CBCS SCHEME

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BMATE/BEE301

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Engineering Mathematics for EEE

Time: 3 hrs. Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Use of statistical tables and mathematics formula handbook is permitted.*
3. *M : Marks , L: Bloom's level , C: Course outcomes.*

		Module – 1	M	L	C
Q.1	a.	Solve: $(D^4 - 2D^3 + 5D^2 - 8D + 4)y = 0$	06	L2	CO1
	b.	Solve: $(D^2 - 10D + 25)y = 2e^{5x} + \cos x + 5$	07	L3	CO1
	c.	Solve: $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 2\log x$.	07	L3	CO1
		OR			
Q.2	a.	Solve $(D^3 - 4D^2 + 5D - 2)y = 0$.	06	L2	CO1
	b.	Solve $(1+x)^2y'' + (1+x)y' + y = 2\sin\log(1+x)$	07	L3	CO1
	c.	In L-C-R circuit, the charge q on a plate of a consider is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = E\sin pt$. The circuit is tuned to resonance so that $p^2 = \frac{1}{LC}$, if initially the current I and the charge q be zero, show that, for small values of R/L, the current in the circuit at time t is given by $\left(\frac{Et}{2L}\right)\sin pt$.	07	L3	CO1
		Module – 2			
Q.3	a.	Fit a straight line $y = ax + b$ in the Least Square Method to the following data:	06	L2	CO2

x	50	70	100	120
y	12	15	21	25

	b.	Find the correlation coefficient and hence find the regression lines for the data:								07	L3	CO2

x	1	2	3	4	5	6	7	8	9	10
y	10	12	16	28	25	36	41	49	40	50

	c.	Given the equation of the regression lines $x = 19.13 - 0.87y$ and $y = 11.64 - 0.5x$. Compute the mean of x's, mean of y's and the coefficient of correlation.	07	L3	CO2
		OR			
Q.4	a.	Fit a parabola $y = ax^2 + bx + c$ by the method of least squares for the data:	06	L2	CO2

x	2	4	6	8	10
y	3.07	12.85	31.47	57.38	91.29

	b.	Obtain the lines of Regression and hence find the coefficient of correlation for the data:	07	L3	CO2

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

	c.	The coefficient of rank correlation obtained by ten students in statistics and accountancy was 0.2. It was later discovered that the difference in ranks in the two subjects of one of the students was wrongly taken as 9 instead of 7. Find the correct rank correlation coefficient.	07	L2	CO2

Module – 3

Q.5	a.	Find the Fourier series for the function $f(x) = \|x\|$ in $(-\pi, \pi)$ and hence deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$.	06	L3	CO3
	b.	Obtain a Half Range Sine Series for the function $f(x) = \begin{cases} \frac{1}{4} - x & \text{for } 0 \le x \le \frac{1}{2} \\ x - \frac{3}{4} & \text{for } \frac{1}{2} \le x \le 1 \end{cases}$	07	L2	CO3
	c.	The following table gives the variations of a periodic current A over a period T. Show that there is a constant part of 0.75 Amp in the current A and obtain the amplitude of the first harmonic.	07	L3	CO3

t (Secs)	0	T/6	T/3	T/2	2T/3	5T/6	T
A (Amp)	1.98	1.30	1.05	1.30	–0.88	–0.25	1.98

OR

Q.6	a.	Expand the function $f(x) = x(2\pi - x)$ in the Fourier series over the internal $(0, 2\pi)$.	06	L3	CO3
	b.	Find the half range cosine series for the function $f(x) = \begin{cases} x, & 0 < x \le \pi/2 \\ \pi - x & \pi/2 \le x < \pi \end{cases}$	07	L2	CO3
	c.	Express y as a Fourier series upto first harmonic for the following data:	07	L3	CO3

x	0	1	2	3	4	5
y	9	18	24	28	26	20

Module – 4

Q.7	a.	Find the Fourier transform of the function $f(x) = \begin{cases} 1 & \text{for } \|x\| \le a \\ 0 & \text{for } \|x\| > a \end{cases}$ and hence evaluate $\int_0^{\infty} \frac{\sin x}{x} dx$	06	L3	CO4
	b.	Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a > 0$	07	L2	CO4
	c.	Find the Z – transform of $\cos\left(\frac{n\pi}{2} + \frac{\pi}{4}\right)$.	07	L2	CO4

OR

Q.8	a.	Find the Fourier transform of $f(x) = e^{-\|x\|}$.	06	L2	CO4
	b.	Find the inverse Z-transform of $\frac{z^2}{(z-1)(z+3)}$	07	L2	CO4
	c.	Solve the difference equation $y_{n+2} - 4y_n = 0$, given that $y_0 = 0$ and $y_1 = 2$.	07	L3	CO4

Module – 5

Q.9	**a.**	The probability density function of a variable x is given by the following table: x: 0 1 2 3 4 5 6 p(x): K 3K 5K 7K 9K 11K 13K for what value of K this represents a valid probability distribution? Also find $P(x \geq 5)$ and $P(3 < x \leq 6)$.	**06**	**L2**	**CO5**
	b.	If the mean and standard deviation of the number of correctly answered questions in a test given to 4096 students are 2.5 and $\sqrt{1.875}$. Find an estimate number of candidates answering correctly: (i) 8 or more questions (ii) 2 or less (iii) 5 questions	**07**	**L3**	**CO5**
	c.	In a normal distribution 31% of the items are under 45 and 8% of the items are over 64. Find the mean and standard deviation of the distribution.	**07**	**L3**	**CO5**
		OR			
Q.10	**a.**	Explain the terms: (i) Type I and Type II error (ii) Alternative hypothesis (iii) Significance level	**06**	**L1**	**CO5**
	b.	A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure 5, 2, 8, –1, 3, 0, 6, –2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure. $[t_{0.05}(11) = 2.201]$	**07**	**L3**	**CO5**
	c.	4 coins are tossed 100 times and the following results were obtained. Fit a binomial distribution for the data and test the goodness of fit. $[\chi^2_{0.05} = 9.49]$	**07**	**L3**	**CO5**

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CBCS SCHEME

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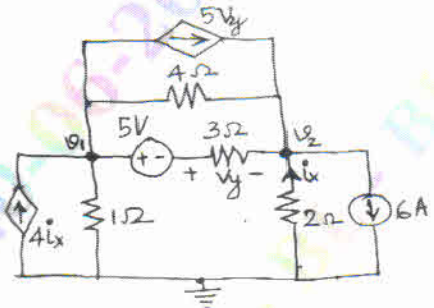
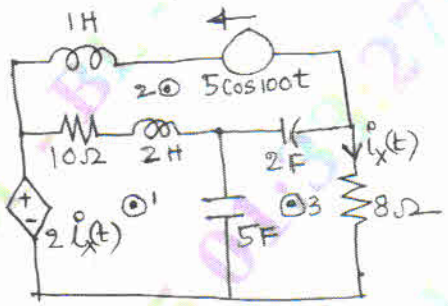
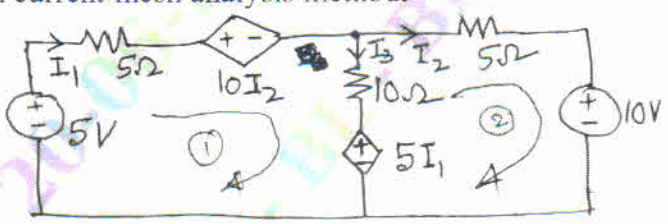
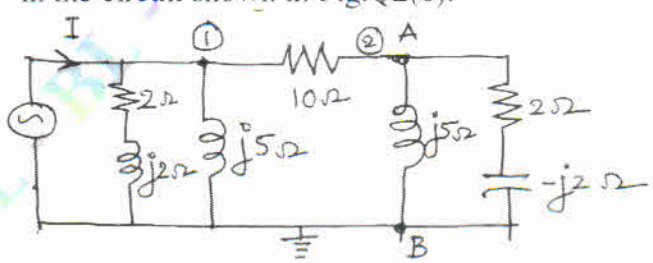
BEE302

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
Electric Circuit Analysis

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.	Write a system of nodal equations for the circuit shown in Fig.Q1(a) using the nodal voltages V_1 and V_2 as the variables. What power is furnished by the dependent sources?	10	L3	CO1
		 Fig.Q1(a)			
	b.	Draw the exact dual of the circuit shown in Fig.Q1(b). Use dot method and hence construct nodal and mesh equations.	10	L3	CO1
		 Fig.Q1(b)			
		OR			
Q.2	a.	Describe the branch currents in the network indicated in the Fig.Q2(a) using branch current mesh analysis method.	10	L3	CO1
		 Fig.Q2(a)			
	b.	Use nodal analysis method to find the current 'I' which results in a voltage V_{AB} of $5\angle 30°$ in the circuit shown in Fig.Q2(b).	10	L3	CO1
		 Fig.Q2(b)			

Module – 2

Q.3	a.	Apply superposition theorem to the networks shown in Fig.Q3(a) to find 'i' through 100V source.	10	L2	CO2

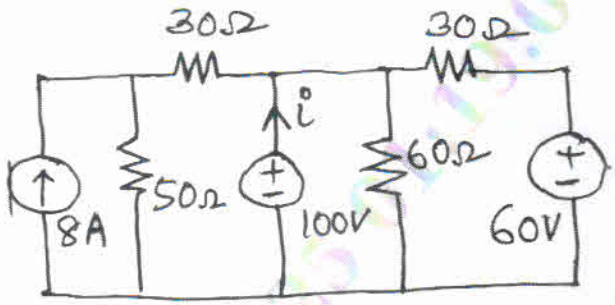


Fig.Q3(a)

	b.	Determine the maximum amount of power that could be dissipated in R_L in the network shown in Fig.Q3(b). Also find the R_L.	10	L2	CO2

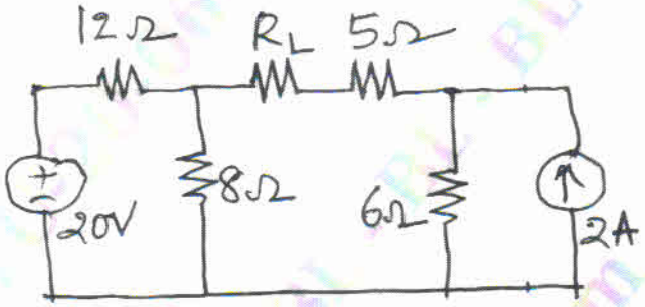


Fig.Q3(b)

