SYED AMMAL ENGINEERING COLLEGE

Approved by the AICTE, New Delhi, and Affiliated to Anna University, Chennai, Govt. of Tamilnadu
Dr. E.M.Abdullah Campus, Ramanathapuram – 623 502.

Department of Electrical and Electronics Engineering

EE6801- ELECTRIC ENERGY GENERATION UTILISATION AND CONSERVATION

TWO MARKS QUESTIONS AND ANSWERS

UNIT 1. ELECTRIC DRIVES & TRACTION

1) What are the requirements of an ideal traction system?

1. Speed control should be easy.
2. The starting tractive effort should be high so as to have rapid acceleration. The wear on the track should be minimum.
3. Pollution free
4. The equipment should be capable of withstanding large temporary loads. Low initial and maintenance cost.
5. There should be no interference to the communication lines running along the lines.
6. Braking should be such that minimum wear is caused on the brake shoes.

2) Name the various systems of traction.

1. Direct steam engine drive
2. Direct Internal Combustion Engine Drive
3. Steam Electric Drive
4. Internal Combustion Engine Electric Drive
5. Petrol Electric traction
6. Battery Electric Drive

3) Classify the supply system for electric traction.

A. D.C system
B. A.C system i) Single phase ii) Three phase
C. Composite system i) Single phase AC-DC ii) single phase-Three phase

4) What are the advantages of electric traction?

1. High starting torque
2. Less maintenance cost
3. Cheapest method of traction
4. Rapid acceleration and braking
5. Less vibration

6. Coefficient of adhesion is better
7. It has great passenger carrying capacity at higher speed.

5) What are the disadvantages of electric traction?

1. High capital cost
2. Problem of supply failure
3. Additional equipment is required for achieving electric braking and control
4. The leakage of current from the distribution mains and drop of volts in the track are to be kept within the prescribed limits.
5. The electrically operated vehicles have to move on guided track only.

6) Define average speed and scheduled speed.

Average speed is the ratio of distance between two consecutive stations to time taken to travel the distance; Scheduled speed is the ratio of distance between two consecutive stations to total time taken for moving including the time for stops.

7).Name the different stages of train movement

1. Acceleration
2. Constant speed or free running
3. Coasting, running with power switched off and brake not applied
4. Retardation with braking

8) What are the essential features (electrical) of an ideal traction motor

1. High starting torque.
2. Series speed torque characteristics
3. Simple speed control
4. Possibility of regenerative braking

9) What is the need for traction motor control?

1. To limit starting current
2. Smooth acceleration without jerk
3. Both manual and automatic control should be possible.

10) What is meant by speed-time curve? Why it is used?

The curve drawn between speed in Kw/hr along Y-axis and time in seconds along X-axis is called speed=time curve. The speed time curve gives the complete information about the motion of the train.

This curve gives the speed at various time instants after the start of run directly. Slope of the curve at any point gives the speed at that instant. The area under the curve gives the total distance traveled by the train.

11) What do you mean by average speed in electric traction?

The mean of the speeds from the start to stop i.e the distance between two stops divided by the actual time of run is known as average speed.
Average speed= Distance between stops in km/ Actual time of run in hours

12) What do you mean by schedule speed in electric traction?

The ratio of distance covered between two stops and total time of run including time of stop is known as schedule speed.

Schedule speed = Distance between stops in km/ (Actual time of run in hours+ Stop time in hours)The schedule speed is always smaller than the average speed. The difference is large in case of urban and suburban services and is negligibly small in case of main line service.

13) What is tractive effort?

The effective force necessary to propel the train at the wheels of the locomotive to which the motor is geared is called the geared effort. It is measured in Newton and is tangential to the driving wheels.

Total tractive effort required to run a train on track = Tractive effort to produce acceleration + Tractive effort to overcome effect of gravity + Tractive effort to overcome train resistance.

14) What are the factors affecting energy consumption?

The various factors affecting energy consumption are

1. Distance between the stops

The greater the distance between the stops, the lesser will be the specific energy consumption for suburban service is 50 to 75 watts-hour/ ton-km and for main line service it is between 18 to 32 watt T hour/ton-km.

2. Train resistance

The train resistance depends upon the nature of track, speed of the train and shape of the rolling stock, particularly the front and rear portions of the train. If the train resistance is greater, the specific energy consumption is more.

3. Acceleration and retardation

If the acceleration and retardation increases, the specific energy consumption is increased.

4. Gradient

The steep gradients will involve more energy consumption though regenerative braking is applied.

