CBCS SCHEME

USN | | | | | | | | | | | **15EE71**

Seventh Semester B.E. Degree Examination, July/August 2021
Power System Analysis – II

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. With usual notations, prove that $Y_{bus} = A^T Y A$ using singular transformation. **(06 Marks)**

b. For the power system shown in Fig.Q1(b), obtain Y_{bus} using singular transformation. **(10 Marks)**

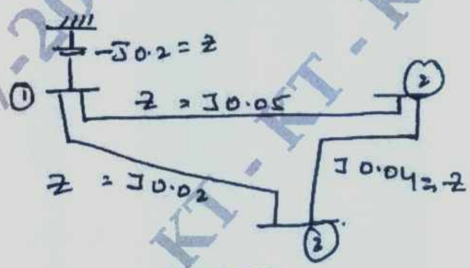

Fig.Q.1(b)

2 a. What is load flow analysis? Explain the different types of buses considered during power system load flow. Discuss the significance of slack bus in load flow studies. **(06 Marks)**

b. Define primitive network. Give the representation of a typical component and arrive at their performance equations in impedance and admittance forms. **(04 Marks)**

c. One line diagram of a power system is shown in Fig.Q2(c). Using Gauss-Seidel method, determine the complex voltage at Bus-2 at the end of first iteration. Given that $V_1 = 1\angle 0$ pu, $P_2 + JQ_2 = -5.96 + J1.46$ pu, $|V_3| = 1.02$ pu, $Z_{12} = 0.04 + J0.06$ pu and $Z_{23} = 0.02 + J0.03$ pu.

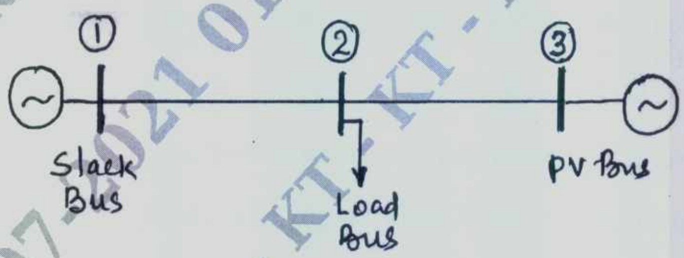

Fig.Q2(c)

(06 Marks)

3 a. What are Jacobian elements? Obtain Jacobian elements for basic equations for J_1 and J_3 only. **(04 Marks)**

b. Give the algorithm for Newton-Raphson Load Flow (NRLF). **(06 Marks)**

c. Explain any two methods of control of voltage profile. **(06 Marks)**

4 a. Starting all assumptions, deduce the FDLF model and give the flow-chart. **(10 Marks)**

b. Compare Gauss-Seidal and Newton-Raphson methods of load flow analysis. **(06 Marks)**

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5 a. Derive an expression for optimal operation of 'n' units within a plant considering the effect of transmission losses. **(06 Marks)**

b. What are B-coefficients? For the system shown in Fig.Q5(b), obtain loss coefficients and the power loss. Take $I_1 = 1\lfloor 0$ pu. $I_2 = 0.8\lfloor 0$ pu, $V_3 = 1\lfloor 0$ pu. Transmission lines impedances, $Z_a = 0.02 + J0.25$ pu and $Z_b = 0.03 + J0.35$ pu.

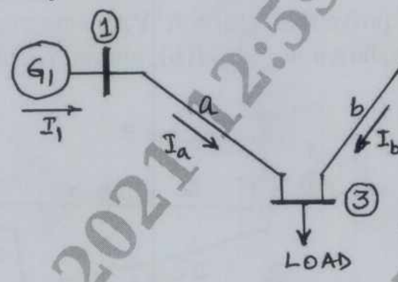

Fig.Q5(b)

(10 Marks)

6 a. The fuel input per hour of plant 1 and plant 2 are given by,

$F_1 = 0.2P_1^2 + 40P_1 + 120$ RS/Hr $\quad F_2 = 0.25P_2^2 + 30P_2 + 150$ RS/Hr

Determine the economic scheduling neglecting the losses for a load of 180 MW. Also calculate cost of production of 180 MW for the obtained schedule. **(04 Marks)**

b. Obtain transmission line loss coefficients interms of plant generation capacities for two units delivering a load. **(06 Marks)**

c. Obtain economic scheduling for a system having transmission line losses and no limits on generators. **(06 Marks)**

