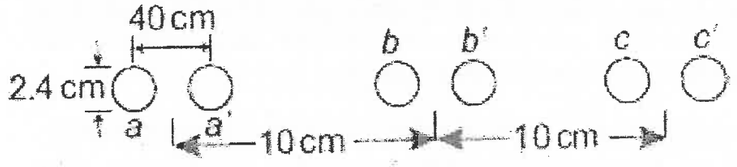
6.a.i. A 300 kV, three-phase bundle conductor line with two sub conductor per phase has a horizontal configuration as shown below. Find the inductance per phase, if the radius of each sub-conductor is 1.2cm. — 12 | 1 | 2 | 1



ii. A three phase line, 20 km long delivers 10 MW at 11 kV, 50 Hz, 0.8 power factor lagging. The power losses in the line is 10 percent of the power delivered. Find the resistance of each conductor in the transmission line. — 6 | 2 | 2 | 2

b. Two arrangements of conductors are proposed for a 3 phase transmission line: one with equilateral spacing of 4m and the other a flat with 4m between the conductors. The conductor diameter in each case is 2cm. assuming that the line is transposed in both cases, which one of the following statements would be true? (justify) — 1 | 3 | 2 | 1

(A) $Cn_1 = Cn_2$ and $L_1 > L_2$ (B) $Cn_1 > Cn_2$ and $L_1 < L_2$
(C) $Cn_1 = < Cn_2$ and $L_1 > L_2$ (D) $Cn_1 > Cn_2$ and $L_1 = L_2$

c. With 100% inductive shunt compensation, the voltage profile is flat for (justify) — 1 | 1 | 2 | 1

(A) 100 % loading of line (B) 50 % loading of line
(C) Zero loading of line (D) 75% loading on line

7.a.i. An overhead line of cross-section 2.5 cm^2 is supported at a river crossing from two towers at heights of 50m and 100 m above the water level. The horizontal distance between the towers is 400m. If the maximum stress in the line does not exceed $1/5^{th}$ of UTS of 6000 kg/cm^2 and weight of the conductor is 0.9 kg/m, find the clearance between the conductor and water at a point mid-way between the towers. — 12 | 2 | 4 | 2

ii. "The insulator should have good mechanical and dielectric strengths to withstand the load and operating or flashover voltages, respectively". List and explain three tests that are conducted on insulators to determine its strength. — 6 | 1 | 4 | 1

b. Which of the following is not the reason for the failure of insulators in an overhead transmission line? (justify) — 1 | 1 | 4 | 1

(A) Fault current (B) Accumulation of dust
(C) Flashover voltage (D) Type of conductor

c. A single core cable has conductor diameter of 2 cm and sheath of inside radius 5cm, if maximum stress on the cable is 51.55kV/cm r.m.s. What will be the rms voltage rating of the cable? (justify) — 1 | 1 | 4 | 2

(A) 82.96 kV (B) 11.9 kV
(C) 55.45 kV (D) 27.65 kV

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Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2023
OPEN BOOK EXAMINATION
Fourth Semester

18EEC208T – GENERATION, TRANSMISSION AND DISTRIBUTION
(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

- Specific approved THREE text books (Printed or photocopy) recommended for the course
- Handwritten class notes (certified by the faculty handling the course / head of the department)

Time: 3 Hours Max. Marks: 100

Answer **FIVE** questions
(Question No 1 is compulsory)

	Marks	BL	CO	PO

1.a.i. Load factor of a consumer is 35% and the monthly consumption is 408kWh. If the rate of electricity is ₹ 250kW of maximum demand plus ₹ 4.00 per kWh, find — 8 | 2 | 1 | 2

(i) The monthly bill and the average cost per kWh
(ii) The overall cost per kWh if the consumption is increased by 10% with the same load factor

ii. The yearly load duration curve of a power plant is a straight line. The maximum load is 750 MW and minimum load is 600 MW. The capacity of the plant is 900 MW. Find the capacity factor and utilization factor. — 5 | 2 | 1 | 2

iii. A residential consumer has 10 number of lamps with 400 W capacity. But at the same time only 9 number of lamps will gets ON means find the demand factor of this load. — 5 | 1 | 1 | 2

b. A daily load curve which exhibits a 15 minutes peak of 3000kW is drawn to scale of 1cm=3 hours and 1cm = 100 kW. The total area under the load curve is measured and is found to be $15cm^2$. Then what will be the average demand (justify) — 1 | 2 | 1 | 1

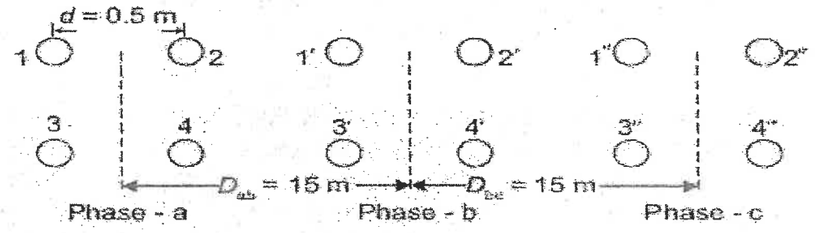
(A) 1875 kW (B) 1785 kW
(C) 1675 kW (D) 1125 kW

c. Find the bill of a consumer per year if the unit consumed per year is $10.512*10^5$kWh at 0.8 power factor lagging and load factor of 60%. The tariff used to calculate the bill is ₹ 75 per kVA plus 15 paise per kW consumed (justify) — 1 | 1 | 1 | 1

(A) ₹. 1, 67, 430 (B) ₹. 1, 57, 680
(C) ₹. 1, 87, 500 (D) ₹. 1, 76, 430

2.a.i. The capacitance of a 120 km long 1φ transmission line is 0.56μF. the separation distance between the conductors is 2m. Determine the radius of the conductor. — 8 | 1 | 2 | 1

ii. Calculate the inductance per phase of a 750kV three-phase single circuit line that utilizes a bundled conductor arrangement as shown below. The space between the two phases is 15 m in a horizontal formation. The sub conductors of a phase are at the corners of a square of sides 0.5m, each sub-conductor has a diameter of 2 cm.



