain constat. Find the height upto which the hearth should be filled to obtain max. heat.

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38. An electrical toaster consists of two resistance elements each of 190 Ohms. Calculate power drawn from 250 V a.c. single phase supply when the elements are connected in (a) parallel (b) series.

In jealousy there is more of self-love than love.

- Francois De La Rochefoucauld

UNIT-III

1. i. Describe the various methods of current flow control in welding transformers.
   ii. Describe butt welding and its various applications. **(May13)**

2. discuss the principle of arc welding. b) Explain the difference between carbon arc welding and metallic arc welding. Also their relative merits and demerits. **(July-12)**

3. i Define the following terms
   i) Squeeze time ii) Weld time iii) Hold time

   ii Explain the following resistance welding process:
   i) Spot welding ii) Seam welding iii) Projection welding iv) Butt welding **(Nov/Dec 2012)**

4. Write short notes on resistance welding. **(Dec, Apr 02)**

5. Compare resistance welding and arc welding. **(Dec 02)**

6. Explain the different methods of electric welding and relative merits. **(Dec 02)**

7. Give the comparison between A.C. and D.C. welding. **(Dec 02)**

8. i. Explain the principle of arc welding. Compare and contrast carbon and metallic arc welding processes.
   ii. A slab of insulating material 150 cm^2 in area and 1 cm thick is to be heated bydielectric heating. The power required is 400 watts at 30 MHZ. Material has permittivity 5 and p.f 0.05. Determine the necessary voltage necessary. Absolute permittivity = 8.854×10^{-12} F/m. **(Dec 02)**

9. i. Describe various types of Electric Arc welding processes. **(Dec 02)**
   ii. Compare resistance welding and arc welding.

10. Distinguish between Butt welding and Spot welding ? What is meant by arc stability. **(AU 02)**

11. Name and describe various resistance welding process.

12. Discuss the principle of arc welding and the difference between carbon and metallic arc welding and their relative merits.

13. Explain resistance welding.

14. Explain seam welding.

15. Write short notes on Projection welding.

16. Write short notes on Submerged Arc Welding.

17. What are the various welding methods describe welding by resistance seem welding butt welding and projection welding.

18. What are the advantages of coated electrodes.

19. Discuss the fundamental of DC arc welding.

The jealous are possessed by a mad devil and a dull spirit at the same time.
- Johann Kaspar Lavater

20. Explain the principles of alternating current applied to welding.

21. What are the advantages of coated electrodes in welding process.

22. Enlist othe advantage of AC arc welding machines.

23. Describe the various methods of current flow control in welding transformers.

UNIT-IV

1. i State and explain laws of illumination.
   1.Solid angle 2.candela, 3.Luminous efficiency. 4.M.S.C.P. 5.M.H.C.P
   ii State and explain laws of illumination. (May-2013)

2. i discuss the laws of illumination and its limitations is actual practice.
   ii Two lamps of 300 CP and another 800 CP are hung at height of 10 meters and 30 meters respectively. The horizontal distance between the poles is 100 meters. Determine the illumination between and the mid point of the poles on the ground. (July-2012)

3. i Define :
   i) space to height ratio ii) specific output
   iii) coefficient of utilization iv) coefficient of reflection.
   ii A room measuring 20m×15m is to be illuminated by 10 lamps and the average illumination is to be 75 lux. Determine the MSCP of each lamp if the utilization and depreciation factors are 0.5 and 0.8 respectively. (Nov/Dec2012)

4. Define
   i. Mean spherical Candlepower
   ii. Mean horizontal Candlepower
   iii. Mean hemispherical Candlepower
   iv. Luminous flux. **(Aug 07, May 06)**

5. i. Discuss inverse square law and cosine law of Illustration.
   ii. A lamp fitted with 120^0 angled cone reflector illuminates circular area of 200 metres in diameter. The illumination of the disc increases uniformly from 0.5 metre-candle at the edge to 2 metre -candle at the centre. Determine (i) total light received (ii) Average illumination of the disc (iii) Average c.p. of the source. **(Aug, May 07, May 06, 05, Nov 03)**

6. i. Compare between filament lamp & Flower cent tube. **(Aug 07, Apr 05)**
   ii. The candle power of a lamp in all directions below the horizontal is 200. If this lamp is suspended 2mts above the center of a square table of n 1 m side, determine the maximum and minimum illumination.

7. i. Explain the measurement techniques used for luminous intensity.
   ii. Write short notes on:
   a. Bunsen photometer head
   b. Lummer - Brodherm photometer head
   c. Flicker photometer head. **(May 07, 06, 05, Aug 06, Nov 03)**

8. i. What do you mean by international luminosim curve's explain. **(May 07, Apr 03)**
   ii. Explain in detail the primary standard of luminous intensity with relevant diagram**.**

- Christopher Bryant

9. i. Explain Cos^3 ø law

   ii. A lamp of 500 candle power is placed at the centre of a room, 20m x 10m x 5m. Calculate the illumination in each corner of the floor and a point in the middle of a 10m wall at a height of 2m from floor.