5. Train equipment

More efficient train equipment will reduce the specific energy consumption.

15) Define dead weight, adhesive weight.

1. Dead weight
2. The total weight of locomotive and train to be pulled by the locomotive is known as dead weight.
3. Adhesive weight
4. The total weight to be carried on the driving wheels is known as the adhesive weight.

16) Name the various methods of traction motor control.

There are various methods for controlling the speed of d.c series motors. They are

1. Rheostatic control
2. Series parallel control
3. Field control
4. Buck and Boost method
5. Metadyne control
6. Thyristor control

17) What are the basic requirements of braking system?

1. The basic requirements of a braking system are given below
2. It should be simple, robust, quick and reliable in action.
3. Easy to use for driver to operate.
4. Maintenance should be minimum.
5. The braking system should be inexhaustible.

- In case of emergency braking, safety consideration is taken into account.
- Kinetic energy of the train must be storable during braking which could be used subsequently during acceleration of the train.

18) What are the various methods of applying electric braking?

There are three methods of applying electric braking; Plugging or Reverse current braking, Rheostatic braking, Regenerative braking.

19) Name the advanced methods of speed control of traction motors.

The latest methods of speed control of traction motors are

1. Tap changer control
2. Thyristor control
3. Chopper control
4. Microprocessor control

20) What are the advantages of microprocessor based control of traction motors?

The advantages of microprocessor based drives are

1. High speed of response
2. High accuracy
3. Over voltage and over speed protection.
4. Electronic interlocking
5. Less sensitive to temperature variations and drift.
6. Numbers of components used are less.

21) What is meant by drives?

Systems employed for motion control are called “DRIVES” and drives employ any of the prime movers such as, diesel or petrol engines, gas or steam turbines, hydraulic motors and electric motors for supplying mechanical energy for motion control. Drives employing electric motion known as “Electric Drives”.

22) Define an electric drive.

The combination of an electric motor, the energy transmitting shaft and the controlling devices for controlling the performance of the motor is called an electric drive

23)Name the factors governing the selection of a motor for a particular purpose.

1. Mechanical output required
2. Electrical input required
3. Environment
4. Cost
5. Electrical characteristics
6. Mechanical characteristic
7. Size and rating

24) How the types of loads of a drive can be classified?

1. Continuous loads (pumps)
2. Intermittent loads (mixer)
3. Fluctuating loads(traction)

25) What are the essential requirements of braking in an electrical rive?

1. Fast reliable and controllable
2. Stored energy should be dissipated efficiently
3. Failure in any part should result in braking only.

26) Name the 2 types of braking

1. Mechanical (friction)
2 . Electrical (electro dynamic)

27) State the merits and de merits of electrical braking.

Merits:
1. Less maintenance
2. No dirt
3. Regenerative braking possible

Demerits:

1. Motor should have suitable braking characteristics.
2. no holding torque
3. During failure of supply mechanical braking needed.

28) Mention the parts of electrical drives?

1. Electric motors and load
2. Power modulator
3. Sources
4. Control unit
5. Sensing unit

29) Mention the application of electric drives?

1. Paper mills
2. Electric traction
3. Cement mills
4. Steel mills.

30) Mention the different types of classes of duty?

1. Continuous duty
2. Discontinuous duty
3. Short time duty
4. Intermittent duty

31) Define equivalent current method.

The motor selected should have a current rating more than or equal to the current. It is also necessary to check the overload capacity of the motor. This method of determining the power rating of motor is known as the equivalent current method.

32) What are the three methods of operation of electric drive?

1. Steady state

2. Acceleration including starting
3. Deceleration including stopping.

33) Define four-quadrant operation?

A motor operate in two modes, motoring and braking. In motoring, it converts electrical energy into mechanical energy, which supports its motion. In braking it works as a generator converting mechanical energy into electrical energy and thus, opposes the motion. Motor can provide motoring and braking operations for both forward and reverse directions.

34) Mention the types of braking?

Regenerative braking, dynamic braking & Plugging

35) Define and mention different types of braking in a dc motor?

In braking, the motor works as a generator developing a negative torque which opposes the motion. Types of regenerative braking are Dynamic (or) Rheostat braking; and plugging (or) reverse voltage braking.

6) List the drawbacks of armature resistance control?

In armature resistance control, speed is varied by wasting power in external resistors that are connected in series with armature. Since it is an inefficient method of speed control, it was used in intermittent load application where the duration of low speed operation forms only a small proportion of total running time.

37) Mention the methods of armature voltage control dc motor?

