



SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.		Attempt any FIVE of the following:	10

- a) State the function of superheater and cooling tower of thermal power plant.

Ans:

Function of Super heater:

It is used to increase temperature and pressure of steam by absorbing heat from exhausted hot flue gases.

1 Mark

Function of Cooling Tower:

The function of cooling tower is to reduce the temperature of cooling water which has been heated due to absorption of heat from steam in condenser.

1 Mark

- b) Name any two hydroplants in Maharashtra with their capacity.

Ans:

Hydroplants in Maharashtra with Their Capacity:

Sr. No	Location	Capacity
1	Koyana	1960 MW
2	Ghatghar	250 MW
3	Bhira (TATA)	150 MW
4	Mulshi Dam	150MW
5	Bhira Tail Race	80 MW
6	Bhivapuri (TATA)	72 MW
7	Khopoli (TATA)	72 MW
8	Tillari	60 MW
9	Pench project	53 MW
10	Bhandara	34 MW
11	Dudhgaon	24 MW
12	Chadholi(Warana)	16MW
13	Jayakwadi	12 MW
14	Ujani	12 MW
15	Veer	9 MW

1 Mark for each of any two plants = 2 Marks



SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

16	Bhatghar	16 MW
17	Vaitarana	1.5 MW
18	Eldary	22.5 MW
19	Radhanagri	4.8 MW
20	Paitan	12 MW
21	Pawan	10 MW
22	Panshet	8 MW
23	Varasgoan	8 MW
24	Kanher	4 MW
25	Bhatsa	15 MW
26	Dhom	2 MW
27	Manikdoh	6 MW
28	Yeoteshwar	0.075 MW
29	Dimbhe	5 MW

c) State the function of penstock related to hydro-power plant.

Ans:

Function of Penstock:

Function of penstock is to carry water from the water reservoir to turbine.

2 Marks

d) State any two disadvantages of solar energy.

Ans:

Disadvantages of Solar Energy:

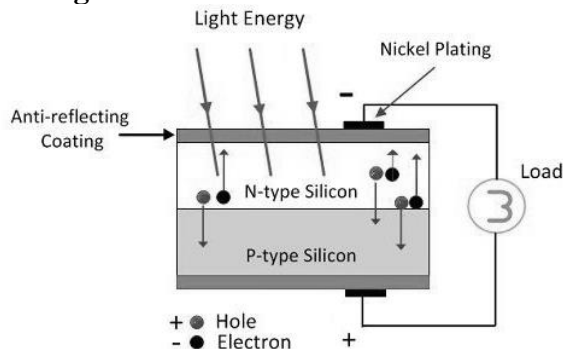
- 1) Weather-dependent: It depends upon availability of sunlight
- 2) Solar energy cannot be stored directly, but after conversion into electricity it can be stored. Storage (battery) is expensive.
- 3) Needs lot of space to install solar panels.
- 4) Intermittent energy source, available only during day time.
- 5) The initial cost of purchasing a solar system is fairly high.
- 6) Although pollution related to solar energy systems is far less compared to other sources of energy, solar energy can be associated with pollution. Transportation and installation of solar systems have been associated with the emission of greenhouse gases.

1 Mark for each of any two disadvantages = 2 Marks

e) State the working of photovoltaic cell in brief.

Ans:

Working of Photovoltaic Cell:



OR Any other equivalent diagram



SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

Solar cell operates on principle of Photo-voltaic effect.

Solar cell works in following steps:

- 1) The solar cell is composed of a P-type semiconductor and an N-type semiconductor.
- 2) When sun light (photon) is absorbed by the semiconductor material at depletion zone (p-n junction), electron-hole pairs are produced,
 - i) A negatively charged electron and
 - ii) Positively charged holes are created due to photovoltaic effect.
- 3) Negatively charged (-) electrons gather around the N-type semiconductor while positively charged (+) holes gather around the P-type semiconductor.
- 4) When you connect loads such as a light bulb, electric current flows between the two electrodes.

2 Marks for explanation

- f) State any two applications of wind energy.

Ans:

Application of Wind Energy:

- 1) Generating electricity.
- 2) Milling grain.
- 3) Pumping water.
- 4) Powering cargo ships (via kites)
- 5) Reducing carbon footprint.
- 6) Sailing.
- 7) Wind surfing.
- 8) Land surfing.

1 Mark for each of any two Application = 2 Marks

- g) Define the following terms:

- (i) Cold reserve (ii) Spinning reserve

Ans:

(i) Cold reserve

It is stand by generating capacity which is available for service but not in operation.

1 Mark

(ii) Spinning reserve

It is the generation capacity that is on-line but unloaded and that can respond within 10 minutes to compensate for generation or transmission outages. “Frequency-responsive” spinning reserve responds within 10 seconds to maintain system frequency. Spinning reserves are the first type used when shortfalls occur.

1 Mark

OR

Spinning Reserve is the provision of standby “spinning” generation ready to commence generation within a few minutes of receiving a dispatch signal from the grid.

e.g If a 160MW capacity generator is supplying 100MW load, then spinning reserve is said to be 60 MW.

2. Attempt any **THREE** of the following:

12

- a) Give the classification of coal and state the properties of each type.