7 a. Discuss the problem formulation and solution procedure of optimal scheduling for hydro thermal plant. **(10 Marks)**

b. Draw the flow chart of optimal load flow solution. **(06 Marks)**

8 a. Describe the power system security assessment and modeling for contingency analysis. **(08 Marks)**

b. Explain power system static security level classification. **(08 Marks)**

9 a. Derive the generalized algorithm for finding the elements of bus – impedance matrix Z_{bus} when a branch in added to the partial network. **(08 Marks)**

b. For the three-bus network shown in Fig.Q.9(b) build Z_{bus}. **(08 Marks)**

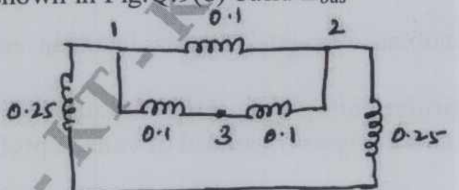

Fig.Q.9(b)

10 a. Explain the numerical solution of swing equation. **(08 Marks)**

b. Explain clearly the steps involved in solving power system stability solution of swing equation using Range-Kutta method. **(08 Marks)**

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CBCS SCHEME

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Seventh Semester B.E. Degree Examination, July/August 2021
High Voltage Engineering

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions.*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Classify the breakdown mechanism in liquid and explain any one mechanism. **(07 Marks)**

b. Explain current growth in presence of secondary ionization. **(06 Marks)**

c. In an experimental in certain gas it was found that the steady state current is 5.5×10^{-8}A at a distance of 0.4cm between electrode keeping the field constant and reducing the distance of 0.1cm result in a current of 5.5×10^{-9} A. Calculate Townsend's primary ionization coefficient 'α'. **(03 Marks)**

2 a. Derive Paschen's Law and draw Paschen's curve in respect of a gas subjected to a uniform static electric field. **(05 Marks)**

b. Explain Electromechanical breakdown and thermal breakdown in solid dielectric. **(06 Marks)**

c. Derive the criterian for breakdown in electro negative gases. **(05 Marks)**

3 a. Explain the principle of operation of Resonant transformer with the circuit, explain series and parallel AC test system. What are the advantages and disadvantages of above? **(08 Marks)**

b. A Cockcroft – Walton type voltage multiple has eight stages with capacitance all equal to 0.05μF. The supply transformer secondary voltage is 125kV at a frequency of 150Hz if the load current to be supplied is 5mA. Find :

i) The percentage ripple
ii) The regulation
iii) The optimum number of stages for minimum regulation or voltage drop. **(08 Marks)**

4 a. Explain construction and working of a three electrode gap tripping circuit used for impulse generator. **(08 Marks)**

b. With a neat diagram, explain two stage cascade transformer connection for producing very high AC voltage. Mention its advantages and disadvantages. **(08 Marks)**

5 a. Describe Chubb and Fortescue method for measurement of peak value of an AC voltage. **(07 Marks)**

b. Explain Cathode Ray oscilloscope for impulse voltage measurement with neat block diagram. **(04 Marks)**

c. Explain clearly the factors influencing the spark over voltage of sphere gap. **(05 Marks)**

6 a. Write a brief note on capacitance voltage divider. **(05 Marks)**

b. Explain principle of an electrostatic voltmeter. Show that it measure DC voltage. **(05 Marks)**

c. What is Rogowski coil? Explain with neat diagram its principle of operation for measurement of high impulse current. **(06 Marks)**

7 a. Explain the defining theory of charge information in clouds. **(08 Marks)**

b. What are different methods employed for lighting protection of overhead lines? Explain them. **(08 Marks)**

8 a. Explain the successive reflection and lattice diagram. **(08 Marks)**

b. Explain the principle of insulation co-ordination in EHV and UHV system. **(08 Marks)**

9 a. With neat diagram describe a high voltage Schering bride to measure the capacitance and dissipation factor of sample of dielectric. **(08 Marks)**

b. Discuss the method of balanced detection for locating partial discharge in electrical equipment. **(08 Marks)**

10 a. Explain in brief the different tests that are conducted on bushing. **(08 Marks)**

b. With neat sketch, explain the procedure for impulse testing of transformer. **(08 Marks)**

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CBCS SCHEME

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Seventh Semester B.E. Degree Examination, July/August 2021
Advanced Control Systems

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. List the advantages of state variable analysis over the conventional approach. **(08 Marks)**

b. For the network shown in Fig.Q1(b) below, choosing $i_1(t) = X_1(t)$ and $i_2(t) = X_2(t)$ as state variables, obtain the state equation and output equation in vector matrix form. **(08 Marks)**

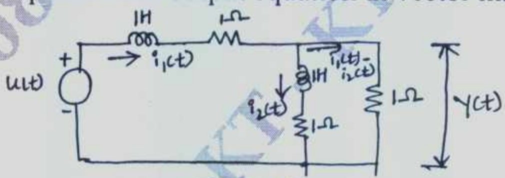

Fig.Q1(b)

