EE 6th Sem.

CBCS SCHEME

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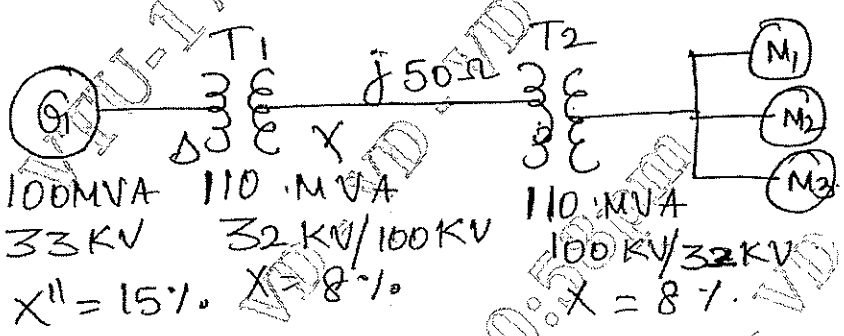
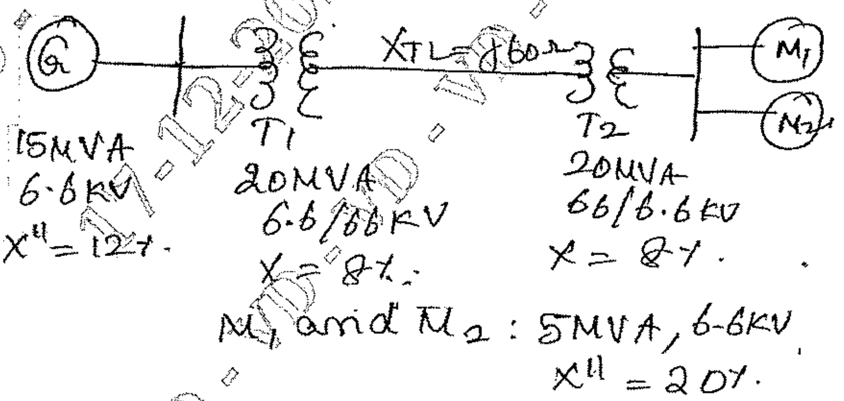
BEE601

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Power System Analysis – I

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define per unit. Show that the per unit impedance of a transformer is same irrespective of the side on which it is calculated.	8	L1	CO1
	b.	The one line diagram of a power system is as shown in Fig.Q1(b). The motors have rated output of 30MVA, 20MVA and 50MVA at 30KV with 20% subtransient reactance each. Selecting generator rating as base, develop the per unit reactance diagram.  Fig.Q1(b)	12	L3	CO1
		OR			
Q.2	a.	Define impedance and reactance diagram. Explain with the help of typical electrical power system.	8	L2	CO1
	b.	Develop the per unit reactance diagram of the system shown in Fig.Q2(b).  Choose generator as a base. Fig.Q2(b)	12	L3	CO1

		Module – 2			
Q.3	**a.**	With the oscillogram of the short circuit current of synchronous machine, define direct axis synchronous reactance, transient and subtransient reactance.	**8**	**L2**	**CO2**
	b.	For the radial network shown in Fig.Q3(b) when a 3ϕ fault occurs at point F, solve by Thevenin's method to determine fault current and the line voltage at 11 KV bus. Choose 100 MVA 33 KV as base.	**12**	**L3**	**CO2**

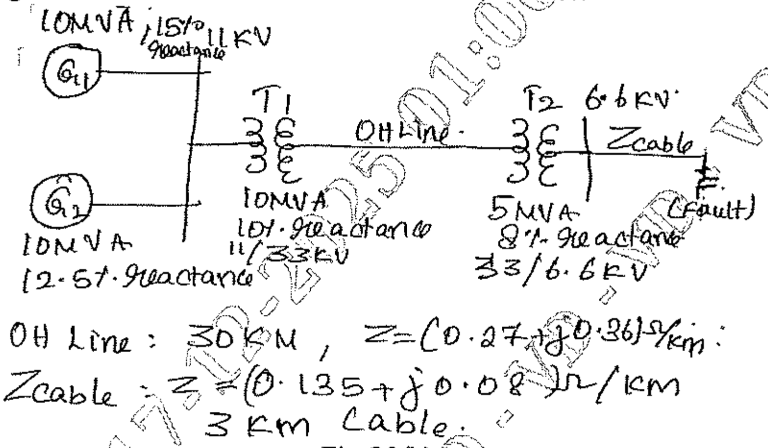


Fig.Q3(b)

		OR			
Q.4	**a.**	Explain doubling effect in transmission line substantiate with equations.	**8**	**L2**	**CO2**
	b.	A generator is connected to a synchronous motor through a transformer, on a common base the per unit sub transient reactance of generator and motor are 0.15 and 0.35 respectively. The leakage reactance of the transformer is 0.1 pu. A 3ϕ short circuit fault occurs at the terminals of the motor when terminal voltage of generator is 0.9 pu and output current of the generator is 1 pu at 0.8 pF leading. Develop the sub transient current in the fault, generator and motor.	**12**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Derive an expression for symmetrical components of voltage in terms of phase voltage.	**6**	**L2**	**CO3**
	b.	Derive an expression for complex power in terms of symmetrical components.	**4**	**L2**	**CO3**
	c.	A balanced delta connected load is connected to 3ϕ symmetrical supply. The line currents are each 10A in magnitude. If fuse in one of the lines blows out, determine the sequence components of line currents.	**10**	**L4**	**CO3**

