2012 – 2013
B.TECH. AUTUMN (VII SEMESTER) EXAMINATION
(Electrical Engineering)
COMPUTER METHODS IN POWER SYSTEMS
(EE – 436)
Credits – 04

Maximum Marks – 60
Duration: Three Hours

INSTRUCTIONS TO THE EXAMINEES

1. Answer all questions.
2. All Symbols have their usual meaning.
3. Assume missing data, if any.

1. a) Discuss the building algorithm for the formation of bus impedance matrix in a large power system.

b) Derive static load flow equations using Y BUS as network model.

- OR -

1'. The bus data in per unit of a three bus power system are:

<table>
<thead>
<tr>
<th>Bus #</th>
<th>Type</th>
<th>Voltage</th>
<th>Generation</th>
<th>Load</th>
<th>Q-Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>V</td>
<td>P_G</td>
<td>Q_G</td>
<td>P_D</td>
</tr>
<tr>
<td>1</td>
<td>Slack</td>
<td>1.04</td>
<td>0.0</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>2</td>
<td>PV</td>
<td>1.02</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>3</td>
<td>PQ</td>
<td>?</td>
<td>?</td>
<td>0.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Each diagonal element of Y BUS is equal to 6.0 – j 24.0 p.u. and each off diagonal element of Y BUS is equal to -3.0 + j 12.0 p.u. Using FDLF calculate (i) P_2^{(0)}, P_3^{(0)} and Q_3^{(0)}; (ii) Matrices B' and B'' and (iii) δ_2, δ_3 and V_3 at the end of first iteration.

2. a) Derive general expressions for fault current and bus voltages during fault in a large power system using 3-phase Z BUS as network model. Justify the assumptions made.

b) The expression for the fault current in symmetrical components is given as:

\[ I^{0,1,2}_{p(0)} = \frac{\sqrt{3} P^s_{p(0)}}{z_f + Z^{(1)}_{pp} + Z^{(2)}_{pp}} \begin{bmatrix} 0 \\ 1 \\ -1 \end{bmatrix} \]

For a fault at bus # 2, calculate fault current in phase coordinates and mention the type of fault. Data in per unit:

\[ Z^{(0)}_{22} = j0.035; \ Z^{(1)}_{22} = Z^{(2)}_{22} = j0.088; \ z_f = j0.05; \ E^s_{2(0)} = 1.025 \angle 4^\circ. \]
3. a) What are the objectives of AGC for an interconnected power system? What is meant by area control error (ACE)? Define ACE for single and two-area AGC. 

b) With the help of neat diagram explain the working of a speed governor for thermal power plants. 

c) Obtain steady state frequency error with step increase in load demand, for an isolated power system with free governor action. 

4. Define the problem of 'Optimal Power Flow'. How it is solved with the help of steepest gradient technique? Give various steps of solution. Explain how the inequality constraints on control and dependent variables are taken into account. What is meant by soft and hard limits? 

- OR -

4'. a) Explain the necessity of hydrothermal scheduling. In what way it is different from economic dispatch in a power system having all thermal plants? 

b) A hydro station in combination with steam station is supplying a common load. The characteristics of the plants are:

\[ C_s = 100 + 20P_s + 0.04P_s^2 \] 
\[ W_h = 8P_h + 0.003P_h^2 \] 
Rs/hour 
\[ m^3/sec \]

The hydro plant can use 155 million m\(^3\) of water per day. The load is: from 9 a.m. to 9 p.m. 400 MW and from 9 p.m. to 9 a.m. is 180 MW. Neglecting transmission losses, determine the scheduling and cost of thermal generation by: (i) using thermal plant as base load plant and (ii) using hydro plant as base load plant. (iii) If water restriction is relaxed and the fictitious cost of water is taken as Rs. 4 per hour per cusec, determine the scheduling for 400 MW load. 

5. a) Explain the weighted least square estimation technique for state-estimation in a power system. 

b) How 'network outages' are considered in contingency analysis? 

- OR -

b) Give a detailed account of various methods of static VAR compensation for voltage control in an interconnected power system.
2012-2013
B.TECH AUTUMN (VII SEMESTER) EXAMINATION
(ELECTRICAL ENGINEERING)
CONTROL SYSTEMS
(EE-442N)
Credits: 04

Maximum Marks: 60
Duration: Three Hours

Note:
Answer all the questions.
Symbols used have their usual meanings.
Suitable value may be assumed for missing data.

