Total No. of printed pages = 8

CAI-603/SS&P/6th Sem/2017/N

SUBSTATION, SWITCHGEAR AND PROTECTION

Full Marks – 70

Time – Three hours

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

PART – A

Question Nos. 1-3, fill up the blank (One Mark each).

1. An AC generator converts _____ energy to _____ energy.

2. The standard frequency of AC voltage adopted in India is _____ Hz.

3. Potential transformer is a transformer which is used for the measurement of _____ voltage.

[Turn over

Question Nos. 4-13, fill up the blank with the proper word given in the bracket (One Mark each).

4. A fuse element should have _____ melting point. (high / low / very high)

5. Induction relays are used with _____ quantitates. (AC / DC / AC & DC)

6. In India _____ system is adopted for transmission of electric power. (3-phase, 3-wire / 3-phase, 4-wire)

7. Buchholz relay is installed between _____ and conservator. (winding / main tank / bushings)

8. Majority of distribution substations are of _____ type. (indoor / outdoor / pole mounted)

9. The voltage rating of the transformer in a pole mounted substation is _____. (132 kV to 66 kV / 11 kV to 400V)

10. Buchholz relay can detect fault _____ oil level in the transformer. (above / below)

11. For a fuse element, the current rating is _____ than fusing current. (more / less)

12. The operator 'a' rotates the vector through _____ in the anticlockwise direction. (90° / 120° / 150°)

13. An earth fault current is generally _____ than short circuit current. (less / greater)

Question Nos. 14-25, choose the most appropriate option (One Mark each).

14. Which of the following medium is employed for extinction of arc in air circuit breaker ?

    (i) Sulphur hexafluoride (SF_6) gas

    (ii) Air

    (iii) Oil

    (iv) Water

15. The arcing contacts in a circuit breaker are made of

    (i) copper tungsten alloy

    (ii) aluminium

    (iii) porcelain

    (iv) electrolytic copper

16. What is the actuating quantity of a relay ?

(i) Magnitude of current

(ii) Frequency

(iii) Phase angle

(iv) All of these

17. What is the purpose of back-up protection ?

(i) To increase the speed

(ii) To increase the reach

(iii) To leave no blind spot

(iv) To guard against failure of primary

18. The full form of ACSR is

(i) All Conductors Steel Reinforced

(ii) All Conductors Silicon Reinforced

(iii) Aluminium Conductor Steel Reinforced

(iv) None of the above

19. HRC fuses are widely used in industries. The full form of HRC is

(i) High Resistance Capacity fuse

(ii) High Reactance Capacity fuse

(iii) High Rating Capacity fuse

(iv) High Rupturing Capacity fuse

20. In electrical power generating stations, large alternators are used to produce electric power. When the prime mover of the alternator fails

(i) the alternator will run as an induction motor

(ii) the alternator will run as an induction generator

(iii) the alternator will run as a single phase machine

(iv) None of the above

21. Protective relays are devices that detect abnormal conditions in electrical circuits by measuring

(i) current during abnormal condition

(ii) voltage during abnormal condition

(iii) constantly the electrical quantities which differs during normal and abnormal conditions

(iv) None of the above

22. A differential relay measures the vector difference between

(i) two currents

(ii) two voltages

(iii) two or more similar electrical quantities

(iv) None of the above

23. The nature of the fault L-L-L-G is

(i) symmetrical

(ii) unsymmetrical

(iii) can't be determined

(iv) depends on the conductor size

24. The line current in the primary side of a 11kV/400V, 250kVA distribution transformer will be

(i) 31.12 A (ii) 16.40A

(iii) 22.73A (iv) 13.12 A

25. An ideal electric transformer is a device which can change

(i) electric power

(ii) only voltage level

(iii) voltage and frequency both

(iv) only current and power.

PART – B

Answer any *five* questions.

1. What do you mean by protective relays in power system ? What is the duty of a protective relay ? How it is connected with current transformer and circuit breakers to protect an equipment ? Explain with a neat diagram. 1+2+6=9

2. What is a differential relay ? Describe the working of a current differential relay with proper diagram. 2+7=9

3. Write the working principle of sulphur hexafluoride circuit breaker. State three main advantages of sulphur hexafluoride circuit breaker. 6+3=9

4. Why underground substation is required ? Write the classification of substations. 2+7=9

5. With neat diagram, briefly discuss about the primary and back-up protection scheme of power system. 9

6. What is operator 'a' ? Show that 9

(i) $a^2 = -0.5 - j0.866$

(ii) $1 + a + a^2 = 0$

(iii) $a - a^2 = j\sqrt{3}$

7. Write short notes : 4.5+4.5=9

(i) Current and potential transformers

(ii) Buchholz relay.