Paper / Subject Code: 32025 / Department Level Optional Course-I: Renewable Energy Sources

P.E. [illegible] Sem.-V | Elect | May-June-2024

13/06/24

(3 Hours) [Total Marks: 80]

(1) Question No.1 is compulsory
(2) Attempt any three from the remaining
(3) Figures to the right indicate full marks

			Marks
Q.1		Solve **ANY FOUR** questions from following. (Each question carries 5 marks)	(20)
	a)	State and explain the parameters related to batteries 1) C-rating 2) Depth of Discharge.	
	b)	What are different ways to use solar thermal energy? Summarize anyone in brief with the help of diagram.	
	c)	Discuss the working of micro-hydro power plant.	
	d)	Compare advantages and disadvantages of Horizontal axis wind turbine (HAWT).	
	e)	Summarize solid oxide fuel cell with the help of diagram.	
Q. 2	a)	With neat diagram explain the working principle of solar concentrators.	(10)
	b)	Discuss Latent Thermal Energy storage. Demonstrate how solar power can be stored by using Latent heat energy storage.	(10)
Q. 3	a)	Analyze the impact of change in solar radiation and temperature on solar PV Characteristics with a neat figure.	(10)
	b)	Discuss the mismatch in PV module and the phenomenon of hotspots.	(10)
Q.4	a)	Demonstrate India's reserves of Conventional and Non-Conventional energy resources. Draw the current generation status of different energy alternatives. What is the impact of CO2 emissions in the environment?	(10)
	b)	Interpret working of Wind energy system (WES) with its various components. What are different power converter topologies used for WES? Explain anyone in detail.	(10)
Q.5	a)	What are the different types of fuel cells available? Compare the features of each with neat diagrams.	(10)
	b)	Discuss the different topologies used in fuel cell power system.	(10)
Q.6	a)	Summarize the following technologies: i) Wave energy ii) Tidal Energy	(10)
	b)	Interpret the working principle of geothermal energy conversion. Write its advantages and disadvantages	(10)

Paper / Subject Code: 32024 / Electromagnetic Field & Wave

Time: 3 Hours Marks: 80

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

Q. 1 Solve **ANY FOUR** questions from following. (Each question carries 5 marks)

a) Explain differential area in rectangular, cylindrical and spherical co-ordinate systems with an example. Give its significance **(05)**

b) Explain and derive the polarization of a dielectric material. **(05)**

c) What are advantages and limitation of Lorentz's force equation? **(05)**

d) 'The line integral of the magnetic field intensity around some closed loop is equal to the sum of the currents which pass through the loop.'Is the statement true or false. Justify the same. **(05)**

e) Point charge Q= -0.2 μC placed at origin in free space. Find electric field intensity and electric potential at (0,6,8)m. **(05)**

Q. 2 a) Formulate electromagnetic wave equation from Maxwell's equation for perfectly conducting and insulating media. **(10)**

Q. 2 b) State coulomb's law. Also derive electric field intensity due to an infinite and finite plane having density $\rho_s \left(C/m^2\right)$. **(10)**

Q. 3 a) If a current density is directed radially outward and decreases exponentially with time $\bar{J}=\frac{10}{r} e^{-t} \bar{ar}$ A/m² Calculate current I at **(10)**
1) t=1 and r=5m ,
2) t=1 r=6 ,
And also calculate rate of change of volume charge density

Q. 3 b) Derive the expression for magnetic field intensity due to infinite and finite wire carrying current I. **(10)**

Q. 4 a) Derive electrostatic Gauss Divergence equation in both integral and point form. **(10)**

Q. 4 b) Give the potential difference $V=2x^2y-5z$ and a point p(-4,3,6)m. Find the electric field intensity and flux density at P.

Q. 5 a) Derive Kirchhoff current law KCL from continuity equation of current. **(10)**

Q. 5 b) Derive Faraday's law of electromagnetic induction in time and frequency. Domain. **(10)**

Q. 6 a) Use Biot-Savart's Law for any finite current carrying conductor to find magnetic field intensity. **(10)**

Q. 6 b) Find charge Q and volume charge density $\rho_v \left(C/m^3\right)$ for **(10)**
$\bar{D} = e^{-x} \sin y\, \bar{ax} - e^{-x} \cos y\, \bar{ay} + 2z\bar{az}$
For a cube with $-10 \le x \le 10$, $-10 \le y \le 10$, $-10 \le z \le 10$

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) Explain the terms short circuit MVA and symmetrical fault. **05**

B) Describe the volt time curve as required for insulation coordination studies in power system with an example **05**

C) Discuss in brief the significance of tower footing resistance **05**

D) Describe the working principle of lightning arrester. Explain any arrester in detail. **05**