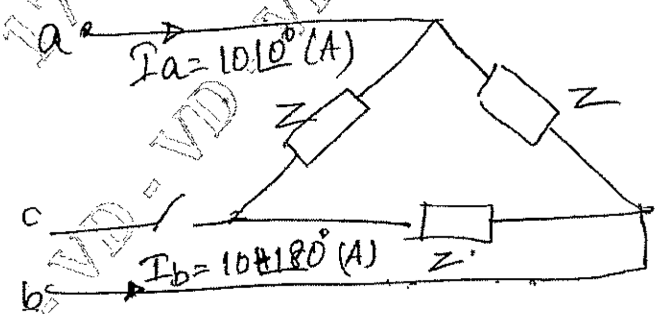
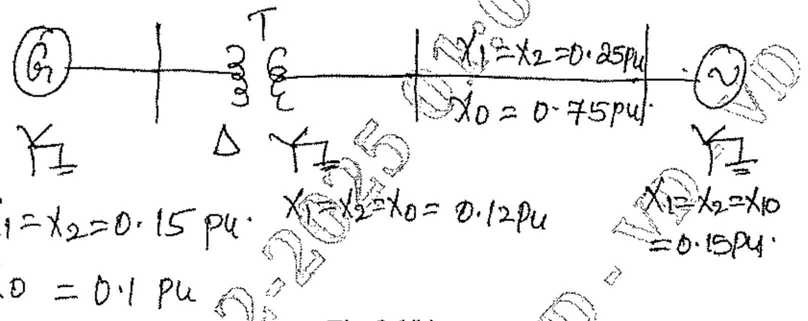
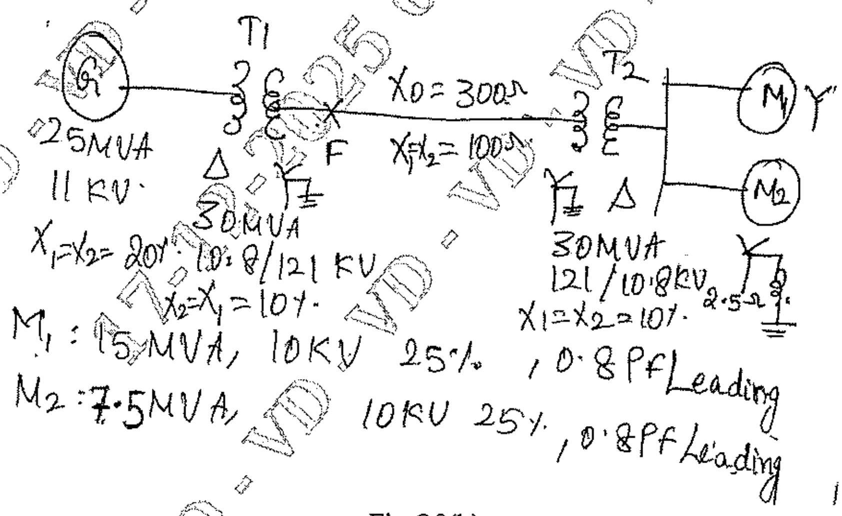


Fig.Q5(c)

		OR			
Q.6	**a.**	Derive the relation between sequence components of phase and line voltages in star connected systems.	**10**	**L2**	**CO3**
	b.	A 250MVA, 11 KV, 3ϕ generator is connected to a large system through a transformer and a line as shown in Fig.Q6(b). All parameters on 250MVA base. Develop the sequence network diagrams for the system and indicate all per unit values.  Fig.Q6(b)	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	For a double line to ground fault on an unloaded generator, derive the equation for fault current and draw the inter connected sequence network.	**8**	**L2**	**CO4**
	b.	A 3ϕ generator with an open circuit voltage of 400 V is subjected to an LG fault through a fault impedance of j2Ω. Determine the fault current if $Z_1 = j4\Omega$, $Z_2 = j2\Omega$, $Z_D = j1\Omega$. Repeat the problem for LL and LL G fault.	**12**	**L3**	**CO4**
		OR			
Q.8	**a.**	Explain the series types of faults in a power system.	**8**	**L2**	**CO4**
	b.	Determine the fault current when a L – G fault occurs at point F in the Fig.Q8(b).  Fig.Q8(b)	**12**	**L3**	**CO4**

		Module – 5			
Q.9	**a.**	Derive swing equation and also draw the swing curve.	**10**	**L2**	**CO5**
	b.	A 50 Hz, 4 pole turbo generator rated 100 MVA, 11 KV has an inertia constant of 8 MJ/MVA. i) Determine the stored energy ii) If mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW, find the rotor acceleration iii) If acceleration calculated in (ii) is maintained for 10 cycles, find the change in torque angle and rotor speed in revolutions per minute at the end of the period.	**6**	**L3**	**CO5**
	c.	Two power stations A and B are located close together. Station A has four identical generators each rated 100 MVA, 9 MJ/MVA where as station B has three sets each rated 200 MVA, 4MJ/MVA. Calculate the inertia constant of the equivalent machines of both stations on 150 MVA base.	**4**	**L3**	**CO5**
		OR			
Q.10	**a.**	Derive power angle equation as applied to a salient pole synchronous machine.	**10**	**L3**	**CO5**
	b.	Explain equal area criterion when a power system is subjected to a sudden change in mechanical input.	**10**	**L2**	**CO5**