(May 07, Apr 04, Nov 03)

10. i. Explain how the determination of Mean horizontal luminous intensity and polar curve is made.

    ii. Find the height which a light having uniform spherical distribution should be placed over a floor in order that the intensity of horizontal illumination at a given distance from its vertical line may be greatest. **(May 06,05)**

11. Along the center of a line of a corridor, number of lamps are fitted with reflectors. The distance between the two adjacent lamps is 7.5cm and the height of each lamp from the floor is 5m. The candlepower of each lamp is 100 in all directions below the horizontal. Determine the maximum and minimum illumination along the centerline of the floor and draw a graph showing the variation of the illumination along this line between the two lamps. **(May 06)**

12. i. Explain in detail the inverse square law.

ii. What are the various types of lighting schemes. Explain with relevant diagrams. **(Apr 05)**

13. i. Define Horizontal portal curve and Vertical polar curve.

    ii. It is required to provide an illumination of 100m candle in a factory hall 40mx10m. Assume that the depreciation factor is 0.8, coefficient of utilization is 0.4 and efficiency of lamp is 14 lumens per watt. Calculate the number of lamps and their disposition. **(Apr 05)**

14. i. Prove that 1 candle / sq.feet = □□ft-L

    ii. A lamp giving 300 c.p in all directions below the horizontal is suspended 2metres above the centre of a square table of 1metre side. Calculate the maximum and minimum illumination on the surface of the table. **(Apr 05, Nov 03)**

15. What is a polar curve? What is its importance to a source of light? **(Dec 03, Apr 02)**

16. Explain the principal of arc welding ? Compare contrast carbon & metallic arc welding processes?

(Dec 03, 02)

17. Explain :
    i. Luminous efficiency
    ii. MSCP
    iii. MHCP
    iv. Solid angle
    v. Mercury vapour lamp **(Apr 03, 02)**

18. Prove that luminous intensity of a point source is equal to the luminous flux per unit solid angle.

(Apr 03)

19. How will you measure the candle power of a source light. **(Apr 03)**

20. Define:
    i. MHSCP
    ii. Lowliness
    iii. Luminous intensity
    iv. Point source
    v. Luman
    vi. Uniform point source **(Apr 03)**

Things are pretty, graceful, rich, elegant, handsome, but until they speak to the imagination, not yet beautiful.

- Ralph Waldo Emerson

21. Define term
    i. Candela
    ii. Lux
    iii. Brightness constant
    iv. Illumination **(Apr 02)**
22. Explain the inverse square law of illumination. **(Apr 02)**

23. Define :
    i. Luminous intensity
    ii. Illumination **(Apr 02)**

UNIT-V

1. i Make a neat sketch of florescent lamp and explain its working.
   ii. What are the essential features of a good lighting scheme for interior of buildings?
   (May-2013)
2. Explain the principle of street lighting. With neat diagram, discuss different schemes of street lighting.
(July 2012)
3. i. Compare the merits and demerits of filament lamps and fluorescent lamps.
   ii. A corridor is lighted by lamps spaced 9.15 cm and suspended at a height of 4.575m above centre line of the floor. If each lamp gives 100 candle power in all directions below the horizontal, find the maximum and the minimum illumination on the floor along the center line. **(Nov-2012)**

4. i. Discuss about M.B Type mercury vapor lamp
ii. A room measuring 10m x 10m is to be illuminated by 5 lamps and the average illumination required is 40 lumens/m^2. Taking utilization and depreciations factor as 0.5 and 1.2 respectively, determine the man spherical candlepower per lamp. **(Sep 07, Aug 06, Apr 05)**

5. i. Discuss about street lighting.
   ii. Compare in detail the various features of industrial lighting and domestic lighting.
(Sep 06, May 06, 02)
6. Give the construction and working of the following types of lamps.
   i. Arc lamp
   ii. Neon lamp
   iii. Sodium lamp **(May 07, Apr 05)**

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(Sep 06, May 06, 02)
9. Give the construction and working of the following types of lamps.
   i. Arc lamp
   ii. Neon lamp
   iii. Sodium lamp **(May 07, Apr 05)**

10. i. Discuss about filament design incandescent lamps.
ii. What are the various factors involved in the selection of lamps and the illumination required for street lighting. **(May 06)**

11. i. Discuss the flood lighting with suitable diagrams.
ii. What do you understand by polar curves as applicable to light source? Explain. **(May 06, Nov 03)**

12. i. Compare a tungsten filament lamp with fluorescent lamp in detail.
ii. Explain with sketches the constructional features of a filament lamp. **(May 06)**

13. i. Enumerate various factors which have to be considered while designing any lighting scheme.
ii. Six lamps are used to illuminate a certain room. If the luminous eciency of each lamp is 11 lumens/watt and the lamps have to emit a total flux of 10,000 lumens, calculate.
a. the mean spherical luminous intensity
b. the cost of energy consumed in 4hours if the charge for electrical energy is 50 paise per unit.
(May 06, Apr 05, Nov 03)

14. i. What are the various type of lighting scheme.
ii. The illumination level of a field on account of sunlight when the sun is at 45 degrees above the horizon is 60,000 lum. How much illumination will be produced by sunlight under identical conditions, when the sun reaches an altitude of 60 degrees. **(Apr 04)**

15. write short notes on
i. High pressure mercury vapour lamp
a. M.a. type
b. M.T. type
c. M.B. Type
ii. Low pressure fluoroscent lamp
iii. Explain (Cos $\square\square^3$ law
iv. Inverse square law and corire law of ilumnation. **(Apr 04, 03, Nov 03)**

