

MIZORAM PUBLIC SERVICE COMMISSION
DEPARTMENTAL EXAMINATION FOR JUNIOR GRADE OF M.E.S. (AE/SDO)
UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT,
GOVERNMENT OF MIZORAM, DECEMBER, 2024.

ENGINEERING PAPER – II
ELECTRICAL ENGINEER

Time Allowed : 3 hours

FM : 100 PM : 40

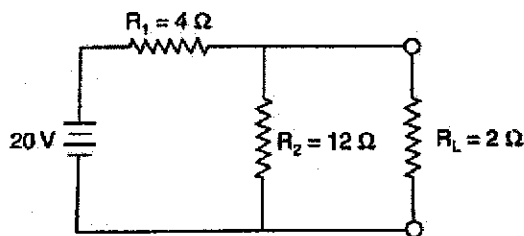
Marks for each question is indicated against it.

Attempt all questions.

PART – A (50 MARKS)

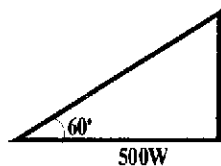
All questions carry equal marks of 2 each.

1. The resistance of a straight conductor is independent of
 - (a) temperature
 - (b) material
 - (c) cross-sectional area
 - (d) shape of cross-section
2. If R_L of Figure is the load resistance, then Thevenin's equivalent resistance R_{TH} of the circuit will be



- (a) 3Ω
 - (b) 5Ω
 - (c) 7Ω
 - (d) 10Ω
3. Mesh current analysis is based on
 - (a) Kirchhoff's current law
 - (b) Kirchhoff's voltage law
 - (c) Maxwell's law
 - (d) Norton's law
4. The supply voltage of a consumer is 220VAC and his internal wiring is protected by 9A fuse. How many 60W bulb in parallel can be turned on simultaneously without breaking the fuse?
 - (a) 33 nos
 - (b) 44 nos
 - (c) 22 nos
 - (d) 20 nos
5. The heat produced (in kcals) in a resistance R ohms when a current I amperes flows through it for t seconds is given by
 - (a) $I^2 Rt$
 - (b) $I^2 Rt / (4.2 \times 10^3)$
 - (c) $I^2 Rt \times 4.2$
 - (d) $I Rt / J$
6. In a capacitor the electric charge is stored in
 - (a) dielectric
 - (b) metal plates
 - (c) both dielectric and metal plates
 - (d) electric charge is not stored

7. Inductive reactance is measured in ohms because it
(a) reduces the amplitude of the alternating current (b) increases the amplitude of alternating current
(c) increases the amplitude of direct current (d) has a back e.m.f opposing a steady direct current
8. The e.m.f induced in a coil of N turns is given by
(a) $d\Phi/dt$ (b) $N d\Phi/dt$
(c) $-N d\Phi/dt$ (d) $N dt/d\Phi$
9. Mutual inductance between two coils can be decreased by
(a) increasing the number of turns in either coils (b) moving the coils closer
(c) moving the coils apart (d) none of the above
10. When magnetic flux linking a conductor changes
(a) an e.m.f is always induced (b) a current is always induced
(c) both e.m.f and current are always induced (d) neither e.m.f or current are induced
11. Lenz's law is related to
(a) the direction of magnetic field (b) the direction of motion of conductor
(c) the direction of the induced current (d) both (a) and (b)
12. For a sine wave with peak value I_m the r.m.s value is
(a) $0.818 I_m$ (b) $0.707 I_m$
(c) $0.5 I_m$ (d) $1.414 I_m$
13. The power factor of an a.c. circuit is given by
(a) X_L/R (b) Z/R
(c) R/X_L (d) R/Z
14. Reactive power in an a.c circuit is
(a) measured by a wattmeter (b) the useful power
(c) consumed in the circuit (d) a liability on the circuit
15. A low power factor of the circuit means that it will
(a) draw more active power (b) draw less line current
(c) draw more reactive power (d) cause less voltage drop in the line
16. In the power triangle shown in figure, the reactive power is?

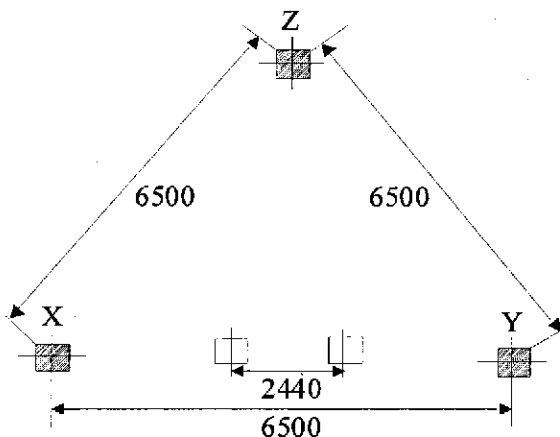


- (a) 1000 VAR leading (b) 1000 VAR lagging
(c) 866 VAR lagging (d) 866 VAR leading
17. A 3-phase load is balanced if all three phases have the same
(a) impedance (b) power factor
(c) impedance and power factor (d) none of the above
18. The phase sequence of a 3-phase balanced system is RYB. The other possible phase sequence can be
(a) BRY (b) YRB
(c) RBY (d) BRB