10 2 2 1

b. Calculate the resistivity the conductor if resistance of conductor is 40Ω, the length of the wire is 20 m and its area of cross section is $4m^2$. (justify)
(A) 8 Ωm (B) 16 Ωm
(C) 8 kΩm (D) 16 kΩm

1 1 2 1

c. In 110 kV, 3ϕ transposed transmission system, the conductors A, B and C are arranged horizontally. The distance between the conductors AB = BC = 40 cm and AC = 80 cm, find the capacitance per phase per km of the line by assuming the radius of each conductor being 0.042cm. (justify)
(A) 0.00784 μF/ph/km (B) 0.00392 μF/ph/km
(C) 0.00184 μF/ph/km (D) 0.01532 μF/ph/km

1 1 2 1

3.a.i. A 100 km long three-phase 50Hz transmission line delivers a power of 30 MW at a power factor of 0.95 lagging to a balanced load whose line voltage is 66 kV. The transmission line parameters are R = 0.22Ω/ km/ phase, Xl=0.5Ω/km/phase and Y=0.06*$10^{-4}\Omega^{-1}$/km/phase. Find (1) sending end current and voltage (2) ABCD constants.

6 1 3 1

ii. A single-phase, 11kV line with a length of 15km is to transmit 500kVA. The inductive reactance of the line is 0.6Ω/km and the resistance is 0.25Ω/km. Calculate the efficiency and regulation for a power factor of (1) 0.75 lagging (2) 0.75 leading and (3) unity.

12 2 3 1

b. For a long transmission line YZ=0.0712∠147.38° and $\sqrt{YZ} = 0.267\angle 73.69°$, calculate the magnitude of $\sinh\sqrt{YZ}$. (justify)
(A) 0.2442 (B) 0.2246
(C) 0.2642 (D) 0.2846

1 1 3 2

c. Find the A and D constant of a 132kV, 400 km long transmission line with its resistance/phase = 64Ω, X_l/ phase = 100Ω and its shunt admittance is j0.0006. (justify)
(A) 0.9190 (B) 0.9290
(C) 0.9590 (D) 0.9890

1 1 3 1

4.a.i. In a single core cable three insulating materials with breakdown strength of 250kV/cm, 200kV/cm. 150 kV/cm with the permittivity of 2.5, 3.0 and 3.5 are used. If the factor of safety for the material is 5, then what is the location of materials with respect to the core of the cable?

4 3 4 2

ii. Is string efficiency in a DC system 100%? Justify your answer.

4 1 4 1

iii. A string of suspension insulators consists of three units. The capacitance between each pin and earth is 25% of the self-capacitance of the unit. If the maximum peak voltage per unit is not to exceed 30kV, determine the greatest working voltage and the string efficiency.

10 2 4 1

b. A single core cable has a conductor diameter of 0.5cm and intersheath radius of 4.8 cm, permittivity of insulating material 4, if capacitance of the cable 0.475μF. What will be the length of the cable? (justify)
(A) 4.82 km (B) 3.52 km
(C) 6.25 km (D) 1.25 km

1 1 4 2

c. During rainy season when the insulators are wet, which leads to (justify)
(A) Same string efficiency as before (B) Decreased string efficiency
(C) Increased string efficiency (D) 0% string efficiency

1 1 4 1

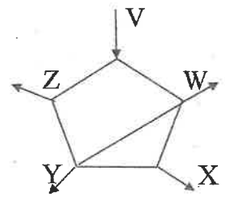
5.a.i. An electric train runs between two sub-stations 6 km apart maintained at voltages 600 V and 590 V respectively and draws a constant current of 300 A while in motion. The track resistance of go and return path is 0.04Ω/km. Calculate (1) the point along the track where minimum potential occurs (2) the current supplied by the two sub-stations when the train is at the point of minimum potential.

12 2 5 1

ii. What are the factors to be considered while selecting the location of a substation?

6 1 5 1

b. A ring main distribution system is fed at V, with an interconnector connected between the point WY and its resistance is 0.05Ω. The resistance of various sections are R_{VW} = 0.065Ω, R_{WX} = 0.025Ω, R_{XY}=0.01Ω, R_{YZ}=0.04Ω and R_{ZV} = 0.11Ω. Calculate the Thevenin's resistance viewed from the interconnector. (justify)



1 2 5 2

(A) 0.0301Ω (B) 0.0042Ω
(C) 0.042Ω (D) 0.301Ω

c. Out of the given bus bar schemes, in which schemes the maintenance work is difficult. (justify)
(A) Single bus (B) Main bus and transfer
(C) Double bus double breaker (D) Double bus single breaker

1 1 5 1