2 a. Explain the concept of state with an example of simple mechanical system. **(06 Marks)**

b. Obtain the state model of the system whose closed loop transfer function is

$$\frac{C(s)}{R(s)} = \frac{2(s+3)}{(s+1)(s+2)}$$ **(05 Marks)**

c. Derive state model for the system describe by the differential equation,

$$D^3y + 4D^2y + 5Dy + 2y = 2D^2u + 6Du + 5u$$

where $D = d/dt$ in phase variable form. **(05 Marks)**

3 a. Obtain the eigen values, eigen vectors and modal matrix for,

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix}$$

and prove that, $M^{-1}AM = \wedge$ = diagonal matrix. **(08 Marks)**

b. Find the state transition matrix for $A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}$ using Cayley Hemilton theorem. **(08 Marks)**

4 a. Derive the general solution of non-homogeneous state equation. **(06 Marks)**

b. Evaluate controllability and observability of the following state model.

$$A = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix}, \quad B = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \quad C = [1 \quad 1]$$ **(05 Marks)**

c. Using similarity transformation method, find e^{At} for, $A = \begin{bmatrix} -4 & 3 \\ -6 & 5 \end{bmatrix}$ **(05 Marks)**

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5 a. Explain the different steps to evaluate the state feedback gain matrix K using transformation matrix T. **(06 Marks)**

b. Consider the system defined by $\dot{x} = AX + BU$

where $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ by using the state feedback control $u = -Kx$. It is desired to have the closed loop poles at $s = -1 \pm j2$, $s = -10$. Determine the state feedback gain matrix K using Ackermann's formula. **(10 Marks)**

6 a. Explain the necessary and sufficient condition for state observation and derive the state observer gain matrix K_e. **(06 Marks)**

b. A system is defined by the following state space model.

$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -6 & -5 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

Design a state feedback controller such that the poles are moved to $-1 \pm j, -5$. **(10 Marks)**

7 a. Discuss the basic features of the following non-linearities:
(i) Non-linear friction
(ii) On-off controller
(iii) Back-lash **(09 Marks)**

b. What are singular points? Explain the classification of singular points based on the location of eigen values of the system. **(07 Marks)**

8 a. Explain the construction of a phase trajectory by Delta method. **(06 Marks)**

b. Draw the phase plane trajectory for the following equation using Isocline method.
$\ddot{X} + 2\xi\omega\dot{X} + \omega^2 X = 0$. Given $\xi = 0.5$, $\omega = 1$, initial point (0, 6) **(10 Marks)**

9 a. State and explain Liapunov's theorem on
(i) Asymptotic stability (ii) Global asymptotic stability (iii) Instability. **(10 Marks)**

b. Investigate the stability of the following non-linear system using direct method of Liapunov.
$\dot{x}_1 = x_2$, $\dot{x}_2 = -x_1 - x_1^2 x_2$ **(06 Marks)**

10 a. A system is described by the following equation.

$\dot{x} = Ax$ where $A = \begin{bmatrix} -1 & -2 \\ 1 & -4 \end{bmatrix}$

Assuming matrix Q to be the identify matrix, solve the matrix P and comment on the stability of the system using the equation $A^T P + PA = -Q$. **(10 Marks)**

b. Consider the system with differential equation

$\ddot{e} + K\dot{e} + K_1 e^3 + e = 0$

Examine the stability by Liapunov's method, given that $K > 0$ and $K_1 > 0$. **(06 Marks)**

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15EE742

Seventh Semester B.E. Degree Examination, July/August 2021
Utilization of Electrical Power

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions.*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Draw the equivalent circuit of an arc furnace and thereby obtain the condition for maximum output. **(08 Marks)**

b. A 15 kW, 220 volts single phase resistance oven employs Nickel chrome wire for its heating elements. If the wire temperature is not exceed 1000°C and the temperature of the charge is to be 600°C, calculate the diameter and length of the wire. Assume radiating efficiency to be 0.6 and emissivity as 0.9. For Nickel-chrome, resistivity = $1.016\times10^{-6}\,\Omega$m. **(08 Marks)**

2 a. A piece of insulating material is to be heated by dielectric heating. The size of the piece is $12\text{cm}\times12\text{cm}\times3\text{cm}$. A frequency of 20 MHz is used and the power absorbed is 450 W. If the material has a relative permittivity of 5 and a power factor of 0.05, calculate the voltage necessary for heating and current that flows in the material. Assume $\epsilon_0 = 8.854\times10^{-12}$ F/M. **(06 Marks)**

b. Bring out any five differences between resistance and arc welding. **(04 Marks)**

c. Explain the terms current efficiency, voltage and energy efficiency associated with electrolytic processes. **(06 Marks)**