Ans:

Classification of Coal:

1. **Anthracite:** The highest rank of coal. It is a hard, brittle, and black lustrous coal, often referred to as hard coal, containing a high percentage of fixed carbon and a low percentage of volatile matter.

SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

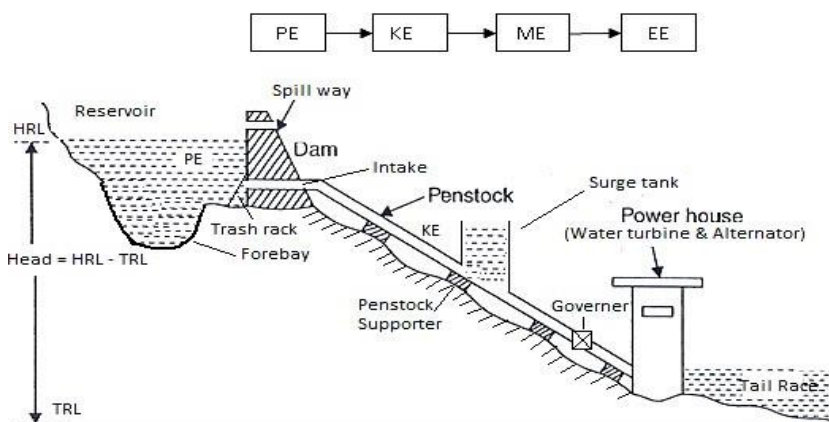
2. **Bituminous:** Bituminous coal is a middle rank coal between subbituminous and anthracite. Bituminous coal usually has a high heating (Btu) value and is used in electricity generation
3. **Subbituminous:** Subbituminous coal is black in colour and is mainly dull (not shiny). Subbituminous coal has low-to-moderate heating values and is mainly used in electricity generation.
4. **Lignite:** Lignite coal, aka brown coal, is the lowest grade coal with the least concentration of carbon. Lignite has a low heating value and a high moisture content and is mainly used in electricity generation.

1 Mark for each of any four types = 4 Marks

- b) Draw the layout of a hydro-electric power plant and also state the function of reservoir and surge tank.

Ans:

Layout of a Hydro-Electric Power Plant:



2 Marks

Function of Reservoir:

Its function is store the water during rainy season and supplies the same throughout the year.

1 Mark

Function of Surge Tank:

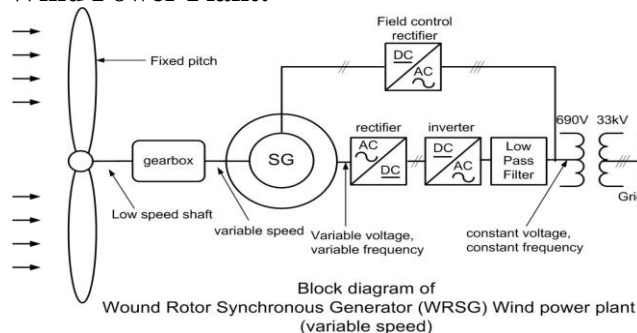
- 1) It protects penstock from water hammer effect when load on turbine reduces.
- 2) It avoids cavity effect in penstock when load on turbine increases.

1 Mark

- c) Draw a neat layout of geared wind power plant and label it.

Ans:

Layout of Geared Wind Power Plant:



4 Marks for fully labelled diagram

2 Marks for partially labelled diagram

OR

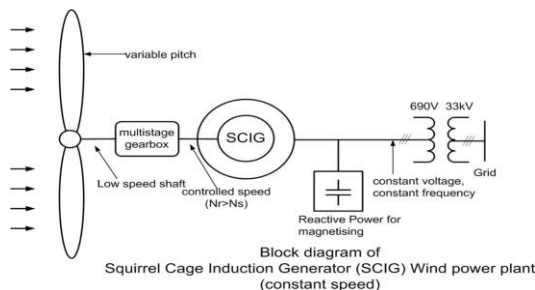


SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG



OR any other equivalent diagram

- d) State any four factors which should be considered while deciding the number of generating units and its size.

Ans:

Selection of Size and Number of Generating Units:

- 1) The size/rating and number of generating units in such way that they approximately match with the load curve/load duration curve as closely as possible.
- 2) In order to calculate the size of the units, the station auxiliary load should be taken in to account.
- 3) Also the transmission line losses should be considered. It can be approximately taken as 20 % of the consumer load.
- 4) The future demand and expansion should also be considered as the load on the station always increases.
- 5) The plant must have some reverse capacity at least 15-20 % more than M.D. under abnormal conditions.
- 6) Select size/rating of generating units in such way that reliability to maintain supply will be more.
- 7) Select size/rating of generating units in such way that the plant capacity factor, load factor diversity factor, plant use factor will be more.
- 8) Select size/rating of generating units in such way that unit almost run at full load or at load which gives maximum efficiency.
- 9) Select size/rating of generating units in such way that power generation will be economical.
- 10) Initial and operating cost also to be taken in to account
- 11) Space required also to be considered.
- 12) The minimum number of units should be two.
- 13) As far as possible, the units of equal capacities are selected which will have following advantages.
 - i) The parts can be interchanged.
 - ii) The maintenance will be easier.
 - iii) The working time of each plant regulated.
 - iv) The spare parts required to be stored are less.
- 14) While selecting the size/rating and number of generating units there are two options
 - i) To select single generating unit of large capacity
 - ii) To select more numbers of small capacity generating unit either of same ratings or different ratings.
Both options have its own advantages and disadvantages.
- 15) In summary,

1 Mark for each of any four factors = 4 Marks



SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

Load on the power system is variable where reliability of supply is important so it is neither practicable nor economical to use a single unit of large capacity. But, if power plant is connected to grid system then generating unit of higher capacity can be installed.