OR

Q.4	a.	Use Thevenin's theorem to find the power delivered to the 3Ω resistor in the network of Fig.Q4(a).	10	L3	CO2

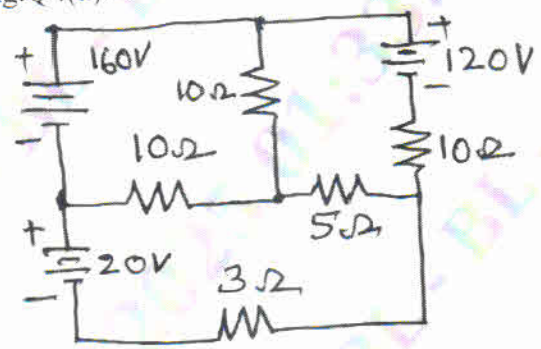


Fig.Q4(a)

	b.	Find the current flowing through the detector having a resistance of 30 Ω as shown in Fig.Q4(b) using Norton's Theorem.	10	L2	CO2

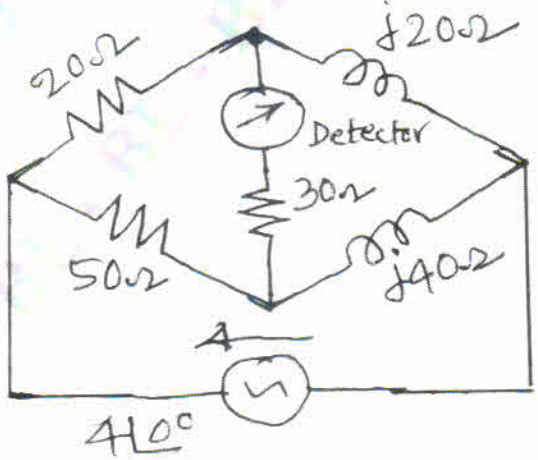
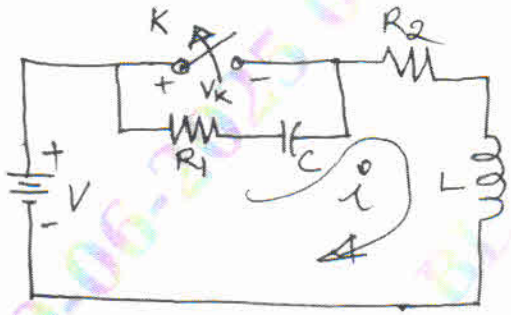
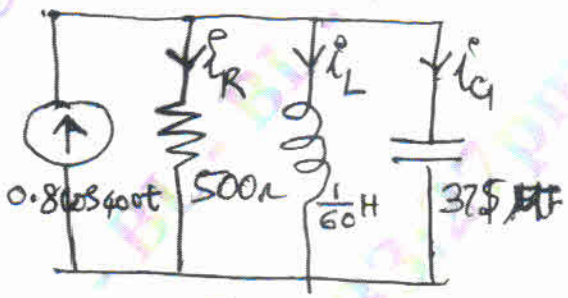
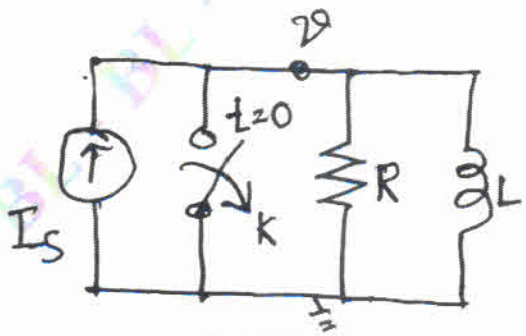
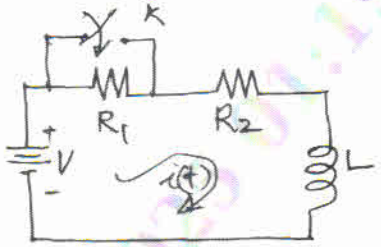
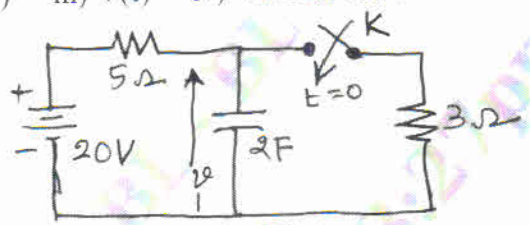
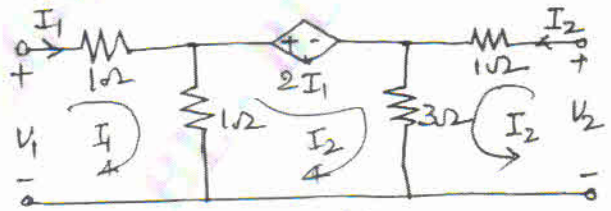


Fig.Q4(b)

Module – 3

Q.5	**a.**	In the network shown in Fig.Q5(a). The switch ' K' is opened at t = 0 after the network has attained a steady state with switch closed. i) Find an expression for the voltage across the switch at $t = 0^+$ ii) If the parameters are adjusted such that $i(0^+) = 1$ and $\frac{di}{dt}(0^+) = -1$, what is the value of the derivative of voltage across the switch $\frac{dv_k}{dt}(0^+)$?  Fig.Q5(a)	**10**	**L3**	**CO3**
	b.	Derive an expression for the quality factor (Q_0) of a parallel RLC resonant circuit.  Fig.Q5(b)	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	A 400V, 200Hz AC source is connected in series with a capacitor and a coil whose resistance and inductance are 20 mΩ and 6 mH, respectively. If the circuit is in resonance at 200 Hz, find : i) Capacitor value ii) The circuit current iii) Voltage across the capacitor iv) The maximum instantaneous energy stored in the coil v) The half–power frequencies for the circuit.	**10**	**L3**	**CO3**
	b.	The network shown in Fig.Q6(b) has the switch 'K' opened at t = 0. Solve for : i) V ii) $\frac{dv}{dt}$ iii) $\frac{d^2V}{dt^2}$ at $t = 0^+$, if I_s = 1A, R = 100 Ω, α = 1H.  Fig.Q6(b)	**10**	**L4**	**CO3**

		Module – 4			
Q.7	**a.**	In the circuit shown in Fig.Q7(a) the battery has remained switched on for a long time. Suddenly the switch 'K' is closed. Using Laplace transformation method, find : i) i(t) ii) If $R_1 = 4\ \Omega$, $R_2 = 8\ \Omega$, d = 4 H and V = 24 V, find the current 1.5 seconds after closing the switch.  Fig.Q7(a)	**10**	**L3**	**CO4**
	b.	Using the initial and final value theorems where they apply, find $f(0^+)$ and $f(\infty)$ for the following : i) $F(s) = \frac{(s+1)(s+2)}{(s+3)(s+4)}$ ii) $F(s) = \frac{s}{(s+1)(s-2)}$ iii) $F(s) = \frac{(s+3)(s+7)}{(s+2)(s+5)}$	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	The circuit shown in Fig.Q8(a) has been in this condition for a long time. At t = 0 the switch is closed. Find using L.T technique i) $V(0^-)$ ii) $V(0^+)$ iii) V(t) iv) What is the time constant of the circuit?  Fig.Q8(a)	**10**	**L3**	**CO4**
	b.	State and prove : i) Initial value theorem ii) Final value theorem as referred to the Laplace transformation operations.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Three impedances $10\angle 0°$, $15\angle 30°$ and $10\angle -30°$ ohm are concreted in star across a balanced 208V system. Take $V_{an} = \left(\frac{208}{\sqrt{3}}\right)\angle 90^0$ V as reference voltage. Find the line currents and neutral shift voltage. Construct voltage triangle.	**12**	**L3**	**CO5**
	b.	Find the Z-parameters of the networks shown in Fig.Q9(b). Find where the networks is i) reciprocal ii) symmetrical.  Fig.Q9(b)	**8**	**L3**	**CO5**
		OR			
Q.10	**a.**	Explain ABCD parameters. Derive the conditions of reciprocity and symmetry of transmission parameters.	**10**	**L2**	**CO5**
	b.	A 3-ϕ, 440V symmetrical system supplies a start connected load. $Z_a = 10\angle 30°$, $Z_b = 12\angle 45°$ and $Z_c = 15\angle 45°$ ohm. The phase sequence is abc. Find the neutral shift voltage.	**10**	**L3**	**CO5**

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CBCS SCHEME

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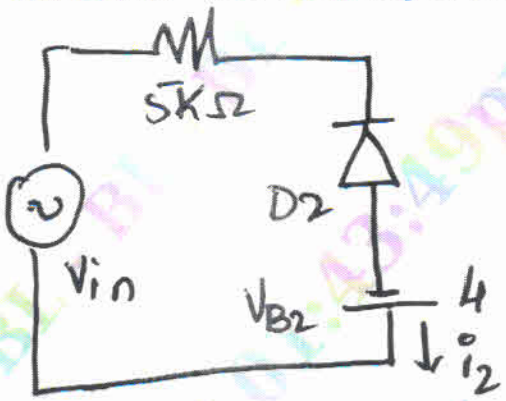
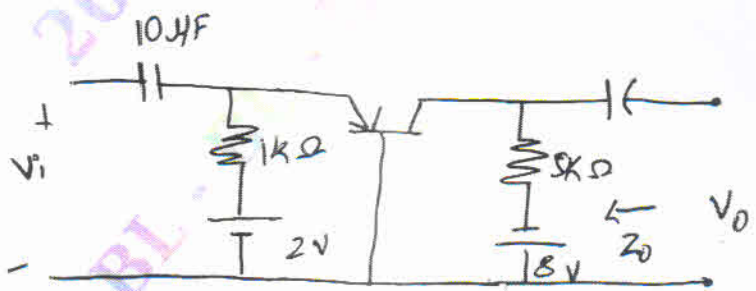
BEE303

