CBCS SCHEME

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Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Power System Analysis - II

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. What is primitive network? Explain its significance. **(06 Marks)**

b. The impedance data for a sample power system is given below. Find the admittance matrix of the system in bus frame of reference by singular transformation method. (Using ground as reference) **(10 Marks)**

Bus code	Impedence	Line Charging admittance
1 – 2	0.08+j0.24	0.0
1 – 3	0.02+j0.06	0.0
2 – 3	0.06+j0.18	0.0

OR

2 a. Define subgraph, tree, co-tree as applied to graph theory. Give example for each. **(06 Marks)**

b. Using Gauss-Seidel load flow method, find bus voltage at the end of one iteration for the system shown in Fig. Q2 (b). Ignore resistance and line changing.
Assume initial voltage at all buses to $1.0\angle 0^\circ$. Use 1.0 as acceleration factor.
The bus data is given in the table below:

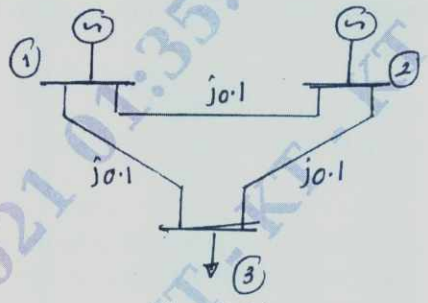

Fig Q2 (b)

Bus data table

Bus No.	Specified P (PU)	Injection Q (PU)	Specified voltage (PU)
1	-	-	1.0
2	0.3	-	1.0
3	0.5	0.2	-

(10 Marks)

Module-2

3 a. Explain the algorithmic procedure for load flow analysis using Newtonian Raphson's method in polar co-ordinates. **(08 Marks)**

b. List the advantages and limitation of Gauss-Seidel method and Newton-Raphson's of load flow analysis. **(08 Marks)**

OR

4 a. Explain the step by step procedure of fast decoupled load flow analysis and the assumptions made. **(08 Marks)**

b. Explain any two methods of voltage control in power system. **(08 Marks)**

Module-3

5 a. Explain the following with respect to optimal operation of power system:

(i) Input-output curve.
(ii) Cost-curve.
(iii) Incremental cost curve.
(iv) Heat rate curve. **(08 Marks)**

b. The incremental fuel costs in ruppes/Mwh for a plant consisting of two units are given by,

$$\frac{dC_1}{dP_1} = 0.16P_1 + 30$$

$$\frac{dC_2}{dP_2} = 0.20P_2 + 25.$$

Assume that both units are operating all the time throughout the year. The maximum and minimum loads on each unit are 200 MW and 50 MW respectively. If the load varies between 100 MW and 400 MW, find the load division between two units as the system load varies over the full range in steps of 100 MW. **(08 Marks)**

OR

6 a. Derive the exact co-ordination equation for economic load dispatch in a thermal power system with the consideration of transmission losses. **(08 Marks)**

b. Explain unit commitment using dynamic programming method. **(08 Marks)**

Module-4

7 a. Discuss in detail optimal scheduling for Hydrothermal system. **(08 Marks)**

b. Clearly explain availability and un-availability of reliability consideration. **(08 Marks)**

OR

8 a. Explain with a flow chart for optimal load flow solution. **(08 Marks)**

b. Explain state space method used for power system reliability evaluation. Discuss Loss Of Load Probability (LOLP). **(08 Marks)**

Module-5

9 a. For the system shown in Fig. Q9 (a) with bus 1 as reference and line data impedance as shown. Compute Z_{bus} by adding 1-2, 2-3 and 1-3. **(08 Marks)**

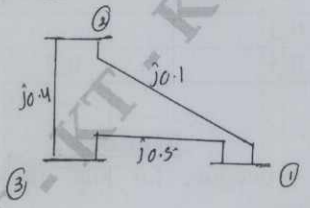

Fig. Q9 (a)

b. Discuss in detail the point by point method of solving the SWING EQUATION. **(08 Marks)**

OR

10 a. Discuss the various steps for determining multi machine stability of power system. **(08 Marks)**

b. Derive the generalized algorithm for finding the elements of bus impedance matrix when a branch is added to the partial network. Discuss the special cases. **(08 Marks)**

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15EE72

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Power System Protection

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the nature is causes of faults. Discuss the consequences of faults on a power system. **(08 Marks)**

b. Discuss how an amplitude comparator can be converted to a phase comparator. **(08 Marks)**