3. Attempt any **THREE** of the following:

12

- a) Describe methods to dispose solid, liquid and gaseous nuclear waste in short.

Ans:

Nuclear Waste:

The waste produced in nuclear power plant is in the form of solid, liquid & gases, these are radioactive. These are very harmful to human being, animals, environment and nature, if it is not carefully disposed off.

1 Mark

Solid Waste Disposal:

- Solid wastes removed from the reactor are very hot and radioactive.
- Solid waste is filled in a sealed container.
- And is kept under water for 5 to 10 years under supervision to reduces its temperature.
- The solid waste container is buried deeply in the ground by making tunnel, however the area must be unused land, away from populated area and there is less rain fall in that area.

1 Mark

OR

- Solid waste is filled in a sealed container and is disposed off away from sea shore.

OR

- Many times old and unused coal mines, salt mines, can be used for waste disposal

Liquid Waste Disposal:

1 Mark

- The liquid waste is diluted to a sufficient level by adding large quantity of water.
- The liquid waste after analysis (concentration of radioactive material are measured.) is sealed in a container.
- Then it is disposal off into the sea several kilometres away from sea shore.

Gaseous Waste Disposal:

1 Mark

- Gaseous wastes are generally diluted with adding air.
- And passed through high efficiency filter.
- Then passed through radiation monitoring system.
- In this system concentration of radioactive material are measured.
- If it is safe then released to atmosphere at high level through large height chimney.

SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

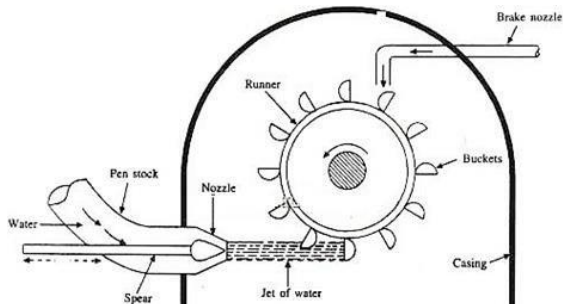
Model Answer :

22327:EPG

b) Draw a neat labelled diagram of Pelton turbine and explain its working in brief.

Ans:

Diagram of Pelton Turbine:



2 Marks for diagram

Working:

- The water stored at high head is made to flow through the penstock and reaches the nozzle of the Pelton turbine.
- The nozzle increases the K.E. of the water and directs the water in the form of jet.
- The jet of water from the nozzle strikes the buckets (vanes) of the runner. This made the runner to rotate at very high speed.
- The quantity of water striking the vanes or buckets is controlled by the needle valve present inside the nozzle.
- The generator is attached to the shaft of the runner which converts the mechanical energy of the runner into electrical energy.

2 Marks for working

c) Describe the working of Fresnel reflectors in detail.

Ans:

Working of Fresnel Reflectors:

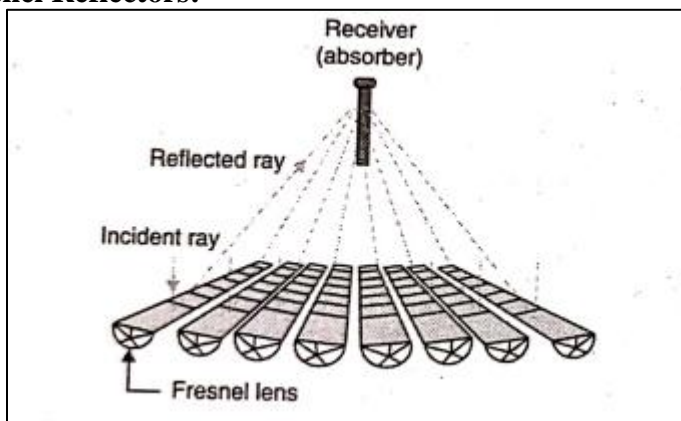


Fig: Installation of linear Fresnel reflectors

OR

2 Marks for diagram

SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

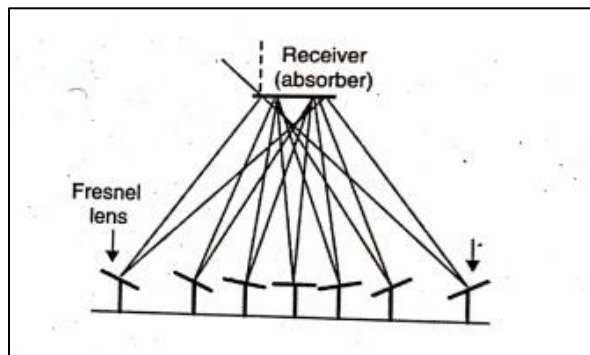


Fig: Arrangement of linear Fresnel collector

2 Marks for working

- i) A linear Fresnel reflector's design is based on a principle between the power tower and parabolic trough concentrator systems. It is similar to parabolic trough system but contains fixed receiver pipe while mirrors track.
 - ii) The trough shape is split into multiple mirror facets. This mirror based system uses the same principle as a Fresnel lens uses for flat plane mirrors that track the sun to reflect light onto a tube.
 - iii) An additional secondary mirror is used in some systems behind the focal plane which directs the sunlight into the absorber pipe.
 - iv) The linear Fresnel reflector system shown in Fig. uses long rows of flat or slightly curved mirrors to reflect sunlight onto a downward facing raised linear collector containing two stainless steel absorber tubes.
 - v) The collector in this system is a fixed absorber tube located at the common focal line of the mirror reflectors equipped with single or dual axis tracker to maximize the amount of sun energy collected throughout the day.
 - vi) A secondary concentrator is used to reflect the rays within the accepting angle. The Fresnel reflectors concentrate beam radiation to a stationary receiver.
 - vii) The receiver consists of two stainless steel absorber tubes. Each receiver has a secondary reflector that directs beam radiation on to the absorber tube.
 - viii) The entire optical system is enclosed in a sealed glazed casing. The absorber tube contains transfer fluid which is heated to create superheated steam that runs a turbine to produce electricity.
- d) List out the salient features of wound rotor induction generator used in large wind power plants.

Ans:

Salient Features of Wound Rotor:

- i) Reliable system.
- ii) Very simple design.
- iii) Operating speed range is wide (70% to 130% slip)
- iv) Controlled load and variation in power output for gust wind.
- v) Active power control can be implemented.
- vi) Terminal Voltage control can be implemented.
- vii) Power factor control can be implemented.
- viii) Can be controlled to provide inertial support and frequency support.

1 Mark for each of any four features = 4 Marks

4. Attempt any **TWO** of the following:

12

- a) Describe four stroke cycle of a Diesel engine in detail.



SUMMER – 2022 EXAMINATION

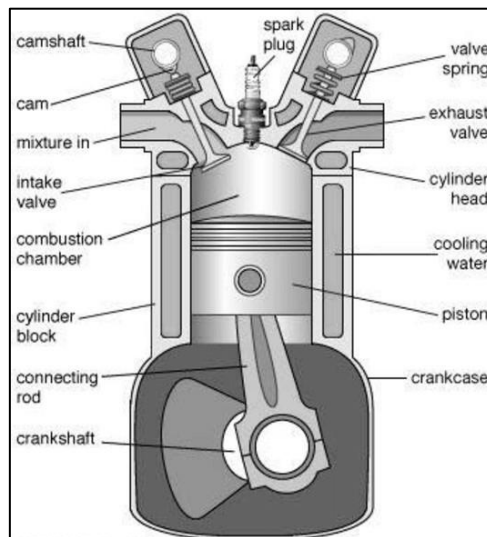
Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

Ans:

Four Stroke Cycle of a Diesel Engine:



1 Mark for each of four cycle = 4 Marks

OR Equivalent Figure

1. First stroke suction:

- Inlet valve (IV) and exhaust valve (EV) closed.
- Air is taken inside the cylinder under pressure so piston is ready to move down from top dead centre (TDC).
- Air is sucked into the engine cylinder.
- This stroke is completed when the piston reaches bottom dead centre.

2. Second stroke compression-

- During this stroke both IV & EV are closed.
- During this stroke piston starts moving upward from the BDC position.
- As the piston moves up the air compressed to a high pressure (60 bar) and temperature (600°C).
- Just before the end of compression stroke a fine spray of diesel is injected into the cylinder.
- Fuel ignites instantaneously.

3. Third stroke Expansion or power stroke

- During this stroke both IV & EV remain closed.
- Due to combustion of fuel pressure in cylinder increases.
- So piston is pushed down with a large force.
- Expansion of gases takes place and work is done during this stroke.
- Expansion stroke is completed when piston reaches point BDC position.

4. Fourth stroke Exhaust stroke-

- During this stroke IV remain closed while EV remains open.
- Piston moves up from BDC to TDC position.
- So it pushed out the burned gases (smoke) from engine.
- The stroke is completed when piston reaches the TDC position.
- And cycle is repeated



SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

- b) State the features of the solid, liquid and gas biomasses as fuel for biomass power plant.

Ans:

Features of Solid Fuel:

1. Ash is high.
2. Low thermal efficiency
3. Low calorific value and require large excess air.
4. Cost of handling high.

2 Marks

Features of Liquid Fuel:

1. High calorific value
2. No ash produces
3. Ignite easily
4. Firing can be controlled easily

1 Mark

Features of Gas Fuel:

1. High calorific value
2. No ash produces
3. Ignite easily
4. Firing can be controlled easily

1 Mark

- c) List out the features of permanent magnet synchronous generator.

Ans:

Features of Permanent Magnet Synchronous Generator:

1. Dynamic performance in both high and low-speed operation
2. High power density
3. Low rotor inertia makes it easy to control
4. No torque ripple when the motor is commutated
5. High and smooth torque
6. High efficiency at high speeds
7. Resistant to wear and tear
8. Available in small sizes at different packages
9. Easy maintenance and installation
10. Capable of maintaining full torque at low speeds
11. High reliability
12. Efficient dissipation of heat
13. Less noisy

1 Mark for
each of
any four
features
= 4 Marks

- d) Compare base load plants with peak load plants on any four points.