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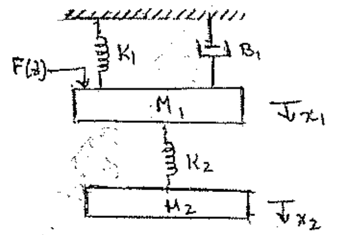
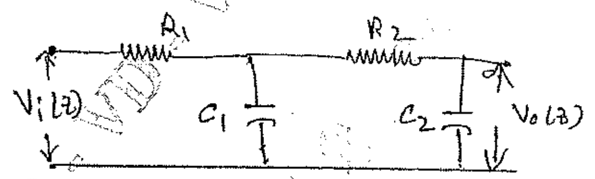
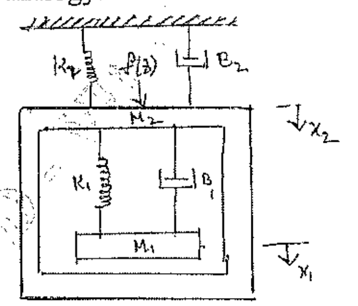
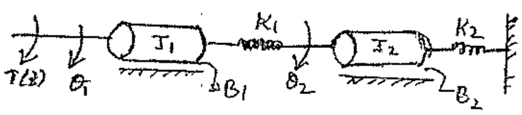
BEE602

Sixth Semester B.E/B.Tech. Degree Examination, Dec.2025/Jan.2026

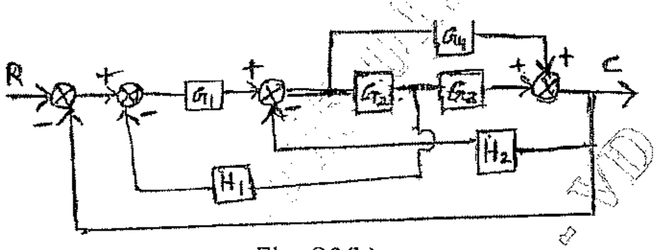
Control System

Time: 3 hrs. Max. Marks:100

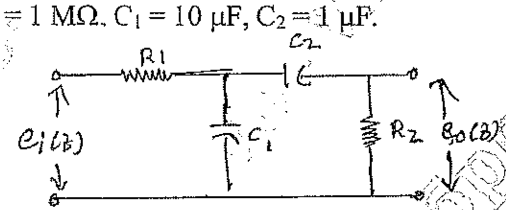
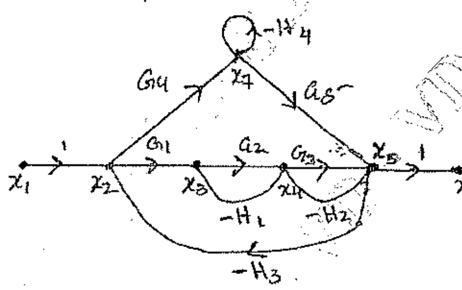
Note: ***1. Answer any FIVE full questions, choosing ONE full question from each module.***
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
1	a.	Define control system. Explain open loop and closed loop control system with the help of neat block diagram.	6	L2	CO1
	b.	For the mechanical system shown in Fig.Q1(b). Write the differential equations governing the behavior of mechanical system and obtain force-current analogous electrical system.  Fig.Q1(b)	8	L2	CO1
	c.	For the electrical network shown in Fig.Q1(c). Obtain transfer function $\frac{V_0(s)}{Vi(s)}$.  Fig.Q1(c)	6	L2	CO1
		OR			
2	a.	Define the transfer function and derive transfer function of an armature controlled DC motor and construct the block diagram of DC motor.	8	L2	CO1
	b.	For the mechanical system shown in Fig.Q2(b). Obtain analogous electrical circuit based on force-voltage analogy.  Fig.Q2(b)	6	L2	CO1
	c.	Draw the analogous electrical circuit for the mechanical system shown in Fig.Q2(c) base on torque–voltage.  Fig.Q2(c)	6	L2	CO1

Module – 2

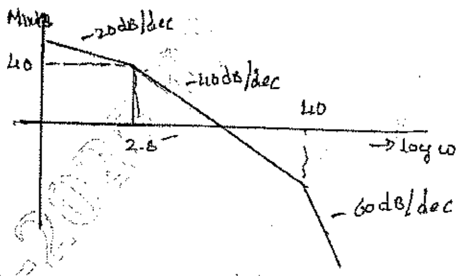
3	a.	Define the following terms : i) Source node ii) Sink node iii) Forward path iv) Forward path gain v) Loop vi) Self loop.	6	L1	CO2
	b.	Obtain the closed loop transfer function : $\frac{C(s)}{R(s)}$ using block diagram reduction technique and also verify the result by signal flow graph method for Fig.Q3(b).  Fig. Q3(b)	14	L3	CO2

OR

4	a.	Draw the block diagram of electrical circuit shown in Fig.Q4(a) and evaluate transfer function $E_0(s)/E_i(s)$ using block diagram reduction techniques. $R_1 = 100\ K\Omega$, $R_2 = 1\ M\Omega$, $C_1 = 10\ \mu F$, $C_2 = 1\ \mu F$.  Fig.Q4(a)	10	L3	CO2
	b.	Apply the mason's gain formula to the signal flow graph shown in Fig.Q4(b) to find the transfer function $\frac{X_6}{X_1}$.  Fig.Q4(b)	10	L3	CO2