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
Analog Electronic Circuits

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.	How can a diode circuit be implemented to represented parallel independent clipper, illustrate with circuit equations and waveforms.	10	L2	CO1
	b.	The emitter bias circuit has the following specifications : $I_{cQ} = \frac{1}{2} I_{sat}$, $I_{sat} = 8$ mA, $V_C = 18$V, $V_{CC} = 18$V, $\beta = 110$. Determine R_C, R_E and R_B.	10	L3	CO1
		OR			
Q.2	a.	Find the output voltage V out of the clipper circuit shown assuming. i) Diode are ideal ii) $V_{on} = 0.7$V. For both cases, $R_f = 0$. Sketch the output waveforms.  Fig.Q2(a)	10	L3	CO1
	b.	Explain the voltage divider bias circuit and derive I_c and V_{CE} and terminal voltages.	10	L2	CO2
		Module – 2			
Q.3	a.	With the help of small signal low frequency transistor model, draw generalized model of the amplifier.	10	L2	CO3
	b.	For the networks shown in below, find – I_E, r_e, Z_i, Z_0, A_V , A_i.  Fig.Q3(b)	10	L3	CO3
		OR			
Q.4	a.	Explain miller effect capacitance. Derive C_{mi}.	10	L2	CO3
	b.	Enumerate on general frequency consideration for a Transistors.	10	L2	CO3

		Module – 3			
Q.5	**a.**	Derive Z_{in} and Z_0 of darlington amplifier also derive A_i and A_V.	**10**	**L4**	**CO3**
	b.	Explain cascade amplifier and explain the overall gain equation.	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	For a transformer coupled amplifier with $V_{CC} = 12V$, $C_{in} \rightarrow \infty$, $\beta = 100$, $V_{BE} = 0.7V$, $A_i = 0$. Find power supplied to load and power required from supply.	**10**	**L3**	**CO3**
	b.	Write important characteristics of : i) Darlington emitter follower ii) Feedback amplifier.	**10**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Explain push-pull circuit with a circuit and derive A_v.	**10**	**L2**	**CO3**
	b.	Draw DC equivalent circuit for class C amplifier and explain.	**10**	**L2**	**CO3**
		OR			
Q.8	**a.**	With a neat circuit diagram explain RC phase shift oscillator and derive equation for frequency.	**10**	**L2**	**CO3**
	b.	The turned collector oscillator circuit used in the local oscillator of radio makes use of LC turned circuit with $L1 = 58.6\mu H$, $C_1 = 300$ pf calculate oscillation frequencies.	**5**	**L3**	**CO3**
	c.	What are the advantages and disadvantages of using crystal oscillator?	**5**	**L2**	**CO3**
		Module – 5			
Q.9	**a.**	Explain the operation of JFET.	**10**	**L2**	**CO3**
	b.	Derive g_m for n-channel JFET and draw its characteristic curve.	**6**	**L4**	**CO3**
	c.	What are the advantages of FET over BJT?	**4**	**L2**	**CO3**
		OR			
Q.10	**a.**	With a neat circuit diagram for FET – voltage divider bias – derive I_D and $V_{GS(min)}$, $V_{GS(max)}$.	**10**	**L3**	**CO3**
	b.	Derive i_d, μ, g_m for FET amplifier.	**10**	**L3**	**CO3**

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BEE304

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
Transformers and Generators

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 an exact equivalent circuit diagrams of a single phase transformer referred to primary side. Indicate all the parameters in each development stage.	10	L2	CO1
	b.	Find the all day efficiency of single phase transformer having maximum efficiency of 98% at 15 KVA at UPF and loaded as follows : 12 hours – 2 KW at 0.5 p.f lagging 6 hours – 12 KW at 0.8 p.f lagging 6 hours – No load.	10	L3	CO1
		OR			
Q.2	a.	Explain the open circuit and short circuit test of a single phase transformer with neat circuit diagram. Show the calculation of efficiency at any load.	10	L2	CO1
	b.	Draw the load phasor diagram of a single phase transformer supplying load with lagging, leading and unity power factor.	10	L4	CO1
		Module – 2			
Q.3	a.	Explain with the help of connection and phasor diagram how SCOTT connections are used to obtain two phase from three phase supply.	10	L2	CO2
	b.	A 400 KVA load at 0.7 pf lagging is supplied by three phase transformers connected in Δ–Δ. Each of Δ–Δ transformer is rated at 200 KVA, 2300V/230V. If one defective transformer is removed from service, calculate for V–V connection. i) The KVA load carried by each transformer ii) Percent rated load carried by each transformer iii) Total KVA ratings of two transformer bank in V–V iv) Ratio of V–V bank to Δ–Δ bank transformer ratings.	10	L3	CO2
		OR			
Q.4	a.	Analyze the parallel operation if a transformer with unequal voltage ratio. And obtain the expression fro current shared by two transformers.	10	L4	CO2
	b.	Analyze the current distribution in step up and step down auto transformer with the help of neat diagram. And derive the expression for saving of copper in an auto transformer.	10	L4	CO
		Module – 3			
Q.5	a.	Derive an EMF equation of an alternator. Also give the expression for pitch factor and distribution factor.	10	L3	CO3
	b.	A 3 phase star connected alternator is rated at 1600 KVA, 13500 volts. The armature resistance and synchronous reactance are 1.5 Ω and 30 Ω respectively/phase calculate the percentage regulation for a load of 1280 KW at a pf 0.8 lag, UPF 0.8 load.	10	L3	CO3

OR

Q.6	**a.**	Derive the expression for EMF induced (E_{ph}) interns of terminal voltage, load current armature resistance, synchronous reactance along with phasor diagram for lagging, leading and unity power factor load.	**10**	**L4**	**CO3**
	b.	The open and short circuit test reading for a 3-ϕ star commented 1000 KVA, 2000 V, 50 Hz synchronous generator are :	**10**	**L4**	**CO3**

Field amps	10	20	25	30	40	50
OC terminal voltage	800	1500	1760	2000	2350	2600
SC armature current in amps	–	200	250	300	–	–

The armature effective resistance is 0.2 Ω/phase. Draw the characteristics curves and estimate the full load percentage regulation for 0.8 p.f leading.

Module – 4

Q.7	**a.**	Explain the lamp dark and lamp bright method of synchronization of alternators. Also mention the necessary conditions.	**10**	**L2**	**CO4**
	b.	Discuss the concept of two reaction theory in a salient pole synchronous machine with the help of phasor diagram.	**10**	**L2**	**CO4**

OR

Q.8	**a.**	Analyze the electrical load diagram of a synchronous generator connected to infinite bus bar and draw the electrical load diagram.	**10**	**L4**	**CO4**
	b.	A 400 V, 50 Hz delta connected alternator has a direct axis reactance of 0.1Ω and a quadrate axis reactance of 0.07Ω/phase. The armature resistance is negligible the alternate is supplying 1000 A at 0.8 pf lagging. i) Find the excitation emf neglecting saliency and assuming $X_S = X_d$ ii) Find the excitation emf, by taking saliency into account.	**10**	**L4**	**CO4**

Module – 5

Q.9	**a.**	Sketch basic components block diagram of a wind electric system. Discuss all the components in wind electric system.	**10**	**L3**	**CO5**
	b.	Sketch basic elements of a photo voltaic cell and explain the working of PV cell.	**10**	**L3**	**CO5**

OR

Q.10	**a.**	Sketch horizontal and vertical axis wind power generation. Explain both in detail.	**10**	**L3**	**CO5**
	b.	List : i) Advantages and disadvantages of WECS. ii) Advantages and disadvantages of solar power system.	**10**	**L1**	**CO5**

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CBCS SCHEME

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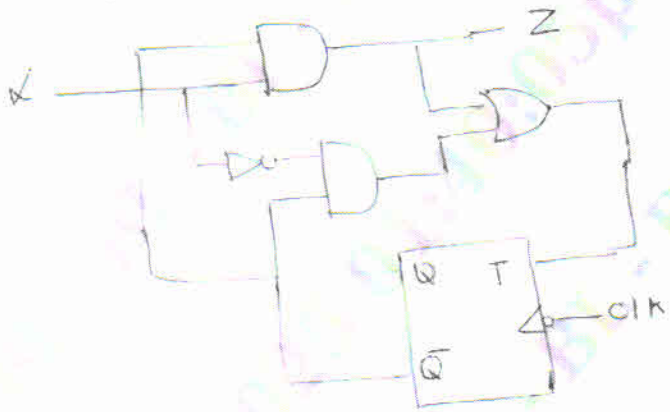
BEE306A

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
Digital Logic Circuits

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 combinational Logic with examples.	04	L1	CO1
	b.	Design a combinational logic truth table and circuit diagram so that an output is generated indicating when a majority of four inputs is true.	06	L5	CO1
	c.	Simplify the function using karnaugh map. i) f (A,B,C,D) = Σm (1,3,7,11,15) + Σd (0,2,4) ii) f (A,B,C,D) = ΠM (0, 2, 3, 8, 9,1 2, 13, 15)	10	L4	CO1
		OR			
Q.2	a.	Define the following terms with an example: i) Minterm ii) Maxterm	04	L2	CO1
	b.	Find the prime implicants and essential prime implicants. f(v, w, x,y,z) = Σm (4,5,6,7,9,11,13,15,25,27,29,31)	06	L5	CO1
	c.	Simplify the given Boolean function using Quine Mccluskey method. y = f (a,b,c,d) = Σ (0,1,2,6,7,9,10,12) + d (3,5)	10	L5	CO1
		Module – 2			
Q.3	a.	Explain the design procedure for combinational circuits.	06	L2	CO2
	b.	Implement full subtractor using a decoder and write a truth table.	07	L5	CO2
	c.	Implement the following Boolean function with 8:1 MUX. F(A,B,C,D) = Σm (0,2,6,10,11,12,13) + d (3, 8, 14)	07	L5	CO2
		OR			
Q.4	a.	Design a carry look ahead 4 –bit parallel adder. Show that the time for addition is independent of the length.	08	L5	CO2
	b.	With the help of truth table and simplification using K – map, design a 2 bit comparator using basic gates.	08	L4	CO2
	c.	What is an Encoder? Explain.	04	L1	CO2
		Module – 3			
Q.5	a.	Compare between combinational and sequential circuits.	04	L1	CO3
	b.	With the help of truth table explain application of the SR Latch.	08	L3	CO3
	c.	Derive the characteristics equations of the following flip flops. i) JK flip flop ii) T flip flop	08	L4	CO3