Ans:

Comparison Between Base Load Plant and Peak Load Plant:

Sr. No.	Points	Base load plant	Peak load plant
1	Definition	The power plant which supplies base load of load curve is known as base load plant	The power plant which supplies peak load of load curve is known as peak load plant
2	Generating capacity	High	Low

1 Mark for
each of
any four
Points
= 4 Marks



SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

3	Firm capacity	High	Low
4	Working Hours	24 hours	Only during peak load hours
5	Starting time	Both quick & more starting time power plants can be selected as a base load plants	Only quick starting time power plants are selected as a peak load plants
6	Load factor	High	Low
7	Capacity Factor	High	Low
8	Plant use factor	High	Low
9	Examples	Large capacity hydro, thermal, nuclear power station	Small capacity storage hydro, pumped storage hydro, gas, diesel power station.

e) State the impact and reasons of Grid system fault.

Ans:

Reasons of Grid System Fault:

1. Major imbalance between generation and consumption, i.e. demand is more than generation.
2. Low frequency, due to some faults the frequency mismatches i.e (49.5 to 50.3 Hz). If the frequency falls or rises above the permissible limit then there is possibility of failure of power grid.
3. Due to breaking of conductor or due to short circuit between two conductors, fault occurs which leads to failure of grid.
4. Power surge causes rapid overheating and tends to lead failure of grid.
5. Minor fault in high voltage equipment, if not attended over a period of time, results in a total breakdown of equipment suddenly causing grid failure.
6. Illegal utilization of electricity (theft of energy) is also a major reason for power grid failure.
7. Ageing of power equipment have higher failure rates, which increases the risk of frequent breakdown.
8. Due to failure of grid and subsequent tripping of line joining generators to system, few generators get disconnected and the load is shifted to other already loaded generators. So they are overloaded and tripped. This causes cascade tripping due to over loading.
9. Due to ineffective power delivery planning, co-ordination, supervision and control over generation system, failure of grid can occur.

2 Marks

Impact of Grid System Fault:

1. All industries are badly affected due to failure of supply and causes huge losses.
2. All health care centres (Major hospitals) are badly affected due to failure of supply and causes disturbance in treatment on emergency patients.
3. Drinking water supply system are badly affected due to failure of supply and causes insufficient/no water supply.
4. All electrical long route trains, local trains, tramways, metro and railway signal system are badly affected due to failure of supply and causes inconvenience.
5. All communication system is badly affected due to failure of supply and causes

2 Marks

SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

inconvenience to people.

6. Disturb the routine work of common all people.

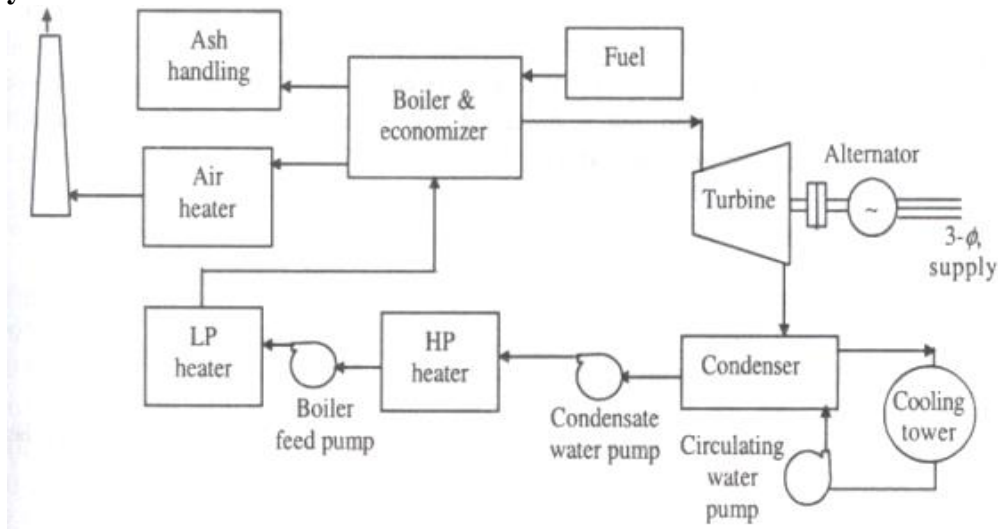
5. Attempt any TWO of the following:

12

a) Draw a neat labelled layout of thermal power plant and explain the function of coal and ash handling plant.

