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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022
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. Discuss the difference between conventional electric power grid and smart grid.
2. Explain load factor, diversity factor and connected load.
3. Compare Ferranti effect and skin effect.
4. Examine the need for transposition of transmission lines.
5. Define critical disruptive voltage and visual critical voltage.
6. Surge impedance loading is a key parameter of any power system. Why?
7. Explain the different causes of over voltages in power system.
8. Draw the block diagram of a microprocessor based over current relay.
9. Discuss the classification of series and shunt FACTS devices.
10. List the advantages and disadvantages of aerial bunched cables.

PART B

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

MODULE I

11. a) With the help of a block diagram, explain the working of a wind energy conversion system. (7)
    b) A power station is to supply four regions of loads whose peak values are 10,000kW, 5000 kW, 8000 kW and 7000 kW. The diversity factor of the load at the station is 1.5 and the average annual load factor is 65%. Calculate the maximum demand on the station and annual energy supplied from the station. (7)

OR

12. a) With the help of a block diagram, explain the working of a thermal power plant. (7)
    b) Explain the design steps of a ground mounted solar farm. (7)

MODULE II

13. a) Derive an expression for inductance of a three-phase transmission line with symmetrical and unsymmetrical spacing. (7)

b) Calculate the inductance of each conductor in a 3-phase, 3-wire system when the conductors are arranged in a horizontal plane with spacing such that D_{31} = 4m, D_{12} = D_{23} = 2m. The conductors are transposed and have a diameter of 2·5 cm. (7)

OR

14. a) Derive the generalized circuit constant of a medium transmission line using nominal π method. (7)

b) A 3-phase, 50 Hz, 16 km long overhead line supplies 1000 kW at 11kV, 0·8 p.f. lagging. The line resistance is 0·03 Ω per phase per km and line inductance is 0·7 mH per phase per km. Calculate the sending end voltage, voltage regulation and efficiency of transmission. (7)

MODULE III

15. a) Illustrate the methods used for improving string efficiency of overhead line insulators. (7)

b) A string has five suspension discs. The capacitance between each unit and earth is one-fifth of the mutual capacitance. i) Find the voltages across different discs as percent of total string voltage ii) Find the string efficiency. (7)

OR

16. a) Derive the equation for sag in transmission line when supports are at equal and unequal heights. (7)

b) Explain capacitance and inter sheath grading of cables using figures. (7)

MODULE IV

17. a) Define the terms restriking voltage, recovery voltage and arc voltage. Derive an expression for rate of rise of restriking voltage in circuit breakers. (7)

b) Explain the operation of SF6 circuit breaker using a neat sketch and write its advantages. (7)

OR

18. a) Explain the working principle of electromagnetic induction type relays. (7)

b) Discuss (i) Fibre optic communication and (ii). IEC61850 enabled substation. (7)

MODULE V

19. a) Explain tariff and its classification. (7)

b) 3-phase, 5 kW induction motor has a p.f. of 0·75 lagging. A bank of capacitors is connected in delta across the supply terminals and p.f. raised to 0·9 lagging. Determine the kVAR rating of the capacitors connected in each phase. (7)

OR

20. a) Explain the different types of HVDC links. (7)

b) With necessary sketches, explain different types of AC distributors. (7)

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