

MIZORAM PUBLIC SERVICE COMMISSION
DEPARTMENTAL EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. (AE/SDO)
UNDER POWER & ELECTICITY DEPARTMENT,
GOVERNMENT OF MIZORAM, JULY, 2022.

ENGINEERING PAPER – II
Mechanical Engineers under Electrical Wing

Time Allowed : 3 hours

FM : 100 PM : 40

Marks for each question is indicated against it.
Attempt all questions.

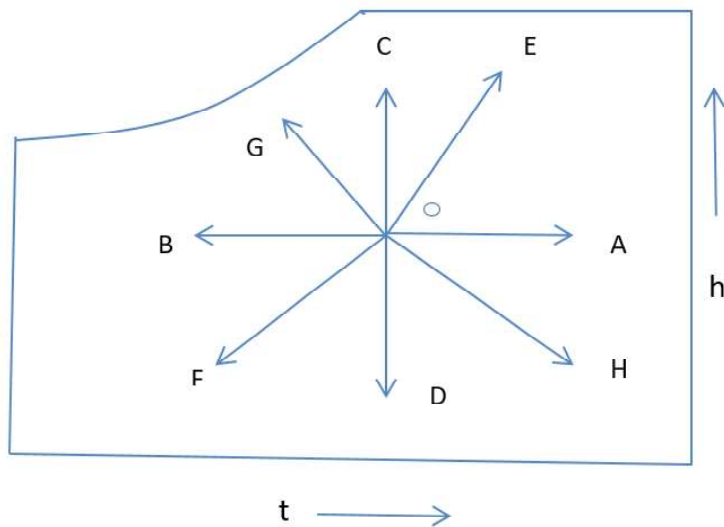
PART - A (50-MARKS)

This Section should be answered only on the Separate Answer Sheet provided.

1. Hydraulic turbines are the machines which use the energy of water (Hydro power) and convert it into (1)
(a) Potential Energy (b) Kinetic Energy
(c) Mechanical Energy (d) Hydraulic Energy
2. Which machine is directly responsible for generation of electric power? (1)
(a) Turbine (b) Substation Transformer
(c) Electric Generator (d) Hydraulic Pump
3. Why is Hydroelectric power chosen over other power sources like Coal, Natural gas, Petroleum and Nuclear? (1)
(a) Abundance of Hydro potential
(b) Generation cost is relatively cheaper
(c) Thermal power technologies are not easily available
(d) Hydro potential is available naturally
4. Which element does not directly relate to Hydroelectric power plant? (1)
(a) Reservoir (b) Penstock
(c) Forebay (d) ACSR Panther
5. In the hydraulic turbine, which is the correct relation for Net head between Gross head (H1), Net head (H2) and loss of head (H3) (1)
(a) $H1 = H2 + H3$ (b) $H2 = H1 + H3$
(c) $H3 = H1 - H2$ (d) $H2 = H1 - H3$
6. What is the classification for hydraulic turbine on the basis of action of water on turbine runner? (2)
Or
Mention two classification of turbine on the basis of head and quantity of water required.
7. Give two examples of Impulse turbine. (2)
Or
Give two examples of Reaction turbine.

8. Define specific heat of turbine. (2)
9. All are components of centrifugal pump, except (1)
- (a) Impeller (b) Propeller
 - (c) Suction pipe (d) Delivery pipe
10. Give two advantages of Centrifugal pump over Reciprocating pump. (2)
11. In the working principle of Centrifugal pump, the first step in the operation is (1)
- (a) Oiling (b) Heating
 - (c) Churning (d) Priming
12. The Centrifugal pumps may be classified on the basis of certain factors, except (1)
- (a) Number of Impeller per shaft (b) Relative direction of flow through impeller
 - (c) Number of shafts per impeller (d) Number of entrances to the impeller
13. The static head and manometric head of the Centrifugal pump is same, when (1)
- (a) The losses of head in the pump is zero (b) Suction head and delivery head equals static head
 - (c) Manometric head is smaller than static head (d) Static head has small losses of head
14. The main components of gas turbine plant are as below, except (1)
- (a) Compressor (b) Combustion chamber
 - (c) Condenser (d) Turbine
15. The main difference of Open cycle and Closed cycle gas turbine is (1)
- (a) Fuel used (b) Plant capacity
 - (c) Exhaust gas utilization (d) Carbon and ash handling
16. What is the main function of belt? (2)
17. All are types of belt, except (1)
- (a) Triangular belt (b) V – belt
 - (c) Flat belt (d) Circular belt
18. What is the main function of gear? (1)
- (a) To change direction of rotation (b) To increase the rotation speed
 - (c) To reduce the rotation speed (d) Transmission of power to engaging shaft
- Or**
- All are gearing system, except
- (a) Circular gearing (b) Spur gearing
 - (c) Helical gearing (d) Bevel gearing
19. Give two design considerations for a gear drive. (2)
- Or**
- Define main function of flywheel.
20. Distinguish between internal energy and heat. (2)
- Or**
- Briefly define the process of convection