OR

2 a. Compare numerical relay with an electromechanical relay. **(05 Marks)**

b. Explain various methods of backup protection. **(05 Marks)**

c. Briefly explain the essential qualities of a protective relay. **(06 Marks)**

Module-2

3 a. An earth fault develops at point F on the feeder shown in Fig Q3(a) and the fault current is 16000A. The IDMT relays at points A & B are fed via 800/5 A CTs. The relay at B has a plug setting of 125% and Time Multiplier Setting (TMS) of 0.2. The circuit breakers take 0.20s to clear the fault, and the relay error in each case is 0.15s for a plug setting of 200% on the relay A, determine the minimum TMS on that relay for it not to operate before the circuit breaker at B has cleared the fault. Assume the operating time at PSM of 10 for a TMS of 1 = 3.0s. **(08 Marks)**

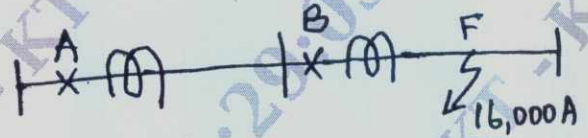

Fig Q3(a)

b. What is an impedance relay? Explain its operating principle, torque equation and operating characteristics for impendence relay. **(08 Marks)**

OR

4 a. Describe the operating principle of reverse power or directional relay with neat diagram. **(08 Marks)**

b. Explain Angle impedance relay with neat diagram. **(08 Marks)**

Module-3

5 a. Describe the balanced voltage (or opposed voltage) differential protection scheme. **(08 Marks)**

b. With a neat sketch, discuss the differential scheme for bus zone protection. **(08 Marks)**

OR

6 a. Describe with a neat sketch, the percentage differential protection of a modern alternator. **(08 Marks)**

b. Define the term pilot, with reference to power line protection lit the difference types of wire pilot protection schemes and explain any one of the scheme. **(08 Marks)**

Module-4

7 a. With a neat sketch, explain the recover rate theory and energy balance theory of arc interruption in a circuit breaker. **(08 Marks)**

b. For a 132KV system, the reactance and capacitance up to the location of the circuit breaker is 3Ω and 0.015μF, respectively. Calculate the following :
   i) The frequency to transient oscillation
   ii) The maximum value of restriking voltage across the contacts of the circuit breaker
   iii) The maximum value of RRRV. **(08 Marks)**

OR

8 a. With a neat sketch, explain the direct testing of circuit breaker. **(05 Marks)**

b. List the classification of circuit breaker. **(05 Marks)**

c. What are the merits and demerits of SF_6 circuit breaker? **(06 Marks)**

Module-5

9 a. What do you mean by discrimination? Discuss discrimination between i) two fuses ii) a fuse and an over current relay. **(08 Marks)**

b. Describe the protection of stations and substations against direct lighting strokes. **(08 Marks)**

OR

10 a. What is GIS? What are the various component of a GIS? Briefly, describe their functions. **(08 Marks)**

b. Write short notes on :
   i) Klydonograph
   ii) Rod gap. **(08 Marks)**

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15EE73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
High Voltage Engineering

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Mention few preferred properties of gaseous dielectric for high voltage applications. Give any three example of gaseous dielectric. **(06 Marks)**

b. Explain the process of ionization by collision. Derive an expression for the current in the air gap considering Townsend's first ionization coefficient. **(10 Marks)**

OR

2 a. State and explain Paschen's Law. **(06 Marks)**

b. Briefly explain electro mechanical breakdown and thermal breakdown in solid dielectrics. **(10 Marks)**

Module-2

3 a. Explain the need of generating very high voltages in the laboratory. **(04 Marks)**

b. With a neat sketch, explain Cockcroft Walton principle for generating high dc voltages. **(06 Marks)**

c. Explain the working principle of a series resonant transformer. **(06 Marks)**

OR

4 a. Explain the Marx circuit arrangement for generation of high impulse voltages. **(08 Marks)**

b. A 12 stage impulse generator has 0.126μF capacitors. The wave front and wave tail resistance are 800Ω and 5000Ω respectively. If the load capacitor is 1000pF. Find the front time and tail time of the impulse wave produced. **(08 Marks)**

Module-3

5 a. Explain the Chubb and Fortescue method for measurement of pack value of an ac voltage waveform. **(08 Marks)**

b. Explain the principle of operation of an electrostatic voltmeter for measurement of high dc and ac voltages. **(08 Marks)**