16. What are various factors to be considered in the design of factory lighting. Explain them. **(Nov 03, Dec 02)**

17. Draw the sketch of flourescent lamp. Explain its working. **(Apr 03, 02 Dec 02)**

18. Explain the Rossealis construction for calculating M.S.C.P. of lamp. **(Apr 03)**

19. Explain with sketch the construction and operation of an filament lamp. **(Apr 03)**

20. Explain how the standard lamps can be calibrated with respect to primary & secondary standards. **(Apr 03)**

21. What is stroboscopic effect and how is it minimised. **(Apr 02)**

22. Write short notes on sodium vapour lamp & its advantages. **(Apr 02, Dec 02)**

23. State the function of starter and chock in flouroscent lamp. **(Nov 02)**

24. A during hall 30mx15m with a ceiling height of 5m is to be provided with illumination of 120 lux. Taking a coeffcient of utilization of 0.5 and depreciation actor of 1.4, determine the number of fluorescent tubes required, their spacing, mounting height and total voltage. Take luminous efficiency of fluorescent tube as 40 lumens/watt for 80 Watt tube. **(Nov 02)**

25. A small light source with uniform intensity is mounted at a height of 10 metres 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 of that at A? **(Nov 02)**

26. i. With the help of a neat diagram, explain the principle of operation of fluorescent lamp.
    ii. A machine shop 30m long and 15m wide is to have a general illumination of 150 lux on the work plane provided by lamps mounted 5m above it. Assuming a coefficient of utilization of 0.55, determine suitable number and position of light. Assume any data if required. **(Nov 02)**

27. i. Explain the principle of operation of sodium vapour lamp and its advantages. **(Nov 02)**
    ii. A corridor is lighted by lamps spaced 9.15m apart and suspended at a height of 4.75m above the centre line of the floor. If each lamp gives 100 candle power in all directions, find the maximum and minimum illumination on the floor along the centre line. Assume any data if required.

28. i. What is meant by stroboscopic effect and how it is minimised?
    ii. A drawing hall measured 30M x 15M x 5M is to be provided with illumination of 100 lux. Assuming coefficient of utilization 0.5 and power factor 0.8. Determine the no.of lamps required their spacing, mainly higher and total wattage luminous efficiency of the clamp is 16.67 lumneous/watt for 300 watts. **(Nov 02)**

29. Discuss the
    i. Specular reflection principal
    ii. Diffusier principal of Street lighting
    iii. What is Glare **(Apr 02)**

UNIT-VI

1. i Compare various types of braking methods.
   ii. A 230V, 20HP shunt motor with full load speed of 1500 rpm is to be braked by plugging. If full load efficiency is 80%, armature and field resistances 0.3&! and 203&! respectively, calculate the initial braking torque.

(May-2013)

2. Explain electric braking by plugging. Why in case of shunt motor connections are reversed for armature?

(July-2012)

3. i Explain electric braking by plugging.
   ii. Discuss various factors which are taken into account while deciding the changeover from existing system of electrification to a new system of electrification. **(Nov-Dec-12)**

4. i Describe about duplication of railway transmission lines.
   ii. Write short notes on feeding and distributing system on A.C Traction and for DC tramways.

(Sep 07, May 06,04,03)

5. i. What are various types of electric braking used?
   ii. Explain how rheostatic braking is done in D.C. shunt motors and series motors.

(Sep 07, 06, May 07, 06, Nov 03)

6. i. Discuss the merits and demerits of the D.C and single phase AC systems for the main and suburban line electrification of the railways.
   ii. Which system you consider to be the best for the suburban railways in the vicinity of large cities? Given reasons for your answer. **(Sep, May 07, Aug, Apr 06, 05, 04)**

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   ii. Which system you consider to be the best for the suburban railways in the vicinity of large cities? Given reasons for your answer. **(Sep, May 07, Aug, Apr 06, 05, 04)**

10. i. Discuss relative merrits of
    a. 1500 Volts D.C
    b. 25 KV
    Single phase 50 Hz rectifier locomotive system for the main line electrification of a railway in an industrial belt where a grid net work exists.
    ii. Describe briefly with the help of neat sketch the single and double cater many over head line construction for railways. **(Sep 07, May 07, 06)**

11. i. Explain the characteristics of D.C. compound motors and explain its advantage over the series motor.
    ii. What are the requirements to be satisfied by an ideal traction system? **(Sep 07, May 07, 06,03)**

12. i. What are the requirements of good electric braking?
    ii. Explain the method of rheostatic braking. **(Sep 07, May 06,03)**

13. State the condition under which regenerative braking with d.c. series motor is possible and explain with the help of circuit diagram. Also explain the various methods of providing regeneration.
(Sep 07, Apr 05)

14. Describe how plugging, Rheostatic braking and Regenerative braking are employed with D.C. Shunt motors & D.C. Series motor in electric traction. How is braking torque varied ?
(Sep 07, Nov, Apr 03, Dec 02)

15. i. What are various electric traction systems in India & compare them. **(Sep 06, Apr 04, Nov 03)**
    ii. Give the features of various motors used in electric tractions.

16. i. What are the requirements of ideal electric traction **(Sep 06, Nov 03)**
    ii. What are advantages and disadvantages of electric traction?

17. i. Review the various systems of traction work.
    ii. Write short notes on sub-traction for single-phase A.C systems. **(Apr 05)**

18. i. Explain how rheostatic braking is done in case of induction motors and shunt motors.
    ii. Give the characteristics of D.C. shunt motors used in traction. **(Apr 05, 04)**

19. i. What are the advantages of electric braking over mechanical braking.
    ii. Explain regenerative braking of traction motors? **(Apr 04)**

20. What are the advantages and disadvantages of electrification of track? **(Apr 04)**

21. Discuss the Relative merits and demerits of Electric traction and the factors on which the choice of traction system depends. **(Apr 04, Nov 03, Dec 02)**

22. Write a note on feeding & distrubuting system on A.C. traction and for D.C. tram way's.
(Apr 04, 03)

To fear love is to fear life.
- Bertrand Russell

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23. Write a brief note on the single phase A.C. series motor and comment upon its suitability for traction services. How it compare in performance with the D.C. series motor. **(Apr 04, Nov 03)**

24. What are different systems of track electrification. **(Apr 03, 02)**

25. Discuss why a D.C. series motor is ideally suited for traction services. **(Apr 03, Nov 03)**

26. i. What are various types of traction motors?
ii. What are the advantages of series and parallel control of D.C. motors? **(Apr 03)**

27. i. Explain why a series motor is preferred for the electric traction.
ii. The characteristics of a series motor at 525 Volts are as follows.