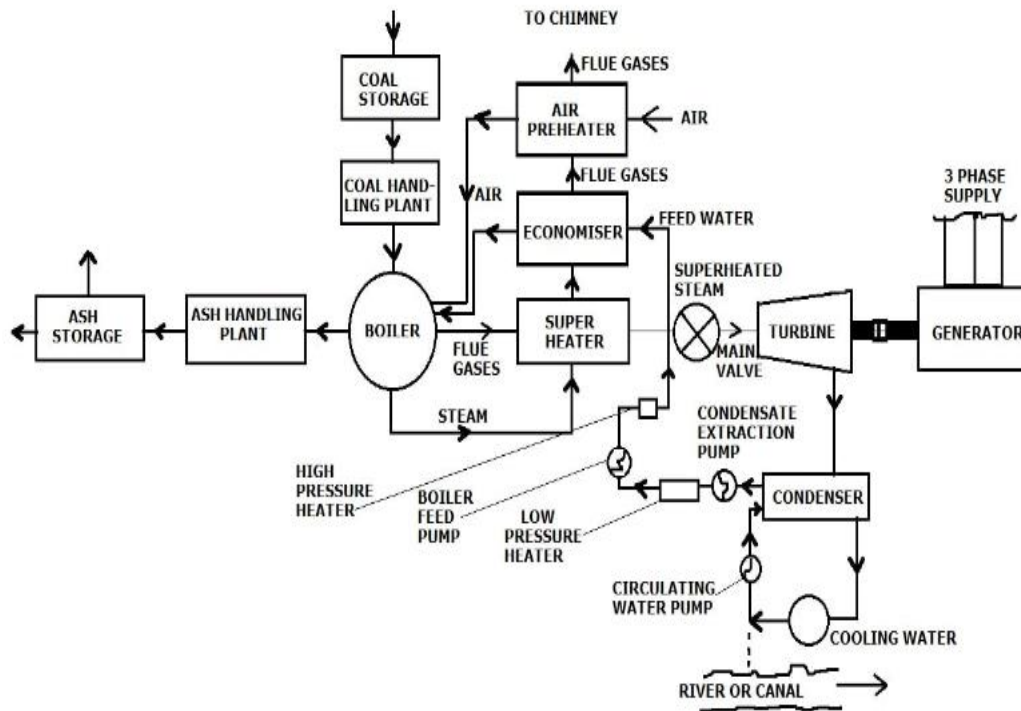
Ans:

Layout of Thermal Power Plant:



4 Marks for layout of thermal power plant

OR



OR Equivalent Layout Diagram

SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

Function of Coal Handling Plant:

A large quantity of coal is required as a fuel in furnace of boiler for combustion to produce heat energy for production of steam. To look after the activities from unloading of coal from wagons, storage, pulverization and final supply to boiler, coal handling unit is required.

1 Mark

Function of Ash Handling Plant:

A large quantity of ash about 10 % is produced in furnace, the removal of ash from boiler furnace is necessary for efficient combustion. To look after the activities related to removal of ash from boiler, its storage and transportation, ash handling unit is required.

1 Mark

b) Classify hydro power plant according to head of water and explain each type in brief.

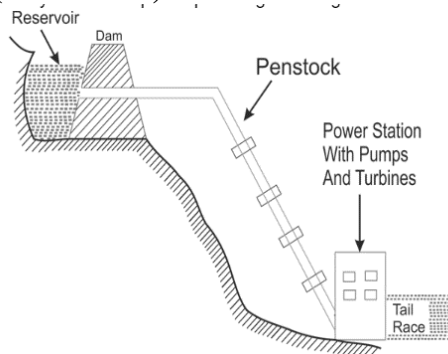
Ans:

Classification of Hydro-Power Plant According to Head of Water:

1. Low head power plant (Below 30m)
2. Medium head power plant (30 to 300 m)
3. High head power plant (above 300m)

1 Mark

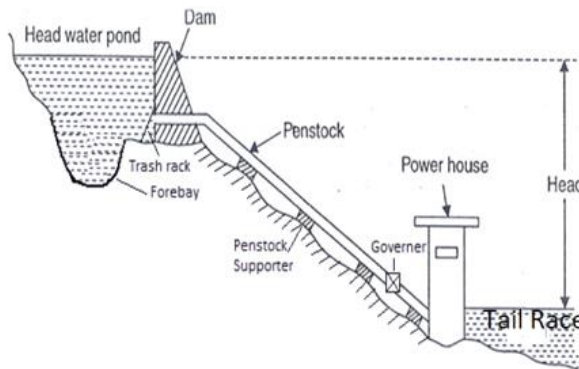
Low Head Power Plant (Below 30m):



2 Marks

If the available water head is less than 30 m, the plant is called a low-head plant. The necessary head is created by construction of a dam or barrage.

Medium Head Power Plant (30 to 300m):



2 Marks

OR Equivalent Figure.

1. If head of water is between 30 and 100 m, the plant is called a medium-head plant.
2. Potential energy of stored water is medium. Larger volume of water is required. Catchment area of medium capacity is required as water requirement is more.

SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

3. The power plant is situated at medium distance from dam. There is no surge tank forebay acts as a surge tank.
4. Penstocks are of medium length and comparatively medium in diameter.
5. Francis turbines are normally used.
6. Alternator required in these plants is of low speed and large in diameter.