OR

6 a. Discuss the factors influencing the spark over voltages of sphere gaps. **(08 Marks)**

b. Explain measurement of high impulse currents using Rogowski coil, with a neat figure. **(08 Marks)**

Module-4

7 a. Discuss the chief causes of over voltages in electric power systems. **(06 Marks)**
b. Explain charge formation in clouds using Simpson's cloud model. **(10 Marks)**

OR

8 a. With typical wave shapes, mention the characteristic of switching surge voltages. **(08 Marks)**
b. What is meant by insulation coordination? **(04 Marks)**
c. Discuss the ideal characteristics of protective devices connected in shunt for protection of electrical apparatus. **(04 Marks)**

Module-5

9 a. With the help of a diagram of a Schering bridge, explain how the capacitance and tan δ, can be measured. **(08 Marks)**
b. What is meant by partial discharge? Explain how it can be measured using balanced detection method. **(08 Marks)**

OR

10 a. Explain the testing of circuit breakers and insulators. **(08 Marks)**
b. What are the tests on transformers and explain the impulse testing of transformers. **(08 Marks)**

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15EE741

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Advanced Control Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. List the advantages of Advanced Control Theory Over Conventional Control Theory and define the concept of :
i) State ii) State variable. **(08 Marks)**

b. A feedback system is represented by the closed loop transfer function :

$$T(s) = \frac{Y(s)}{U(s)} = \frac{s^2+3s+8}{s^3+5s^2+2s+1}$$

Draw a suitable signal flow graph and obtain the state model. **(08 Marks)**

OR

2 a. Obtain the state model of electrical network shown in Fig.Q2(a), using minimal number of state variables. Select the current in resistor R_2 as output.

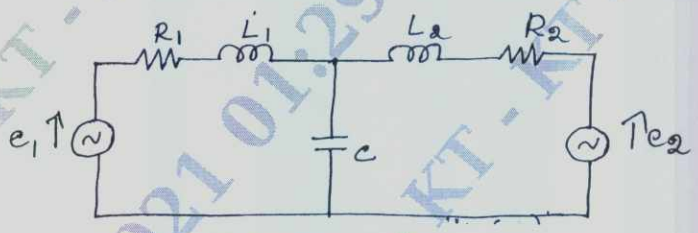

Fig.Q2(a) **(08 Marks)**

b. Obtain state model in Jordan canonical form for the system with transfer function :

$$\frac{Y(s)}{U(s)} = \frac{2s^2+6s+8}{(s+1)^2(s+2)}.$$ **(08 Marks)**

Module-2

3 a. For the matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -4 & -3 \end{bmatrix}$. Find the eigen values, eigen vectors and model matrix M. **(08 Marks)**

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

OR

4 a. Obtain a transfer function representation of the system described by the state model $\dot{x} = Ax + Bu$ and $y = Cx$, where $A = \begin{bmatrix} 0 & 1 & 0 \\ -1 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$; $B = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$ and $C = [0\ 0\ 1]$. **(08 Marks)**

b. Determine the controllability and observability of the following state model by Kalman's test.

$$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} u \qquad y = [10\ 5\ 1]X.$$ **(08 Marks)**

Module-3

5 a. 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 by Ackermann's formula. **(08 Marks)**

b. A system represented by following state model is controlled but not observable. Show that the non observability is due to a pole zero cancellation in $C[SI - A]^{-1}$.

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u\ ;\ y = [1\ 1\ 0]x.$$ **(08 Marks)**

OR

6 a. Consider the system $\dot{x} = Ax + Bu$ and $y = Cx$, where $A = \begin{bmatrix} -1 & 1 \\ 1 & 2 \end{bmatrix}$, $C = [1\ 0]$. Design a full order state observer. The desired eigen values for the observer matrix are $\mu_1 = -5$, $\mu_2 = -5$. **(08 Marks)**

b. Consider a linear system described by the transfer function $\frac{y(s)}{U(s)} = \frac{10}{s(s+1)(s+2)}$. Design a feedback with a state feedback so that closed loop poles are placed at $-2, -1 \pm j$. **(08 Marks)**

Module-4

7 a. Explain common behaviours of nonlinear system. **(08 Marks)**

b. Determine the kind of singularity of the following differential equation :

$\ddot{y} + 3\dot{y} + 2y = 0$. **(08 Marks)**

OR

8 a. Draw the phase – plane trajectory for the following equation using isocline method :

