MIZORAM PUBLIC SERVICE COMMISSION

DEPARTMENTAL EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. (AE/SDO) UNDER POWER & ELECTICITY DEPARTMENT, GOVERNMENT OF MIZORAM, JUNE-2024.

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.
All questions carry equal mark of 1 each.

1. Pelton wheel is used in those place where
(a) high head and low discharge are available
(b) low head and high discharge are available
(c) high head and high discharge are available
(d) low head and low discharge are available

2. Hydraulic gradient line represents the sum of
(a) pressure head and kinetic head
(b) kinetic head and datum head
(c) pressure head, kinetic head and datum head
(d) pressure head and datum head

3. Hydraulic ram is a pump which works
(a) on the principle of centrifugal action
(b) on the principle of reciprocating action
(c) on the principle of water hammer
(d) on the principle of reaction

4. Following is an impulse turbine
(a) Petlon wheel turbine
(b) Tubular turbine
(c) Propeller turbine
(d) Francis turbine

5. The water compressibility effect produces traveling waves of pressure and is usually called
(a) water pressure
(b) water impact
(c) water hammer
(d) water force

6. Hydraulic turbines are classified based on
(a) Energy available at inlet of turbine
(b) Direction of flow through vanes
(c) Head at inlet of turbine
(d) Energy available, Direction of flow, Head at inlet.

7. High specific speed of turbine implies that it is
(a) Francis turbine
(b) Propeller turbine
(c) Pelton turbine
(d) Kaplan turbine

8. Hydraulic Turbines installed at Serlui B Hydropower Project (3x4MW) of medium head 24 – 180 metre is an example of
(a) Petlon wheel turbine
(b) Tubular turbine
(c) Kaplan turbine
(d) Francis turbine

9. Centrifugal pump is a
   (a) Turbomachinery
   (b) Flow regulating device
   (c) Drafting device
   (d) Intercooling device

10. The main function of nozzle is to
   (a) Varying temperatures
   (b) Pressure variations
   (c) Load variations
   (d) Heat variations

11. Centrifugal pumps transfer energy from
   (a) Rotor to fluid
   (b) Fluid to rotor
   (c) Draft to rotor
   (d) Rotor to draft

12. Which among the following control the flow rate?
   (a) Valve
   (b) Pump
   (c) Head
   (d) Tank pipe

13. For small discharge and high heads which pump is preferred?
   (a) centrifugal type
   (b) reciprocating type
   (c) axial flow type
   (d) radial flow type

14. Heavy lifting work is often accomplished by shifting fluids in big machines. The power system of such machines can be described as
   (a) Reciprocating
   (b) Pneumatic
   (c) Hydraulic
   (d) Hybrid

15. Which component of a hydraulic system is used to store the sufficient amount of hydraulic oil?
   (a) Rotatory pumps
   (b) Oil reservoir
   (c) Flow control valve
   (d) Pressure gauge

16. Pneumatic and other power systems can support three kinds of motion; they are-
   (a) Linear, reciprocating, and random motion
   (b) Linear, flowing, and rotary motion
   (c) Linear, zigzag, and spiral motion
   (d) Linear, reciprocating, and rotary motion

17. In a hydraulic crane _____ is the component mainly responsible for lifting.
   (a) Boom
   (b) Counter-weights
   (c) Jib
   (d) Rotex Gear

18. The ratio of work-done per cycle to the stroke volume of the compressor is known as
   (a) Compressor capacity
   (b) Compression ratio
   (c) Compressor efficiency
   (d) Mean effective pressure

19. A compressor at high altitude will draw
   (a) more power
   (b) less power
   (c) Isothermal compression
   (d) Isentropic compression

20. The pressure of air at the beginning of the compression stroke is.....atmospheric pressure
   (a) less than
   (b) more than
   (c) equal to
   (d) two times atmospheric pressure

21. The ratio of indicated HP to shaft HP is known as
   (a) Volumetric efficiency
   (b) Mechanical efficiency
   (c) Compressor efficiency
   (d) Thermal efficiency