		OR			
Q.6	**a.**	With the help of logic diagram. Explain working of master slave JK Flip Flop along with waveforms. Explain race around condition. How is it eliminated?	**10**	**L2**	**CO3**
	b.	Write the Truth table of SR, T and D flip flops.	**06**	**L4**	**CO3**
	c.	What is the difference between latches and flip flops?	**04**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	With the help of a suitable example, explain the following operations in a shift register i) SISO ii) PISO	**08**	**L4**	**CO4**
	b.	Design mod 6 ripple counter using T – flip flops	**08**	**L5**	**CO4**
	c.	Differentiate between Asynchronous and synchronous counters.	**04**	**L2**	**CO4**
		OR			
Q.8	**a.**	With the help of a diagram, explain ring counter and twisted ring counter.	**06**	**L2**	**CO4**
	b.	Design a synchronous Mod – 6 counter using clocked D Flip Flops.	**08**	**L5**	**CO4**
	c.	Design a 3 bit asynchronous ripple counter using T – flip flops and explain the operation.	**06**	**L5**	**CO4**
		Module – 5			
Q.9	**a.**	Explain Mealy and Moore model of a sequential circuit.	**08**	**L2**	**CO5**
	b.	Construct the transition table, state table and state diagram for the sequential circuit given below. 	**08**	**L5**	**CO5**
	c.	Define state diagram with an example.	**04**	**L2**	**CO5**
		OR			
Q.10	**a.**	With a basic structure, explain clearly programmable Read only Memories (PROMS) and EEPROM.	**10**	**L2**	**CO5**
	b.	Explain the following : i) Flash Memory ii) Read only Memory	**10**	**L2**	**CO5**

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CBCS SCHEME

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BEE401

Fourth Semester B.E/B.Tech. Degree Examination, June/July 2025
Electric Motors

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.	What is back emf? Derive the armature torque of a DC motor.	6	L1	CO1
	b.	Sketch the speed v/s I_a and torque v/s I_a characteristic of DC : i) Shunt motor ii) Series motor iii) Cumulatively compounded motor iv) Differentially compound motor.	6	L2	CO1
	c.	What are the losses that occur in DC machines? Draw the power flow diagram of DC motor.	8	L2	CO1
		OR			
2	a.	Explain the operation of four point starter with neat diagram, mention its advantage.	6	L1	CO1
	b.	Explain the fields test on series motor and explain the method to find out efficiency.	6	L2	CO1
	c.	A series motor having resistance of 1Ω between its terminals drives a fan, the torque of which is proportional to the square of the speed. At 230V its speed is 300 rpm and takes 15A. The speed of the fan is to be raised to 375 rpm by supply voltage control estimates the supply voltage required.	8	L3	CO1
		Module – 2			
3	a.	With the help of neat diagram, explain how efficiency of DC motor can be determined by the retardation test.	10	L1	CO2
	b.	A test on two coupled similar tram way motors with their field connected in series gave following results when one machine acted as a motor and the other as a generator, calculate the efficiency of motor and generator. Motor : Armature voltage : 590V, armature current : 56A voltage drop across field winding : 40V Generator : Armature voltage : 400V, Armature current : 44A, Field winding drop : 40V, resistance of each armature : 0.3Ω 10M.	10	L2	CO2
		OR			
4	a.	What is slip in induction motor? Explain its significance.	4	L1	CO2
	b.	A 12 pole, 50 Hz, 3ϕ IM has rotor resistance of 0.15Ω and stand still reactance of 0.25 PS phase. On full load it is running at a speed of 480 rpm. The rotor induced emf per phase at stand still is observed to be 32V. calculate : i) Starting torque ii) Fill load torque iii) Maximum torque iv) Speed at maximum torque.	8	L2	CO2
	c.	Explain and derive the torque equation for 3-ϕ induction motor and derive the condition for maximum torque.	8	L2	CO2

		Module – 3			
5	a.	Starting from the fundamentals develop the equivalent circuit of a polyphase induction motor and explain the mechanical power developed is taken care of in equivalent circuit.	10	L1	CO4
	b.	Explain no load test and blocked rotor test in a 3-ϕ induction motor. How are the parameters of equivalent circuit electro mined from test results?	10	L2	CO3
		OR			
6	a.	What is the purpose of using deep bar rotor? Explain the construction and working of deep bar rotor induction motor.	10	L1	CO3
	b.	A 415V, 29.84KW, 50Hz delta connected motor gave the following test data : No load test : 415V, 21A, 1250W Blocked rotor test : 100V, 45A, 2730W Construct the circle diagram and determine : i) Line current and power factor for rated output. ii) The maximum torque. Assume stator and rotor copper losses are equal at stand still.	10	L2	CO4
		Module – 4			
7	a.	Explain in detail auto transformer method of starting a squirrel Cage induction motor.	10	L2	CO6
	b.	Mention the different methods of speed control of 3-ϕ induction motor.	10	L2	CO5

		Module – 5			
9	a.	What are v and inverted v curves? Sketch them and explain their significance.	10	L2	
	b.	Explain the operation of synchronous motor at constant load variable excitation.	10	L2	
		OR			
10	a.	Explain the principle of operation of linear induction motor. List the some applications of it brief the working of linear conduction motor.	10	L2	
	b.	State the methods of starting synchronous motor. Explain any one details.	5	L2	
	c.	Explain the importance of daraping winding in synchronous motor.	5	L1	

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BEE402

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Transmission and Distribution

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 the help of single line diagram, explain the structure of electrical power system indicating standard voltages.	06	L2	CO1
	b.	Explain the effects of high voltage transmission based on the conductor volume, transmission efficiency and percentage line drop.	06	L2	CO1
	c.	The towers of height 95 m and 70 m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 400 m. If the tension in the conductor is 1100 kg and its weight is 0.8 kg/m, calculate: (i) Sag at lower support (ii) Sag at upper support (iii) Clearance of lowest point on the trajectory from water level. Assume bases of towers are at water level.	08	L3	CO1
		OR			
Q.2	a.	Explain the different methods to equalize the potential across the string of suspension insulator.	06	L2	CO1
	b.	Write a short note on Bundled conductors.	06	L1	CO1
	c.	Each line of 3-phase system is suspended by a string of 3 similar insulators. If the voltage across the bottom most unit is 17.5 KV. Calculate the voltage across the insulator string. Also find the string efficiency. Assume that the earth capacitance is $1/8^{th}$ of mutual capacitance.	08	L3	CO1
		Module – 2			
Q.3	a.	Derive an expression for inductance of a single phase two wire line starting from fundamentals.	08	L3	CO2
	b.	Explain the terms (i) GMD and (ii) GMR with the help of suitable examples.	06	L1	CO2
	c.	The three conductors of a 3-phase line are arranged at the three corners of a triangle of sides 2 m, 2.5 m and 4.5 m. Calculate the inductance per km of the line when conductors are regularly transposed. The diameter of each conductor is 1.24 cm.	06	L3	CO2
		OR			
Q.4	a.	Derive an expression for capacitance of a 3-phase line with equilateral spacing.	08	L3	CO2
	b.	Compare single circuit and double circuit lines.	05	L2	CO2
	c.	A single-phase over head line 30 km long consists of two parallel wires each 5 mm in diameter and 1.5 m apart. If the line voltage is 50 KV, 50 Hz. Calculate the charging current with line open circuited.	07	L3	CO2
		Module – 3			
Q.5	a.	Briefly explain the purpose of overhead transmission line and how transmission lines are classified.	06	L2	CO3
	b.	Discuss the terms voltage regulation and transmission efficiency as applied to transmission line.	04	L2	CO3

	c.	A three phase 50 Hz overhead transmission line 100 km long has following constants: Resistance/ph/km = 0.1 Ω ; Reactance/ph/km = 0.2 Ω; susceptance/ph/km = 0.04×10^{-4} siemens. Determine: (i) Sending end current (ii) Sending end voltage (iii) Sending end p.f. (iv) Transmission efficiency When supplying a balanced load of 10,000 KW at 66 KV, 0.8 p.f. lagging. Use nominal T-method.	10	L3	CO3
		OR			
Q.6	a.	With the help of vector diagram, explain the nominal-π method for obtaining the performance of medium transmission line.	08	L3	CO3
	b.	What are A, B, C, D parameters? Briefly explain.	04	L2	CO3
	c.	A 3-phase transmission line is 400 km long and feeds a load of 450 MVA, 0.8 p.f. lagging at 345 KV. The ABCD constants are A = D = $0.8181\angle 1.3°$; B = $172.2\angle 84.2°$, C = $1.93\times10^{-3}\angle 90.4$ Ʊ. Calculate sending end current and percentage voltage drop at full load.	08	L3	CO1
		Module – 4			
Q.7	a.	Briefly explain the factors influencing the corona.	06	L2	CO4
	b.	Explain the terms with reference to corona: (i) Critical disruptive voltage (ii) Visual critical voltage (iii) Corona power loss	06	L2	CO4
	c.	Determine the critical disruptive voltage and the visual critical voltage for a 3-phase, 132 KV, 50 Hz line situated in a temperature of 30°C and at a barometric pressure of 74 cm. The conductor diameter is 1.5 cm while the spacing between the conductors is 2.75 m. The surface irregularity factor is 0.9 while $m_{vi} = 0.75$ and $m_0 = 0.9$.	08	L3	CO4
		OR			
Q.8	a.	With the help of cross sectional diagram, explain the construction of single core cable.	06	L2	CO4
	b.	Explain the inter sheath grading of cables.	06	L2	CO4
	c.	Single core, lead covered cable has a conductor diameter of 3 cm with insulation diameter of 8.5 cm. The cable is insulated with two dielectrics with permittivities 5 and 3 respectively. The maximum stress in the two dielectrics are 38 KV/cm and 26 KV/cm respectively. Calculate radial thickness of insulating layers and the working voltage of the cable.	08	L3	CO4
		Module – 5			
Q.9	a.	Explain the following terms with reference to distribution system: (i) Radial feeder (ii) Parallel feeder (iii) Loop feeder (iv) Interconnected network	08	L2	CO5
	b.	A single phase distributor 2 km long supplies a load of 120 A at 0.8 p.f lagging at its far end and a load of 80 A at 0.9 p.f. lagging at its mid point. Both power factors are referred to the voltage at the far end. The resistance and reactance per km (go and return) are 0.05 and 0.1 Ω respectively. If the voltage at the far end is maintained at 230 V, calculate: (i) Voltage at the sending end (ii) Phase angle between voltages at the two ends.	12	L3	CO5
		OR			
Q.10	a.	Define the terms: (i) Reliability (ii) Availability (iii) Adequacy (iv) Security	08	L2	CO5
	b.	Explain with neat sketch different failure modes of bath tub curve.	06	L2	CO5
	c.	Write a short note on power quality.	06	L2	CO5