High Head Power Plant (above 300m):

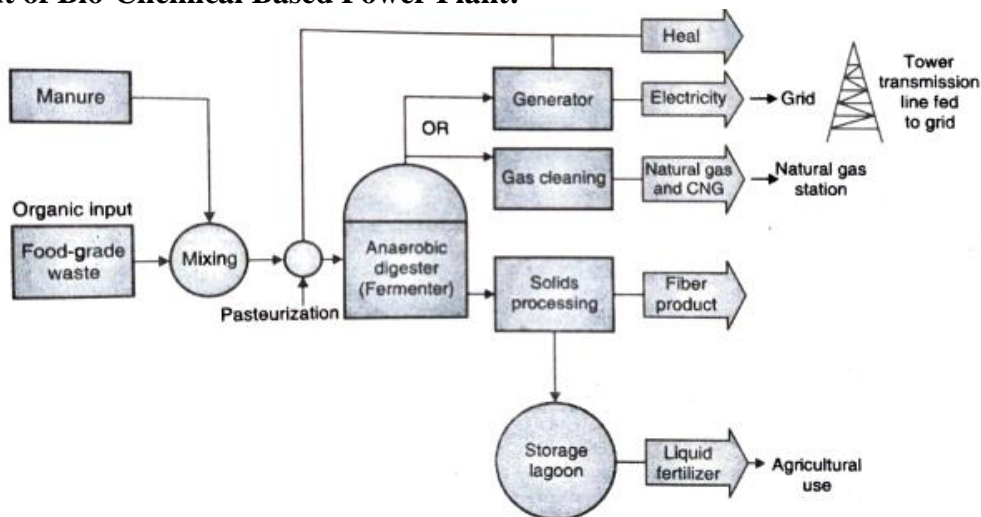
1. If the available head is more than 300 m, the plant is called high-head plant.
2. A dam is constructed such level that maximum reserve water level is formed.
3. A pressure tunnel is constructed which is connected to the valve house. Water is coming from reservoir to valve house via this pressure tunnel and it is the starting of penstock. A surge tank is also constructed before valve house which reduces water hammering to the penstock in case of sudden closing of fixed gates of water turbine.
4. The penstock is a connecting pipe which supplies water from valve house to turbine.
5. For high head more than 500 meters, Pelton wheel turbine is used.

1 Mark

c) Describe the working of Bio-Chemical based power plant with it's layout.

Ans:

Layout of Bio-Chemical Based Power Plant:



3 Marks for layout

OR Equivalent Layout Diagram

Working:

1. The bio chemical based plant is fed by organic input material such as food stuff remnant, sludge, manure or cowing.
2. In fermenter substrate is decomposed by microorganisms as it is heated for the process.
3. Methane is the main product of fermentation process.
4. Generated biogas is stored in the roof of the tank and it is burned in the heat to generate electric power which can be fed into electric grid.
5. Fermented substrate after process is transported to residue storage which is further used as a high quality fertilizer.
6. Heat generated can be used to heat binding or drying applications.

3 Marks for working

6. Attempt any **THREE** of the following:

12

a) Describe the specific safe practices to be followed with respect to hydro power plants.

Ans:



SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

Safe Practices to be Followed with Respect to Hydro-Power Plant

1. The Personal Protective Equipment (PPE) / protective devices made available for individual or collective use of the workers likely to be affected by the hazards of the workplace or process.
2. Not to allow any worker to work in an unsafe condition, nor with unsafe equipment
3. Sufficient number of Supervisors shall be appointed for adequate and constant supervision at all times and in all workplaces
4. All workers are protected from the hazards, arising out of their work or due to the work carried out by others, in the vicinity
5. Safety training shall be provided to all employs Appoint a Safety Officers with the qualifications and experience
6. Safety posters, slogan competition, special meetings and talks shall be organized.
7. Emergency action plan should be ready to deal with fire and explosion
8. Power plant should be protected against lightning stroke i.e. use appropriate type of lightning arrestor.
9. Barricades, warning sign, safety posters should be provided to hazards and important locations
10. Station should have at least two independent ways to exit. If one route becomes inaccessible, an alternative emergency escape route should always be available. Adequate lighting is essential for emergency escapes.
11. During flood there should be provision of automatically stop the hydro plant.
12. Plant should be inspected from OSHA and NFPA organization

1 Mark for
each of
any Six
Points
= 6 Marks

OR

Following are the different protection provided to HPP for safety:-

1. Fore bay:

It serves the following function is-

- It store rejected water immediately when load on turbine reduces so it avoid water hammer effect in penstock and protect the penstock.
- It avoids cavity effect in penstock when load on turbine increases (Because it immediately supplies the water).
- It acts as buffer storage of water during flooding which increases the safety of dam.

2. Trash rack (Screen/ Booms):

- It avoids entry of debris (solid particles, large fish, and ice) going towards the turbine.
- It avoids choke up of penstock and damage to turbine.

3. Spillways:

- It discharge excess water from reservoir when the water exceeds the storage capacity of reservoir.
- It avoids damage to dam due to excess pressure of water.
- It acts as a safety valve to the dam.