Module – 3

5	a.	Define and derive the expression for rise time (f_r), peak time (f_p) for a under-damped second order system excited by a step input.	8	L2	CO3
	b.	The loop transfer function of a feed back control system is given by $G(s)H(s) = \frac{100}{s^2(s+4)(s+12)}$. Determine the steady state error constants and steady state error for the input $r(z) = 2z^2 + 5z + 10$.	6	L3	CO3
	c.	Determine the stability of the system represented by following characteristics equation : $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$.	6	L3	CO3

		OR			
6	a.	Explain the necessary and sufficient condition for a system to be stable according the RH criteria.	4	L1	CO3
	b.	A unity feedback control system is characteristized by the open loop transfer function : $G(s)=\frac{K(s+13)}{s(s+5)(s+7)}$ using RH criterion, calculate the range of K for the system to be stable and frequency of oscillations.	8	L3	CO3
	c.	A unity feedback control system is characterized by an open loop transfer function $G(s)=\frac{k}{s(s+10)}$. Determine K value for damping ratio of 0.5 and for the value of K find t_p, M_p, t_s for 2% tolerance.	8	L3	CO3
		Module – 4			
7	a.	Draw the complete root locus plot for the system $G(s)H(s)=\frac{k}{s(s+2)(s+4)}$. Find the range of K, so that damping ratio of the closed loop system is 0.5.	10	L4	CO4
	b.	A unity feedback control system has $G(s)=\frac{80}{s(s+20)(s+10)}$. Draw the bode plot, determine GM, PM W_{gc} and W_{pc} comment on stability.	10	L4	CO4
		OR			
8	a.	The open loop transfer function of a control system is given by : $G(s)H(s)=\frac{k}{s(s+6)(s^2+4s+13)}$ Determine : i) Break point ii) Angle of departure.	8	L4	CO4
	b.	Define the following terms of second order system. i) Resonant peak M_r ii) Resonant frequency W_r.	4	L2	CO4
	c.	Determine the open loop transfer function of a system where approximate plot is shown in Fig.Q8(c).  Fig.Q8(c)	8	L4	CO4
		Module – 5			
9	a.	What is controller? Explain the effect of P, I, D PI, PD and PID controller on second order system.	10	L	CO
	b.	Obtain the transfer function of the system described by $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u,\ x(0)=\begin{bmatrix}1\\ 1\end{bmatrix}\ y=[1\ 0]\begin{bmatrix}x_1\\ x_2\end{bmatrix}$.	10	L3	CO5
		OR			
10	a.	Explain the effect of lag and lead compensator.	10	L2	CO5
	b.	Obtain state transition matrix for the state model where A value is given by $A=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}$.	10	L3	CO5

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BEE613B

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Embedded System Design

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Describe the elements of an embedded system with a block diagram.	10	L1	CO1
	b.	Explain the different classifications of embedded system. Give an example for each.	10	L1	CO1
		OR			
Q.2	a.	Describe the functions of opto-couples I2C and IrDA for embedded system.	10	L1	CO1
	b.	Explain the role of watchdog timmer in embedded system.	6	L1	CO1
	c.	Differentiate between RISC and CISC.	4	L1	CO1
		Module – 2			
Q.3	a.	With a functional block diagram, explain the working of a washing machine.	8	L1	CO2
	b.	Explain different characteristics of Embedded System.	8	L1	CO2
	c.	Explain the role of Embedded System in Automotive domain.	4	L1	CO2
		OR			
Q.4	a.	Explain operational quality attributes in any embedded system design.	8	L1	CO2
	b.	Explain different communication buses in automotive application.	7	L1	CO2
	c.	Explain product life cycle curve of an Embedded product development.	5	L1	CO2
		Module – 3			
Q.5	a.	Explain the fundamental issues in hardware and software co-design.	8	L1	CO3
	b.	Explain significance of open collector and tri-state output in embedded hardware development.	8	L1	CO3
	c.	Write difference between digital combinational and sequential circuit.	4	L1	CO3
		OR			
Q.6	a.	Explain the role of the Analog electronic components in Embedded hardware design.	8	L1	CO3
	b.	Explain the role of state machine in Embedded System design.	6	L1	CO3
	c.	Write the different types of IC design. Give an example for each.	6	L1	CO3
		Module – 4			
Q.7	a.	Explain the different embedded firmware design approaches in details.	10	L1	CO4
	b.	Explain the high level language based embedded firmware development technique.	10	L1	CO4
		OR			
Q.8	a.	Explain various details held by a map file generated during the process of cross compilier an embedded C-Project.	8	L1	CO4
	b.	Explain In Circuit Emulator (ICE) based debugging in detail.	8	L1	CO4
	c.	What is the difference between a simulator and an emulator?	4	L1	CO4

Module – 5					
Q.9	**a.**	Explain Monolithic and Micro Kernel.	**6**	**L1**	**CO5**
	b.	Explain the basic functions of a real time Kernel.	**10**	**L1**	**CO5**
	c.	What is the difference between hard and soft real time system?	**4**	**L1**	**CO5**
OR					
Q.10	**a.**	Explain the concept of multithreading.	**8**	**L1**	**CO5**
	b.	Explain the various factors to be considered for the selection of a scheduling criteria.	**8**	**L1**	**CO5**
	c.	Compare Threads and Processes.	**4**	**L1**	**CO5**