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CBCS SCHEME

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21EE51

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Transmission and Distribution

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain typical line diagram of transmission and distribution scheme indicating voltage level used at different stages. **(06 Marks)**

b. Deduce an approximate expression for sag in overhead lines when support are at unequal level. **(06 Marks)**

c. Each line of a phase system is suspended by a string of 3 similar insulator, if the voltage across the line unit is 17.5 kV. Calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $1/8^{th}$ of the capacitance of the insulator itself. Also find the string efficiency. **(08 Marks)**

OR

2 a. Enumerate the advantages of HVDC over HVAC transmission. **(06 Marks)**

b. With suitable expression, explain the advantage of high transmission voltage. **(06 Marks)**

c. The tower of height 30 m and 90 m respectively support a transmission line conductor at water crossing. The horizontal distance between the tower is 500 m if the tension in the conductor is 1600 kg. Find the minimum clearance of the conductor and water and clearance mid way between the support, weight of conductor is 1.5 kg/met, base of the tower can be considered to be at water level. **(08 Marks)**

Module-2

3 a. Derive an expression for inductance per phase of a 3 phase overhead transmission line when conductors are symmetrically placed. **(08 Marks)**

b. Explain the concept of i) Self GMD ii) Mutual GMD. **(06 Marks)**

c. A 3 phase 50 Hz, 66KV overhead line conductor are placed in a horizontal plane as shown in Fig.Q.3(c). The conductor diameter is 1.25 cm. If the line length is 100 km calculate i) Capacitance per phase ii) Charging current per phase assuming complete transposition of the line **(06 Marks)**

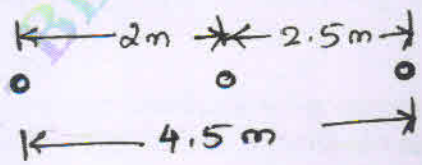

Fig.Q.3(c)

OR

4 a. Derive an expression for capacitance of a 3 phase line with unsymmetrical spacing but transposed. **(10 Marks)**

b. Fig.Q.4(b) shows the spacing of a double circuit 3 phase overhead line. The phase sequence is ABC and the line is completely transposed the conductor radius in 1:3 cm. Find the inductance per phase per kilometer. **(10 Marks)**

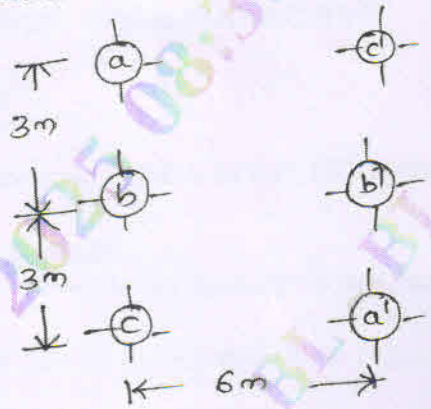

Fig.Q.4(b)

Module-3

5 a. Derive an expression for A, B, C, D constant of a medium transmission line using nominal π method of analysis. Show that AD – BC = 1. **(10 Marks)**

b. A 3 phase 50 Hz overhead transmission line 100 km long has following constant resistance/km/phase = 0.1 Ω , inductive reactance / km / phase = 0.2 Ω , capacitive susceptance / km / phase = 0.04×10^{-4}s.
Determine : i) Sending end current ii) Sending end voltage iii) Sending end power factor iv) Transmission efficiency when supplying a balance load of 10.000 kW at 66 kV pf 0.8 lagging. Use nominal T methods. **(10 Marks)**

OR

6 a. Derive an expression for voltage regulation and transmission efficiency of a single phase short transmission line with the help of vector diagram. **(10 Marks)**

b. An overhead 3 phase transmission line delivers 5000 kW at 22 kV at 0.8 pf lagging. The resistance and reactance of each conductor is 4 Ω and 6 Ω respectively. Determine: i) Sending end voltage ii) Percentage regulation iii) Transmission efficiency. **(10 Marks)**

Module-4

7 a. What is Corona? State and explain with the expression for disruptive critical voltage and visual critical voltage. **(10 Marks)**

b. What is grading of cable? Briefly explain inter sheath grading. **(10 Marks)**

OR

8 a. Derive an expression for insulation resistance of single core cable. **(10 Marks)**

b. Calculate the capacitance and charging current of a single core cable used on a 3 phase, 66 kV system. The cable is 1 km long having a core diameter of 10 cm and an impregnated paper insulation of thickness of 7 cm. The relative permittivity of the insulation may be taken as 4 and the supply at 50 Hz. **(10 Marks)**

Module-5

9 a. Explain radial distribution system. State its merits and demerits. **(10 Marks)**

b. A single phase ac distribution AB 300 meter long is fed from end A and is waded under.

i) 100 A at 0.707 pf lagging 200 m from point A

ii) 200 A at 0.8 pf lagging 300 m from point A

The load resistance and reactance of the distribution is 0.2 Ω and 0.1 Ω per kilometer. Calculate the total voltage drop in the distribution. The load power factor refers to the voltage at the far end. **(10 Marks)**

OR

10 a. What is power quality? Explain various power quality problems. **(06 Marks)**

b. Define reliability. Write a short note on Bath tub curve. **(06 Marks)**

c. Non reactive loads of 10 kW, 8 kW and 5 kW are connected between the neutral and the red, yellow and blue phase respectively of a 3 phase 4 wire system. The line voltage is 400 V. Calculate current in each line. **(08 Marks)**

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21EE52

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Control Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain briefly the classification of control systems. **(08 Marks)**

b. Draw the force voltage analogous circuit for the mechanical system shown in Fig Q1(b).

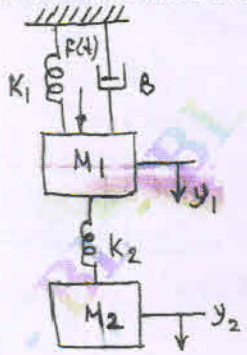

Fig Q1(b) **(08 Marks)**

c. What is a synchro pair? What for it is used? **(04 Marks)**

OR

2 a. Derive the transfer function of armature controlled dc servomotor. **(08 Marks)**

b. For the electrical network shown in Fig Q2(b), find the transfer function $V_2(s)/V_1(s)$.

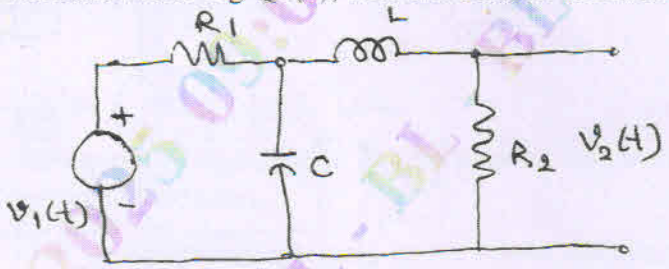

Fig Q2(b) **(08 Marks)**

c. What are gear trains? What for gear trains are used in control systems? **(04 Marks)**

Module-2

3 a. For the system shown in Fig Q3(a), find C(s)/R(s) using block diagram reduction technique.

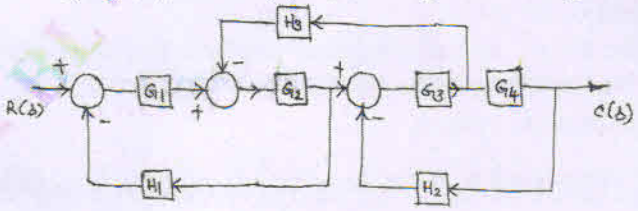

Fig Q3(a) **(10 Marks)**

b. Draw the block diagram for the network shown in Fig Q3(b).

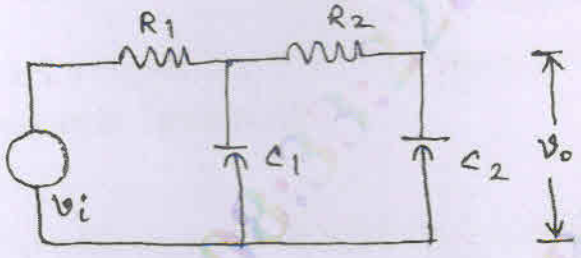

Fig Q3(b) **(10 Marks)**

OR

4 a. Find C(s)/R(s) for the system whose signal flow graph is shown in Fig Q4(a).

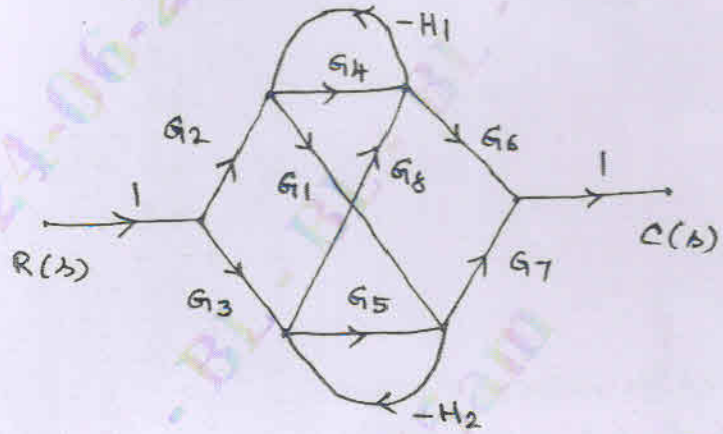

Fig Q4(a) **(10 Marks)**

b. Draw the signal flow graph for the system shown in Fig Q4(b) and hence find the overall gain using Mason's gain formula.

