

Note: - 1. Question No. 1 is compulsory.

2. Attempt any **three** questions out of remaining **five** questions.

3. Assume suitable data if necessary & justify the same.

4. Figures to the right indicate marks.

Qu.1 Attempt any Four.

- (a) Discuss the various losses occurs in solar cell. [5]
- (b) Discuss the effect of hot spots in Solar PV module [5]
- (c) Differentiate between Horizontal axis and Vertical axis wind turbine system. [5]
- (d) Draw and describe the static characteristics of fuel cell in brief [5]
- (e) Write a short note on tidal energy generation [5]
- (f) Write a short note on solar pond. [5]

Qu.2 (a) Explain any two types of concentrating collectors in brief. State its advantages [10]
 (b) Discuss the power electronics topologies for fuel cell along with neat diagram. [10]

Qu.3 (a) Illustrate the significance of MPPT in Solar PV system with neat block diagram. [10]
 Explain perturb and observe MPPT algorithms with the help of suitable diagram.

(b) What are the different methods to use solar thermal energy? How Solar air heater is useful for energy generation? Explain [10]

Qu.4 (a) Enlist the topologies of wind energy system. Discuss the power converter topology used for double feed induction generators (DFIG) in wind turbines. [10]
 (b) Analyze the impact of change in solar radiation and temperature on solar PV characteristics with a neat diagram. [10]

Qu.5 (a) Discuss the types of stand-alone PV system configurations. Explain it in brief [10]
 (b) Explains the working of wind energy system along with its various components. Also discuss the wind power curve in detail [10]

Qu.6 (a) Draw the two junction model of solar cell. Also draw I-V and P-V characteristics of solar cell at STC. Analyze the impact of change in series and shunt resistance on the efficiency of solar cell. [10]

(b) Explain the working principle of Ocean energy conversation system with neat diagram. [10]



TE Sem Vth

Electrical R-19 scheme

Max. Marks: 80

Time: 3 Hours

Note :

- Question No.1 is compulsory.
- Solve ANY THREE questions from the remaining five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.

- | | | Marks |
|------|---|-------|
| Q. 1 | Solve ANY FOUR questions from following. (Each question carries 5 marks) | |
| a) | "The line integral of the magnetic field around some closed loop is equal to the sum of the currents which pass through the loop". Justify the statement. | (05) |
| b) | Explain Lorentz's force equation for moving charge. Enlist its application | (05) |
| c) | Point charge $Q=0.2 \mu\text{C}$ placed at origin, find electric field intensity at (0,6,8)m. | (05) |
| d) | Define scalar and vector quantity with example. Also state coulomb's law. | (05) |
| e) | State and derive the polarization of a dielectric materials. | (05) |
| Q. 2 | a) Define Biot-Savart's Law & use it to derive expression for magnetic field intensity due to infinite wire carrying current I. | (10) |
| Q. 2 | b) Show that the \vec{E} due to infinite sheet of charge at a point is independent of the distance of that point from the plane containing the charge. | (10) |
| Q. 3 | a) An infinite long current filament is placed along z-axis. The magnetic field intensity at point P(6,8,0) is $10(-1.6\vec{a}_x + 1.2\vec{a}_y) \text{ A/m}$. Find current through the filament. | (10) |
| Q. 3 | b) Derive Maxwell's second equation in both integral and point form. | (10) |
| Q. 4 | a) Formulate electromagnetic wave equation from Maxwell's equation for dielectric medium. | (10) |
| Q. 4 | b) Find \vec{D} , \vec{B} and \vec{H} displacement current density in free space, given $\vec{E} = E_m \sin(\omega t - \beta z)\vec{a}_y$. | (10) |
| Q. 5 | a) Prove that $\vec{E} = -\nabla V$. Also derive the Poisson's and Laplace equation. | (10) |
| Q. 5 | b) In Cartesian co-ordinate a potential is a function of x only. At $x = -2 \text{ cm}$, $V = 25 \text{ V}$ and $\vec{E} = -1.5 \times 10^3 \vec{a}_x \text{ V/m}$ throughout the region. Find V at $x=5 \text{ cm}$. | (10) |
| Q. 6 | a) Draw rectangular, cylindrical and spherical co-ordinate system and explain differential element dl, differential surface ds and differential volume dv for all coordinate system | (10) |
| Q. 6 | b) A Charge $Q_1 = -20 \mu\text{C}$ is placed at P(-6,4,6) m and a charge $Q_2 = 50 \mu\text{C}$ is placed at R(5,8,-2) m in free space. Calculate the exerted force on Q_2 by Q_1 in vector form. | (10) |