CURRENT (A)	50	100	150	200
SPEED (RPM)	1200	952	840	745

Determine the current when working as a generator at 1000 R.P.M and loaded with a resistance of 3 ohms. The resistance of the motor is 0.5 ohms. **(Apr 03)**

28. Briefly explain about the A.C. motors used in traction. **(Apr 03)**

29. Explain the general features of traction motors. **(Nov, Apr 03, Dec 02)**

30. State the condition under which regenerative braking with D.C. series motor is possible and with the aid of diagrams of connection, explain various methods of providing regeneration. **(Nov 03)**

31. Explain the advantages of series parallel control of starting as compared to the rheostatic starting for a pair of D.C. Traction motors. **(Nov 03, 02)**

32. Explain clearly regenerative braking when used for D.C. series traction motor. How it is different from the regenerative braking as used for D.C. shunt motor ? How the starting torque varied?
(Apr, June 02)

33. Explain the method of plugging when induction motors are employed for electric traction.
(Apr, Dec 02)

34. i. Discuss various traction systems you know of ? **(Dec 02)**
ii. Explain the requirements for ideal traction and show which drive satisfies almost all the requirements.

35. i. Explain the general features of traction motors.
ii. A 250 tonne electric train maintains a scheduled speed of 30 kmph between stations situated 5km apart, with station stops of 30 sec. The acceleration is 1.8 kmphps. and the braking retardation is 3 kmph ps. Assuming a trapezoidal speed-time curve, calculate (i) maximum speed of the train (ii) energy output of the motors if the tractive resistance is 40 NW per tonne. **(Dec 02)**

36. i. Explain the advantages of series parallel control of starting as compared to the rheostatic starting for a pair of dc traction motors. **(Dec 02)**
ii. Discuss the main features of various train services. What type of servicescorrespond to trapezoidal and quardrilateral speed-time curves.

UNIT-VII

1. i. Draw the speed time curve for different services and explain them in detail
   ii. A suburban electric train has a maximum speed of 65kmph. It has a scheduled speed of 43.5 kmph with a stop of 30sec. The acceleration of the train is 1.3 kmphps. Calculate the retardation. The average distance between stops is 3 km. **(May-2013)**

2. Discuss how different parameters of speed-time curve will vary with the type of train service. **(July-2012)**

3. i Derive an expression for the distance traveled by an electric train using trapezoidal speed time curve.
   ii The average speed of a train is 50 kmph. Determine its maximum speed assuming trapezoidal speed-time curve, if the distance between the stops is 2.5km, acceleration 1.8 kmphps and retardation 3 kmphps.
(July-2012)

4. i. For a trapezoidal speed-time curve of an electric train, derive expression for maximum speed and distance between stops.
   ii. A mail is to be run between two stations 5kms apart at an average speed of 50km/hr. If the maximum speed is to be limited to 70km/hr, acceleration to 2km/hr/sec, braking retardation to 4km/hr/sec and coasting retardation to 0.1km/hr/sec, determine the speed at the end of coasting, duration of coasting period and braking period. **(May 07, 06, 05, Aug 06, Nov 03)**

5. i. Draw the speed-time curve of a suburban service train and explain.
   ii. A train accelerates to a speed of 48km/hr in 24sec. Then it coasts for 69sec under a constant resistance of 58 newton / tonne and brakes are applied at 3.3km/hr/sec in 11sec. calculate (i) the acceleration (ii) the coasting retardation (iii) the scheduled speed if station stoppage is 20secs. What is the effect of scheduled speed if station stoppage is reduced to 15sec duration, other conditions remaining same. Allow 10% for rotational inertia. **(May 07, Nov 03)**

6. Derive an expression for specific energy output on level track using a simplified speed-time curve. What purpose is achieved by this quantity? **(Nov 03)**

7. i. For a trapezoidal speed-time curve of an electric train, derive expression for maximum speed and distance between stops.
   ii. A mail is to be run between two stations 5kms apart at an average speed of 50km/hr. If the maximum speed is to be limited to 70km/hr, acceleration to 2km/hr/sec, braking retardation to 4km/hr/sec and coasting retardation to 0.1km/hr/sec, determine the speed at the end of coasting, duration of coasting period and braking period. **(May 07, 06, 05, Aug 06, Nov 03)**

8. i. Draw the speed-time curve of a suburban service train and explain.
   ii. A train accelerates to a speed of 48km/hr in 24sec. Then it coasts for 69sec under a constant resistance of 58 newton / tonne and brakes are applied at 3.3km/hr/sec in 11sec. calculate (i) the acceleration (ii) the coasting retardation (iii) the scheduled speed if station stoppage is 20secs. What is the effect of scheduled speed if station stoppage is reduced to 15sec duration, other conditions remaining same. Allow 10% for rotational inertia. **(May 07, Nov 03)**

9. Derive an expression for specific energy output on level track using a simplified speed-time curve. What purpose is achieved by this quantity? **(Nov 03)**