When the supply voltage is ac

i) Ward-Leonard schemes ii) Transformer with taps and uncontrolled rectifier bridge iii) Static Ward-Leonard scheme (or) controlled rectifiers

When the supply is dc

i) Chopper control

38) What are the disadvantages of conventional ward-Leonard schemes?

Higher initial cost due to use of two additional machines. Large weight and size. Needs more floor space and proper foundation. Required frequent maintenance. Higher noise and higher loss.

39) Mention the drawbacks of rectifier fed dc drives?

1. Distortion of supply
2. Low power factor
3. Ripple in motor current

40) What are the different methods of speed control of induction motors?

1. Stator voltage control
2. Supply frequency control
3. Rotor resistance control
4. Slip power recovery control

41) What is meant by stator voltage control?

The speed of the induction motor can be changed by changing the stator voltage. Because the torque is proportional to square of the voltage.

42) Mention the applications of stator voltage control?

The stator voltage control method is suitable for applications where torque demand reduced with speed, which points towards its suitability for

i) Fan ii) Pump drives

43) Mention the applications of AC drives?

AC drives are used in a number of applications such as fans, blowers, mill run-out tables, cranes, conveyors, traction etc.

44) What are the advantages of stator voltage control method?

1. The control circuitry is simple
2. Compact size

3. Quick response time

There is considerable savings in energy and thus it is economical method as compared to other methods of speed control.

45) What are the features of variable frequency control?

1. Speed control and braking operation are available from zero speed to above base speed.
2. Drop in speed from no load to full load is small.
3. Copper losses are low. Hence efficiency and power factor are high as the operation is restricted between synchronous speed and maximum torque point at all frequencies.
4. During transient (starting, braking and speed reversal) operation can be carried out at the maximum torque with reduced current giving good dynamic response.

46) What is meant by frequency control of induction motor?

The speed of the induction motor can be controlled by changing the supply frequency, because the speed is directly proportional to supply frequency. This method of speed control is called frequency control.

47) What is meant by V/F control?

When the frequency is reduced, the input voltage must be reduced proportionally so as to maintain constant flux. Otherwise the core will get saturated resulting in excessive iron loss and magnetizing current. This type of induction motor behavior is similar to the working of dc series motor.

48) What is meant by regenerative braking?

Regenerative braking occurs when the motor speed exceeds the synchronous speed. In this case, the induction motor would runs as the induction machine is converting the mechanical power into electrical power, which is delivered back to the electrical system. This method of braking is known as regenerative braking.

49) What is meant by dynamic braking?

Dynamic braking of electric motor occurs when the energy stored in the rotating mass is dissipated in an electrical resistance. This requires the motor to operate as a generator to convert this stored energy into electrical.

50) What is meant by plugging?

It is one method of braking of induction motor. When phase sequence of supply of the motor running at a speed is reversed, by interchanging connections of any two phases of stator with respect to supply terminals, operation shifts from motoring to plugging region.

UNIT-II

ILLUMINATION

1) ***Define luminous flux.***

It is defined as the total quantity of light energy emitted per second from a luminous body. It is represented by symbol F and is measured in lumens. The conception of luminous flux helps us to specify the output and efficiency of a given light source.

2) What is meant by candle power?

It is defined as the number of lumens given out by the source in a unit solid angle in a given direction n. It is denoted by CP.

CP=lumens /ω

3) Define MHCP.

The mean of candle power in all directions in the horizontal plane containing the source of light is termed as Mean Horizontal Candle Power.

4) Define utilization factor.

It is defined as the ratio of total lumens reaching the working plane to total lumens given out by the lamp.

Utilization factor= Total lumens reaching the working plane/Total lumens given out by the lamp

3) What are the laws of illumination?

Law of Inverse Squares:

Illumination at appoint is inversely proportional to square of its distance from the point source and directly proportional to the luminous intensity (CP) of the source of light in that direction. If a source of light emits light equally in all directions be placed at the center of a hollow sphere, the light will fall uniformly on the inner surface of the sphere. If the sphere be replaced by one of the larger radius, the same total amount of light is spread over a larger area proportional to the square of the radius.

Lambert's cosine law:

The illumination at a point on a surface is proportional to cosine of the angle which ray makes with the normal to the surface at that point.

4) What is meant by luminance?

It is defined as the luminous intensity per unit projected area of either a surface source of light or a reflecting surface and is denoted by L.

11) What are all the sources of light?

According to principle of operation the light sources may be grouped as follows.

1. Arc lamps
2. High temperature lamps
3. Gaseous discharge lamps
4. Fluorescent type lamps

12) What is stroboscopic effect of fluorescent tubes?