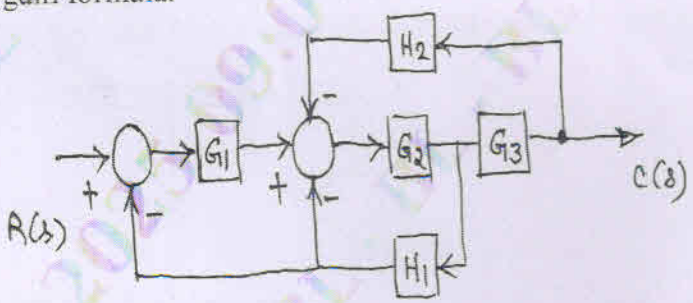

Fig Q4(b) **(06 Marks)**

c. Define the following terms as referred to signal flow graphs.
i) Forward path ii) Non – touching loops iii) Output node iv) Loop gain. **(04 Marks)**

Module-3

5 a. Define the following terms as referred to unit step response of a typical under damped second order system.
i) Rise time ii) Settling time iii) Steady state error iv) Peak time. **(04 Marks)**

b. Derive an expression for i) Peak time ii) Peak over shoot for a typical second order underdamped system. **(08 Marks)**

c. The open-loop transfer function of a unity feedback system is $G(s) = \frac{4}{s(s+1)}$. Determine:
i) Damping ratio ii) Rise time iii) Peak time iv) Peak overshoot v) Settling time. **(08 Marks)**

OR

6 a. What are the difficulties which may arise in the formation of the Routh table? How to overcome these difficulties? **(08 Marks)**

b. Examine the stability of the system having the characteristics equation
i) $2s^5 + 6s^4 + 2s^3 + 4s^2 + 3s + 7 = 0$ ii) $s^5 + 9s^4 + 43s^3 + 101s^2 + 156s + 90 = 0$. **(06 Marks)**

c. For the feedback system shown in Fig Q6(c), find the range of K for which the system is stable. Also, determine the value of K for which the system response is oscillatory and the value of frequency of oscillations at this value of K.

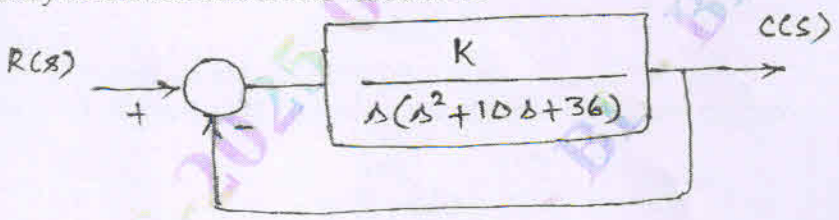

Fig Q6(c) **(06 Marks)**

Module-4

7 a. Sketch the root locus for the unity feedback system having
$G(s) = \frac{K}{s(s+2)(s+4)}$. Where K is varied from 0 to ∞. **(10 Marks)**

b. Sketch the asymptotic Bode plot for the system having
$G(s) = \frac{20}{s(1+0.1s)}$. **(10 Marks)**

OR

8 a. Find the centroid and angle of asymptotes of the root locus of a system with open loop transfer function
$G(s)\,H(s) = \frac{K}{s(s+1)(s+2)}$. **(06 Marks)**

b. Sketch the Bode plot showing the magnitude in db and phase angle in degrees as a function of log frequency for the transfer function.
$G(s)\,H(s) = \frac{2000}{s(s+2)(s+100)}$. Determine the gain cross – over frequency phase cross over frequency, gain margin and phase margin. **(14 Marks)**

Module-5

9 a. A unity feedback control system has
$G(s) = \frac{10}{s(s+1)(s+2)}$
Draw the Nyquist plot and comment on closed loop stability. **(14 Marks)**

b. With the help of a polar plot, explain gain margin and phase margin. **(06 Marks)**

OR

10 a. What is a PID controller? Write the procedure for the design of a PID controller. **(12 Marks)**

b. What are the steps to design lead compensator? **(08 Marks)**

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21EE53

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Power System Analysis – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is one line diagram? What is the need of single line diagram? Explain the procedure for finding the per unit reactance diagram by stating all the assumptions involved. **(10 Marks)**

b. The single line diagram of a power system is shown in Fig.Q1(b). Draw the per unit impedance diagram.

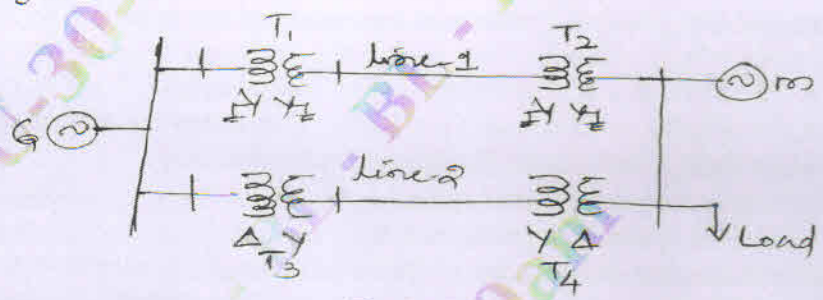

Fig.Q1(b)

G : 90 mVA. 11 KV X″ = 18% line 1 : Z = j80Ω
T_1 : 70 mVA. 11/110 KV X = 15% line 2 : Z = j120Ω
T_2 : 60 mVA. 110/11KV X = 10% m = 85 mVA, 11KV X″ = 13%
T_3 : Three 1ϕ units each rated at 10 mVA, 11/127 KV X = 9%
T_4 : Three 1ϕ units each rated at 16.67 mVA 127/11 KV X = 12%
The load Absorbs 74 mVA, 0.8 pf lagging at 6.5 KV. Select a common base of 100 mVA, 11 KV on the generator side. **(10 Marks)**

OR

2 a. Define the per unit system. The advantages of a per unit system. **(05 Marks)**

b. Prove that the per unit impedance of a two winding transformer on either of its side is equal **(05 Marks)**

c. A single line diagram of a power system is shown in Fig.Q2(c). Draw its impedance diagram. Choose a base of 100 mVA, 220 KV in 50 Ω line. The ratings of generator, motor and transformer are given below.

Fig.Q2(c)

G: 40 mVA, 25 KV X″ = 20% m = 50 mVA, 11 KV X″ = 30%
T_1 : 40 mVA, 33/220 KV X = 15%
T_2 : 30mVA, 220/11 KV X = 15%. **(10 Marks)**

Module-2

3 a. Draw the oscillogram of short circuit current, when an unloaded generator is subjected to symmetrical fault. Determine the steady state, transient and sub transient reactance's is from the oscillogram. **(10 Marks)**

b. A 100 mVA, 13.8 KV, 50 Hz Y–connected 3ϕ synchronous generator is connected to a 13.8/220 KV, 100 mVA Δ-Y transformer. The machine reactance on its own base are X_d = 1.1 pu, X_d' = 0.25 pu. The transformer reactance is 0.2 pu, A 3ϕ load of 100 mVA 0.8 pf lag is connected to transformer secondary. A 3ϕ short circuit occurs at the load terminals. Find the generator transient current, if before the fault, the load is operating at 220 KV, choose a base of 220 KV, 100 mVA on HT side of the transformer. **(10 Marks)**

OR

4 a. Describe the doubling effect on transmission line under 3ϕ short circuit with neat sketches. **(10 Marks)**

b. A 75 mVA, 6.6 KV generator connected through a 5 cycle breaker, having reactance of X_d'' = 9% X_d' = 15% and X_d = 100%. It operates on noload and at rated terminal voltage when short circuit occurs behind circuit breaker find :

i) Sustained short circuit current
ii) Initial symmetrical rms current
iii) Maximum possible decomponent of short circuit current after 5 cycle
iv) Interrupting mVA. **(10 Marks)**

Module-3

5 a. What is symmetrical components? How they are useful in the solution of power system? **(05 Marks)**

b. Show that the symmetrical component transformation is power invariant. **(05 Marks)**

c. The symmetrical component of phase currents are I_{a1} = $100\angle 30°$ A, I_{b2}= $40\angle 90°$ A and $I_{co} = 10\angle -30°$ A, evaluate the phase currents I_a, I_b and I_c. **(10 Marks)**

OR

6 a. Prove that set of balanced phasors have only positive sequence symmetrical component. **(06 Marks)**

b. Draw the zero sequence networks for the following 3-ϕ transformers.

i) Y-Y ii) Y-Y iii) Δ-Δ

iv) Y-Δ v) Y-Δ

(06 Marks)

c. The current flowing to a Δ connected load through line a is 10A with current on line a as reactances and assuming that line c is open find the symmetrical component of line currents. **(08 Marks)**

Module-4

7 a. Derive an expression for fault current, when double line to ground fault through impedance occurs on power system. **(10 Marks)**

b. A 3ϕ, 400V Y connected neutral grounded generator is subjected to various faults. Find positive negative and zero sequence impedances, also compute the fault current if LLG fault occurs. The current for : 3ϕ fault is 120A. LL fault is 160A, for LG fault it is 240 A. **(10 Marks)**

OR

8 a. Derive an expression for fault current for SLG fault, without fault impedance on an alternator. **(10 Marks)**

b. A 25 mVA, 13.2 KV alternator, with a solidly grounded neutral has a subtransient reactance of 0.25 pu. The negative and zero sequence reactance's are 0.35 and 0.1 pu respectively. Determine the fault current when the line to line fault current occurs at the terminals of the alternator. Neglect the resistance. **(10 Marks)**

Module-5

9 a. Derive an expression for power angle equation for salient pole synchronous machine connected to infinite bus. Also draw the power angle curve. **(10 Marks)**

b. A 50 Hz, 4-pole turbo generator rated 150 mVA, 11KV has an inertia constant of 9 mJ/mVA, find :

i) Stored energy at synchronous speed

ii) The rotor acceleration, if the input mechanical power is raised to 100 MW, when the electrical load is 75 MW

iii) The speed at the end of 10 cycles, if the acceleration is assumed constant at the initial value. **(10 Marks)**

OR

10 a. Derive an expression for swing equation of a generators when generator connected to infinite bus. **(10 Marks)**

b. 50 Hz, 4-pole turbo generator rated 100 mVA, 11 KV has an inertia constant of 8 mJ/mVA.

i) Find stored energy in rotor at synchronous speed

ii) If the mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW. Find rotor acceleration neglecting mechanical and electrical losses. **(10 Marks)**

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21EE54

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Power Electronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain five different types of power electronic converter circuits with neat circuit diagram, input and output waveforms. **(10 Marks)**

b. With neat figure, explain the V-I characteristics of diode. **(05 Marks)**

c. Explain peripheral effects of power electronics equipments with block diagram. **(05 Marks)**

OR

2 a. With neat circuit diagram and waveforms explain single phase full wave rectifier with R load. And also derive the expression for average output voltage. **(10 Marks)**

b. Explain reverse recovery characteristics of a diode with waveforms. **(06 Marks)**

c. Explain the significance of free-wheeling diode. **(04 Marks)**

Module-2

3 a. Explain steady state and switching characteristics of BJT. **(10 Marks)**

b. Explain the switching limits of BJT. **(04 Marks)**

c. The bipolar transistor in Fig.Q.3(c) is specified to have β_F in the range of 8 to 40. The load resistance is $R_C = 11\Omega$. The dc supply voltage is $V_{cc} = 200$ V and the input voltage to the base circuit is $V_B = 10$ V. If $V_{CE(sat)} = 1.0$ V and $V_{BE(sat)} = 1.5$ V. Find : i) The value of R_B that results in saturation with an ODF of 5 ; ii) The B_{forced} ; iii) The power loss P_T in the transistor.