21. Heat transfer is possible only when (1)
- (a) Internal energy is same with thermal energy
 - (b) Two bodies are maintain at same temperature
 - (c) When two systems are in equilibrium
 - (d) A body of higher temperature to that at lower temperature
22. A well-known refrigerant Freon 12 (R12) is used in domestic refrigerator, room air-conditioner etc. whose chemical formula is (1)
- (a) $\text{C Cl}_3 \text{F}$
 - (b) $\text{C Cl}_2 \text{F}_2$
 - (c) C H Cl F_2
 - (d) C Cl F_3
23. Give the main chemical requirements of refrigerants.. (2)
- Or**
- What are types of condensers commonly used?
24. Define evaporators. (2)
25. A single parameter for measure of comfort in air conditioning is (1)
- (a) Temperature
 - (b) Humidity
 - (c) Air velocity
 - (d) Effective temperature
26. From below Psychrometric processes chart





- (a) Process $O \rightarrow A$ stands for :
 - (b) Process $O \rightarrow F$ stands for :
 - (c) Process $O \rightarrow C$ stands for :
 - (d) Process $O \rightarrow H$ stands for :
 - (e) Process $O \rightarrow G$ stands for :
27. In the Gas welding a high temperature obtained by a mixture of two gases, such as (1)
- (a) Oxygen and Calcium Carbide
 - (b) Oxygen and Acetylene
 - (c) Hydrogen and Acetylene
 - (d) Hydrogen and Calcium Carbide
- Or**
- Equipment for Arc welding are as follows, except
- (a) Welding torch
 - (b) Flux
 - (c) Welding rod
 - (d) Electrode


28. Give three examples of modern welding machines using gas arc techniques are (3)
29. Following are advantages of work study except.. (1)
- (a) Higher productive efficiency
 - (b) Always lower wages to workers
 - (c) Fast and accurate delivery dates
 - (d) Reduced manufacturing costs
30. Objectives of a good plant layout are as below, except.. (1)
- (a) Materials handling and transportation is minimized
 - (b) Bottlenecks and point of congestions are eliminated
 - (c) Working conditions are safer, better and improved
 - (d) The movements made by workers are maximized
31. Give five important factors governing selection of plant location (5)

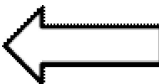
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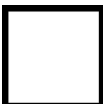
From the following Process Chart Symbols, what is the type of event each represents

(a)  = _____

(b)  = _____

(c)  = _____

(d)  = _____

(e)  = _____

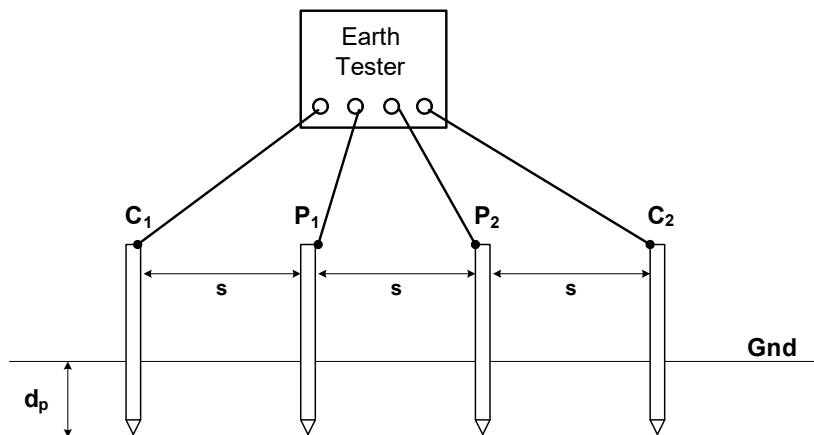
PART - B (50-MARKS)

This Section should be answered only on the Separate Answer Sheet provided.