22. The air standard cycle for a Gas-Turbine called

(a) Reheat cycle (b) Rankine cycle

(c) Brayton cycle (d) Diesel cycle

23. Gas Turbine is which type of combustion plant?

(a) external (b) open

(c) internal (d) cannot say

24. Which among these is the main component of a gas turbine plant?

(a) Condenser (b) Compressor

(c) Boiler (d) Both Compressor & Boiler

25. The gas turbine power plant mainly uses which among the following fuels?

(a) Coal and Peat (b) Kerosene oil and diesel oil and residual oil

(c) Gas oil (d) Natural gas and liquid petroleum fuel

26. The smaller and generally the driving gear of a pair of mated gears is called

(a) rack (b) pinion

(c) module (d) pitch

27. When large gear reductions are needed _____ gears are used.

(a) bevel (b) worm

(c) helical (d) spur

28. Automobile steering gear is an example of

(a) higher pair (b) sliding pair

(c) rotary pair (d) lower pair

29. Vee-belt E-type cross-sections are generally used in

(a) Automobiles (b) Small Engines

(c) Heavy duty machine (d) When driver and driven units are far off

30. If T1, T2 are the respective tensions on the tight and slack side of the open belt drive in Newtons and v is the velocity in the belt in m/s, then the power transmitted by the belt drive will be given by:

(a) $P = (T1 - T2)/v$ (b) $P = (T1/T2)v$

(c) $P = (T1 - T2)v$ (d) $P = (T1 + T2)v$

31. In a Hartnell governor, if the stiffness of the spring is increased, the governor will become

(a) less sensitive (b) more sensitive

(c) hunting (d) isochronous

32. If it is required to connect two parallel shafts, the distance between whose axes is small and variable, the shafts are coupled by

(a) universal joint (b) knuckle joint

(c) Oldham's coupling (d) flexible coupling

33. The amount of energy absorbed by a flywheel is determined from the

(a) Torque-Crank angle diagram (b) Speed-Space diagram

(c) Speed-Energy diagram (d) Acceleration- Crank angle diagram

34. For conduction heat transfer, the heat energy propagation will be minimal for

(a) Copper (b) Air

(c) Water (d) Lead

35. The appropriate rate equation for convective heat transfer between a surface and adjacent fluid is prescribed by which law?
    (a) Newton's law of cooling
    (b) Kirchhoff's law
    (c) Newton's first law
    (d) Wein's displacement law

36. Which of the following is NOT the advantages of using a closed Air Refrigeration system?
    (a) Compact in construction
    (b) Lower coefficient of performance
    (c) Lighter in weight
    (d) Environmental friendly

37. Which of the following refrigerants are used in Electrolux and Li-Br water refrigeration system?
    (a) Ammonia and Water
    (b) Water and Bromide
    (c) Ammonia and Lithium
    (d) Water and Fluoride

38. Which of the following process is used in winter air conditioning?
    (a) Cooling and Dehumidification
    (b) Dehumidification
    (c) Heating and Dehumidification
    (d) Heating and Humidification

39. Compressor used in Window Air Conditioner is
    (a) Rotary compressor
    (b) Reciprocating compressor
    (c) Sealed compressor
    (d) Open type compressor

40. Tap water is not preferred as coolant while drilling. What is the reason for this?
    (a) Insufficient cooling effect
    (b) Danger of corrosion
    (c) Quick evaporation of water
    (d) Decrease in cutting action of drill

41. TIG welding is best suited for welding
    (a) Stainless steel
    (b) Carbon steel
    (c) Aluminium
    (d) Silver

42. A cutting tool used to finish and enlarge a hole is known as
    (a) Drill
    (b) Reamer
    (c) Die
    (d) Tap

43. Which of the following is an example of hybrid machining?
    (a) Ultrasonic machining
    (b) Electron beam machining
    (c) Laser beam machining
    (d) Ultrasonic assisted electrochemical machining

44. Cutting tool can never have its
    (a) Clearance angle- positive
    (b) Rake angle - positive
    (c) Clearance angle- negative
    (d) Rake angle - negative