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BEE701

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

Switchgear and Protection

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	With a help of neat diagram, explain briefly the zones of protection. Write the need for protective schemes.	10	L2	CO1
	b.	Discuss the classification of protective relays and explain them briefly.	10	L2	CO1
		OR			
Q.2	a.	Explain the following armature relays : i) Hinged Armature Type Relay ii) Plonger Type Relay iii) Reed Relay	12	L2	CO1
	b.	Discuss the merits and demerits of Electro mechanical Relay and Numerical Relay.	8	L2	CO1
		Module – 2			
Q.3	a.	Discuss the significance of the Time current characteristics and also define the terms Plug setting Multiplier and Time Multiplier setting with relevant formulas.	10	L2	CO2
	b.	With the help of block diagram , explain definite time over current relay.	10	L2	CO2
		OR			
Q.4	a.	Describe the over current protection for parallel Feeders and Ring Mains.	10	L2	CO2
	b.	Explain with the help of neat sketch the construction of reactance relay. Obtain its torque equation and draw the operating characteristics on R – X diagrams.	10	L2	CO2
		Module – 3			
Q.5	a.	Explain the working of following differential relays : i) Current differential relays ii) Percentage differential relays	10	L2	CO3
	b.	With a neat sketch, explain the operation of restricted earth fault protection for generators.	10	L2	CO3
		OR			
Q.6	a.	Describe the different types of faults encountered in Transformer. Explain the function of Buchholz Relay.	10	L2	CO3
	b.	A 11 KV , 100 MVA alternator is provided with differential protection. The percentage of winding to be protected against phase to ground fault is 85%. The relay is set to operate when there is 20% out of balance current. Determine the value of the resistance.	10	L3	CO3

Module – 4					
Q.7	**a.**	Discuss the Recovery rate theory and Energy balance theory of arc interruption in a.c. circuit breaker.	**10**	**L2**	**CO4**
	b.	Write a note on physical, chemical and dielectric properties of SF_6 gas and explain non – puffer type SF_6 circuit breaker.	**10**	**L2**	**CO4**
OR					
Q.8	**a.**	With neat sketch, explain the working of i) Axial blast air circuit breaker ii) Cross blast circuit breaker	**10**	**L2**	**CO4**
	b.	Write notes on : i) Unit testing ii) Synthetic testing	**10**	**L2**	**CO4**
Module – 5					
Q.9	**a.**	Explain with neat sketch, the construction and working of HRC fuse. Also explain its properties and characteristics.	**8**	**L2**	**CO5**
	b.	What are the causes of over voltages arising on a power system? Why it is necessary to protect the lines and other equipments of the power system against over voltages?	**6**	**L1**	**CO5**
	c.	Explain Expulsion type lighting arrestor.	**6**	**L2**	**CO5**
OR					
Q.10	**a.**	Describe the various methods used for protection of Transmission lines against Direct Lightning Strokes.	**10**	**L2**	**CO5**
	b.	Discuss the Modern Trends in power system protection and explain Gas Insulated Substation (GIS) switchgear.	**10**	**L2**	**CO5**

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CBCS SCHEME

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BEE702

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Industrial Drives and Applications

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Derive the fundamental torque equations of a motor load system.	4	L3	CO2
	b.	Explain the speed torque conventions and multi quadrant operations of a motor, driving a hoist load.	10	L2	CO2
	c.	A drive has following parameters J = 10 kg-m^2 , T = 15 + 0.05 N, N – m and T_ℓ = 5 + 0.06 N-m where N is the speed in rpm. Initially the drive is working in steady state. Torque of the motor in braking is given by T = -10 – 0.04N, N-m, when the drive is braked by electric braking. Estimate the time taken by the drive to stop.	6	L3	CO2
		OR			
Q.2	a.	State the advantages of an electric drive. Mention the factors on which choice of an electric drive depends.	7	L1	CO1
	b.	Explain the operation of phase – locked loop speed control scheme. State its applications.	6	L2	CO1
	c.	Derive the expression for the equivalent load torque and equivalent moment of Inertia for loads with translational and rotational motion.	7	L3	CO2
		Module – 2			
Q.3	a.	Explain the operation of single phase half controlled rectifier control of separately excited dc motor for continuous conduction.	8	L2	CO3
	b.	Explain the rectifier control of dc series motor and draw its speed – torque characteristics.	8	L2	CO3
	c.	A 200V, 875 rpm , 150A separately excited dc motor has an armature resistance of 0.06Ω. It is fed from a single phase fully controlled rectifier with an ac voltage of 220V, 50Hz. Assuming continuous conduction , Evaluate : i) Firing angle for rated motor torque and 750 rpm. ii) Motor speed for α = 160° and rated torque.	4	L3	CO3
		OR			
Q.4	a.	Explain the dynamic braking of separately excited motor by chopper control.	6	L2	CO3

