Total No. of Questions :6]

SEAT No. : ____

P5158

[Total No. of Pages : 3

B.E./Insem.-563
B.E.(Electrical)
CONTROL SYSTEMS - II
(2012 Pattern)

Time : 1 Hour] ***[Max. Marks :30***

Instructions to the candidates:

1) ***Answer Q.1 or Q2, Q.3 or Q.4, or Q.5 or Q.6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***

Unit - I

Q1) a) State the main (basic) types of compensators. **[3]**

b) The open loop transfer function of the Unity feedback system is given as- **[7]**

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

The phase margin of the uncompensated system is 17°. obtain the Transfer function of the Cascade Lead compensator so that the new gain cross over frequency (ω_m) is 9 rad/sec, Phase Margin (PM) is at least 50° & Static velocity Error constant, Kv is 20/sec. Assume factor of safety ($\in$) as 5°. Draw the Bode plot for the compensated system.

OR

Q2) a) Sketch & Explain the pole-zero plot of the Lag compensator. **[3]**

b) The open loop transfer function of the Unity feedback system is given as- **[7]**

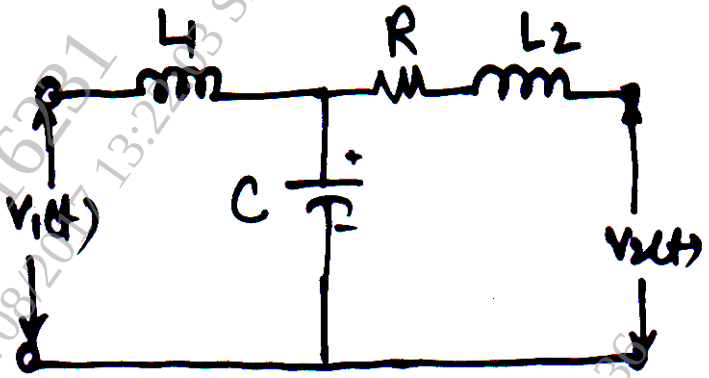
$$G(s)=\frac{1}{s(s+1)(0.5s+1)}$$

Design a Cascade Lag compensator so that the pahse Margin (PM) is at least 40° & static velocity error constant, Kv=5/sec. Assume β = 10. & factor of safety ($\in$)=12°

P.T.O.

Unit - II

Q3) a) Given the electrical network as shown in figure1. obtain the state space representation for it. **[5]**



b) The system is described by **[5]**

$$\dot{x}_1 = -4x_1 - x_2 + u$$
$$\dot{x}_2 = 3x_1 - x_2 + u$$

And the output equation

$$y = x_1$$

Obtain the transfer function of the system.

OR

Q4) a) The state model of a system is given by **[5]**

$$\dot{x} = \begin{bmatrix} -6 & 4 \\ -2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Obtain a Diagonal Canonical form of the state model by a suitable transformation matrix.

b) A system is given by the following vector-matrix equations- **[5]**

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Compute i) Resolvent matrix Φ(s) ii) state transition matrix Φ(t) for the system. matrix A.

Unit - III

Q5) a) State the duality between controllability and observability. **[3]**

b) A control system is described as - **[7]**

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ +1 \end{bmatrix} u(t)$$

It is desired to place the closed loop poles at s= –1 and s=–2. Determine the state feedback gain matrix H=[h1 h2].

OR

Q6) a) State the necessity of state observer. **[3]**

b) The transfer function of a plant is given by. **[7]**

$$G(S) = \frac{(s+3)}{s^3 + 7s^2 + 14s + 8}$$

It is desired to place the observer poles at s= –2,–3 & –4. Design an observer for the plant.

Total No. of Questions : 6]

SEAT No. :

P5165

[Total No. of Pages : 2

BE/Insem. - 570
B.E. (Electrical) (Semester - I)
EHV AC TRANSMISSION
(2012 Pattern)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates :

1) ***Use of non programmable calculator is allowed.***
2) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Unit - I

Q1) a) A power of 2000 MW is to be transmitted over a span of 800 km using 400kV and 750 kV EHV ac line. Determine the optimal number of circuits required with 50% line compensation and calculate total power loss and loss per km. **[6]**

b) Explain the terms Aeolian vibration & Galloping with respect to transmission line performance. **[4]**

OR

Q2) a) A power of 12,000 MW is required to be transmitted over a distance of 1000 km. At voltage levels of 750 kV and 1000 kV, determine the currents transmitted and the total line losses. The magnitudes for sending and receiving end voltages are equal with 30° phase difference. The line resistance and reactance values are given below. **[6]**

	750 kV	1000 kV
r (ohm/km)	0.0136	0.0036
x (ohm/km)	0.272	0.231

b) Write note on dampers and spacers. Draw the neat sketches. **[4]**

P.T.O.