45. If all the processing equipment and machines are arranged according to the sequence of operations of a product, the layout is known as
    (a) Product layout
    (b) Process layout
    (c) Process layout
    (d) Combination layout

46. Which of the following industries should be located near the vicinity of raw materials?
    (a) Automobiles
    (b) Televisions
    (c) Sewing machines
    (d) Steel mills

47. Break-even analysis consists of
    (a) Fixed cost
    (b) Variable cost
    (c) Fixed and variable cost
    (d) Operation cost

48. In perpetual inventory control, the material is checked as it reaches its
    (a) minimum value
    (b) maximum value
    (c) average value
    (d) alarming value

49. Gnatt chart provides information about
    (a) material handling
    (b) proper utilisation of manpower
    (c) production schedule
    (d) efficient working of machine

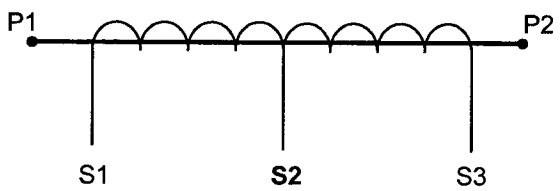
50. Material handling and plant location is analysed by
    (a) bar chart
    (b) bin chart
    (c) Emerson chart
    (d) travel chart

PART - B (50-MARKS)

This Section should be answered only on the Separate Answer Sheet provided.
All questions carry equal marks of 5 each.

1. What is the short-circuit current on the LV side of 132/33kV 12.5MVA Power Transformer whose % impedance is 9.6%?
2. Insulation resistance of 1.6MVA, 33/11kV transformer is measured between HV and LV side and the result obtained is shown below:
    1. 0.48 GΩ after 10 minutes
    2. 0.23 GΩ after 1 minutes
    3. 0.15 GΩ after 30 seconds

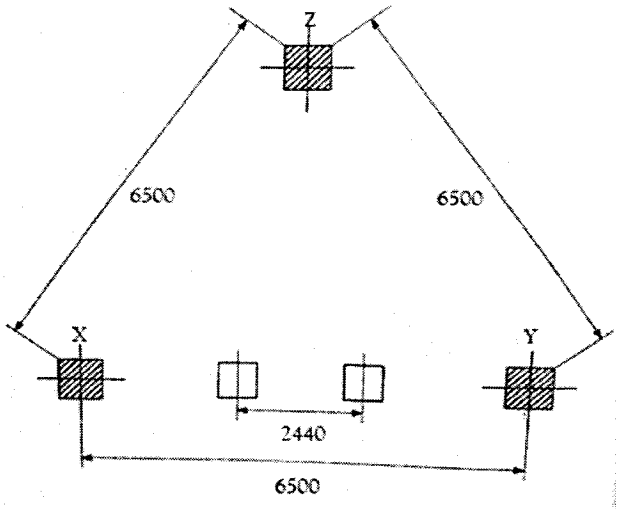
    Calculate the Polarization Index (PI) value and the Dielectric Absorption Ratio (DAR) value?
3. In a 3-point method of Earth Resistance measurement, what is the minimum distance between earth electrode and potential electrode and what will be the corresponding distance between the potential and current electrodes. If the voltage between Earth and Potential electrode is V volts and the current across Earth and Current electrode is I amps, what will be the earth resistance?
4. Mention three differences between CT and PT? Why is CVT used in long transmission lines instead of PT?
5. FIG shows a 33kV Current Transformer (CT) circuit diagram. What does P1, P2 & S1,S3 nad S3 denotes? Is it a single core CT or three core CT? How many CT core do we usually used for 33kV line protection?



6. Briefly describe the function of trip supervision relay in 33kV Control and Relay panel? How can we know whether 33kV Circuit Breaker will be able to trip at the time of fault? What is the most common element that makes the trip circuit faulty?

7. The total unit of 11kV panel energy meter for one month is 340kWh from the normal meter reading. 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?

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



9. (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 2023 ?

   (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?

10. What do you mean by span and sag of an overhead transmission line? What are the factors upon which the sag in an overhead line depends?

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