UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, NOV/DEC 2018

COURSE NO: EL 371
COURSE NAME: Power Generation and Supply
CLASS: EL III **TIME**: 3 Hours

Name**:** _____Index Number: _____

INSTRUCTION: ATTEMPT ALL QUESTIONS IN SECTION A AND ANY TWO (2) IN SECTION B IN THE ANSWER BOOKLET PROVIDED

SECTION A (30 marks)

1. The choice of materials used for solar cells is mainly decided by what factor? ***(1 mk)***
2. The ratio of the heat equivalent of the electric output of generator to the heat of combustion of coal in a thermal plant is termed specifically as what? ***(1 mk)***
3. State any TWO demerits of a steam power plant. ***(2 mks)***
4. Why should thermal plants be located near load centres? ***(1 mk)***
5. What is the basic function of the surge tank of a hydro plant? ***(1 mk)***
6. Determine the power that can be produced by a hydro plant when the discharge of water is 100 m^3/sec, water head 200 m and plant efficiency being 90%. ***(2 mks)***
7. Mention THREE factors that influence the installed capacity of hydro power station. ***(3 mks)***
8. The thermal reactor of nuclear power stations consists basically of fuel burning system, *moderator* and coolant. Define the term in italics. ***(1 mk)***
9. State THREE classifications of nuclear reactors based on the type of coolant used. ***(3 mks)***
10. Why should nuclear power plants be erected near a river? ***(1 mk)***
11. Why is it necessary to use high voltages for transmission systems? ***(2 mks)***
12. Define the term "economic transmission voltage". ***(1 mk)***
13. The number of cross-arms carried by a pole depends basically on what? ***(1 mk)***
14. Why are a.c. systems mostly preferred over d.c. systems for the transmission of bulk power. ***(1 mk)***
15. What do you think will happen if the control engineer does not endeavour to maintain the output from the generators equal to the connected load at a specific frequency and voltage? ***(1 mk)***
16. Outline any FOUR major problems associated with the development of atomic power plants. ***(4 mks)***
17. The time of operation of the inverse time –lag relay is directly proportional to the reciprocal of the current flowing through it. **True or False?** ***(1 mk)***
18. Short-circuit studies can also be used to design grounding systems. **True or False**? ***(1 mk)***
19. Francis turbines are suitable for medium heads. **True or False**? ***(1 mk)***
20. The safety factor for line insulators is defined as the ratio of puncture strength to flashover strength. **True or False**? ***(1 mk)***

SECTION B (50 marks)

QUESTION 1

(a) List **TWO** major types of test carried out on line insulators before their installation. ***(2 mks)***

(b) State **THREE** characteristics of line insulators. ***(3 mks)***

(c) Mention **THREE** advantages of suspension insulators over pin insulators. ***(3 mks)***

(d) In what practical ways can the string efficiency of a suspension insulator be improved? ***(2 mks)***

(e) A suspension insulator having three (3) discs is subjected to a 161 kV. Deduce the:
   (i) general expression for the voltage distribution along the insulator piece
   (ii) magnitude of the voltages across each disc.
   (iii) efficiency of the string.
   (Take m = 0.08) ***(15 mks)***

QUESTION 2

(a) Mention **TWO** classifications of substations according to their:
   (i) purpose ***(2 mks)***
   (ii) constructional features ***(2 mks)***

(b) Briefly explain with the aid of a suitable diagram the one and a half breaker arrangement. **(5 mks)**

(c) Deduce the ABCD parameters for a medium transmission line using the nominal π method. ***(11 mks)***

(d) A 150 km, 3-phase, 110 V, 50 Hz transmission line transmits a load of 40,000 kW at 0.8 p.f. lag at the receiving end.
   resistance/km/phase =0.15 Ω
   reactance/km/phase =0.6 Ω
   susceptance/km/phase =10^{-5} S.

   Determine the A, B, C and D constants of the line using the nominal-π method ***(5 mks)***

QUESTION 3

(a) Differentiate between pin insulators and strain insulators with the aid of appropriate diagrams. ***(8 mks)***

(b) State **FOUR** main functions of electrical power substations. ***(4 mks)***

(c) Sketch a typical single-line diagram of a local distribution system in Ghana. ***(3 mks)***

(d) State the empirical formula for the economic voltage between lines in a three-phase ac system. ***(2 mks)***

(e) List **THREE** advantages of the ring scheme as compared to the radial scheme. ***(3 mks)***

(f) Sketch a line diagram of a thermal power station. ***(5 mks)***

QUESTION 4

(a) Define the following terms:
   (i) Feeder
   (ii) Distributor
   (iii) Service line. ***(3 mks)***

(b) Give a sketch of the classification of distribution systems according voltage, kind of currents, service, construction, number of wires and connection schemes. ***(6 mks)***

(c) Mention **FIVE** criteria that determine the choice of scheme for substation breaker arrangements. ***(5 mks)***

(d) Identify the names of each component in the substation layout shown in Figure 1. ***(6 mks)***

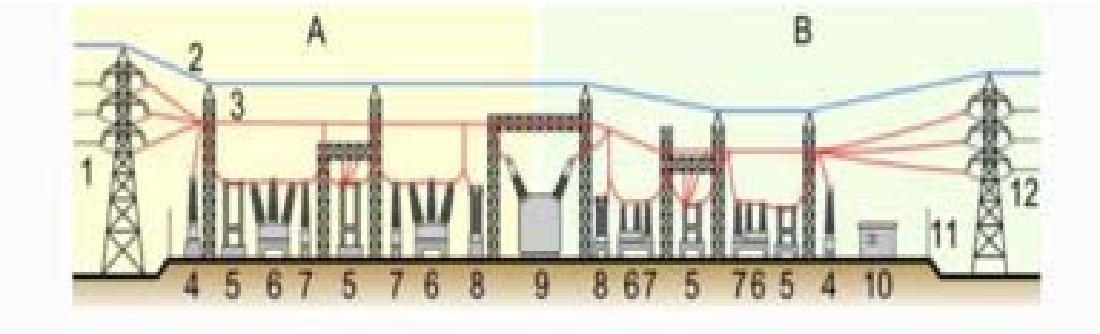

Figure 1

(e) Mention **FIVE** factors that must be considered in the selection of site for hydroelectric power stations. ***(5 mks)***

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