1. What the short-circuit current on the LV side of 132/33kV 12.5MVA Power Transformer whose % impedance is 9.6%? (5)
2. Insulation resistance of 1.6MVA, 33/11kV transformer is measured between HV and LV side and the result obtained is shown below: (5)
 - (a) 0.48 GV after 10 minutes
 - (b) 0.23 GV after 1 minutes
 - (c) 0.15 GV after 30 seconds

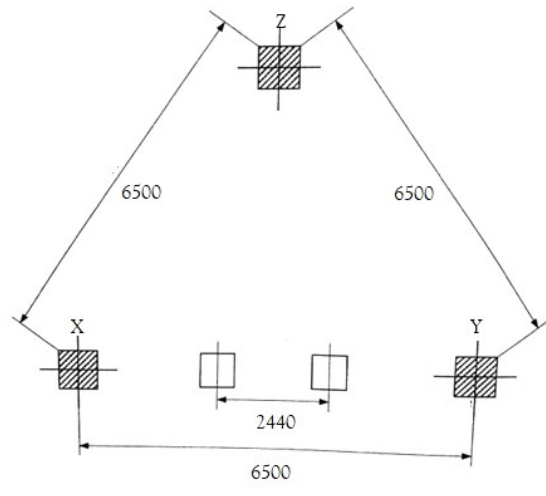
Calculate the Polarization Index (PI) value and the Dielectric Absorption Ratio (DAR) value?

3. Calculate the apparent soil resistivity from below figure where the distance between the four electrodes, $s = 4$ mtrs and the earth tester reading, $R = 9.8\Omega$. What is the recommended depth of each electrode below earth surface, d_p ? (5)

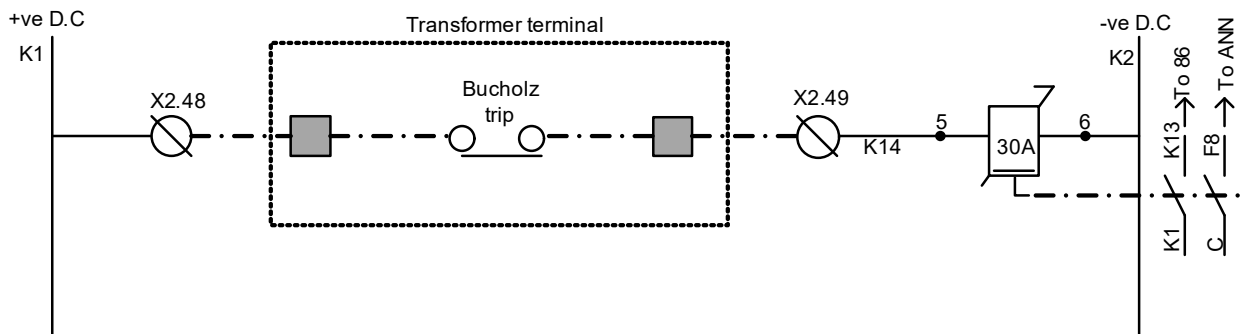


4.
 - (a) What is the highest available transformation voltage level in transmission system in Mizoram?
 - (b) Name all the location of Power Substations interconnecting with highest system voltage.
 - (c) What is the proposed voltage level of the new double circuit transmission line between Silchar and Sihhmui, Sairang Sub-station? (5)
5.
 - (a) Mention three differences between CT and PT? (5)
 - (b) Why is CVT used in long transmission lines instead of PT?
6.
 - (a) In the technical specification of 33kV Outdoor Vacuum Circuit Breaker the following rated values are given 36kV, 1250A & 25kA. What are these rated values?
 - (b) What is the rated voltage of tripping & closing coil for 33kV Outdoor type CB commonly used in Mizoram?
 - (c) What is the function trip supervision circuit in CB? Will the CB trips if the trip supervision circuit is faulty? (5)

7. Figure below shows the schematic diagram of Distribution Transformer Earthing. Describe the connections to the three electrodes X, Y, Z. (5)



8. The total unit of 11kV panel energy meter for one month is 340kWh. The external PT ratio is 11000/110V and CT ratio is 50/5A. If the energy meter is calibrated for PT ratio 11000/110V, CT ratio 25/5A what will be the actual energy in kWh? (5)
9. Figure below shows transformer auxiliary protection scheme, where NO contact of Bucholz Trip at Transformer marshalling box is connected to Auxilliary Relay of 33kV C&R panel having coil 30A. What will happen if NO contact of Bucholz trip closes due to fault sensed by Bucholz Relay of 10 MVA, 33/11kV Power Transformer? (5)



10. (a) How many poles will be required in 1 km of LT ABC line if standard spacing between each pole is maintained as per SOR 2020?
 (b) In 33kV and 11kV line construction, when shall double pole structure must be used?
 (c) How many hours new transmission line shall be charged for observation? (5)