1. (a) Compare the state space technique with the transfer function technique for the analysis and design of control systems. (4)

(b) Develop a state model for the system shown in figure 1. Where $x_1$, $x_2$, and $x_3$ constitute the state vector. Find out characteristic equation of the system and location of closed loop poles from the developed state model. (8)

OR

1'. (a) Check the controllability and observability of a system represented by its state model as:

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$
$$y = \begin{bmatrix} 1 & 1 \end{bmatrix} x$$

(4)

(b) A system is represented by its state model as:

$$\dot{x} = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} x$$
$$y = \begin{bmatrix} 1 & 1 \end{bmatrix} x$$

Consider a linear transformation defined as: $z = \frac{1}{2} \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix} y$.
Develop a state model in $z$ and show that the input output relationship of the system remains unchanged under linear transformation. Assume the initial conditions as:

$$x(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

(8)

2. (a) Explain the difference between a zero order hold and a first order hold. (2)

(b) $Z$ transform is not a completely reversible process. Why? (2)

(c) Find the overall transfer function of the system shown in figure 2. (8)

3. (a) Examine the stability of the following characteristic equation using Jury’s stability criterion.

$$D(z) = z^3 + 1.3 z^2 - 0.08 z + 0.24$$

(6)

(b) Discuss various configurations for implementing a digital controller. (6)

OR
3' (a) The closed loop transfer function of system is given as
\[ T(z) = \frac{3z^2 - 2z + 8}{z^3 + 0.5z^2 - 0.25z + 0.75} \]
Write two different state models for it.

(b) Examine the stability of the following characteristic equation using Bilinear transformation.
\[ D(z) = z^3 + 1.3z^2 - 0.08z + 0.24 \]

4. (a) Define and explain
i) State feedback  ii) Stabilizability iii) Observer

(b) A system is represented by its state model as
\[
\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -5 & -7 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u
\]
\[ y = \begin{bmatrix} -2 & 4 & 3 \end{bmatrix} x \]
It is desired to place the close loop poles at \( s = -4, -4, \) and \(-5\). Find the required state feedback gain matrix using Ackerman’s formula.

(c) A system is represented by its state model as
\[
\dot{x} = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u
\]
i) check controllability of the system
ii) Check stability of the system
iii) If unstable, can it be stabilized by using state feedback?

5. (a) Discuss the significance of Describing Function in the analysis of non-linear systems. Also explain the conditions under which Describing Function analysis is valid.

(b) Consider the system described by
\[ \dot{y} + y - 2.5y^2 + 5y = 0 \]
Determine the nature of singular points and comment on their stability.

OR

5'. (a) Define and explain:
(i) Local stability (ii) Global Asymptotic Stability (iii) Limit Cycle (iv) Autonomous system

(b) Consider the system described by its dynamic equation as
\[ \dot{y} + 0.6y + 1 = 0 \]
Draw the phase trajectory using method of isoclines.
Fig. 1

Fig. 2
# 2012 – 2013
B. TECH. AUTUMN (VII SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
High Voltage Engineering
EE –461

**Maximum Marks: 60**

**Credits: 04**

**Duration: Three Hours**

<table>
<thead>
<tr>
<th>S. No. of the Question</th>
<th>Instruction to the Examinees</th>
<th>Marks allotted</th>
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<tbody>
<tr>
<td>(i) Attempt all questions (ii) All symbols &amp; abbreviations have their usual meaning (iii) Assume missing data if any.</td>
<td>Q1.(a) Define Townsend’s primary and secondary ionization coefficients and hence derive Townsend’s breakdown equation of a gas under uniform fields. Also define attachment coefficient and explain how the breakdown equation gets modified for electronegative gases. (b) Explain Paschen’s law and its limitations. Explain the existence of a minimum sparking potential in Paschen’s curve.</td>
<td>06</td>
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<td>(i) Attempt all questions (ii) All symbols &amp; abbreviations have their usual meaning (iii) Assume missing data if any.</td>
<td>Q1'.(a) Explain Streamer theory for breakdown in gases. Compare it with Townsend’s breakdown theory. (b) What are commercial liquid dielectrics and how are they different from pure liquid dielectrics? Explain any two theories that explain breakdown in commercial liquid dielectrics.</td>
<td>06</td>
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<td>(i) Attempt all questions (ii) All symbols &amp; abbreviations have their usual meaning (iii) Assume missing data if any.</td>
<td>Q2.(a) Describe a method of connection to obtain 1050 kV at 50 Hz by using testing transformers. What are the advantages and limitations of this method? (b) Explain the Sphere Gap method for measurement of ac high voltages.</td>
<td>06</td>
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<td>(i) Attempt all questions (ii) All symbols &amp; abbreviations have their usual meaning (iii) Assume missing data if any.</td>
<td>Q2'.(a) With the help of a neat diagram explain the working of Resonant Transformer for generation of high ac voltages? (b) Discuss Chubb and Fortescue method used for the measurement of high voltages. Discuss the limitation of this method.</td>
<td>06</td>
</tr>
</tbody>
</table>
Q3.(a) Explain the working of Generating Voltmeter for the measurement of high dc voltages.

(b) With the help of a neat sketch explain the working of Van de Graaff generators for generation of high dc voltages.

OR

Q3'.(a) With the help of a neat sketch explain the working of a cascaded rectifier voltage multiplier circuit for generating high dc voltages. Also develop an expression for total ripple in the output voltage for the circuit.

(b) Enumerate different methods for measurement of high dc voltages. Explain Resistance Potential divider method in detail.

