MIZORAM PUBLIC SERVICE COMMISSION

DEPARTMENTAL EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. (AE/SDO)
UNDER POWER & ELECTRICITY DEPARTMENT,
GOVERNMENT OF MIZORAM, DECEMBER, 2019.

ELECTRICAL ENGINEERING PAPER – I

Time Allowed : 3 hours   FM : 100   PM : 40

The figures in the margin indicate full marks for the questions.
Attempt all questions.

1. Choose the correct answers: **(7×2=14)**
   (a) Width of Right of Way as per guidelines of Forest Conservation Act 1980 for 132kV line is **22 / 27 / 35** meter.
   (b) Tower bolts shall be punched as per specification and nuts shall be properly tack welded. It shall be ensured that the circular length of each welding shall be at least **5 / 10 / 22** mm.
   (c) IR values of individual disc of at least **5 / 10 / 15** % insulators at random shall be checked by 5kV or 10kV Megger at the time of erection of new Transmission Lines.
   (d) **500V or 1000V / 1000V or 2500V / 5000V or 10000V** Megger may be used for measurement of Insulation Resistance of transmission line.
   (e) For observation the transmission line shall be charged at least **8 / 10 / 12** hours. During this time continuous monitoring and inspection will be maintained in control room, auxiliary system areas and switchyards.
   (f) The power line tower stubs are set using **templates / steel boxes / jacks**.
   (g) For 33kV and 11kV line construction, double pole structure must be used for angle of deviation more than **10 degree/15 degree/ 20 degree.**

2. Mention the seven major components of works for erection of transmission lines?   **(6)**

3. Choose the correct answer: **(5×2=10)**
   (a) Pole earthing of LT line must be done after every **3rd/ 4th/ 5th** consecutive pole
   (b) The permissible tower footing resistance is **10 / 5 / 15** Ohms
   (c) The Bentonite clay consists of a hydrous aluminium silicate which can absorb water up to **3 / 5 / 7** times its weight and swells up to 13 times.
   (d) In Werner or a four electrode method of measuring soil resistivity, the inner two electrodes are connected to the **potential terminals / current terminals** of the Megger.
   (e) The formula for calculating Specific Resistivity of the soil is $2\pi AR$, where A is the **surface area of the electrode / distance between the electrodes**

4. What is step potential?   **(5)**

5. Figure A below shows the schematic diagram of Distribution Transformer earthing. Describe the connections to the three electrodes X, Y, Z with respect to Distribution Transformer and Lightning Arrestors. **(5)**
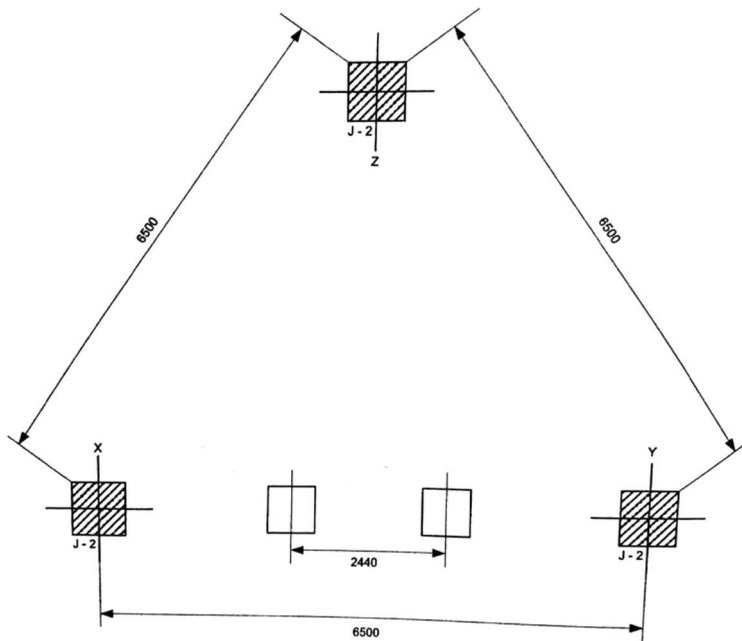

FIGURE A

6. Choose the correct answer: **(5×2=10)**

   (a) Standard Bay widths of 33kV Substation switchyard is **3.5 / 4.7 / 5.2** meters.

   (b) When overhead ground wires are used in substation switchyard, all electrical equipment within the area enclosed by the ground wires shall fall within the area covered by a **30 degree/ 40degree / 60 degree** angle of protection.

   (c) As per O&M guidelines for Lines and Sub-Stations, February 2017 issued by P&E Department, the recommended Breakdown Value of Oil for new Distribution Transformer must be **15kV / 20kV / 30kV**.

   (d) As per maintenance schedule of Power Transformer checking the colour of silicagel in the breather must be done on **hourly basis / daily basis / weekly basis**

   (e) Trip Circuit Supervision will detect loss of **AC supply/ DC supply** in the tripping circuit

7. Why is the protection class of metering core different from protection core in a Current Transformer? **(5)**

8. Figure B below show Panel Drawing of 33kV Transformer metering Scheme. **(5)**

    (a) What does ferrule no X3.6 signifies?