Unit - II

Q3) a) Explain temperature rise of EHV conductors using heat balance equation. **[6]**

b) The conductor configuration of 750 kV EHV line are N = 4, d = 3.46cm & B = 45 cm Calculate γ_{eq}. **[4]**

OR

Q4) a) Derive an expression for total inductance of a solid round conductor due to internal and external flux linkages. **[6]**

b) What do you mean by bundled conductors? Give properties of these conductors and show conductor configurations used for bundles in EHV-lines. **[4]**

Unit - III

Q5) a) Explain Field of sphere gap and also derive equation as $S_1 S_2 = R^2$ **[6]**

b) A charge of 10 micro coulomb is placed at a distance of 2 meters from the centre of the sphere of radius 0.5 meters (1- metre diameter sphere). Calculate the magnitude, polarity and location of a point charge Q2, which will make the sphere at zero potential. **[4]**

OR

Q6) a) Explain the properties of the field of a point charge. **[6]**

b) Explain the importance of surface voltage gradient factors in extra high voltage lines. **[4]**

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Total No. of Questions :6]

SEAT No. :

P5157

[Total No. of Pages : 2

B.E./Insem.-562
B.E.(Electrical) (Semester - I)
PLC AND SCADA APPLICATIONS
(2012 Pattern)

Time : 1 Hour] *[Max. Marks :30*

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***

Q1) a) What are different benefits of automation in industry? **[5]**

b) Explain different types of PLC. **[5]**

OR

Q2) a) Draw and explain overall PLC block diagram. **[8]**

b) What are different selection criteria for PLC? **[2]**

Q3) a) Explain various rules for construction of ladder diagram. **[6]**

b) Draw and explain electromagnetic relay. **[4]**

OR

Q4) a) Explain up counter in detail with its related bits and timing diagram. **[6]**

b) Draw the ladder diagram for the following function table. **[4]**

Inputs – I1,I2 Outputs - Q1, Q2, Q3, Q4

I1	I2	Q1	Q2	Q3	Q4
0	0	1	0	0	1
0	1	0	0	1	1
1	0	0	0	1	1
1	1	0	1	1	0

P.T.O.

Q5) a) List Output Analog devices. Explain any one example in detail. **[6]**

b) What are different input ON/OFF devices? **[4]**

OR

Q6) a) What is the effect of change of Kp on the output of the system? Explain with response curves. **[6]**

b) What is the effect of change in integral constant (Ki) and derivative constant (Kd) on the performance of the system. **[4]**

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Total No. of Questions :6]

SEAT No. :

P5156

[Total No. of Pages : 2

B.E./Insem.-561
B.E.(Electrical) (Semester - I)
POWER SYSTEM OPERATION & CONTROL
(2012 Pattern)

Time : 1 Hour] *[Max. Marks :30*

Instructions to the candidates:

1) ***Solve three questions Q.1 or Q.2, Q3. Q4., Q5. or Q6.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary.***
4) ***Use of electronic calculator is allowed.***

Q1) a) Obtain the swing equation of synchronous machine. **[5]**

b) Define the critical clearing angle and critical clearing time for power system stability. Obtain the expression for critical clearing time in terms of critical clearing angle. **[5]**

OR

Q2) a) Explain the equal area criterion of transient stability studies for sudden rise in mechanical input. **[6]**

b) State and explain methods to improve stability of the power system. **[4]**

Q3) a) What is the necessity of reactive power control? Discuss the various sources of reactive power. **[5]**

b) Discuss the problems associated with the series compensation. **[5]**

OR

Q4) a) Draw and explain the loading capability curve of a synchronous generator. **[6]**

b) Compare synchronous condenser with static capacitor in context with reactive power management. **[4]**

P.T.O.