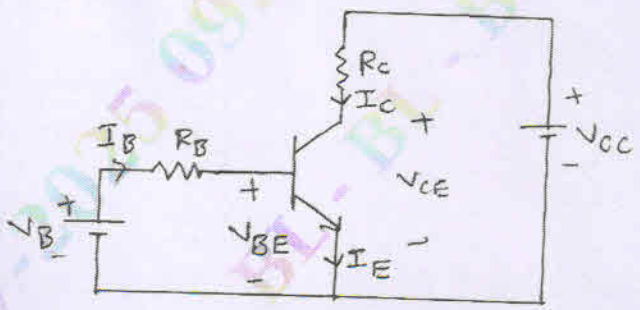

Fig.Q.3(c)

(06 Marks)

OR

4 a. With the help of neat figures, explain steady state and switching characteristics of MOSFET. **(10 Marks)**

b. With neat circuit diagram, explain pulse transformer and opto coupler. **(06 Marks)**

c. The maximum junction temperature of a transistor is $T_J = 150°C$ and the ambient temperature is $T_A = 25°C$. If the thermal impedances are $R_{JC} = 0.4°C/W$, $R_{CS} = 0.1°$ C/W and $R_{SA} = 0.5°$ C/W, calculate

i) The maximum power dissipation

ii) The case temperature. **(04 Marks)**

Module-3

5 a. Explain V – I characteristics of SCR. And also define i) Latching current ii) Holding current. **(12 Marks)**

b. Ten thyristors are used in a string to withstand a dc voltage of V_S = 15 kV. The maximum leakage current and recovery charge differences of thyristors are 10 mA and 150 μC, respectively. Each thyristor has voltage sharing difference of R = 56 KΩ and capacitance of C_1 = 0.5 μF. Determine : i) The maximum steady state voltage sharing ii) The steady-state voltage derating factor iii) The maximum transient voltage sharing $V_{DT(max)}$ iv) The transient voltage derating factor. **(08 Marks)**

OR

6 a. Explain with neat figure two-transistor model of thyristor and also write relevant equations. **(08 Marks)**

b. Explain briefly different thyristor turn-on methods. **(06 Marks)**

c. Explain $\frac{di}{dt}$ protection and $\frac{dv}{dt}$ protection. **(06 Marks)**

Module-4

7 a. With circuit diagram and waveforms explain single phase half wave controlled rectifier with R-L load. **(08 Marks)**

b. A single phase full converter bridge is connected to RLE load. The source voltage is 230 V, 50Hz. The average load current of 10 A is continuous over the working range. For R = 0.4Ω and L = 2 mH, compute i) Firing angle for E = 120 V ii) Firing angle for E = -120 V. **(06 Marks)**

c. With neat circuit diagram and waveforms explain J-ϕ dual converter. **(06 Marks)**

OR

8 a. With circuit diagram and waveforms explain phase control in ac voltage controller and also derive expression for RMS output voltage. **(08 Marks)**

b. An ac voltage controller has a resistive load of R = 10Ω and rms input voltage is V_s = 120 V, 60 Hz. The thyristor switch is on for n = 25 cycles and is off for m = 75 cycles. Find : i) rms output voltage Vo ii) The input power factor iii) The average and rms current of thyristors. **(06 Marks)**

c. With circuit diagram and waveform explain single phase bidirectional controllers with resistive loads. **(06 Marks)**

Module-5

9 a. Explain the principle operation of step down converter with RL load and also draw the waveforms. **(10 Marks)**

b. For the stepdown chopper consisting of a resistive load of R = 10Ω and the input voltage is V_S = 220 V. When the converter switch remains on, its voltage drop is V_{ch} = 2 V and chopping frequency is f = 1 kHz. If the duty cycle is 50%, determine: i) average output voltage V_a ii) rms output voltage V_o iii) The converter efficiency iv) effective input resistance R_i of the converter v) rms value of the fundamental component of output harmonic voltage. **(10 Marks)**

OR

10 a. Explain :

i) Single pulse – width modulation

ii) Multiple – pulse – width modulation techniques used for voltage control of single phase inverters. **(10 Marks)**

b. Describe 180 – degree conduction operation of three phase bridge inverter with circuit diagram and waveforms of line voltages and phase voltages. **(10 Marks)**

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21EE61

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025
Management and Entrepreneurship

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is Management? Write various characteristics of management. **(07 Marks)**
b. Explain different types of planning. **(07 Marks)**
c. Distinguish between centralization and decentralization. **(06 Marks)**

OR

2 a. What is decision making? Explain different types of decision. **(07 Marks)**
b. Explain management – A science, are or profession. **(07 Marks)**
c. What are different steps involved in planning? **(06 Marks)**

Module-2

3 a. Define the term organization. Explain nature and characteristics of organization. **(07 Marks)**
b. What is staffing? Explain the importance of staffing. **(07 Marks)**
c. Explain with a diagram Maslow's Theory of Motivation. **(06 Marks)**

OR

4 a. What is controlling? Explain steps in controlling. **(07 Marks)**
b. Explain the meaning and importance of co-ordination. **(07 Marks)**
c. Distinguish between centralization and decentralization. **(06 Marks)**

Module-3

5 a. Discuss the social responsibilities of business towards various groups. **(07 Marks)**
b. What is social audit? Discuss merits and demerits. **(07 Marks)**
c. Discuss the Myths of entrepreneurship. **(06 Marks)**

OR

6 a. What are entrepreneurs? Explain any two qualities of good entrepreneurs. **(07 Marks)**
b. Differentiate between entrepreneur and intrapreneur. **(07 Marks)**
c. Explain the role of an entrepreneurs in economic development in INDIA. **(06 Marks)**

Module-4

7 a. Explain different policies for development of SSI in INDIA. **(07 Marks)**
b. Explain the impact of GATT and WTO. **(07 Marks)**
c. Write a note on :
i) SIDBI
ii) KIADB. **(06 Marks)**

OR

8 a. What are the characteristics of small scale industries? (07 Marks)
b. Write a note on TECSOK. (06 Marks)
c. Explain the objectives and functions of :
i) KSFC
ii) NSIC. (07 Marks)

Module-5

9 a. Define the term project. What are the features of project? (07 Marks)
b. Explain the need and significance of project report. (07 Marks)
c. Write a note on PERT and CPM. (06 Marks)

OR

10 a. What is project selection? Explain factors influencing it. (07 Marks)
b. Write a note on project appraisal. (07 Marks)
c. Discuss the concept and importance of network analysis (06 Marks)

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21EE62

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025
Power Systems Analysis – II

Time: 3 hrs. Max. Marks: 100

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

Module-1

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

b. With an example, explain tree and basic cut sets in network topology. **(06 Marks)**

c. Including the generator buses, form an Y_{BUS} using singular transformation for the below network.

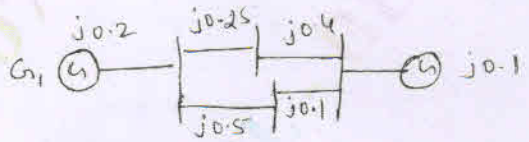


Fig.Q1(c) **(08 Marks)**

OR

2 a. Explain with an example : i) Co-tree ii) Incidence matrix. **(06 Marks)**

b. Derive an expression for bus admittance matrix using singular transformation method. **(06 Marks)**

c. For the system given below, obtain Y_{BUS} using inspection method. Consider bus 1 as reference and all impedance values are in pu.

