KATHMANDU UNIVERSITY
End Semester Examination
August/September, 2017

Mark Scored:

AUG 30 2017

Level : B. E.
Year : III
Course : EPEG 301
Semester : II

Exam Roll No. :
Time: 30 min
F. M. : 20

Registration No.:
Date :

SECTION "A"
[20 Q × 1 = 20 marks]

Choose and **encircle** the most appropriate option:

1. Frequency supplied from the Electrical power system is 50 Hz. When the load consumption is greater than the generation then
   a. the supply frequency is lower than 50 Hz
   b. the supply frequency is greater 50 Hz
   c. the supply frequency is equal to 50 Hz
   d. the supply frequency is fluctuate between 50 Hz

2. **Unit commitment** (UC) is an optimization problem used to determine the operation schedule of
   a. the generating units at every ***second*** interval with ***varying*** loads under different constraints and environments.
   b. the generating units at every hour interval with ***varying*** loads under different constraints and environments
   c. the generating units at every ***second*** interval with ***constant*** loads under different constraints and environments
   d. the generating units at every ***hour*** interval with ***constant*** loads under different constraints and environments

3. In overhead system, insulation between conductors whether at the supports or intermediate points is always provided by suitably spacing the conductors. Therefore, electric discharge cannot occur between conductors. However, the insulation has to be provided between the conductor and supporting structure.
   a. Therefore, ***maximum*** stress is between ***conductor and conductor***
   b. Therefore, ***minimum*** stress is between ***conductor and earth***
   c. Therefore, ***maximum*** stress is between ***conductor and transformer***
   d. Therefore, ***maximum*** stress is between ***conductor and earth***

4. In a 3 wire dc system, there are two outers and a middle or neutral wire which is earthed at the generator end. If the load is balanced the current in the neutral wire is _____.
   a. maximum
   b. greater than the outer wire
   c. zero
   d. half of outer wire

5. Kelvin's Law stated that *the most economical area of conductor is that for which the total annual cost of transmission line is* _____.
   a. maximum *b. minimum* *c. unaffected* *d. highly effected*

6. It will be the annual interest and depreciation on the capital cost of conductors, supports and insulators and the cost of their erection. For an overhead line_____ and the conductor cost is _____.
   a. insulator cost is variable, proportional to the area of X-section
   b. insulator cost is constant, inversely proportional to the area of X-section
   c. insulator cost is variable, inversely proportional to the area of X-section
   d. insulator cost is constant, proportional to the area of X-section

7. For the same conductor length, same amount of power , same losses and same maximum voltage to earth, which system requires minimum conductor area?
   a. dc two wire mid-point earthed
   b. ac single phase 2 wire
   c. ac three phase 3 wire
   d. dc three wire

8. *A feeder is a conductor which connects the sub-station* to the area where power is to be distributed. Generally, no tappings are taken from the feeder so that _____ in it remains the same throughout. The main consideration in the design of a feeder is the _____.
   a. current, current carrying capacity
   b. voltage, current carrying capacity
   c. current, voltage withstanding capacity
   d. voltage, voltage withstanding capacity

9. A uniformly loaded dc distributor is fed at both ends with equal voltages. In comparison to a similar distributor fed at one end only, the maximum voltage drop will be
   a. one half
   b. one fourth
   c. one third
   d. one sixth

10. An a.c. transmission line has **resistance, inductance** and **capacitance** uniformly distributed along its length. These are known as **constants or parameters** of the line. These constants determine whether
   a. the efficiency and current regulation of the line will be good or poor
   b. the costing of the line will be good or poor
   c. the efficiency and voltage regulation of the line will be good or poor
   d. the power factor and voltage regulation of the line will be good or poor

11. Skin effect is negligible when the supply frequency is _____ and conductor diameter is _____.
   a. high (>50 Hz), small (< 1 cm)
   b. low (<50 Hz), large (> 1 cm)
   c. high (>50 Hz), large (> 1 cm)
   d. low (<50 Hz), small (< 1 cm)

12. Although end condenser method for the solution of medium lines is simple to work out calculations, yet it is not used for frequently because
   a. it has a considerable error (about 10 %) in calculations due to the distributed capacitance is assumed to be lumped or concentrated.
   b. this method underestimates the effects of line capacitance.
   c. this method is very cumbersome
   d. this will give the error more that 40%.