    (b) What does ferrule nos. 1D11, 1D31, 1D51, 1D71 signifies?

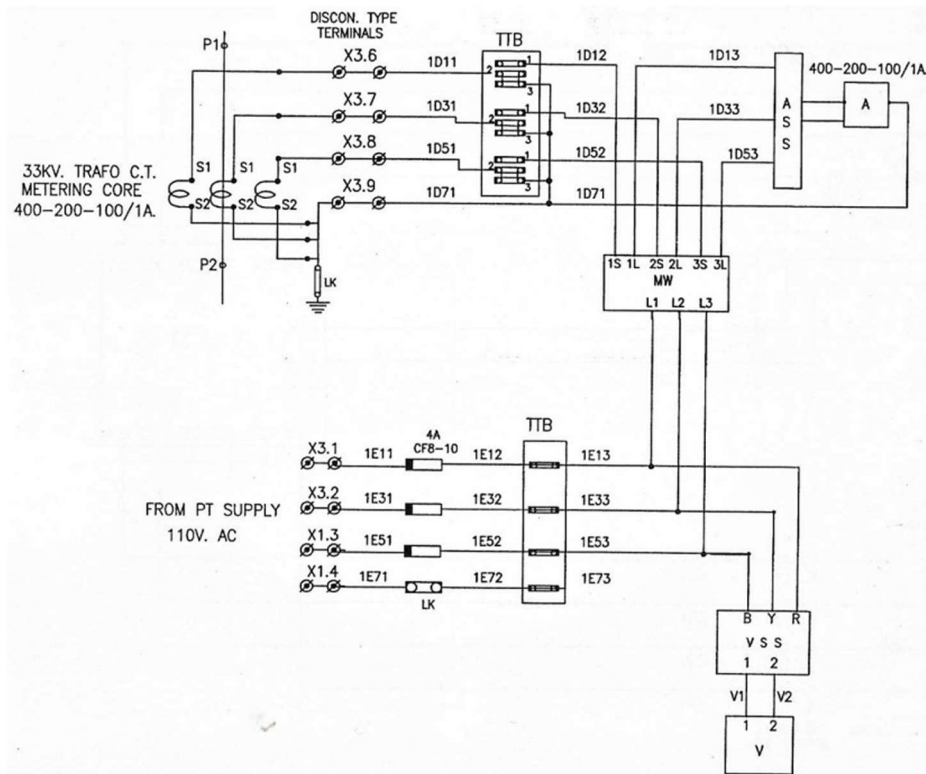   (c) What is the maximum rated current that can flow in this circuit?

FIGURE B

9. Choose the correct answer: **(5×2=10)**

    (a) While commissioning Battery Charger, the insulation of the charger input lines must be checked with 500VMegger and the value must be more than **1MOhms / 1.5MOhms / 2MOhms**.

    (b) The centre point of the Battery Bus is connected to earth fault relay through a resistance voltage divider circuit. The earth fault relay actuates when leakage current through this circuit or Bus is more than **3mA / 5mA / 7mA**.

    (c) Under voltage relay for AC supply voltage of a Battery Charger is normally set between **75-80% / 80-95% / 95-100%** of the supply voltage.

    (d) During first charge of new Lead Acid Batteries, the rate of charging current must be **5 % / 6% / 7%** of the rated AH for standard batteries.

    (e) Electrolyte specific gravities have to be checked every day for periodic maintenance, **3 % / 5% / 7 %** cells of the battery bank can be used as pilot cells for daily specific gravity measurements.

10. Write the formula for calculating short circuit current from transformer nameplate. Calculate the short-circuit current on the HV side of 33/11kV 1.6MVA Power Transformer whose parameter are as shown below: **(10)**

HV rated voltage	= 33kV
HV rated current	= 27.99A
% Impedance	= 9%
Supplied voltage at HV side	= 415V

11. What is the formula for Polarization Index (P.I)? What is the recommended value as per O&M guidelines for Lines and Sub-Stations, February 2017 issued by P&E Department? **(4)**

12. What is the formula for Multiplying Factor (MF) of CT operated energy meter. The reading of 11kV panel energy meter is 15kWh. The external PT ratio is 33000/110V and CT ratio is 50/1A. If the energy meter is calibrated for PT ratio 33kV/110V, CT ratio 15/1A what will be the actual energy in kWh? **(10)**

13. Choose the correct answer: **(3×2=6)**

   (a) The minimum acceptable IR value of instrument transformer (CT & PT) as per IEEMA is **(kV+1)MOhms / (kV+2)MOhms / (kV+3)MOhms** where kV is the system voltage under consideration.

   (b) The turbine used in Serlui B Hydel Project is **vertical francis / vertical kaplan**.

   (c) As per REC standard maximum permissible voltage regulation for distribution line upto transformer level is **2% / 2.5% / 3%**.

* * * * * * *