Q4.(a) Define standard lightening impulse and switching surges as per Indian standards.

(b) With the help of a neat sketch explain the working of a multistage impulse generator. Also develop relevant expressions for time to front and time to tail based on the approximate equivalent circuit.

Q5.(a) Discuss the breakdown of solid insulants due to partial discharges. Draw an analogue circuit and hence determine the expression for partial discharge inception voltage for discharge in voids.

(b) Differentiate between loss tangent and loss index as applied to testing of electric insulation. Also explain a suitable method for measurement of loss tangent of insulation.
Maximum Marks: 60

Duration: Three Hours.

1. (a) What is the current status of global wind energy? 06
      (b) Explain the details of fly wheel energy storage system. 06

2. (a) Explain the usefulness of MPPT in a solar PV system. 06
      (b) A PV system feeds a dc motor to produce 1 kW power at the shaft. The motor efficiency is 80%. Each module has 36 multi-crystalline silicon solar cells arranged in 6x6 matrix. The cell size is 100 mm x 100mm and cell efficiency is 15%. Calculate the number of modules required in the PV array. Assume global radiation incident normally to the panel as 1 kW/m². 06

3. (a) List the common fuels used in fuel cells. Also indicate their main features. 06
      (b) With the help of diagram show the constructional details of Proton Exchange Membrane fuel cell. Also explain its working principle. 06

   OR

3'(a) What are advantages and major limitations of fuel cell? 04
      (b) What are different usable forms of biomass? Briefly explain the main features of each of them. 08

4. (a) What are the advantages and limitations of MHD power generation? 06
      (b) What are the factors considered for selecting the site for installing wind generators? 06

   OR

4'(a) Define the terms "angle of attack", "pitch angle", "drag force" and "lift force" as used in wind energy system. 06
      (b) Explain various types of drive schemes used in WECS. 06

5. (a) With the help of diagram explain the general structure of hydrothermal resource. 06
      ......2.
(b) A hot dry rock (HDR) resource has a geothermal temperature gradient at 40 °K km⁻¹. The minimum useful temperature is 100 °K above the surface temperature, $T_0$. Water at flow rate of 0.5 m³ s⁻¹ km⁻² is used for heat extraction. The density and specific heat capacity for water may be assumed as 1000 kg m⁻³ and 4200 J kg⁻¹ K⁻¹ respectively. Calculate,

(i) The heat content per square kilometer of HDR to a depth of 10 km, assuming $\rho_r = 2700$ kg m⁻³ and $c_r = 820$ J kg⁻¹ K⁻¹.

(ii) Useful average temperature, initially and after 25 years.

OR

5(a) What are the major advantages and limitations of OTEC systems?

(b) Describe the main characteristics of magma resource.
2012-2013
B.Tech. Autumn (VII Semester) Examination
( Electrical Engineering)
Principles of Communication Engineering
EL-440N
(Credits-04)

Maximum Marks: 60
Duration: Three Hours

Answer ALL questions.

1. (a) What are the two primary communication resources? Explain the trade-off between them. 3
(b) Explain source coding and channel coding with their advantages and disadvantages. 3
(c) State sampling theorem and explain the process of interpolation in detail. 5
(d) Determine the Fourier transform of a signal \( x(t) = \text{sgn}(t) \). Also plot the frequency spectrum of \( x(t) \). 4

OR

(d') Determine the Fourier transform of a signal
\[
x(t) = \begin{cases} 
1, & |t| < 1 \\
0, & \text{elsewhere}
\end{cases}
\]

Also plot the frequency spectrum of \( x(t) \) 4

2. (a) A baseband or modulating signal \( x(t) = 5\cos(2\pi 15 \cdot 10^3 t) \) angle modulates a carrier signal \( A\cos\omega_c t \): Determine the modulation index and bandwidth for FM system and PM system. Assume \( k_c = k_p = 1.5\text{kHz/volt} \). 7

OR

(a') Write down different pulse modulation techniques. Explain the generation of any one of them and compare it with other pulse modulation schemes. 7
(b) Draw the spectra of DSB-SC, DSB, SSB, and VSB. Also give comparison among these modulation schemes. 4
(c) Briefly explain different types of detection methods that can be used to demodulate AM with their advantages and disadvantages. 4

3. (a) Name different line coding techniques with their advantages and disadvantages. Draw all types of line coding waveforms for the sequence: 1101011. 6

OR

(a') Explain PCM technique using uniform quantization. What is the disadvantage of using uniform quantization and how it is removed? 6
(b) What is data compression? Why it is done? Explain briefly different types of data compression techniques.

OR

(b') Write a short note on DPCM technique.

(c) Write the Lempel-Ziv code of sequence: 000101110010

(d) Compare the following digital modulation techniques in terms of bandwidth, power and error performance: BPSK, BFSK and QPSK

4. (a) Explain the principle of signal propagation in optical fiber and write down the various advantages of optical fiber system.

(b) Write short note on any two:
   (i) Satellite communication system
   (ii) Computer network
   (iii) Wireless and mobile communication system

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