$\ddot{x} + 2\xi\omega\dot{x} + w^2x = 0$ given $\xi = 0.5$, $\omega = 1$, initial point (0, 6). **(08 Marks)**

b. Explain :

i) Dead zone

ii) Backlash. **(08 Marks)**

Module-5

9 a. Use Krasovskii's theorem to show that the equilibrium state x = 0 of the system described by

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

$\dot{x}_2 = x_1 - x_2 - x_2^3$

is asymptotically stable in the large. **(08 Marks)**

b. Consider the system with differential equation $\ddot{e} + K\dot{e} + K_1\dot{e}^3 + e = 0$. Examine the stability by Liapunov's method, given that $K > 0$ and $K_1 > 0$. **(08 Marks)**

OR

10 a. Using Lyapunov's direct method, find the range of K to guarantee stability of the system shown in Fig.Q10(a).

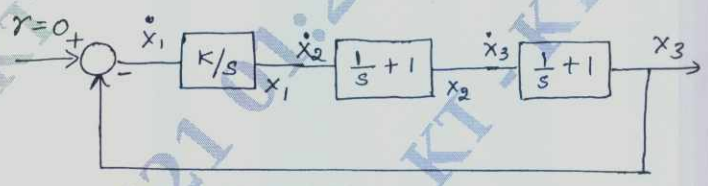

Fig.Q10(a) **(08 Marks)**

b. Determine whether or not following quadratic form is positive definite.

$V(X) = 8x_1^2 + x_2^2 + 4x_3^2 + 4x_1x_2 - 4x_1x_3 - 2x_2x_3$ **(08 Marks)**

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15EE742

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Utilization of Electrical Power

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain with a neat diagram the working of "Direct arc furnace". Mention its applications. **(08 Marks)**

b. Explain :
i) Direct resistance heating
ii) Indirect resistance heating. **(08 Marks)**

OR

2 a. Explain first and second laws of Faraday of electrolysis. **(08 Marks)**

b. Calculate the ampere hours required to deposit a coating of silver 0.05 mm thick on a sphere of radius of 5cms electrochemical equivalent of silver is 0.001118 and density of silver is 10.5 gms per cubic centimeter. **(08 Marks)**

Module-2

3 a. State and explain the two laws of illumination. **(08 Marks)**

b. Deduce the relation to find illumination at any point on the surface due to a light source suspended at a height "h" above the surface. **(08 Marks)**

OR

4 a. Mention and Briefly explain the factors to be considered in the design of lighting schemes. **(08 Marks)**

b. A small assembly shop 16m long, 10m wide and 3m up to trusses is to be illuminated to a level of 200 Lux. The utilisation and maintenance factors are 0.74 and 0.8 respectively. Calculate the number of lamps required to illuminate the whole area/if the lumen output of the lamp selected is 3000 lumens. **(08 Marks)**

Module-3

5 a. Sketch and explain typical speed –time curves for :
i) Main line service
ii) Suburban service
iii) Urban service in traction services. **(08 Marks)**

b. An electric train has an average speed of 42Kmph on a level track between stops 1400m apart. It is accelerated @ 1.7kmph ps and is braked at 3.3kmph ps. Draw the speed time curve for the train. **(08 Marks)**

OR

6 a. Explain the operating characteristics of DC series motors. Discuss the advantages and disadvantage of using DC series motor for traction duty. **(08 Marks)**

b. Write a note on starting and speed control of DC traction motors explaining Rheostatic control and series parallel control in detail. **(08 Marks)**

Module-4

7 a. What are the different types of mechanical braking of electric trains? **(08 Marks)**
b. What are the advantages and disadvantages of regenerative braking? **(08 Marks)**

OR

8 a. Explain Bow Collector and pantograph collectors used as current collectors in over head systems with suitable sketches. **(08 Marks)**
b. A train weighing 500tormes is going down a gradient of 1 in 50. It is desired to keep train speed at 40Kmph by regenerative braking. Calculate the power fed into the line. Tractive resistance is 40N/tone. Rotational inertia : 10% and efficiency of conversion : 75%. **(08 Marks)**

Module-5

9 a. Compare electric vehicles with conventional IC engine vehicles. **(06 Marks)**
b. Discuss the concepts and configuration of modern electric drives in detail with suitable sketches. **(10 Marks)**

OR

10 a. Explain the concept and working principle of hybrid electric drive trains. With its architecture with suitable sketches. **(08 Marks)**
b. Write a note on the performance of electric vehicles. **(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.*

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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