Q 2 a) Illustrate the short circuit of synchronous machine at no load condition. **10**

Q 2 b) Build the Z-bus for the 3 Bus network in which elements are connected as **10**

Bus 1-Bus 2: j0.2;

Bus 1-Bus 2: j0.4;

Bus 1-Bus3: j0.35

Bus 2-Bus 3: j0.25. (Assume Bus 3 as a reference bus)

Q 3 a) Explain and draw the zero sequence networks for following types of connections of a three phase transformer **10**

i) Delta-Delta

ii) Delta-Star(ungrounded)

iii) Delta-Star(Grounded)

iv) Star(Grounded)- Star(Grounded)

v) Star(ungrounded)- Star(ungrounded)

Q 3 b) Derive the equation for fault current and sequence network for single line to ground fault. State the various assumptions in derivation. **10**

Q 4 a)	A star connected balanced load of 10ohm each has the following voltages across its terminals Vab=200V, Vbc=220V and Vca=180V.Calculate the symmetrical components of line and phase voltages. From the symmetrical components of line voltages determine the line current.	10
Q 4 b)	Describe the generation of voltage and current travelling waves on a short circuited line with figure and equations.	10
Q 5 a)	Explain the principle of lightning phenomenon and protection against lightning with respect to power system.	10
Q 5 b)	Discuss the advantages and disadvantages of Corona	10
Q 6 a)	Describe the Z-bus formulation.	10
Q 6 b)	Explain the following (i) critical disruptive voltage and visual disruptive voltage (ii) transient recovery voltage	10

T.E/Elect/Sem.V/May.2024

05.06.2024

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ICOE/LIB TE/ Elect / Sem-V/ CS/ 07/06/2024

Paper / Subject Code: 32023 / Control System

T.E / Elect / Sem-V / May-2024

07-06-24

Time: 3 Hours **Total 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. 20
(A) Explain the effects of addition of open loop poles and zeros on root locus and transient response.
(B)Derive force to current analogy between mechanical and electrical system.
(C)Define the term damping ratio and explain its condition for stability.
(D Explain advantages of state space approach over conventional approach.
(E)Explain stability condition of Bode plot by using suitable diagram.

2. (A) Consider a unity feedback system with closed loop transfer function 10

$C(s)/R(s)=2/(s^2+3s+7)$. Find open loop transfer function. Show that the steady state error in the unit step response is 0.714.

(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. 10

3. (A)) For the unity feedback system find the steady state error for the following test input of $2+6t$ for $G(s)=1000(S+6)/(S+7)(S+10)$. 10

(B) The unity feedback system is characterized by an open loop transfer system $G(s)= 10/(S+2)(s+5)$.Determine damping ratio, undamped natural frequency of oscillation. What is the percentage overshoot of the response to a unit step input. 10

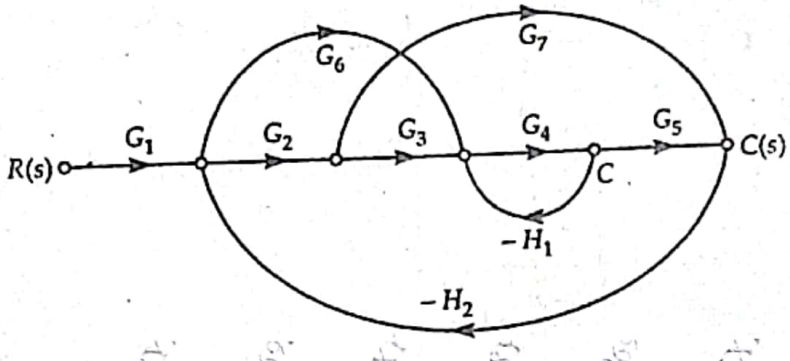
4. (A)Determine gain margin, phase margin, gain crossover frequency and phase cross over frequency for following transfer function: 10

$$G(s) = \frac{100(s+4)}{s(s+0.5)(s+10)}$$

(B) Sketch the root locus for unity feedback system for the transfer function given below: 10

$$G(s) = \frac{20}{S(S+2)(S+4)}$$

5. (A) Use Mason gain formula to find C(s)/R(s) of following signal flow graph: 10



(B) Represent the following system in state space in phase variable form and draw its state model. 10

$$G(s) = \frac{100(s+5)}{s(s+1)(s+4)}$$

6. Write notes on any two: 20

(A) Define Gain Margin, Phase Margin, Phase cross over frequency and gain Cross over Frequency in frequency domain

(B) Draw the block diagram of closed loop linear time invariant system and define its components.

(C) Write a short note on State Transition Matrix.