13. The life span of wooden poles for transmission line is expected to be
   a. 1-2 years
   b. 2-5 years
   c. 10-20 years
   d. 20-50 years

14. The potential across the various discs of suspension string is different because of
   a. shunt capacitance
   b. series capacitance
   c. leakage current
   d. eddy currents

15. The conductor material used for transmission and distribution of electric power should have the following properties :
    a. ***low*** electrical conductivity, ***low*** tensile strength, ***low*** cost and ***low*** specific gravity
    b. ***high*** electrical conductivity, ***high*** tensile strength, ***low*** cost and ***low*** specific gravity
    c. ***high*** electrical conductivity, ***high*** tensile strength, ***low*** cost and ***high*** specific gravity
    d. ***high*** electrical conductivity, ***low*** tensile strength, ***low*** cost and ***low*** specific gravity

16. The cost of a 3-phase overhead transmission line is Rs (25000 a + 2500) per km where 'a' is the area of X-section of each conductor in cm^2. The line is supplying a load of 5 MW at 33kV and 0·8 p.f. lagging assumed to be constant throughout the year. Energy costs 4P per kWh and interest and depreciation total 10% per annum. Annual cost of energy lost is Rs 1256.96/a and variable annual charge is Rs. 2,500 a. The most economical size of the conductor is ____
    a. 0.71 cm^2 b. 3.25 cm^2 c. 1.74 cm^2 d. 1.56 cm^2

17. The time interval from the instant of fault to the instant of energizing the trip coil is known as
    a. arcing time b. operating time c. breaking time d. protection time

18. Air blast circuit breakers are used above
    a. 11 kV b. 33 kV c. 66 kV d. 132 kV

19. What is the correct expression for the electrical power developed by a hydroelectric plant in kW? Where w is specific weight of water in kg/m^3, **Q** is the rate of flow of water in m3/s, **H** isthe height of fall or head in meter and η is the generation efficiency.
    a. $9.81 \times (wQH\eta)$ b. $9.81 \times 10^{-3}(wQH/\eta)$
    c. $9.81 \times 10^{-3}(wQH\eta)$ d. $9.81 \times 10^{-3}(wQ/H\eta)$

20. If the conductors are polished and smooth
    a. the corona glow will not occur
    b. power loss due to corona will be least
    c. hissing sound will be more intense during corona
    d. corona glow will be uniform along the length of the conductor

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SECTION "B"
[5Q × 11 = 55 marks]

Attempt *ANY FIVE* questions. Missing data may be suitably assumed.

Q.1 [2.5+2.5+6 =11]

a. Find the ratio of volume of copper required to transmit a given power over a given distance by overhead system using (i) dc three-wire system (ii) 3-phase, 4-wire system.
b. A 2-conductor cable one km in length is required to supply a constant load of 200 A throughout the year. The cost of cable including installation is Rs(20**a**+20) per metre where **a** is the area of cross section of the conductor in cm^2. The cost of energy is 5 Paisa per kWh and interest and depreciation charges amount to 10%. Specific resistivity of copper is 1.73 μΩ-cm. Find the cross section area **a**.

Q.2 [3+4+4 =11]

a. Explain the following systems of distribution :
(i) Radial system (ii) Ring main system (iii) Interconnected system
b. A 2-wire d.c. distributor cable AB is 2 km long and supplies loads of 100 A, 150 A, 200 A and 50 A situated 500 m, 1000 m, 1600 m and 2000 m from the feeding point A. Each conductor has a resistance of 0·01 Ω per 1000 m. Calculate the p.d. at each load point if a p.d. of 300 V is maintained at point A.
c. A 250 m, 2-wire d.c. distributor fed from one end is loaded uniformly at the rate of 1·6 A/metre. The resistance of each conductor is 0·0002 Ω per metre. Find the voltage necessary at feed point to maintain 250 V (i) at the far end (ii) at the mid-point of the distributor.

Q.3 [3+4+4 =11]

a. A single phase overhead transmission line delivers 1100 kW at 33 kV at 0.8 pf lagging. The total resistance and inductive reactance of the line are 10 Ω and 15 Ω respectively. Determine: (i) sending end voltage (ii) sending end power factor and (iii) transmission efficiency.
b. Show how regulation and transmission efficiency are determined for medium lines using nominal Π method. Illustrate your answer with suitable vector diagrams.
c. Evaluate the generalised circuit constants for short transmission line.

Q.4 [5+6 =11]

a. Each line of a 3-phase system is suspended by a string of 3 similar insulators. If the voltage across the line unit is 17·5 kV, calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is 1/8th of the capacitance of the insulator itself. Also find the string efficiency.
b. Derive an expression for sag of a line supported between two supports at the same height. What are the factors affecting the sag in a transmission line?

Q.5 [6+5 =11]

a. Explain the classification of protective relays based on their function. What are the common methods of line protection?
b. With neat diagram explain the basic operating principle of circuit breaker.

Q.6 [2 × 3 + 5 =11]

a. Write a short notes on (*ANY THREE)*
   i) Earthing of power system
   ii) Power transformer
   iii) Generalized Circuit constants (A,B,C and D)
   iv) Hydro power development in Nepal
b. What is corona? Explain briefly the factors which affect corona.