10. The maximum speed of a suburban electric train is 60km/hr. Its scheduled speed is 40km/hr and duration of stops is 30sec. If the acceleration is2km/hr/sec and distance between stops is 2kms, determine the retardation. **(May 06, 05)**

11. Which system you consider to be the best for the suburban railways in the vicinity of large cities? Given reasons for your answer. **(Apr 04)**

12. A locomotive accelerates a 350 tonne train up a gradient of 1 in 100 at 0.8km/hr/sec. Assuming the coefficient of adhesion to be 0.25, determine the minimum adhesive weight of the locomotive. Assume train resistance 40 newtons/tone and allow 10% for the effect of rotational inertia. **(Apr 04)**

13. Explain the requirements for ideal traction and show which drive satisfier almost all the requirements. **(Apr 04, 02 Dec 02)**

14. Derive from the first principles the relationship between acceleration retardation, max. speed, running time, distance between stops for a simplified speed time curve run of an electic than. **(Apr 04)**

15. Why the suburban railway & better in large cities - Explain. **(Apr 04, 03)**

16. Explain : Speed time curve for different services & explain **(Nov 03, Dec 02)**

17. For a quadrelateral speed time curve of electic traction, drive expression for the distance between stops & speed at end of coasting period. **(Apr 03)**

18. The maximum speed of a suburban electric train is 60km/hr. Its scheduled speed is 40km/hr and duration of stops is 30sec. If the acceleration is 2km/hr/sec and distance between stops is 2kms determine the retardation. **(Apr 03)**

19. A train is required to run between stations 1.6kms apart at an average speed of 40km/hr. The run is to be made from a quadrilateral speed-time curve. The acceleration is 2km/hr/sec. The coasting and braking retardations are 0.16km/hr/sec and 3.2km/hr/sec respectively. Determine the duration of acceleration, coasting and braking and the distance covered in each period. **(Apr 03)**

20. i. Briefly explain the a.c. motors used in traction.

ii. The scheduled speed of a trolley service is to be 53km/hr. The distance between stops is 2.8km. The track is level and each stop is of 30 sec duration. Using simplified speed-time curve, calculate the maximum speed, assuming the acceleration to be 2km/hr/sec, retardation 3.2km/hr/sec, the dead weight of the car as 16 tonnes, rotational inertia as 10% of the dead weight and track resistance as 40 newtons/tonne. If the overall efficiency is 80%, calculate (i) the maximum power output from the driving axles (ii) the specific energy consumption in watt-hr/tonne-km. **(Apr 03)**

21. Explain the terms

i. Average speed

ii. Scheduled speed

iii. Factors effecting specific energy consumption **(Dec 02, Apr 02)**

22. Discuss the factors which effect the scheduled speed of train. **(Dec 02)**

23. Define 'Coefficient of adhesion' and explain the factors on which it depends. **(Dec 02)**

24. Discuss the main features of various train services. What type of services correspond to trapizoidal and quadrelateral speed -type curves. **(Dec 02)**

The manner of giving is worth more than the gift.

- Pierre Corneille

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25. i. Define crest speed, average speed and schedule speed and discuss the factors which affect the schedule speed of a train. **(Dec 02)**

    ii. A train is required to run between the two stations 1.5 km apart at a schedulespeed of 36 km ph, the duration of stop being 25 sec. The braking retardation is 3 kmphps. Assuming a trapezoidal speed/time curve, calculate the acceleration if the ratio of maximum speed to average speed is to be 1.25.

26. i. Explain the general features of traction motors.

    ii. A 250 tonne electric train maintains a scheduled speed of 30 kmph between stations situated 5km apart, with station stops of 30 sec. The acceleration is 1.8 kmphps. and the braking retardation is 3 kmph ps. Assuming a trapezoidal speed-time curve, calculate (i) maximum speed of the train (ii) energy output of the motors if the tractive resistance is 40 NW per tonne. **(Dec 02)**

27. An electric train maintains a scheduled speed of 40 kmph between stations situated at 1.5 km apart. If is accelerated at 1.7 kmph.ps. and is braked at 3.2kmph.p.s. Draw the speed-time curve for the run. Estimate the enrgy consumption at the axle of the train. Assume tractive resistance constants at 50 NW per tonne and allow 10% for the effect of rotation inertia. **(Dec 02)**

28. A train runs at an average speed 45 km per hour between stations 2.5 km apart. The train accelerates at 2 k.m.p.h.p.s. and retards at 3 k.m.p.h.p.s. Find its maximum speed assuming a trapezoidal speed time curve. Calculate also the distance travelled by it before the brakes are applied. **[BHU, 1978]**

29. The schedule speed with a 200 tonne train on an electric railway with stations 777 metres about is 27.3 km. per hour and the maximum speed is 20 per cent higher than the average running speed. The braking rate is 3.22 km.p.h.p.s. and the duration of stop is 20 seconds. Find the acceleration required. Assume a simplified speed-time curve with free running at the maximum speed. **(A U, 1976)**

30 . A suburban electric train has a maximum speed of 65 km.p.h. The schedule speed including a station stop of 30 seconds is 43.5 km.p.h. If the acceleration is 1.3 km.p.h.s. Find the value of retardation when the average distance between stops is 3 km. **(Gorakhpur Uni, 1975)**

25. An electric train is accelerated uniformly from rest to a speed of 40 km.p.h. The period of acceleration being 20 seconds. If it coasts for 60 seconds against a constant resistance of 50 N-Tonne and is brought to rest in a further period of 10 seconds by braking, determine :

    i. The acceleration
    ii. The coasting retardation
    iii. The braking retardation **(Punjab Univ., 1973)**
    iv. Distance travelled
    v. Schedule speed with station stops of 10 seconds duration. Allow 10 per cent for rotational inertia.