	b.	A 220V, 600 rpm, 50 A separately excited motor with armature resistance of 0.02Ω is fed from a 3 phase fully controlled rectifier. A three – wire three - phase ac source with a line voltage of 440 V, 50 Hz is available. A star delta connected transformer is used to feed the armature so that motor terminal voltage equals rated voltage when converter firing angle is zero. i) Calculate transformer turns ratio. ii) Determine the value of firing angle for rated torque and 400 rpm.	6	L3	CO3
	c.	Explain the dual converter scheme for multi quadrant operation of dc separately excited motor fed from fully controlled rectifier.	8	L2	CO3
		Module – 3			
Q.5	a.	Explain the operation of induction motor with unbalanced rotor impedances.	6	L2	CO3
	b.	Explain the ac dynamic braking of induction motor for two – lead connection.	6	L2	CO3
	c.	A star – connected, 3 phase, 50 Hz, 6 pole, slip ring induction motor has following data : Rating : 400 V, 50 kW, 960 rpm and $R_1 = 0.08\Omega$, $R_2 = 0.1\Omega$, $X_1 = X_2 = 0.3\ \Omega$, $J = 10$ kg-m^2. Motor is to be stopped from its no – load speed under reverse voltage braking operation. i) Find the value of external resistance to be inserted in rotor circuit so that the braking process will take minimum time. ii) Find energy loss in the motor.	8	L3	CO3
		OR			
Q.6	a.	For variable frequency control of induction motor, explain the following points : i) For speeds below base speed (V/f) ratio is maintained constant. ii) For speeds above base speed, the terminal voltage is maintained constant.	7	L2	CO3
	b.	A Y – connected squirrel – Cage induction motor has following ratings and parameters : 400 V, 50 Hz, 4 pole, 1370 rpm, $R_s = 2\ \Omega$, $R_r^1 = 3\ \Omega$, $X_s = X_r^1 = 3.5\ \Omega$, $X_m = 55\ \Omega$. It is controlled by current source inverter at a constant flux. Calculate motor torque, speed and stator current when operating at 30 Hz and rated slip speed.	6	L3	CO3
	c.	Explain the operation of VSI induction motor drive with regenerative braking which employs synchronous link converter feeding PWM inverter.	7	L2	CO3
		Module – 4			
Q.7	a.	Derive the torque expression for cylindrical rotor wound field motor thereby illustrate the operation of synchronous motor shifting from rotring to regenerative braking.	8	L3	CO3
	b.	A 3 phase, 5 kW, 440 V, 50 Hz, 4 pole star connected synchronous motor has stator winding resistance of 0.2 Ω, synchronous reactance of 8 Ω and a rated field current of 1A. Motor is operated under regenerative braking with its terminals connected to a bus having rated motor voltage. Field current is adjusted so that the motor operates at rated current and unity power factor. Calculate braking torque, torque angle and field current.	6	L3	CO3

	c.	Distinguish between modes of variable frequency control is synchronous motor.	6	L2	CO3
		OR			
Q.8	a.	Load commutated inverter fed synchronous motor drive is found suitable for high speed and high power application. Substantiate the statement with the help of block diagram.	6	L2	CO3
	b.	Application of stepper motor is widespread, list out the features.	7	L2	CO5
	c.	State and explain the mode of operation of switched reluctance motor drive employed at high speed.	7	L2	CO5
		Module – 5			
Q.9	a.	Discuss the factors on which energy efficiency operation of the drives depend on.	7	L2	CO4
	b.	Explain with characteristics Solar power pump drives.	7	L2	CO4
	c.	State the problems created by the Harmonics produced by non linear loads.	6	L2	CO4
		OR			
Q.10	a.	Draw and explain the schematic diagram of various stages in the reversing hot rolling mill and mention the requirement of the drives.	7	L2	CO5
	b.	Explain in detail , the types of drives used in machine tools.	7	L2	CO5
	c.	Describe the details of drive requirements used in cranes and hoists.	6	L2	CO5

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CBCS SCHEME

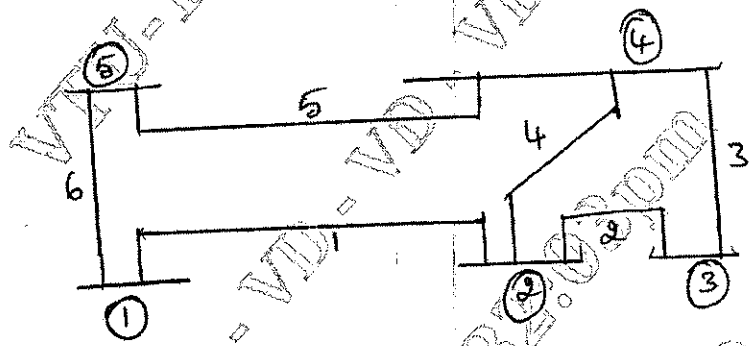
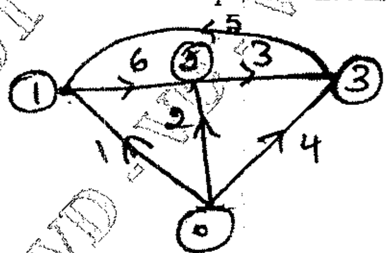
USN | | | | | | | | | | | **BEE703**

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

Power System Analysis – II

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain with an example : i) Oriented graph ii) Basic cutsets iii) Basic loops.	6	L2	CO1
	b.	For the network shown in Fig.Q.1(b) below, draw the graph and mark a tree. How many trees will this graph have? Mark the basic cut sets and basic loops.  Fig Q1(b)	8	L3	CO1
	c.	Explain with an example, primitive networks in i) Impedance form ii) Admittance form.	6	L2	CO1
		OR			
Q.2	a.	For the networks shown in Fig Q2(a) form the bus incidence matrix A, branch path incidence matrix K and loop incidence metric C  Fig Q2(a)	6	L2	CO1
	b.	Derive an expression for bus admittance matrix (Y_{Bus}) using singular transformation method.	8	L2	CO1

	c.	For the system shown in Fig.Q.2(c), obtain Y_{Bus} by inspection method. Take Bus ① as reference. The impedance marked are in P.U.	6	L3	CO1