3 a. Define the following terms: (i) Solid angle (ii) Light (iii) Luminous intensity (iv) MSCP. **(08 Marks)**

b. Explain the concept of measurement of mean spherical candle power by integrating sphere. **(08 Marks)**

4 a. Describe the construction and working of an incandescent lamp. **(08 Marks)**

b. Compare the performance of florescent lamp and CFL lamp. **(05 Marks)**

c. A 250 volt lamp has a total flux of 3000 lumecs for a current of 0.8 A. Find MSCP per watt. **(03 Marks)**

5 a. Mention the advantages and limitations of electric drives. **(08 Marks)**

b. With usual notations show that, $\frac{1}{2}\left[\frac{1}{\alpha}+\frac{1}{\beta}\right]=\frac{3600D}{V_m^2}\left[\frac{V_m}{V_a}-1\right]$. **(08 Marks)**

6 a. Discuss the requirements of electric motors for Traction work. **(08 Marks)**

b. A 200 tonne motor coach has 4 motors, each developing 600 Nm torque during acceleration, start from rest. If the gradient is 30 in 1000, gear ratio 4, gear transmission efficiency 90%, wheel radius 45 cm, train resistance 50 N/tonne and additional rotational inertia 10%, calculate the time taken to attain a speed of 50 kmph. If the line voltage is 3000 volts dc and efficiency of motors 85%, find the current during the notching period. **(08 Marks)**

7 a. Explain how regenerative and Rheostatic braking is obtained with single phase AC series motors? Three phase induction motor. **(08 Marks)**

b. Describe the concept of electrolysis by currents through earth. **(08 Marks)**

8 a. Explain the function of a negative booster in a Tramway system. **(08 Marks)**

b. Write a note on : (i) Tramway and (ii) Trolley Bus. **(08 Marks)**

9 a. Explain configuration of electric vehicles with neat diagram. **(08 Marks)**

b. Discuss the energy consumption in electric vehicles. **(08 Marks)**

10 a. Discuss the hybrid electric vehicle-working principle, with relevant block diagram. **(08 Marks)**

b. Write a note on: (i) Parallel hybrid drive system (ii) Series hybrid drive system. **(08 Marks)**

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CBCS SCHEME

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15EE752

Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Testing & Commissioning of Power System Apparatus

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain the various steps in installation of transformers. **(08 Marks)**
b. With neat sketch, explain rating and terminal plate for power transformers. **(08 Marks)**

OR

2 a. Explain the significance of polarity and phase sequence with respect to transformers. **(05 Marks)**
b. What are the qualities of good insulating oil? **(05 Marks)**
c. Briefly explain the different steps in dryingout process of transformers. **(06 Marks)**

Module-2

3 a. Write the specifications of synchronous machines as per BIS standards. **(06 Marks)**
b. Define Excitation system. Explain brushless excitation system. **(06 Marks)**
c. List the various tests performed on synchronous generators. **(04 Marks)**

OR

4 a. With neat sketch, explain sudden 3-ϕ short circuit test on generator. **(08 Marks)**
b. With relevant equations, explain slip-test and calculation of x_q and x_d. **(08 Marks)**

Module-3

5 a. List and explain the important steps in selection of an induction motor for specific applications. **(08 Marks)**
b. With neat sketches, explain alignment of shaft with respect to induction motors. **(08 Marks)**

OR

6 a. With neat sketches, explain the various methods of drying out of induction motors. **(06 Marks)**
b. Explain in brief, mechanical alignment and air gap symmetry with respect to induction motors. **(04 Marks)**
c. What is the importance of temperature rise test? Explain the methods of measuring temperature rise. **(06 Marks)**

Module-4

7 a. With respect to underground cables, list the various steps involved in transportation and handling of cables. **(08 Marks)**
b. Explain the various steps in Excavation of trenches. **(08 Marks)**

OR

8 a. Explain testing and commissioning of cable jointing and terminations. **(08 Marks)**
b. Explain in brief, location of faults using megger. **(08 Marks)**

Module-5

9 a. Write the functions of different devices used in protection of Electrical equipment. **(08 Marks)**
b. List the standard specifications of high voltage circuit breaker. **(08 Marks)**

OR

10 a. Explain the various steps in testing of electrical installation of a building. **(08 Marks)**
b. List IE rules for domestic installation. **(08 Marks)**

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