MIZORAM PUBLIC SERVICE COMMISSION

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

ENGINEERING PAPER – II

(Electricals/Electronics/Electrical & Electronics/Electronics & Communication/ Electronics & Telecommunication 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 <u>Separate Answer Sheet</u> provided.

1. Which of the following has negative temperature co-efficient?   **(1.5)**
   (a) Constantan   (b) Carbon
   (c) Manganin   (d) Tungsten

2. 100 cm length of a wire of cross-section A has a resistance of R ohms. The resistance of the wire of same material having length of 200 cm and cross-sectional area 2A will be   **(2)**
   (a) 4R   (b) 2R
   (c) R   (d) R/4

3. An essential condition for Ohm's law to be applicable to a circuit is that   **(1.5)**
   (a) resistance must be at room temperature   (b) voltage should be only DC
   (c) the current should flow in forward direction only (d) the resistance must be uniform

4. When two resistances are connected in parallel   **(1.5)**
   (a) the current through each must be the same.
   (b) the voltage across each must be the same.
   (c) their combined resistance value equals the sum of the individual values.
   (d) each must have the same resistance value

5. Kirchhoff's law is applicable to   **(1.5)**
   (a) AC circuits only   (b) DC circuits only
   (c) both AC as well as DC circuits   (d) passive networks only

6. When converting a star resistive network to an equivalent delta network, if all the three resistors are equal in value, then the value of the resultant resistors in the equivalent delta network will be   **(2)**
   (a) same as that of star resistors   (b) 2 times the value of the star resistors
   (c) 3 times the value of the star resistors (d) 4 times the value of the star resistors

7. Which of the following statement is false?   **(1.5)**
   (a) The stored energy in a capacitor increases with applied voltage
   (b) The leakage resistance of ceramic capacitors is generally high
   (c) A twirl cable has distributed capacitance between the conductors
   (d) The stored energy in a capacitor decreases with reduction in value of capacitance
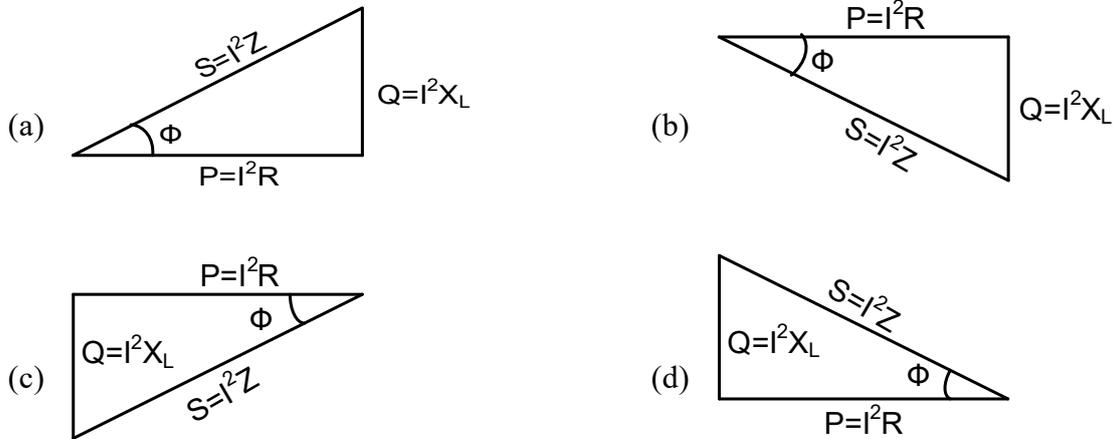
8. Capacitance increases with **(1.5)**

    (a) increase in plate area and the distance between the plates

    (b) reduction in plate area and the distance between the plates

    (c) increase in plate area and decrease in the distance between the plates

    (d) decrease in the plate area and the value of the applied voltage

9. Inductive reactance is measured in ohms because it **(1.5)**

    (a) reduces the amplitude of alternating current   (b) increases the amplitude of alternating current

    (c) reduces the amplitude of direct current   (d) has a back emf opposing a steady direct current

10. The RMS value and mean value is the same in case of **(1.5)**

    (a) sine wave   (b) square wave

    (c) triangular wave   (d) half wave rectified sine wave

11. From the fig. showing sinusoidal waves of induced e.m.f. A and B, we may say that **(1.5)**
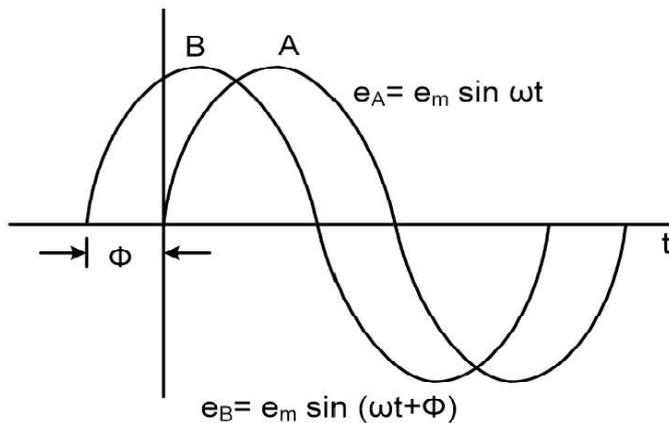
    (a) A & B are in phase with each other   (b) A is leading B by vt

    (c) A is leading B by F   (d) B is leading A by F

12. A 50-Hz alternating current has a time period (T) of **(1.5)**

    (a) 1/50 second   (b) 10/50 second

    (c) 50 second   (d) 5 second

13. Which of the following statement is wrong **(1.5)**

    (a) Stationary magnetic flux will not induce any e.m.f in a stationary conductor.