26. A 230 V d.c. shunt motor has an armature resistance of 0.06 ohm and with full field has an e.m.f. of 225 V at a speed of 1500 rpm. It is coupled to an over hauled load with a torque of 225 N-m. Determine the lowest speed at which the motor can hold the load by regenerative braking.

[AMIE (Sec-B), Winter 1980]

UNIT-VIII

1. i Define the terms

   a) adhesive height and b) Coefficient of adhesion.

   ii Derive an expression to calculate the specific energy consumption of a main line service.

   iii An electric train has an average speed of 42km/hr on a level track between stops 1400m apart. It is accelerated at 1.7 km/hr/sec and it is braked at 3.3 km/hr/sec. Assuming tractive resistance as 50 N/ ton and allowing 10% for rotational inertia, estimate the specific energy consumption. **(May-2013)**

2. A 400 ton goods train is to be hauled by a locomotive on a gradient of 2% with an acceleration of 1 kmphps. Coefficient of adhesion is 0.2, track resistance is 40N/Ton and effective rotating masses 10% of dead weight. Find the weight of the locomotive and number of axels if the axle load is not to be beyond 22 tons. **(July-2012)**

3. i Determine and discuss the significance of the following terms:

   i) Dead weight ii) Accelerate weight. iii) Adhesive weight.

   ii What is coefficient of adhesion? How the value of coefficient of adhesion affects the slipping and skidding of the driving wheels of traction unit? **(Nov-Dec-2012)**

4. i. An electric locomotive is required to haul a train of 12 coaches each weighing 30 tonnes on the main line service requiring an initial acceleration of 0.8km/hr/sec up a gradient of 1 in 100. Estimate the adhesive weight and hence the number of driving axles the locomotive must have, if the permissible axle loading is 20 tonnes per axle. Assuming for rotational inertia to be 4%, for the coaches and 15% for the locomotive. Maximum coecient of adhesion is 0.2 and the tractive resistance 5kg/tonne.

   ii. An electric train weighing 200 tonnes has 8 motors geared to driving wheels, each wheel is of 80cms diameter. Determine the torque developed by each motor to accelerate the train to a speed of 48km/hr in 30seconds up a gradient of 1 in 200. The tractive resistance of 50newtons/tonne, the eect of rotational inertia is 10% of the train weight, the gear ratio is 4 in 1 and gearing eciency is 80%.

(Aug 07, 06, May 06, 05)

5. i. Define specific energy output and specific energy consumption ?

   ii. An electric locomotive of 100 tonnes can just accelerate a train of 500 tonnes (trailing weight) with an acceleration of 1km/hr/sec on an up gradient 1 in 1000. Tractive resistance of the track is 45 newtons/ tonne and the rotational inertia is 10%. If this locomotive is helped by another locomotive of 120 tonnes, find (i) the trailing weight that can be hauled up the same gradient, under the same condition (ii) the maximum gradient, the trailing hauled load remaining unchanged. Assume adhesive weight expressed as percentage of total dead weight to be same for both the locomotives.**(Aug 07, Apr 03)**

6. i. A train maintains the scheduled speed of V_s = 40km/hr while running the distance of 3.2km with 30sec stops. It accelerates at 2.4 km/hr/sec and brakes at 3.6km/hr/sec. Assuming a simplified trapezoidal speed-time curve, calculate (i) the maximum speed (ii) average energy output of the motor in watt-hr/ tone-km, if the tractive resistance averages 45newtons/tonne and additional rotational inertia 8%.

ii. Derive expression for the specific energy output for a trapezoidal speed-time run of an electric train.

(May 07, Apr 04)

7. i. An electric locomotive is required to haul a train of 12 coaches each weighing 30 tonnes on the main line service requiring an initial acceleration of 0.8km/hr/sec up a gradient of 1 in 100. Estimate the adhesive weight and hence the number of driving axles the locomotive must have, if the permissible axle loading is 20 tonnes per axle. Assuming for rotational inertia to be 4%, for the coaches and 15% for the locomotive. Maximum coecient of adhesion is 0.2 and the tractive resistance 5kg/tonne.

   ii. An electric train weighing 200 tonnes has 8 motors geared to driving wheels, each wheel is of 80cms diameter. Determine the torque developed by each motor to accelerate the train to a speed of 48km/hr in 30seconds up a gradient of 1 in 200. The tractive resistance of 50newtons/tonne, the eect of

rotational inertia is 10% of the train weight, the gear ratio is 4 in 1 and gearing eciency is 80%.
(Aug 07, 06, May 06, 05)

8. i. Define specific energy output and specific energy consumption ?
   ii. An electric locomotive of 100 tonnes can just accelerate a train of 500 tonnes (trailing weight) with an acceleration of 1km/hr/sec on an up gradient 1 in 1000. Tractive resistance of the track is 45 newtons/ tonne and the rotational inertia is 10%. If this locomotive is helped by another locomotive of 120 tonnes, find (i) the trailing weight that can be hauled up the same gradient, under the same condition (ii) the maximum gradient, the trailing hauled load remaining unchanged. Assume adhesive weight expressed as percentage of total dead weight to be same for both the locomotives.**(Aug 07, Apr 03)**

9. i. A train maintains the scheduled speed of V_s = 40km/hr while running the distance of 3.2km with 30sec stops. It accelerates at 2.4 km/hr/sec and brakes at 3.6km/hr/sec. Assuming a simplified trapezoidal speed-time curve, calculate (i) the maximum speed (ii) average energy output of the motor in watt-hr/ tone-km, if the tractive resistance averages 45newtons/tonne and additional rotational inertia 8%.