With a.c. supply frequency of 50 cycles per second, discharge through the lamp becomes zero, 100 times in a second. Due to the persistence of vision, our eyes do not notice this. If this light falls on moving parts, they may appear to be either running slow or in the reverse direction or even may appear stationary. This effect is called stroboscopic effect.

13) Define beam factor.

The ratio of lumens in the beam of a projector to the lumens given out by lamps is called the beam factor. This factor takes into account the absorption of light by reflector and front glass of the projector lamp. Its values vary from 0.3 to 0.6.

14) Mention the types of lighting schemes.

The distribution of the light emitted by lamps is usually controlled to some extent by means of reflectors and translucent diffusing screens or even lenses. The interior lighting schemes may be classified as

1. Direct lighting
2. Semi-direct lighting
3. Indirect lighting
4. Semi-indirect lighting
5. General lighting

15) What are the drawbacks of discharge lamps?

Drawbacks of discharge lamps:

1. Take time to attain full brightness.
2. High initial cost and poor power factor. Starting requires trigger-starter.
3. Light output fluctuates at twice the supply frequency. The flicker causes stroboscopic effect.
4. These lamps can be used only in particular position.

16) What are the requirements of lighting system/

The following factors are required to be considered while designing the lighting scheme.

1. Illumination level
2. Uniformity of illumination
3. Color of light
4. Shadows
5. Glare
6. Mounting height
7. Spacing of luminaries

8. Color of surrounding walls.

UNIT III.
INDUSTRIAL HEATING AND WELDING

1) What are the advantages of electric heating?

The main advantages of electric heating over other systems of heating such as coal, oil or gas heating are given below.

1. High efficiency of utilization
2. Better working conditions
3. Heating of non -conducting materials
4. Safety
5. Special heating features
6. Economical
7. Cleanliness
8. Absence of flue gases
9. Ease of control or adaptation
10. Automatic protection
11. Upper limit of temperature

3) What is meant by indirect resistance heating?

In this method, the current is passed through a high resistance wire known as heating element. The heat produced due to I2 R loss in the element is transmitted by radiation or convection to the body to be heated. Applications are room heaters, in bimetallic strip used in starters, immersion water heaters and in domestic and commercial cooking and salt bath furnace.

4) What is meant by(1) infrared /radiant heating? (2)Dielectric heating?

1. When current possess through a resistive element heat energy is produced and the same is dissipated in the form of infrared radiation this is focused upon a body to be heated .e.g. to dry the wet paint on an object.
2. When a nonmetallic material is placed between two electrodes at high voltage the dielectric loss is dissipated in the form of heat which is used for heating purposes.

5) What are the requirements of a good heating material?

1. High resistivity 2. Low temperature coefficient of resistance

3. High melting point 4. Free from oxidation

6) What are the properties of heating element material?

1. The material of the heating elements should possess the following desirable properties for efficient operation and long life.
2. High resistivity: It should have high specific resistance so that the overall length to produce a certain amount of heat may be smaller.
3. High melting point: It should have high melting point so that high temperatures can be produced without jeopardizing the life of the element.
4. Free from oxidation: It should be able to resist oxidation at high temperatures; otherwise its life will be shortened. Low temperature coefficient: It should have a low temperature coefficient so that resistance remains appreciably constant even with increases of temperature. This helps in accurate control of temperature.

7} What are the causes of failure of heating elements?

Principle causes are

1. Formation of hot spots
2. General oxidation of the element and intermittency of operation
3. Embrittlement caused by grain growth
4. Contamination of element or corrosion

8) Write short note on infrared heating.

In radiant heating, the elements are of tungsten operating about 2300°C as at this temperature a greater proportion of infra-red radiation is given off. Heating effect on the charge is greater since the temperature of the heating element is greater than in the case of resistance heating. Heat emission intensities up to 7500 watts/sq.m can be obtained leading to heat absorption up to 4300 watts/sq.m. This reduces the time taken by various drying process.

9) What is the basic principle of induction heating?;

High frequency eddy current heating produced by eddy currents induced by electromagnetic action in the metal to be heated. It works on the principle of electromagnetic induction as same as a transformer. It has a metal disc surrounded by a copper coil in which a.c supply is flowing. The disc has a finite value of diameter and thickness and is spaced a given distance from the coil and concentric to it. We find that a secondary current is caused to circulate around the outer surface of the disc.