    (b) The magnitude of induced e.m.f depends on the rate of flux linkage.

    (c) When a conductor moves in parallel to the direction of the flux e.m.f is induced.

    (d) E.m.f will be induced if either the flux or the conductor is in motion.

14. In statically induced e.m.f **(1.5)**

    (a) the conductor remains stationary and flux linkage is changed

    (b) the conductor and flux linkage remains stationary

    (c) the conductor moves and flux linkage changes

    (d) the magnetic field is stationary and the conductor cuts across it

15. What is the unit of self-induction (L)? **(1.5)**

    (a) mho   (b) weber

    (c) henry   (d) weber-turn

16. In an ac circuit, the product of r.m.s volts and r.m.s amperes gives **(1.5)**
   (a) reactive power   (b) apparent power
   (c) active power   (d) average power

17. Which is the correct power triangle for series R-L circuit **(1.5)**

(a) $S=I^2Z$ $Q=I^2X_L$ Φ $P=I^2R$

(b) $P=I^2R$ Φ $S=I^2Z$ $Q=I^2X_L$

(c) $P=I^2R$ Φ $Q=I^2X_L$ $S=I^2Z$

(d) $S=I^2Z$ $Q=I^2X_L$ Φ $P=I^2R$

18. In RLC series circuit, the power factor is **(1.5)**
   (a) 0   (b) 1
   (c) between 0 and 1 lag   (d) between 0 and 1 lag or lead

19. What do you mean by phase sequence RYB? **(1.5)**
   (a) It denotes phase R, Y and B
   (b) It is the standard manufacturer's nomenclature
   (c) It is the sequence in which the voltage across R, Y and B attain their maximum values
   (d) It denotes the colour of the wire

20. If V_{PH}, I_{PH} are the phase voltage and current and V_L, I_L are the line voltages in a star connected system, then **(2)**
   (a) $V_L = \sqrt{3}\ V_{PH}$ and $I_L = I_{PH}$ (b) $V_L = \sqrt{3}\ V_{PH}$ and $I_L = \sqrt{3}\ I_{PH}$
   (c) $V_L = 1/\sqrt{3}\ V_{PH}$ and $I_L = I_{PH}$ (d) $V_L = 1/\sqrt{3}\ V_{PH}$ and $I_L = \sqrt{3}\ I_{PH}$

21. If ZY and ZD are the phase impedance of a balance Star and a Delta connected system and if we convert Delta system to its equivalent Star system then **(2)**
   (a) ZD = ZY   (b) 3ZD = ZY
   (c) ZD = 3ZY   (d) $\sqrt{3}$ ZD = ZY

22. In an alternator, if the frequency is f, the rotational speed is N and the number of poles is P then **(1.5)**
   (a) P = 120N/f   (b) P = 120f/N
   (c) P = N/120f   (d) P = f/120N

23. In an alternator, an alternating e.m.f in induced when **(1.5)**
   (a) rotating field cuts stationary conductors
   (b) when the machines rotates at a synchronous speed
   (c) moving conductors cuts stationary field
   (d) when the armature rotates and the field is stationary

24. Cylindrical type rotors are used in **(1.5)**
    (a) high speed alternators   (b) medium speed alternators
    (c) low speed alternators   (d) very low speed alternators

25. Long transmission lines may be classified as **(1.5)**
    (a) line length 100km and voltage range upto 50kV
    (b) line length 120km and voltage range upto 100kV
    (c) line length 120km and voltage range above 100kV
   (d) line length above 150km and voltage range above 100kV

26. Due to skin effect **(1.5)**
    (a) portion of the conductor near the surface carries more current and core of the conductor carries less current
    (b) portion of the conductor near the surface carries less current and core of the conductor carries more current
    (c) current flows through half cross-section of the conductor
    (d) current flows equally through the conductor

27. Corona results in **(1.5)**
    (a) improvement in power factor
    (b) increased capacitive reactance of transmission lines
    (c) radio interference
    (d) better regulation

28. Thyristor is basically **(1.5)**
    (a) SCR   (b) Triac
    (c) all PNPN devices   (d) both SCR and Triac

29. The rectifier which requires minimum amount of filtering is **(1.5)**
    (a) Half wave rectifier   (b) Full wave rectifier
    (c) Voltage double circuit   (d) SCR half wave rectifier