4. Protection provided to penstock:

- Surge Tank or fore bay
- Automatic butterfly valve

SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

- Air valve

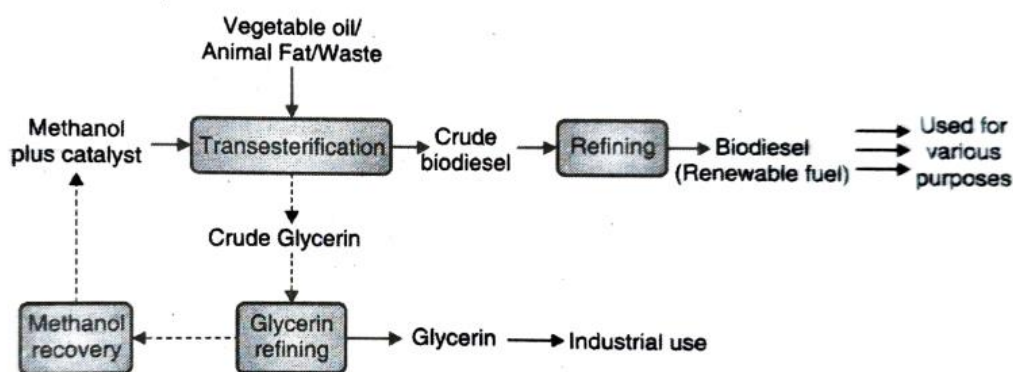
5. Surge tank:

- It protects penstock from water hammer effect when load on turbine reduces (Because it immediately stores the rejected water).
- It avoids cavity effect in penstock when load on turbine increases (Because it immediately supplies the water).

b) Discuss the energy extraction process of Agro-chemical based power plant with it's layout.

Ans:

Layout of Agro-Chemical Based Power Plant:



3 Marks for layout diagram

OR Equivalent Layout Diagram

Energy Extraction Process of Agro-Chemical Based Power Plant

1. Agro-chemical based power plant is also known as Biodiesel plant.
2. Biodiesel is produced from vegetable oils, yellow grease, used cooking oils, or animal fats.
3. The fuel is produced by transesterification—a process that converts fats and oils into biodiesel and glycerin (a coproduct).
4. Glycerin, a co-product, is a sugar commonly used in the manufacture of pharmaceuticals and cosmetics.
5. After transesterification, crude biodiesel and crude glycerine are obtained.
6. Methanol is used as a catalyst. After the process of refining pure biodiesel and glycerine are available for the further use.
7. Bio diesel has same properties as petro diesel but with some drawbacks.

3 Marks

c) A generating station has the following daily load cycle.

Time (Hours)	0-6	6-10	10-12	12-16	16-20	20-24
Load (MW)	40	50	60	50	70	40

Draw the load curve and find:

- i) Maximum demand
- ii) Units generated per day
- iii) Average load and
- iv) Load factor

Ans:



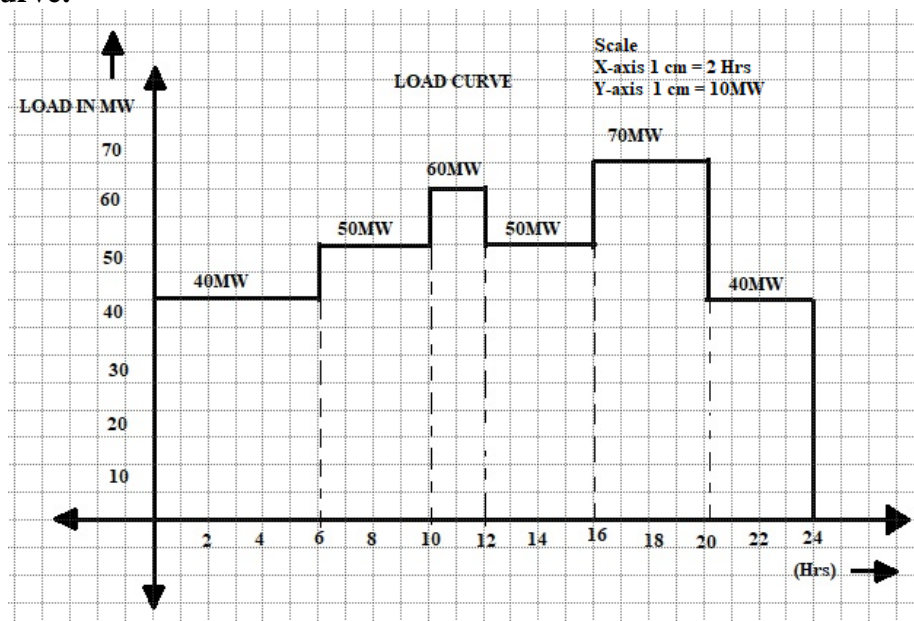
SUMMER – 2022 EXAMINATION

Subject Name: Electrical Power Generation

Model Answer :

22327:EPG

Load Curve:



2 Marks for Load Curve

- i) It is clear from the load curve that maximum demand on the power station is 70 MW and occurs during the period 16-20

Maximum Demand: 70 MW

1 Mark

- ii) **Units generated per day** = Area (in kWh) under the load curve

$$= 10^3(6 \times 40 + 4 \times 50 + 2 \times 60 + 4 \times 50 + 4 \times 70 + 4 \times 40)$$
$$= 1200 \times 10^3 \text{ kWh}$$

1 Mark

- iii) **Average Load** = $\frac{\text{Units generated per day}}{24 \text{ hours}} = \frac{1200 \times 10^3}{24} = 50 \times 10^3 \text{ kW}$

1 Mark

- iv) **Load factor** = $\frac{\text{Average Load}}{\text{Maximum demand}} = \frac{50 \times 10^3}{70 \times 10^3} = 0.714 \text{ or } 71.4 \%$

1 Mark