TE Sem Vth Electrical R-19 scheme

Time: 3 Hrs

Marks: 80

N.B: (1) Question No 1 is compulsory.

(2) Attempt any three from the remaining questions.

(3) Figures to the right indicate full marks.

(4) Use Graph paper and semi log paper wherever necessary.

1. Attempt any four

(A) What are the different elements of a closed loop control system.

(B) Derive force to voltage analogy between mechanical and electrical system.

(C) Explain Nyquist criterion for stability.

(D) Explain advantages of state space approach over conventional approach.

(E) Find break away point for root locus of open loop transfer system

$$G(s) = K/S(S+8)(S+2)$$

2. (A) For a unity feedback system with open loop transfer function

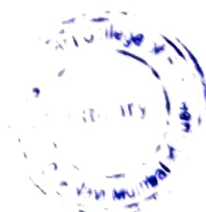
$$G(s) = 100(s+5)/S(S^2+7S+20)(S+10)$$
, Determine order, type of system, k_p , k_v , k_a and steady state error for unit ramp input.
(B) Determine the range of operating values of K so that system will be stable for the unity feedback system having characteristic equation as $S^4+5S^3+5S^2+4s+k=0$ by Routh Hurwitz Method.3. (A) For the unity feedback system find the steady state error for the following test input of $6t$ for $G(s) = 1000(S+6)/(S+7)(S+10)$.(B) For the unity feedback system with open loop transfer function $G(s) = K/S(S+10)$ Determine K , peak overshoot, settling time, time to peak overshoot for step input if damping factor is 0.5.

4. (A) Determine gain margin, phase margin, gain crossover frequency and phase cross over frequency for following transfer function:

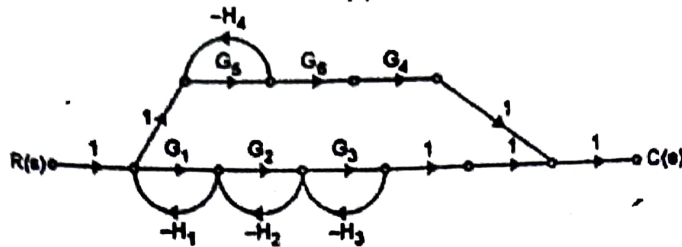
$$G(s) = \frac{80}{s(s+2)(s+20)}$$

(B) Sketch the root locus for unity feedback system for the transfer function given below:

$$G(s) = \frac{K}{S(S+2)(S+4)}$$



5. (A) Use Mason gain formula to find $C(s)/R(s)$ of following signal flow graph:



- (B) Represent the following system in state space in phase variable form and draw its state model.

$$G(s) = \frac{20(s+5)}{s(s+1)(s+4)}$$

6. Write notes on any two:

- (A) Write a short note on Time response specifications.
- (B) Define Gain Margin, Phase Margin, Phase cross over frequency and gain Cross over Frequency in frequency domain
- (C) Write a short note on State Transition Matrix.

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Duration – 3 Hours

Total Marks - 80

N.B.: - (1) Question No.1 is compulsory.

(2) Attempt any Three questions out of the remaining five questions.

(3) Assume suitable data if necessary and justify the same.

Q 1. Answer all questions.