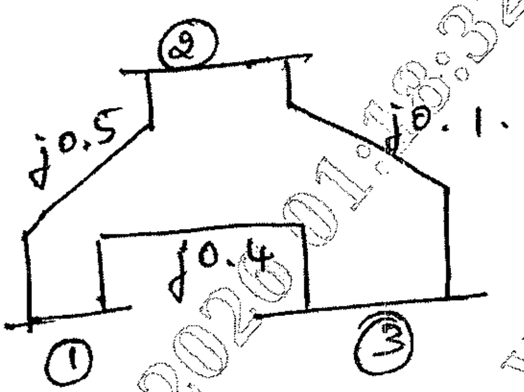


Fig.Q.2(c)

Module – 2

Q.3	a.	Explain the importance of load flow studies in power system analysis.	6	L2	CO2
	b.	Derive the Static Load Flow Equations (SLFE) (in polar form).	8	L2	CO2
	c.	Explain with suitable algorithmatic steps involved in, Gauss-Seidal iterative Method for load flow solution (GSLF method).	6	L2	CO2

OR

Q.4	a.	What are the constraints to be considered for a load flow solution?	5	L2	CO2
	b.	Classify the Buses in power system for conduction of load flow solution.	5	L2	CO2
	c.	For the power system shown in Fig Q4(c), all buses except slack bus are PQ buses. Calculate the voltages at the end of 1st iteration using Gauss Seidal Load Flow (GSLF) method.	10	L3	CO2

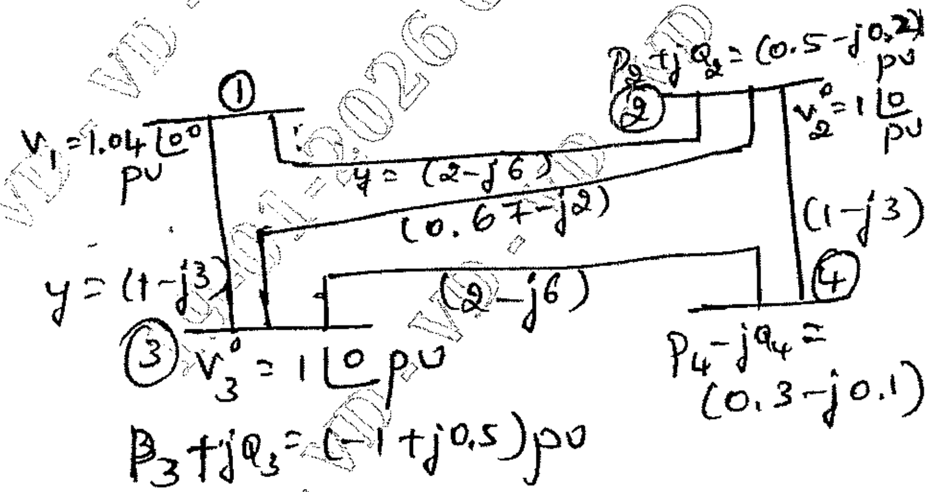
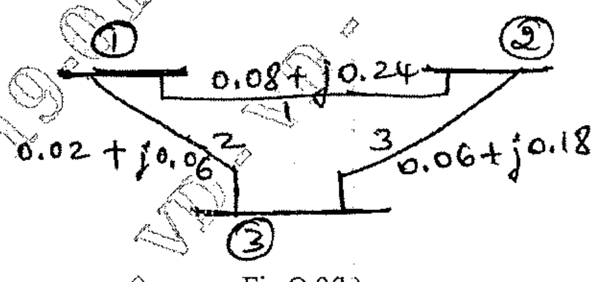


Fig.Q.4(c)

Module – 3

Q.5	a.	Explain with a flowchart Newton Raphson Load Flow (NRLF) method to solve load flow problem (in polar form)	10	L2	CO3

	b.	A sample 3 Bus systems has slack Bus, PQ Bus, PV Bus (one each), write the structural form power system Jacobian matrix (J) with necessary equations to calculate its elements.	10	L3	CO3
		OR			
Q.6	a.	Explain in brief the important assumptions made in arriving at Fast Decoupled Load Flow Method (FDLF) from NRLF method.	10	L2	CO3
	b.	Explain with a flowchart FDLF method (in polar form).	10	L2	CO3
		Module – 4			
Q.7	a.	Write a brief note on the performance curves of a thermal power station for economic load dispatch studies.	6	L2	CO4
	b.	Derive the expression for economic dispatch with transmission losses neglected.	6	L2	CO4
	c.	A power plant consisting of two units $IC_1 = 40 + 0.2P_1$ and $IC_2 = 30 + 0.25P_2$. Find the total yearly saving in fuel cost in rupees, for optimal scheduling of a load of 130 mW as compared to equal distribution of same load between them.	8	L2	CO4
		OR			
Q.8	a.	Derive an expression for condition for economic load dispatch including transmission loss (B-coefficient)	8	L2	CO4
	b.	What is Unit Commitment? What are the constraints to be considered in unit commitment? Explain in brief.	4	L2	CO4
	c.	Explain the algorithm steps in dynamic programming approach to solve unit commitment problem.	8	L2	CO4
		Module – 5			
Q.9	a.	Explain with necessary equations the Z_{Bus} formulation under the following modification – Type 1, Type 2, Type 3, Type 4 (without mutual couplings).	10	L2	CO5
	b.	Consider the system in Fig.Q.9(b) obtain Z_{Bus} by using Building algorithm.  Fig.Q.9(b)	10	L3	CO5
		OR			
Q.10	a.	Derive the swing equation for conducting power system stability studies.	10	L2	CO5
	b.	Write an explanatory note on methods employed for numerical solution of swing equation i) Point by point method ii) R. K method	10	L2	CO5