ii. Derive expression for the specific energy output for a trapezoidal speed-time run of an electric train.
(May 07, Apr 04)

10. Derive expression for the tractive eort for a train on a level track. **(Aug, May 06, 05)**

11. i. Explain briefly the tractive effort required, while the train is moving up the gradient and down the gradient.
    ii. An electric train weighing 450 tonnes has to maintain an average speed of 40km/hr between two stations 3km apart on an incline of 1 in 200. The train accelerates at 2km/hr/sec and retards at 3km/hr/ sec. The tractive resistance is 5kg/tonne and the allowance for rotational inertia is 10%. Assuming at trapezoidal speed-time curve, find the energy consumption for the run, while going up the gradient. The overall eciency be taken as 65%. **(May 06, 05)**

12. i. Explain dead weight, accelerating weight and train resistance referred to traction.
    ii. An electric train has an average speed between start to stop, Va = 40km/hr, acceleration 2.4km/hr/sec and retardation 4km/hr/sec, specific tractive resistance 55 newtons/tonne and average motor efficiency 75%. Estimate the average consumption of energy over a run of 800m, assuming trapezoidal speed-time curve. Add 8% for the rotational inertia. **(Apr 04)**

13. An electric train weighing 450 tons has to maintain an average speed of 40km/hr between two stations 3km apart on an incline of 1 in 200. The train accelerates at 2km/hr/sec and retards at 3km/hr/sec. The tractive resistance is 5kg/tonne and the allowance for rotational inertia is 10%. Assuming a trapezoidal speed-time curve, find the energy consumption for the run, while going up the gradient. The overall efficiency be taken as 65%. **(Apr 04)**

14. Explain briefly the tractive effect required, while the train is moving up the gradient & down the gradient. **(Apr 04)**

15. Explain Energy o/p tractive effort on level track **(Nov, Apr 03, Dec 02)**

ii. A 400 tonne goods train is to be hauled by a locomotive up a gradient of 2% with acceleration of 1km/hr/sec, coefficient of adhesion 20%, track resistance 40newtons/tonne and effective rotating masses 10% of the dead weight. Find theweight of the locomotive and the number of axles if the axle load is not to increase beyond 22 tonnes. **(Nov 03)**

16. i. Explain the terms
a. Adhesive weight
b. Train resistance
c. Speed time curve

ii. A 200 tonne electric train with scheduled speed of 40 kmph runs between two stations 2 km apart with an acceleration of 2 kmphps and braking retardation of 3 kmphps. The train resistance is 50 Nw-m / tonne, effect of rotational inertia 10%, over all efficiency 70% and station stop 10 sec. calculate.
a. The maximum power output from the wheels
b. The specific energy consumption. **(Dec 02)**

17. i. Define the term 'co-efficient of adhesion' and explain the factors on which it depends.

ii. Calculate the adhesive weight of a locomotive which accelerates up a gradient of 1 in 100 at 0.8 kmphps. The self weight of locomotive is 350 Tonnes.Coefficient of adhesion is 0.25. Assume a train resistance of 45 N-m/Tonne and allow 10% for the effect of rotational inertia. **(Dec 02)**

18. i. Explain the terms (i) tractive effort (ii) coefficient of adhesion (iii) specific energy consumption of train (iv) tractive resistance.

ii. A 100 hp motor has a temperature rise of 50^0C when running continuously onfull load. It has a time constant of 90 minutes. Determine ½ hr rating of the motor for same temperature rise. Assume that the losses are proportional to the square ofthe load and motor cools completely between each load period. **(Dec 02)**

19. An electric train weighing 300 tonnes is subjected to a unform acceleration from rest to the speed of 48 km/h is 20 second upto a gradient of 1 in 100. Calculate tractive effect if train resistance is 52 NW per tonne. The rotations inertia being 10% of dead weight. **[AMIE (Sec-B), May 1981]**

20. A 300 tonnes E.M.U. train is started with a uniform acceleration and reaches a speed of 40 km.p.h. in 24 sec. on level section. Find the specific energy consumption, assuming a simplified trapezoidal curve, with rotational inertia as 8% retardation as 3 km.p.h.p.s., the distance between two stations as 3 km, efficiency of motor as 0.9 and train resistance 5 kg/tonne. **[AMIE (Sec-B), May 1982]**

21. Calculate the specific energy consumption if a maximum speed of 12.20 meters / sec and for a given run of 1525 metres an acceleration of 0.366 m/sec^2 are desired. Train resistance during acceleration is
52.6 Newtons / 100 kg and during costing is 6.12 Newtons / 1000 kg, 10% being allowable for rotational inertia. The efficiency of the equipment during the acceleration period is 50%. Assume a quadrilateral speed time curve. **[AMIE (Sec-B), May 1975]**

22. A train with an electric locomotive weighing 300 tonnes is to be acclerated up a gradient of 1 in 100 at an acceeration of 1 km.p.h.p.s. If the train resistance, co-efficient of adhesion and effect of the rotational inertia are 75 Nw per tonne, 0.3 and 15% of the dead weight respectively, determine the minimum adhesive weight of the locomotive. **[AMIE (Sec-B), Dec. 1974]**

23. Define the term ‘Co-efficient of adhesion’ and explain the factors on which it depends.

24. Derive expression for (i) the tractive effort for propulsion of a train on level track (ii) the tractive effort for propulsion of a train up and down a gradient.

