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Subject Code: BEE601

Roll No:

BTECH

(SEM. VI) THEORY EXAMINATION 2025-26

POWER SYSTEM-II

TIME: 3 HRS

M.MARKS: 70

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief.

2x7 = 14

Q.N.	Question	CO	Level
(a)	If $Z_1 = Z_2 = Z_0$, what will be the fault current ratio between SLG and 3-phase fault? (No derivation)	1	K4
(b)	A 2-bus system has $Y_{12} = -j5$ pu. Write YBUS matrix directly and comment on diagonal dominance.	2	K3
(c)	A travelling wave hits an open circuit. What is reflection coefficient for voltage and current?	3	K3
(d)	Define symmetrical components and state their significance.	1	K3
(e)	A relay has pickup current 2 A and $PSM = 5$. Find fault current and state if relay operates instantly.	5	K3
(f)	If fault clearing time increases, what happens to stability margin? Justify briefly.	4	K3
(g)	What is Ferranti effect in transmission lines? State one cause of it.	3	K3

SECTION B

2. Attempt any *three* of the following:

7 x 3 = 21

(a)	Perform one iteration of Newton-Raphson method for a 2-bus system (assume suitable data) and comment on convergence behavior.	2	K5
(b)	Derive the swing equation for power system stability. A generator delivers one pu power over a line with reactance 0.5 pu. Calculate the maximum power and comment on stability.	4	K4
(c)	Explain positive, negative and zero sequence components with their significance's single line-to-ground fault occurs on a system with sequence reactances $X_1 = X_2 = 0.2$ pu and $X_0 = 0.5$ pu. Calculate the fault current.	1	K4
(d)	Explain reflection and refraction of travelling waves on transmission lines. A surge of 100 kV travels on a line of surge impedance 400Ω and meets a line of 200Ω . Calculate reflection and transmission coefficients.	3	K4
(e)	Explain the operating principle of over current relay. A distance relay is set to 80% of line impedance ($Z = 10\Omega$). A fault occurs at 7Ω with fault resistance of 2Ω . Determine whether relay overreaches or under reaches.	5	K5

P.T.O.

SECTION C

3. Attempt any *one* part of the following:

7 x 1 = 7

(a)	A single line to ground fault occurs on a power system. Derive the fault current expression using sequence networks. A 3-phase power system has a fault current of 20 kA at a bus where the line voltage is 11kV. Calculate the fault level (in MVA) at the bus.	1	K3
(b)	Explain line-to-line and double line-to-ground faults with sequence network diagrams. A system has $Z_1 = j0.3$, $Z_2 = j0.3$, $Z_0 = j0.9$ pu. Calculate fault current for double line-to-ground fault.	1	K4

4. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Solve a 3-bus system using Gauss-Seidel method (one iteration) and analyze effect of initial guess.	2	K5
(b)	Derive Jacobian matrix for Newton-Raphson load flow and explain decoupling assumptions.	2	K5

5. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Derive reflection and transmission coefficients for a wave at junction of two lines with different surge impedances. A travelling wave moves from a line of 300Ω to another line of 300Ω. Determine: (a) Reflection coefficient. (b) What happens to the wave?	3	K4
(b)	Explain Bewley's Lattice Diagram with a suitable example. A travelling wave of 100 kV hits a short-circuited line. Determine voltage, current reflections, and explain physical significance.	3	K5

6. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Using equal area criterion, derive critical clearing angle for a sudden fault. A system has maximum power transfer of 2 pu. If mechanical input is 1 pu, determine stability margin.	4	K4
(b)	Explain critical clearing angle with suitable diagram. A system has $P_{max} = 2.5$ pu and input power = 1.5 pu. Determine maximum allowable disturbance without losing stability.	4	K3

7. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Explain restriking voltage and derive condition for arc extinction in circuit breakers. A circuit breaker interrupts a fault current. At current zero, the restriking voltage is 15 kV, and the dielectric strength of the medium is 12 kV. Determine whether the arc will be extinguished successfully or restrike will occur.	5	K4
(b)	Explain zone protection in distance relays. A relay is connected through a CT of ratio 100/5. The relay setting is 125%. The fault current on the primary side is 400 A. Calculate the PSM.	5	K4