International Islamic University Chittagong

Department of Electrical and Electronic Engineering

B. Sc. Engineering in EEE

Final Exam, Autumn 2021

Course Code: **EEE 2415** Course Title: **Transmission & Distribution of Electrical Power System**

Time: 2 hours 30 minutes Full Marks: 50

(i) The figures in the right-hand margin indicate full marks

(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

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| Course Outcomes (COs) of the Questions | |
|---|---|
| **CO1** | Ability to apply various voltage control techniques to maintain proper voltage at the level of end users. |
| **CO2** | Modeling of the transmission and distribution line to analysis of line parameters on the power flow. |

| Bloom's Levels of the Questions | | | | | | |
|---|---|---|---|---|---|---|
| **Letter Symbols** | **R** | **U** | **App** | **An** | **E** | **C** |
| **Meaning** | Remember | Understand | Apply | Analyze | Evaluate | Create |

## Part A

[Answer the questions from the followings]

| | | | | | |
|---|---|---|---|---|---|
| 1. | a) | What is the importance of voltage control? Voltage control equipment is generally located at more than one point-Why? | CO1 | R | 6 |
| 1. | b) | A load of 10,000 kW at a power factor of 0·8 lagging is supplied by a 3-phase line whose voltage has to be maintained at 33kV at each end. If the line resistance and reactance per phase are 5 Ω and 10 Ω respectively, calculate the capacity of the synchronous condenser to be installed for the purpose. Comment on the result. | CO2 | App | 4 |
| 2. | a) | Show that maximum stress in a single-core cable is $\frac{2V}{d \ln\frac{D}{d}}$; where V is the operating voltage and *d* and *D* are the conductor and sheath diameter. | CO2 | An | 6 |
| 2. | b) | Describe the various methods of laying underground cables. What are the relative advantages and disadvantages of each method? | CO1 | U | 4 |
| | | Or, | | | |
| 2. | a) | What are the disadvantages of low p.f? Find an expression for the most economical conductor size of a single core cable. | CO1, CO2 | R,E | 6 |
| 2. | b) | A factory which has a maximum demand of 175 kW at a power factor of 0·75 lagging is charged at Rs 72 per kVA per annum. If the phase advancing equipment costs Rs 120 per kVAR, find the most economical power factor at which the factory should operate. Interest and depreciation total 10% of the capital investment on the phase advancing equipment. | CO2 | E | 4 |

## Part B

[Answer the questions from the followings]

| | | | | | |
|---|---|---|---|---|---|
| 3. | a) | Why are insulators used with overhead lines? Discuss the desirable properties of insulators. | CO1 | U | 4 |
| 3. | b) | A 3-phase transmission line is being supported by three disc insulators. The potentials across top unit (i.e., near to the tower) and middle unit are 8 kV and 11 kV respectively. Calculate (i) the ratio of capacitance between pin and earth to the self-capacitance of each unit (ii) the line voltage and (iii) string efficiency. | CO2 | E | 6 |
| 4. | a) | Define the sag. Calculate sag when supports are at equal level. | CO1 | U | 4 |
| 4. | b) | A transmission line has a span of 150 m between level supports. The conductor has a cross-sectional area of 2 $cm^2$. The tension in the conductor is 2000 kg. If the specific gravity of the conductor material is 9·9 $gm/cm^3$ and wind pressure is 1·5 kg/m length, calculate the sag. What is the vertical sag? | CO2 | E | 6 |
| 5. | a) | Derive an expression for the voltage drop for a uniformly loaded distributor fed at one end. | CO1 | App | 4 |
| 5. | b) | A 2-wire d.c. distributor cable AB is 2 km long and supplies loads of 100A, 150A,200A and 50A 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. | CO2 | E | 6 |

**Or,**

| | | | | | |
|---|---|---|---|---|---|
| 5. | a) | How does a.c. distribution differ from d.c distribution? Which method you will choose for DC distributors? | CO1 | R | 4 |
| 5. | b) | An electric train runs between two sub-stations 6 km apart maintained at voltages 600 V and 590 V respectively and draws a constant current of 300 A while in motion. The track resistance of go and return path is 0·04 Ω/km. Calculate: (i) the point along the track where minimum potential occurs (ii) the current supplied by the two sub-stations when the train is at the point of minimum potential. | CO2 | E | 6 |