# GURU NANAK INSTITUTE OF TECHNOLOGY
## An Autonomous Institute under MAKAUT
## 2020-2021
## POWER SYSTEM-I (Backlog)
## EE502

**TIME ALLOTTED:3Hours**                                              **FULL MARKS:70**

*The figures in the margin indicate full marks.*
*Candidates are required to give their answers in their own words as far as practicable*

### GROUP – A
### (Multiple Choice Type Questions)

**1.** Answer any *ten* from the following, choosing the correct alternative of each question: **10×1=10**

|  |  | Marks | CO No. |
|---|---|---|---|
| 1(i) | If the capacitance of the transmission line is increased, the transmitted power will | 01 | CO1 |

a) remain same
b) increase
c) decrease
d) end to zero at the receiving end.

|  |  | Marks | CO No. |
|---|---|---|---|
| 1(ii) | Ferranti effect will not occur in which of the following transmission lines | 01 | CO3 |

a) long transmission lines
b) short transmission lines
c) medium transmission lines
d) all of the above

|  |  | Marks | CO No. |
|---|---|---|---|
| 1(iii) | Transmission efficiency increases as | 01 | CO1 |

a) Voltage and power factor both increase
b) voltage and power factor both decrease
c) Voltage increases but power factor decreases
d) Voltage decreases but power factor increases.

|  |  | Marks | CO No. |
|---|---|---|---|
| 1(iv) | Which one of the following is an objective of tariff: | 01 | CO3 |

a) Recovery of cost on production of power
b) Recovery of capital investment
c) Profit gain
d) All of these

|  |  | Marks | CO No. |
|---|---|---|---|
| 1 (v) | The most suitable practical value of primary distribution is? | 01 | CO1 |

a) 66 kV
b) 6.6 kV
c) 230 V/ 400 V
d) 22 kV

|  |  | Marks | CO No. |
|---|---|---|---|
| 1 (vi) | The effective resistance of a conductor will be the same as ohmic resistance when | 01 | CO1 |

a) current is in true sine wave form
b) voltage is low
c) Power factor is unity
d) Current is uniformly distributed in the conductor cross-section.

| | | | |
|---|---|---|---|
| 1 (vii) | Rankine cycle efficiency in a good steam power station may be in the range between........<br>    a)  15% - 20%<br>    b)  35% - 40%<br>    c)  50% - 60%<br>    d)  90% - 95% | 01 | CO1 |
| 1 (viii) | Capacitance between the two conductors of a single phase two wire line is 0.5 μ F/km. What is the value of capacitance of each conductor to neutral?<br>    a)  0.5 μ F / km<br>    b)  1 μ F / km<br>    c)  0.25 μ F / km<br>    d)  2.0 μ F / km | 01 | CO2 |
| 1 (ix) | The guard wire is firmly connected with<br>    a)  neutral wire<br>    b)  phase wire<br>    c)  cross arm<br>    d)  earth wire. | 01 | CO1 |
| 1 (x) | The sag of a transmission line with 50 m span is 1 m. What will be the sag if the height of<br>the transmission line is increased by 20%<br>    a)  1.2 m<br>    b)  2 m<br>    c)  1.25 m<br>    d)  1 m. | 01 | CO1 |
| 1 (xi) | When the conductors of a three phase circuit are not spaced equilaterally, the transposition<br>is done to<br>    a)  Decrease the line inductance per phase<br>    b)  Minimize the effect of adjoining communication circuit<br>    c)  Balance the three phases of the circuit<br>    d)  Both (a) and (b) | 01 | CO3 |
| 1 (xii) | The shunt admittance of a transmission line is 3 microsiemens. Its complex notation will be<br>    a)  $3 \times 10\text{-}6 \angle 90^0$<br>    b)  $3 \times 10\text{-}6 \angle 10^0$<br>    c)  $3 \times 10\text{-}6 \angle 0^0$ | 01 | CO1 |

**GROUP – B**
**(Short Answer Type Questions)**
(Answer any *three* of the following)

| | | **3 x 5 = 15** |
|---|---|---|
| | **Marks** | **CO No.** |
| 2.   The three conductors of a three phase balanced lines are arranged in a horizontal plane. The diameter of each conductor is 2 cm | 5 | CO1 |
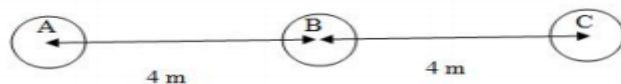