Q5) a) State various types of FACTS controllers used for reactive power control and discuss any one type. **[5]**

b) Explain the STATCOM **[5]**

OR

Q6) Write short note on following:

a) Explain principle of operation of SVC. **[5]**

b) Explain TCSC in details with different operating modes. **[5]**

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Total No. of Questions :6]

SEAT No. :

P5161

[Total No. of Pages : 2

B.E./Insem.-566
B.E.(Electrical)
RENEWABLE ENERGY SYSTEMS
(2012 Pattern)

Time : 1 Hour] *[Max. Marks :30*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Write a note on direct and diffused radiation and its effect on power generation. **[4]**

b) Determine sunset hour angle and day length for Allahabad (24°25'N,82°30'E) for January 1. **[6]**

OR

Q2) a) Define **[6]**

i) Solar constant
ii) Latitude
iii) Zenith angle
iv) Declination
v) Surface azimuth angle
vi) Slope

b) What is LAT? **[4]**

Q3) a) List and explain the factors affecting the electrical design of solar array. **[6]**

b) A solar cell has following parameters: V_{oc} = 0.8V, I_{sc} = 40 mA/cm^2, FF (Fill Factor) = 70%. What will be its efficiency? Assume that the solar cell is tested under standard conditions. **[4]**

OR

Q4) a) What are the different components of standalone PV system? **[6]**

b) Compare single crystalline and polycrystalline PV cell. **[4]**

P.T.O.

Q5) a) What are the different components of wind electric system. **[6]**

b) Describe various factors affecting the site selection of wind electric conversion system. **[4]**

OR

Q6) a) Explain different control mechanisms used for wind turbine (any two) **[6]**

b) A horizontal axis wind turbine has a diameter of 5m. When wind speed unaffected by the turbine is 9 m/s, the turbine rotates at 300 rpm and produces 7 kw of mechanical power. Find power coefficient. [Assume air density $\rho = 1.223 kg/m^3$] **[4]**

Total No. of Questions :6]

SEAT No. :

P5163

[Total No. of Pages : 2

B.E./Insem.-568
B.E.(Electrical) (Semester - I)
RESTRUCTURING AND DEREGULATION
(2012 Pattern) (Elective - II)

Time : 1 Hour] *[Max. Marks :30*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) What are the reasons of initiating the idea of deregulation in power sector? **[5]**

b) Explain any five features of Electricity Act 2003. **[5]**

OR

Q2) a) Explain the structure and working of Indian Energy Exchange (IEX). **[5]**

b) Explain the various functions of Ministry of power. **[5]**

Q3) a) Explain following terms: **[4]**

i) Neat present value

ii) Life cycle cost

b) Explain in brief different performance indices for generation. **[6]**

OR

Q4) a) Explain following economic terms of power sector. **[6]**

i) Fixed cost

ii) Working capital

b) Describe the desirable characteristics of tariff of electricity. **[4]**

P.T.O.

Q5) a) Explain the regulatory process in India. **[5]**

b) Write down advantage and disadvantage of rate of return regulation. **[5]**

OR

Q6) a) Explain performance based regulation in detail. **[5]**

b) Explain the role of State Electricity Regulatory Commission. **[5]**

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Total No. of Questions :6]

SEAT No. :

P5159

[Total No. of Pages : 1

B.E./Insem.-564
B.E.(Electrical)
SPECIAL PURPOSE MACHINES (Elective-I)

Time : 1 Hour] *[Max. Marks :30*

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***All questions carry equal marks.***
4) ***Your answers will be valued as a whole.***
5) ***Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Explain with suitable mathematical expression electromagnetic torque production in machine employing electromagnets. **[10]**

OR

Q2) Explain concept of co-energy. What is the significance it? Is it affecting the performance of the machine? **[10]**

Q3) Explain effect of following on the operation of BLDC motor. **[10]**

a) Number of poles
b) Rotor construction

OR

Q4) Explain steady state characteristics of Brushless DC Motor. **[10]**

Q5) Obtain mathematical expression for converting three phase to two phase conversion. **[10]**

OR

Q6) Explain production of torque in PMSM machine. What is cogging torque? What is the effect of this on machine operation? **[10]**

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