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CBCS SCHEME

USN | | | | | | | | | | |

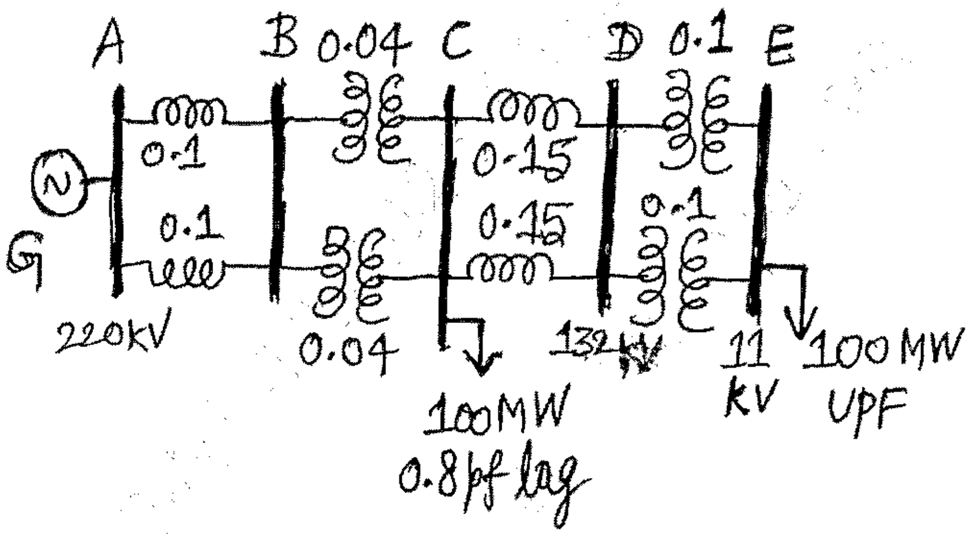
BEE714A

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Power System Operation and Control

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	List out the operating states of a power system and explain them with a neat block diagram.	08	L2	CO1
	b.	Define preventive and emergency controls used in power system operation and list out them in detail.	08	L2	CO1
	c.	Define Energy Management centre and list out its functions.	04	L2	CO1
		OR			
Q.2	a.	List out the major components of SCADA and explain them in detail.	10	L2	CO1
	b.	Classify the SCADA systems according to complexity and number of RTUs and master stating present in the system and explain them in detail.	10	L2	CO1
		Module – 2			
Q.3		Derive the complete mathematical model of load frequency control of an isolated power system by modeling the following components of it. i) Speed Governing System ii) Turbine Model iii) Generator –load Model.	20	L3	CO2
		OR			
Q.4	a.	Explain the operation of load frequency and excitation voltage regulators equipped in turbo-generators with a neat schematic diagram.	08	L2	CO2
	b.	State the need for proportional plus integral control in an isolated power system and derive the transfer function of it with PI Controller using its block diagram.	12	L3	CO2
		Module – 3			
Q.5		Derive the state variable model of Load Frequency Control of a two area power system in terms of state variables, control variables and disturbance variables by properly defining them.	20	L3	CO3
		OR			
Q.6	a.	Develop a mathematical model for a tie-line interconnecting two isolated control areas with usual notations.	10	L3	CO3
	b.	Explain the operation of AVR equipped in a turbo-alternator with a neat schematic diagram. Also derive its transfer function model with usual notations.	10	L3	CO3

		Module – 4			
Q.7	a.	Explain in detail about the generation and absorption of reactive power by various power system components.	08	L2	CO4
	b.	Consider a transmission system shown in Fig. 7 (b) below. The pu reactance values are referred to the respective voltage bases and 100 MVA base power. Determine the power supplied by the generator and its power factor.  Fig. Q. 7(b)	12	L3	CO4
		OR			
Q.8	a.	Explain various methods of voltage, control in power system network by reactive power injection at a node in it.	12	L2	CO4
	b.	Derive a relation between voltage, power and reactive power at a node in a power system network. Also explain the significances of ratio $\frac{\partial Q}{\partial V}$.	08	L3	CO4
		Module – 5			
Q.9	a.	Define power system security and explain in detail about its major three functions which are carried out in an energy control center.	10	L2	CO5
	b.	Explain the simplest form of contingency analysis technique with the help of a neat flow chart.	06	L2	CO5
	c.	List out and explain briefly the factors affecting the power system security.	04	L2	CO5
		OR			
Q.10	a.	List out and explain the linear sensitivity factors. Explain the contingency analysis procedure using sensitivity factors with a neat flow chart.	12	L2	CO5
	b.	Explain 1P1Q method for contingency selection procedure with a neat flow chart.	08	L2	CO5

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