- A) Discuss the role of bundle conductors in corona 0
- B) A travelling wave when reaches the end of open circuited transmission line, determine the following: 0
- Transmitted voltage and current
- Reflected voltage and current.
- C) Illustrate zero sequence network of the transformer for following conditions. 0
- (i) Primary winding star connected with neutral isolated and secondary winding Star connected with neutral grounded
- (ii) Primary winding delta connected and secondary winding delta connected
- D) Explain the selection of circuit breaker for power system protection 0

Q 2 a) Derive the equation for fault current when fault occurs between line and ground of a three phase transmission line. Also draw interconnection of sequence network for the same fault 1

Q 2 b) The line currents in a 3-phase supply to an unbalanced load are respectively $I_a = 10 + j20$, $I_b = 12 - j10$ and $I_c = -3 - j5$ amperes. The phase sequence is abc. Determine the sequence components of currents. 1

Q 3 a) Summarize different algorithms of Z_{bus} formulation. 1

Q 3 b) A 30 MVA, 11 kV generator has $Z_1 = Z_2 = j0.2$ pu, $Z_0 = j0.05$ pu. A line-to-line fault occurs on the generator terminals. Calculate the fault current. Assume that the generator neutral is solidly grounded and that the generator is operating at no load and at rated voltage at the occurrence of the fault. 1

Q 4 a) Illustrate the short circuit of synchronous machine at no load condition. 10

Q 4 b) Discuss the phase shift of symmetrical components in star delta transformer 10

Q 5 a) Why Insulation Coordination is required? Explain the following: 10

1. Surge Reactor 2. Surge Capacitor 3. Lightning Rod

Q 5 b) Discuss the generation of Voltage and current travelling waves on a short circuited line with figure and equations 10

Q 6 a) Discuss the generation and formation of corona rings and corona pulses in EHV lines. 10

Q 6 b) What is arcing ground? Explain its effect on the performance of a power system. 10



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[Total Marks: 80]

(3 Hours)

N.B. 1) Question No. 1 is compulsory

2) Attempt any three of the remaining Questions No. 2 to No. 6.

3) Illustrate answers with diagrams wherever necessary.

4) Assumptions made should be clearly stated.

Q 1. Solve any four

- a) Why is rotating field system used in preference to a stationary field? 05
- b) Define voltage regulation. List out different methods to calculate voltage regulation. 05
- c) State the conditions necessary for paralleling alternators. 05
- d) Write a note on Steady-state analysis of synchronous machines. 05
- e) Explain the principle of operation of a 3-phase synchronous motor. 05

- Q 2. a) Explain the phenomena of armature reaction when an alternator is delivering a load current at a) purely lagging pf b) unity pf c) purely leading pf. 10
- b) Explain how open circuit and short circuit test are conducted on a synchronous machine. What is an air gap line? 10

- Q 3. a) State the applications of synchronous motors. Compare synchronous motor with three phase induction motor. 10
- b) Two station generators A and B operate in parallel. Station capacity of A is 50 MW and that of B is 100 MW. The full-load speed regulation of station A and station B is 4 %. Calculate the load sharing if the connected load is 100 MW. The no-load frequency is 50 Hz. 10

- Q 4. a) Explain the effect of varying excitation on armature current and power factor in a synchronous motor. Draw V-curves and state their significance. 10
- b) Draw equivalent circuit and phasor diagrams for different loads of a cylindrical rotor synchronous motor. 10

- Q 5. a) Explain Blondel's two-reaction theory of salient-pole synchronous machines. 10
- b) A 1500 KVA, Star connected, 2300 V, 3 phase, Salient pole synchronous generator has reactances $X_d = 1.95$ Ohms and $X_q = 1.40$ ohms per phase. All losses may neglected. Find the excitation voltage for operation at rated KVA and power factor of 0.85 lagging. 10

- Q 6. Solve any two. 20
- a) Derive the basic machine relation in dq0 Variables.
 - b) Explain two important function served by damper winding in a synchronous machines.
 - c) What is an infinite bus? State the characteristics of an infinite bus.