19. The frequency of e.m.f. generated in an 8 pole alternator running at 900 r.p.m is
(a) 50 Hz (b) 60 Hz
(c) 120 Hz (d) 140 Hz
20. The speed at which a 6-pole alternator should be driven to generate 50 cycles per second is
(a) 1500 r.p.m (b) 1000 r.p.m
(c) 800 r.p.m (d) 500 r.p.m
21. Corona effect
(a) produces ozone gas (b) reduces transmission efficiency
(c) causes line to draw non-sinusoidal current (d) all the above
22. The capacitance of a transmission line is neglected in case of
(a) medium line (b) long line
(c) short line (d) extra long line
23. The skin effect increases the
(a) resistance of the line (b) inductance of the line
(c) capacitance of the line (d) inductance and capacitance line
24. The most widely used rectifier circuit is
(a) half-wave rectifier (b) centre-tap circuit
(c) bridge circuit (d) full-wave rectifier
25. The function of a filter circuit in a power supply is to
(a) limit the current in the rectifier
(b) limit the peak voltage of the rectifier
(c) separate a.c and d.c component of the rectified voltage
(d) limit the power of the rectifier

PART-B (50 MARKS)

26. Figure below shows the schematic diagram of Distribution Transformer Earthing where the earthing electrodes X, Y and Z are placed 6500mm apart. Describe how the Distribution Transformer and the three electrodes X, Y, Z are inter-connected? (5)

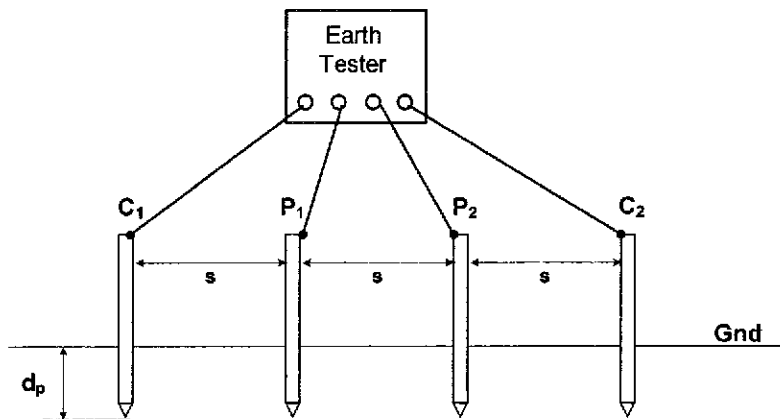


27. Insulation resistance of 25MVA, 33/11kV transformer is measured between HV and LV side and the result obtained is shown below:

1. 0.78 GΩ after 10 minutes
2. 0.39 GΩ after 1 minutes
3. 0.10 GΩ after 30 seconds

Calculate the Polarization Index (PI) value and the Dielectric Absorption Ratio (DAR) value? (5)

28. Calculate the apparent soil resistivity from below figure where the distance between the four electrodes, $s = 6$ mtrs and the earth tester reading, $R = 12\Omega$ as shown in the figure. What is the depth of d_p with respect to the distance 's'? (5)



29. What are the criteria for selection site for Power Sub-Station? (5)

30. By thumb rule what is the minimum acceptable Insulation Resistance (IR) between phase to phase and phase to earth of a Current Transformer (CT) ? If the voltage rating of the CT is 33kV, what should be the minimum IR between phase to phase and phase to earth before charging the CT? (5)

31. What is the short-circuit current on the LV side of 132/33kV 12.5MVA Power Transformer whose % impedance is 11.5%? (5)

32. Name three types of arc quenching medium normally used in 33kV Outdoor Type Circuit Breaker (CB)? Which relay trips the CB remotely? (5)

33. The external PT ratio is 33000/110V and external CT ratio is 200/1A. If the energy meter is calibrated for PT ratio 33000/110V, CT ratio -/1A then what will be the multiplying factor for the meter? (5)

34. How many poles will be required in 1 km of LT ABC line if standard spacing of 25 mtrs is maintained between each pole ? Which type of conductor is normally used in 132kV lines? And what is the minimum number of disc insulators required for stringing 132kV lines? (5)

35. (a) Upto what distance is 11kV voltage normally used for distribution line ?

(b) Why steel core is provided on aluminium conductors?

(c) Pin type insulator are used upto which voltage level? (5)

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