

6. It is normal practice that local distribution from substations is placed close to the load centre and supplied at 11 kV. Transformers in these local substations reduce the voltage to 400 V. Three-phase and neutral distributor cables connect this supply to consumers. This provides a 230 V single-phase supply which is suitable for domestic consumers.

Consider the loads given below:

- 400 kV and 275 kV for the super Grid;
- 132 kV for the original Grid;
- 33 kV for secondary transmission;
- 11 kV for high-voltage distribution;

- a. Draw a well labelled diagrammatic representation showing the distribution of the above power. (10 marks)
- b. Draw a neat labelled simplified diagram of the distribution from the local substation to single-phase supply. (6 marks)
- c. Explain whether the above distribution is best carried out by an underground cable or by an overhead line transmission giving reasons for your choice. (4 marks)

EXAMINATION: AUTHORISATION B

Paper II (Electrical Installation Technology)

Time Allowed: 3 Hrs

July 2016

END OF PAPER

WRITE ALL YOUR WORK ON THE ANSWER BOOK PROVIDED. EVERY ANSWER SHOULD INCLUDE ALL WORKINGS, NECESSARY DIAGRAMS AND FORMULAE.

START EACH ANSWER ON A FRESH PAGE.

Answer any FIVE Questions

1. Describe, with the aid of sketches, the functions of each of the following electrical equipment used on or in relation to switchgear.

- a. Air circuit breaker. (2 marks)
- b. Oil circuit breaker. (2 marks)
- c. Isolator. (2 marks)
- d. Oil switch. (2 marks)
- e. Main Busbar. (2 marks)
- f. Feeder Busbars. (2 marks)
- g. Maximum demand meter. (2 marks)
- h. Current transformers. (2 marks)
- i. Terminal cable joint box. (2 marks)
- j. Earthing grid. (2 marks)

2. a. By drawing a neat and well-labelled diagram describe the construction of each of the following power cables:

- i. Three core solid aluminium conductors, single wire armoured and PVC over-sheathed cable. (3 marks)
- ii. Four core copper stranded, single wire armoured and PVC over-sheathed cable. (3 marks)
- iii. Single core aluminium conductor sectoral cable. (3 marks)
- iv. Four core aluminium cable, with aluminium strip armour and PVC over-sheathed cable. (3 marks)

b. Explain in short steps how to fit a gland on one of the above cables. (8 marks)

3. When choosing an electric motor, considerations should be taken as to the tasks it has to perform. Mention the characteristics and application of each of the motors below:

- a. D.C. shunt motor (4 marks)
- b. D.C. series motor (4 marks)
- c. D.C. compound motor (4 marks)
- d. A.C. squirrel-cage induction motor (4 marks)
- e. A.C. wound-rotor (slip ring induction motor) (4 marks)

4. a. Explain the difference between:-

- i. Planned Maintenance (4 marks)
- ii. Breakdown Maintenance (4 marks)
- iii. Preventive Maintenance (4 marks)

b. As part of a maintenance team you have been called to investigate why a pump motor has stopped running. The pump is directly coupled to the motor and is driven by a three phase induction motor supplied from a nearby distribution board. The motor circuit has its own main switch and direct-on-line starter. What procedure would you take to find the fault? (8 marks)

5. a. A small factory consists of the following load :

- A 30kW three phase induction motor having an efficiency of 90% at 0.8 p.f.
- Three by 6kW three phase induction motors having an efficiency of 85% at 0.8 p.f.
- Three ring circuits feeding 30 single phase switched socket outlet,
- Six instant water heaters each rated 2.5kW (single phase),
- 3kW of fluorescent lighting.

Assuming a three phase 400/230V supply, and that the single phase loads are closely balanced, calculate:

- i. The rating of the BS 88 fuses protecting each individual circuit (I_n), (6 marks)
- ii. Determine the total current demand for the main switch board. In your answer describe how you would place the various loads on the main switchboard. (8 marks)
- iii. Sketch a single line diagram of the main switchboard arrangement and indicate the current rating of BS 88 Part 2 fuses used to protect each circuit. (6marks)

The following table provides the necessary information regarding the BS 88 Part 2 Fuses.

6A	10A	16A	20A	25A	32A	50A	63A	80A	125A	150A	250A
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