25. Write a short notes on:
i. Track equipment and collector gear
ii. Conductor shoe
iii. Bow and pantograph collectors

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26. Explain the speed control technique of single phase and three-phase series motors in electric traction.

27. An electric train weighing 200 tonne is accelerated up a gradient of 1 in 250 at a mean acceleration of 1.5 kmph upto a speed of 40 kmph. Calculate:

    i. the tractive effort required
    ii. the output at the end of the accelerating period. The train resistance is 4 kg/tonne and effective weight is 10% more than the dead weight.

7.1.12
Assignments

Unit I

1. An induction motor has a short circuit current equal to 6 times the full load current at normal voltage. It has a slip of 5 % on full load. Calculate the starting torque in terms full load torque if started by:
a)A star-delta starter.
b)An auto- transformer with 60% tapping. Ignore the magnetizing current

2 Write short notes on Continuous rating motor.

3 Motor for intermittent loads cycle constituted as follows, 0 to 15 sec load rising from 0 to 1050 hp, 15 to 85 sec constant load of 600 hp, 85 to 95 sec regenerative braking with the hp returned falling uniformly from 200 to 0 hp, 95 to 120 sec. motor is at rest. Determine the continuous rating of the motor that would be suitable for the load cycle. Assume the rating to depend upon the:
i) rms value of loading. ii) Average value of loading

4 what is an electric drive? What are its advantages? Compare a group drive and an individual drive.

5 Explain the various methods of speed control of AC motors.

Unit II

1 Explain the principle of dielectric heating and its applications
2 The power required for dielectric heating of a slab of resin 150sq cm in area and 2 cm thick is 200 watts at a frequency of 30 MHz. The material has relative permittivity of 5 and a pf 0.05. determine the voltage necessary and current flowing through the material. If the voltage is limited to 600V, what will be the value of the frequency to obtain the same heating?
3 what are the various types of electric heating methods? Write short notes on each of them.
4 Explain the theory of Induction heating and state its applications.
5 State and explain different types induction heating methods

Unit III

1 a) Define the following terms
i) Squeeze time
ii) Weld time
iii) Hold time
2 b)Explain the following resistance welding process:
i) Spot welding
ii) Seam welding
iii) Projection welding
iv) Butt welding
3 Describe the various methods of current flow control in welding transformers.
4 Describe butt welding and its various applications.
5 a) discuss the principle of arc welding. b) Explain the difference between carbon arc welding and metallic arc welding. Also their relative merits and demerits

Unit IV

1. a) Define :
   i) space to height ratio
   ii) specific output
   iii) coefficient of utilization
   iv) coefficient of reflection

2 b) A room measuring 20m×15m is to be illuminated by 10 lamps and the average illumination is to be 75 lux. Determine the MSCP of each lamp if the utilization and depreciation factors are 0.5 and 0.8 respectively.

3 What are the various methods of resistance heating? Describe each of them with sketches.

4 State and explain laws of illumination.
   i) Solid angle ii)candela, iii)Luminous efficiency, iv) M.S.C.P And v) M.H.C.P

5 A point source of light having a candle power of 100 is placed 10m height above the ground. Find the illumination
   i) Exactly below the light and
   ii)25m away from the source of light with respect to ground.

Unit V

1. Compare the merits and demerits of filament lamps and fluorescent lamps.
2 A corridor is lighted by lamps spaced 9.15 cm and suspended at a height of 4.575m above centre line of the floor. If each lamp gives 100 candle power in all directions below the horizontal, find the maximum and the minimum illumination on the floor along the center line.
3 Make a neat sketch of florescent lamp and explain its working.
4 What are the essential features of a good lighting scheme for interior of buildings?
5 Explain the principle of street lighting. With neat diagram, discuss different schemes of street lighting

Unit VI

1. Explain electric braking by plugging.
2. Discuss various factors which are taken into account while deciding the changeover from existing system of electrification to a new system of electrification.
3. Compare various types of braking methods.
4. A 230V, 20HP shunt motor with full load speed of 1500 rpm is to be braked by plugging. If full load efficiency is 80%, armature and field resistances 0.3&! and 203&! respectively, calculate the initial braking torque.
5. Explain electric braking by plugging. Why in case of shunt motor connections are reversed for armature?

Unit VII

1. Derive an expression for the distance traveled by an electric train using trapezoidal speed time curve.T
2. he average speed of a train is 50 kmph. Determine its maximum speed assuming trapezoidal speed-time curve, if the distance between the stops is 2.5km, acceleration 1.8 kmphps and retardation 3 kmphps.
3. Draw the speed time curve for different services and explain them in detail.
4. A suburban electric train has a maximum speed of 65kmph. It has a scheduled speed of 43.5 kmph with a stop of 30sec. The acceleration of the train is 1.3 kmphps. Calculate the retardation. The average distance between stops is 3 km.
5. Discuss how different parameters of speed-time curve will vary with the type of train service

Unit VIII

1 a) Determine and discuss the significance of the following terms:
- i) Dead weight
- ii) Accelerate weight.
- iii) Adhesive weight.

2 What is coefficient of adhesion? How the value of coefficient of adhesion affects the slipping and skidding of the driving wheels of traction unit?

3 Define the terms
i) adhesive height and ii) Coefficient of adhesion.

4 Derive an expression to calculate the specific energy consumption of a main line service.

5 An electric train has an average speed of 42km/hr on a level track between stops 1400m apart. It is accelerated at 1.7 km/hr/sec and it is braked at 3.3 km/hr/sec. Assuming tractive resistance as 50 N/ ton and allowing 10% for rotational inertia, estimate the specific energy consumption.