10) What are the different types of resistance welding? The different types are as follows

1. Butt welding
2. Spot welding
3. Projection welding
4. Seam welding
5. Percussion
6. welding

11) Compare DC welding and AC welding.

Sl.no	Factors	D.C welding	A.C welding
1.	Equipment	Motor-generator set or rectifier is required in case of availability of a supply; otherwise oil generator set is required.	Only a transformer is required.
2.	Prime Cost	Two or three times of transformer.	Comparatively low
3.	Operating efficiency	Low	High 85%
4.	No-Load voltage	Low	Too high
5.	Power factor	High	Low
6.	Heating	Uniform heating	Non-uniform heating
7.	Arc stability	Higher	-
8.	Arc blow	Pronounced	Not so pronounced

12) What is LASER welding?

LASER (Light Amplification by Stimulated Emission of Radiation) welding is a welding process that uses the heat from a laser beam impinging on the joint. The process is without a shielding gas and pressure.

Unit IV

1. What are the components of solar energy?

1. 1.Collector
2. Storage unit

2. What is concentration ratio?

Concentration ratio is defined as the ratio between the aperture area and the receiver absorber area of the collector.

3. List the various types of solar energy collectors.

1. Stationary collectors (or) Non- concentrating
2. Flat plate collectors
3. Compound parabolic collectors
4. Evacuated tube collectors
5. Sun tracking concentrating collector
6. single axis tracking
7. Two-axis tracking

4. List any four applications of solar collectors.

1. Solar water heating
2. Solar space heating systems
3. Solar refrigeration
4. Industrial process heat systems

5. List the four important solar systems.

1. Low temperature cycles using flat plat collector or solar pond 2.Power tower or central receiver system

2. Distributed collector system
3. Concentrating collectors for medium and high temperature cycle

6. List the advantages of solar Energy.

1. Solar energy is free from pollution
2. They collect solar energy optically and transfer it to a single receiver, thus minimizing thermal-energy transport requirements
3. They typically achieve concentration ratios of 300 to 1500 and so are highly efficient both in collecting energy and converting it to electricity.
4. The plant requires little maintenance or help after setup
5. It is economical

7. List any four disadvantages of solar energy.

1. Avilable in day time only
2. Need storage facilities
3. It needs a backup power plant
4. Keeping back up plants hot includes an energy cost which includes coal burning

8) Define space-height ratio.

It is defined as the ratio of horizontal distance between adjacent lamps and height of their mountings. Space-height ratio= Horizontal distance between two adjacent lamps/ Mounting height of lamps above working plane

9) What is polar curve?

In most lamps or sources of light the luminous intensity is not the same in all directions. If the luminous intensity, i.e. the candle power is measured in a horizontal plane about a vertical axis and a curve is plotted between candle power and the angular position, a curve is obtained is called as horizontal polar curve. The luminous intensity in all the directions can be represented by polar curves. If the luminous intensity in a vertical plane is plotted against the angular position, a curve known as vertical polar curve is obtained.

10) Name the various photometer heads.

1. Bunsen Head (or) Grease spot photometer

2. Lummer-Brodhun photometer head

There are two types of Lummer Brodhun heads

1. Equality of Brightness type photometer head
2. Contrast type photometer head

UNIT V

1) List the various components of wind energy system

1) Gearbox
2) Enclosure
3) Tailvane

2) Write-down the various types of wind power plants.

1) Remote
2) Hybrid
3) Grid connected

3) What is the principle of wind power generation?

Kinetic energy in moving air (wind) is converted into electrical energy. If mechanical energy is directly used it is called a wind mill. e.g. Pump. If mechanical energy is used to generate electrical energy and then used it is a wind energy converter. Cluster of wind mills is called a wind form. Winds are essentially caused by the solar heating of the atmosphere. They carry enormous quantity of energy. Wind as a source of power is very attractive because it is plentiful, inexhaustible, renewable and non -polluting. There is no depletion of scarce resources. In large portion of the world, wind blows for 320 days in a year and this gives them an advantage over sunlight in direct conversion programmes, operating cost of a wind mill is negligible.

4) What are the types of wind mills?

Wind energy conversion system are classified into two types, i) Horizontal axis wind mills The axis of rotation is horizontal and in the aero turbine, plane is vertical facing the wind. ii) Vertical axis wind mills. The axis of rotation is vertical, the blades also be vertical.

5) Define a distributed generation system?

It is a system of modular power generators at are near the customers sites and loads It potentially provide an economic value to the consumers as well as the power grid.

6) What is the application of Wind energy?

1. Energy conversion
2. Water pumping.
3. Driving ship