Phase sequence is A-B-C. Consider A phase as the reference. Find the

magnitude of the capacitance $C_{An}$ in $\mu F/km$ (Lines are not transposed)

| | | | |
|---|---|---|---|
| 3. | In the nominal T model of the transmission line, Z=j80 ohms, Y =j2x10-3 mho. Find the value of A parameter | 5 | CO3 |
| 4. | The monthly readings of a consumer's meter are as follows: | 5 | CO1 |

        Maximum demand = 50 KW

        Energy consumed = 36,000 KWh

        Reactive Energy= 23,400 KVAR

If the tariff is Rs. 80 per KW of maximum demand plus 8 paise per unit plus 0.5 paise per unit for each 1% of power factor below 86%, calculate the monthly bill of the consumer.

| | | | |
|---|---|---|---|
| 5. | An 11 kV three phase transmission line has a resistance of 1.5 ohm and 4 ohm per phase. Calculate the percentage regulation and efficiency of the line when a total load of 5000 kVA at 0.8 lagging power factor is supplied at 11 kV at distant end. | 5 | CO3 |
| 6. | In a 3-phase overhead line, the conductors have each a radius of 1.2 cm and are spaced symmetrically 3 m apart. If the dielectric strength of air is 30 KV per cm (peak), find the disruptive critical voltage. | 5 | CO2 |

### GROUP – C
### (Long Answer Type Questions)
(Answer any *three* of the following)

**3 x 15 = 45**

| | | Marks | CO No. |
|---|---|---|---|
| 7. a) | A 3-phase, 50 Hz, 100 km long transmission line has the following line constants: Resistance/phase/km= $0.1\Omega$, Reactance/phase/km= $0.5\Omega$, Susceptance/phase/km= $10 \times 10^{-6}$ mho. If the line supplies load of 20 MW at 0.9 p.f. lagging at 66 KV at the receiving end, determine the following: | 8 | CO2 |

      i)     Sending end power factor

      ii)    % of regulation

      iii)   Transmission efficiency

Use nominal-$\pi$ method.

| | | | |
|---|---|---|---|
| 7. b) | Draw the Schematic Diagram of a Hydro Power Plant. | 7 | CO2 |
| 8.a) | Derive the expression for Sag when the Tower supports are at Different Levels. | 5 | CO1 |
| 8. b) | A transmission line has a span of 150 m between level supports. Line conductor has a cross- sectional area of 1.25 cm$^2$ and it weighs 1.0 kg/m. if the breaking stress of conductor is 4200 kg/cm$^2$, calculate the maximum sag for a safety factor of 4. Assume a maximum wind pressure of 100 kg/m$^2$ of projected surface. | 5 | CO1 |
| 8.c) | Each conductor of a 3-phase overhead transmission line is suspended from a cross- arm of a steel tower by a string of four suspension insulators. The voltage across the second unit is 15.0 kV and across the third 27.0 kV. Find the voltage between conductors and string efficiency. | 5 | CO1 |

| | | | |
|---|---|---|---|
| 9.a) | What is Transposition?<br>Find out the expression of Inductance of a transposed line. | 7 | CO3 |
| 9.b) | Two electrical units used for same purpose are compared for their economical working:<br>    i.    Cost of Unit-1 is Rs. 6000 and it takes 120 KW<br>    ii.    Cost of Unit-2 is Rs. 16800 and it takes 72 KW<br>Each of them has a useful life of 40000 hours.<br>Which unit will prove economical if the energy is charged at Rs. 96 per KW of maximum demand per year and 6 paise per KWh.<br>Assume both units run at full load. | 8 | CO3 |
| 10.a) | A transmission line has diameter of 20 mm and weight of 1 kg/meter. The horizontal wind pressure is 40 kg/m2 of projected area with ice coating of 10 mm. Density of ice is 900 kg/m3. What will be the resultant force (kg) per meter length of the conductor? | 7 | CO1 |
| 10.b) | A 3-phase, 220 kV, 50 Hz transmission line consists of 1·2 cm radius conductors spaced 2 m at the corners of an equilateral triangle. Calculate the corona loss per km of the line. The condition of the wire is smoothly weathered and the weather is fair with temperature of 20ºC and barometric pressure of 72·2 cm of Hg. | 8 | CO3 |
| 11. | Write Short Note on (Any Three) | 5 | |
| 11.a) | Indian Electricity Rule. | 5 | CO3 |
| 11.b) | Line supports | 5 | CO2 |
| 11.c) | Pump storage plant or SPV plant. | 5 | CO2 |
| 11.d) | Power distribution system | 5 | CO1 |
| 11.e) | Power circle diagram | 5 | CO2 |