30. The circuit shown is **(1.5)**
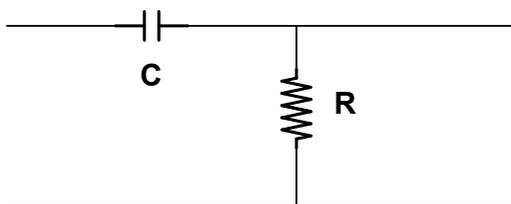
    (a) integrator   (b) low pass filter
   (c) high pass filter   (d) band pass filter

31. In 132kV lines Weight span is defined as **(1.5)**
    (a) span between two adjacent towers
    (b) distance between low point sag of one span to the low point sag of the next span
    (c) distance between low point sag of one span to the next tower
    (d) distance between two span

32. The angle of deviation for B Type tower is **(1.5)**

    (a) 30 to 60 degree   (b) 15 to 30 degree

    (c) 2 to 15 degree   (d) 0 to 2 degree

PART - B (50-MARKS)

This Section should be answered only on the <u>Separate Answer Sheet</u> 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 G$\lor$ after 10 minutes

    (b) 0.23 G$\lor$ after 1 minutes

    (c) 0.15 G$\lor$ 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$\lor$. What is the recommended depth of each electrode below earth surface, d_p? **(5)**
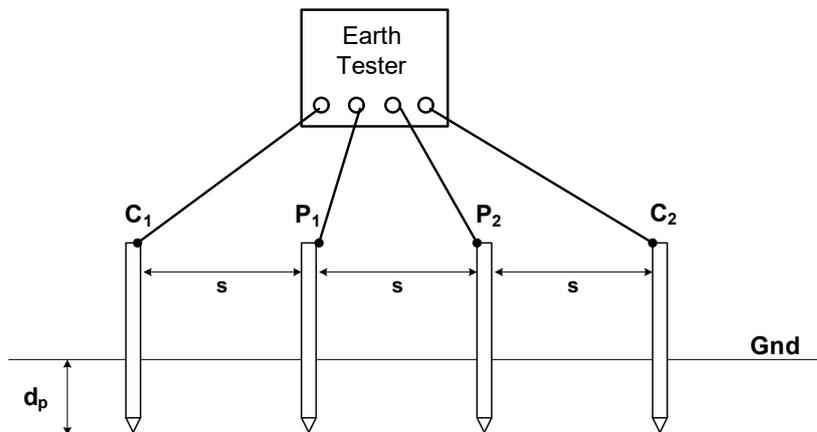
**4.** (a) What is the highest available transformation voltage level in transmission system in Mizoram?

     (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)**
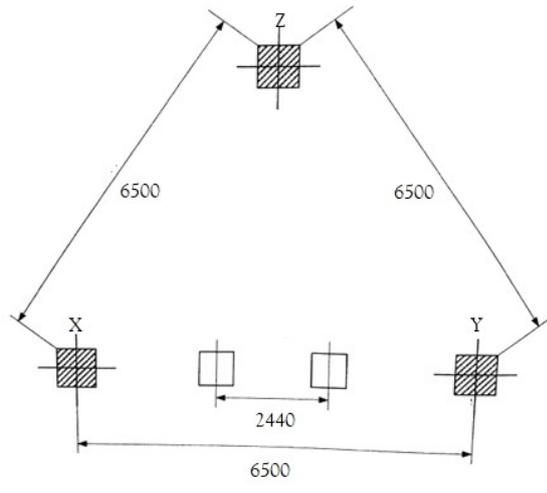
8. The total unit of 11kV panel energy meter for one month is 340kWh. The external PT ratio is 11000/110V and CT ratio is 50/5A. If the energy meter is calibrated for PT ratio 11000/110V, CT ratio 25/5A what will be the actual energy in kWh? **(5)**

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)**
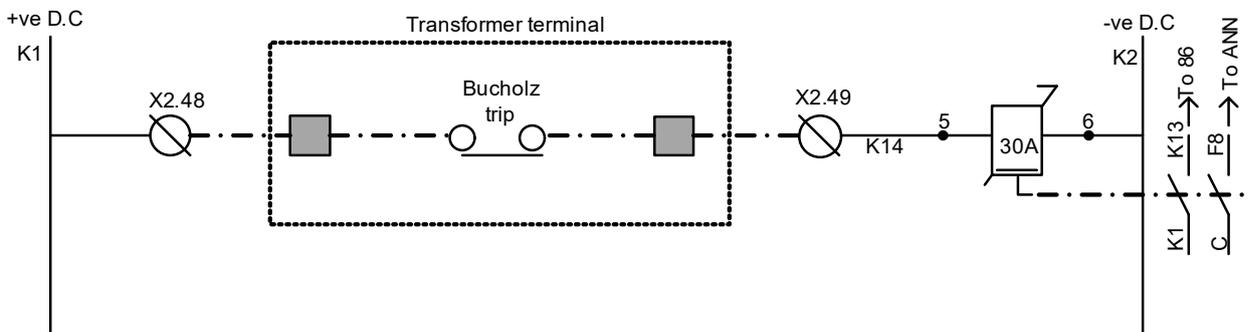
10. (a) How many poles will be required in 1 km of LT ABC line if standard spacing between each pole is maintained as per SOR 2020?

    (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)**

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