Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023
ELECTRICAL AND ELECTRONICS ENGINEERING
(2020 SCHEME)

Course Code : 20EET301

Course Name: Power Systems – I

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. With a population of 1.3 billion, India has a massive demand for energy to fuel its rapidly growing economy. Suggest suitable methods to address this issue.
2. Describe the various components of a nuclear reactor.
3. Explain the effect of unsymmetrical spacing of conductors in a 3-phase overhead transmission line and how it can be eliminated?
4. A medium transmission line has A = D=0.8 $\angle 1^0$, B=170 $\angle 45^0$ and C=0.2x$10^{-3}\angle 90^0$. Sending end voltage is 220 kV. Determine the receiving end voltage under no load condition.
5. Surge impedance loading is a key parameter of any power system. Why?
6. Determine the line voltage that initiates corona in a single-phase overhead line that has two conductors of diameter 1cm with a spacing of 1m between the center.
7. Enlist the essential qualities of protective relays.
8. Explain about IEC 61850 standard.
9. Differentiate between regulated system and deregulated system.
10. Explain the significance of FACTS devices in present scenario.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11 a) Explain the construction and working of hydro power plant with a layout. Discuss the various factors which affect the location of site of a hydro power station. (9)

b) Describe the block diagram of standalone solar electric system. (5)

OR

12. a) A generating station of 10MW supplies two regions A and B which have the following demands. Plot the load curve of the power station. Calculate the diversity factor, average load and load factor of the total system. (9)

Region A			Region B		
From	To	Demand (kW)	From	To	Demand (kW)
Midnight	9 am	600	Midnight	8 am	800
9 am	12 noon	2500	8 am	1 pm	5000
12 noon	5 pm	800	1 pm	2 pm	800
5 pm	6 pm	5000	2 pm	5 pm	5000
6 pm	7 pm	No load	5 pm	Midnight	800
7 pm	Midnight	4000			

b) Differentiate between microgrid and smart grid systems. (5)

MODULE II

13. a) Derive the expression for inductance of a two-wire single phase transmission line. (5)

b) A 3-phase transmission line has its conductors of 1.6cm diameter spaced at the corners of the equilateral triangle of 2.5m side. Find the inductance per phase per km of the system. (4)

c) Obtain the relationship between the sending end and the receiving end voltages and currents of a medium transmission line using nominal π method. Draw the equivalent circuit and phasor diagram. (5)

OR

14. a) A three phase, 50 Hz overhead transmission line 100 km long has the following constants:
Resistance / km / phase = 0.1 Ω, Inductive reactance / km / phase = 0.2Ω, Capacitive susceptance / km /phase = 0.04×10^{-4} mho. (10)
Determine i) Sending end current ii) Sending end voltage iii) Sending end power factor iv) Transmission efficiency when supplying a balanced load of 10,000 kW at 66 kV with p.f. of 0.8 lagging. Use nominal T method.

b) Derive an expression for the capacitance per phase of a 3-phase overhead transmission line with symmetrical spacing. (4)

MODULE III

15. a) The following data refer to an overhead transmission line having parabolic configuration:
Weight of the conductor per metre length= 1.8 kg/m, cross sectional area= 2.3 cm^2, ultimate tensile strength= 7800 kg/cm^2, distance between the supports=500m, difference of levels of supports= 16m, ice load per metre conductor run= 1.1 kg/m, wind pressure =nil. (10)
Determine the vertical sag from the taller of the two supports which must be allowed so that factor of safety shall be 4.

b) Prove that the ratio of maximum potential gradient to the minimum potential gradient in an underground cable is D/d. where d and D are the conductor diameter and internal sheath diameter. (4)

OR

16. a) What are the critical voltages in the formation of Corona? What is the effect of Corona? (5)

b) A 3-phase transmission line is supported by a 3-unit suspension insulator string. The voltage across the line unit is 20 kV and that across the adjacent unit is 15 kV. Determine: (9)
(i) Ratio of ground to mutual capacitance, (ii) System line voltage and (iii) String efficiency.

MODULE IV

17. a) Explain with the help of neat sketch, the construction, working and applications of vacuum circuit breaker. (9)

b) Explain the causes of over voltages. (5)

OR

18. a) Prove that amplitude and phase comparators are dual to each other. (7)

b) Explain the construction and operating principle of overcurrent relay with differential scheme. (7)

MODULE V

19. a) A two-conductor DC distributor AB of length 200 m is fed from both ends. At feeding point A, the voltage is maintained at 240 V and at B 245 V. Loads of 25 A, 50 A, 30 A and 40 A are tapped at distance of 50 m, 75 m, 100 m and 150 m from A respectively. If the resistance per km of one conductor is 0.3 Ω, determine, (9)
(i) the minimum voltage and point at which it occurs.
(ii) the currents in various sections of the distributor.

b) Classify the types of HVDC links and explain the working of each type with the help of necessary diagrams. (5)

OR

20. a) A 3 phase, 50 Hz, 400 V motor develops 74.6 kW, the power factor being 0.75 lagging and efficiency 93%. A bank of capacitors is connected in delta across the supply terminals and power factor raised to 0.95 lagging. Each of the capacitance units is built of 4 similar 100 V capacitors. Determine the capacitance of each capacitor. (9)

b) Calculate the number of units to be consumed so that the annual bill based on the two-part tariff is same for the following data.
Maximum demand = 15 kW,
Two-part tariff is Rs. 1000/ annum/ kW of maximum demand plus Rs. 1.6 per unit consumed. Flat rate tariff is Rs. 2.5 per unit. (5)

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