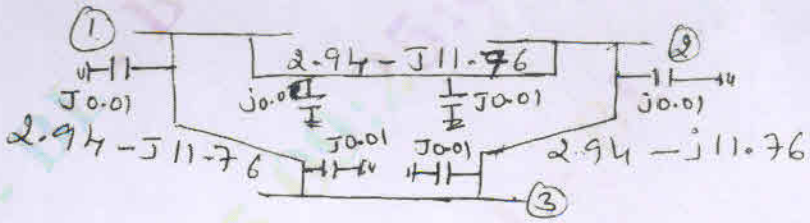


Fig.Q2(c) **(08 Marks)**

Module-2

3 a. Explain the classification of buses in load flow analysis. **(06 Marks)**

b. Explain the operating constraints in load flow studies. **(06 Marks)**

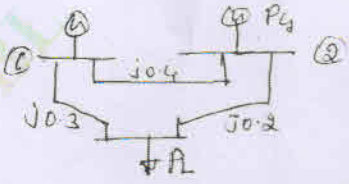
c. With the help of flow chart, explain Gauss-Seidel iterative method for load flow solution. **(08 Marks)**

OR

4 a. Derive the power flow equation for load flow studies. **(06 Marks)**

b. Explain the system data required for load flow studies. **(06 Marks)**

c. For all network given below, calculate the bus voltage 'V_2' after first iteration using Gauss – Seidel method. All impedance values are in pu. **(08 Marks)**



Bus Data

Bus 1 $1.05\angle 0$ pu

Bus 2 $|V| = 1$ pu $P_g = 3$ pu

Bus 3 $P_L = 4$ pu $Q_L = 2$ pu

Fig.Q4(c)

Module-3

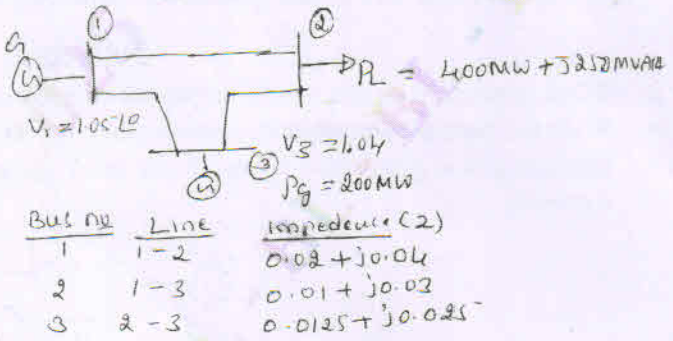
5 a. Discuss the algorithm procedure for load flow analysis using Newton-Raphson method in polar form. **(10 Marks)**

b. Write down the comparison between Gauss-Seidel Newton-Raphson and Fast decoupled methods. **(10 Marks)**

OR

6 a. With a flow chart, explain the algorithm of fast decoupled load flow method. **(10 Marks)**

b. Solve the load flow of the power system shown below using FDLF method.



Bus no	Line	Impedance (Ω)
1	1-2	0.02 + j0.04
2	1-3	0.01 + j0.03
3	2-3	0.0125 + j0.025

Fig.Q6(b) **(10 Marks)**

Module-4

7 a. Write a brief note on performance curves of thermal power plant for economic load analysis. **(06 Marks)**

b. Explain the constraints related to unit commitment in the power system. **(06 Marks)**

c. The cost characteristics of two unit in a plant are :

$C_1 = 0.4\ P_1^2 + 160\ P_2 + K_1$ Rs/h

$C_2 = 0.45\ P_2^2 + 120\ P_2 + K_2$ Rs/h

Where 'P1' and 'P2' are o/p power in 'MW'. Find the optimal load allocation between the two units when the total load is 162.5MW. What will be the daily loss if the units are loaded equally? **(08 Marks)**

OR

8 a. With the help of flow chart, explain forward dynamic programming approach to solve unit commitment problem. **(08 Marks)**

b. Derive the expression for economic load schedule for 'n' plant system by neglecting the transmission losses and generation limits. **(06 Marks)**

c. Obtain a priority list for the following data pertaining to three units in a plant.

Unit 1 : Max 600 MW

$C_1 = 5610 + 79.2\ P_1 + 0.01562\ P_1^2$ Rs/h

Unit 2 : Max 400 MW

$C_2 = 3100 + 78.5\ P_2 + 0.0194\ P_2^2$ Rs/h

Unit 3 : Max 200 MW

$C_3 = 936 + 95.64\ P_3 + 0.0578\ P_3^2$ Rs/h. **(06 Marks)**

Module-5

9 a. Explain point by point method to get numerical solution of swing equation. **(10 Marks)**

b. Explain the algorithm for short circuit analysis using bus impedance matrix. **(10 Marks)**

OR

10 a. Explain Runge-Kutta method of solving swing equation. **(10 Marks)**

b. Obtain a generalized algorithm for finding the elements of all bus impedance matrix when a branch is added. **(10 Marks)**

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21EE63

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025
Signals and Digital Signal Processing

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Signal. Discuss the classification of signals and also draw the waveforms and necessary equations. **(08 Marks)**

b. Determine whether the given signal is energy or power signal. Also find the values of 'E' and 'P'. i) $x(t) = e^{-3t} . u(t)$ ii) $x(t) = \cos t$. **(08 Marks)**

c. Sketch the odd and even component of the given signal x(t), shown in fig. Q1(c) below. **(04 Marks)**

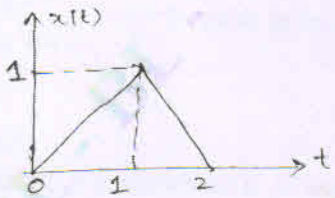

Fig. Q1(c)

OR

2 a. Determine whether the following signals are periodic or non – periodic signals and also find the fundamental period.
i) $x(t) = \cos 2t + \sin 3t$ ii) $x(n) = \cos(0.01 \pi n)$ iii) $x(n) = \sin 3n$. **(06 Marks)**

b. Define System. Discuss any four properties of system. **(08 Marks)**

c. For the following system, determine whether the system is :
i) Linear ii) Time – Invariant iii) Memory less iv) Causal v) stable.
Given $y(t) = e^{x(t)}$. **(06 Marks)**

Module-2

3 a. Calculate the 8 – point DFT of the sequence $x(n) = \{1, 1, 1, 1, 0, 0, 0, 0\}$. Also plot the magnitude and phase plot. **(10 Marks)**

b. The sequence $x(n) = \{3, 0, -2, 0, 2, 1, 0, -2, -1, 0\}$ is filtered through a filter whose impulse response is $h(n) = \{1, 1, 1\}$. Compute the output of the filter y(n) using Overlap – Add method. Use 5 – point circular convolution. **(10 Marks)**

OR

4 a. State and prove the following properties of DFT.
i) Periodicity property ii) Linearity property. **(08 Marks)**

b. Determine the circular convolution of the sequences using DFT – IDFT method.
$x_1(n) = \{2, 1, 2, 1\}$ & $x_2(n) = \{1, 2, 3, 4\}$. **(08 Marks)**

c. Determine the IDFT of the following sequence :
$x(k) = \{1, 1 - j\,1.414, 1, 1 + j\,1.414\}$. **(04 Marks)**

Module-3

5 a. Define FFT. Discuss the number of multiplications and additions required for N = 8 and N = 16. Also find the speed improvement factor. **(06 Marks)**

b. Discuss the similarities and differences between DIT – FFT and DIF – FFT algorithm. **(04 Marks)**

c. Develop the 8 – point DIT – FFT Radix – 2 algorithm and also draw the signal flow graph. **(10 Marks)**

OR

6 a. Determine the DFT of the given sequence
$x(n) = \{2, 1, 4, 6, 5, 8, 3, 9\}$ using DIF – FFT algorithm. **(10 Marks)**

b. Find the DFT of the sequence $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using DIT – FFT algorithm. **(10 Marks)**

Module-4

7 a. Discuss the difference between IIR and FIR filter. **(04 Marks)**

b. Design an analog Butterworth filter with maximally flat response in the pass band and an acceptable attenuation of -2 dB at 10 rad/sec. The attenuation in the stop band should be more than -10dB beyond 20 rad/sec. **(10 Marks)**

c. Transform the analog filter $H(s) = \dfrac{s+0.1}{(s+0.1)^2+9}$ into a digital filter using Impulse Invariant transformation. **(06 Marks)**

OR

8 a. Explain the bilinear transformation method of converting analog filter into digital filter. Show the mapping from S - plane to Z - plane, also obtain the relation between 'w' and 'Ω'. **(08 Marks)**

b. Develop the Direct form – I , Direct form – II , Cascade and Parallel form realization structures for the following difference equation.
$y(n) = 0.75y(n-1) - 0.125y(n-2) + 6x(n) + 7x(n-1) + x(n-2)$. **(12 Marks)**

Module-5

9 a. Define window function. Explain the different types of window functions with necessary equations. Also draw the time domain and magnitude response plot for each type. **(10 Marks)**

b. Design the symmetric FIR filter whose desired frequency response is given by

$$H_d(w) = \begin{cases} e^{-jw\tau} & \text{for } |w| \le w_c \\ 0 & \text{otherwise} \end{cases}$$. Use Rectangular window.

The length of the filter should be 7 and $w_c = 1$ rad/sample. Use Rectangular window. **(10 Marks)**

OR

10 a. Design the symmetric FIR low pass filter whose desired frequency is given as

$$H_d(e^{jw}) = \begin{cases} e^{-j3w} & \dfrac{-3\pi}{4} \le w \le 3\pi/4 \\ 0 & \dfrac{3\pi}{4} < |w| \le \pi \end{cases}$$. Determine $H(e^{jw})$ for m = 7. Use Hamming window. **(10 Marks)**

b. Realize the following system transfer function in Direct form realization
$H(z) = 1 + \frac{3}{4} z^{-1} + \frac{17}{8} z^{-2} + \frac{3}{4} z^{-3} + z^{-4}$. **(04 Marks)**

c. Realize the following system transfer function in linear – phase realization techniques.
$H(z) = \frac{1}{2} + \frac{1}{7} z^{-1} + \frac{17}{8} z^{-2} + \frac{3}{4} z^{-3} + \frac{1}{4} z^{-4} + \frac{1}{2} z^{-5}$. **(06 Marks)**

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21EE652

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025
Renewable Energy Resources

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Briefly explain energy resources and its classification. **(10 Marks)**

b. Define the following terms:
i) Solar azimuth angle
ii) Zenith angle
iii) Declination angle
iv) Incident angle
v) Altitude angle **(10 Marks)**

OR

2 a. Discuss causes of energy scarcity and solution to energy scarcity. **(10 Marks)**

b. Discuss Indian renewable energy availability. **(05 Marks)**

c. Explain solar radiation at earth surface with neat diagram. **(05 Marks)**

Module-2

3 a. Explain the advantages of solar pond. Discuss the operation of solar pond with neat diagram. **(10 Marks)**

b. With the help of diagram, explain solar cooker and mention advantages and disadvantages of it. **(10 Marks)**

OR

4 a. Draw and explain I – V characteristics of solar cell and the factors limiting two efficiency of the cell. **(10 Marks)**

b. Explain the various applications of solar cell systems. **(05 Marks)**

c. Explain solar cell material. **(05 Marks)**

Module-3

5 a. State and explain methods of hydrogen production technologies. **(08 Marks)**

b. Discuss the applications, advantages and disadvantages of hydrogen energy. **(06 Marks)**

c. Describe the main consideration in selecting a site for wind generators. **(06 Marks)**

OR

6 a. With necessary diagram, explain waste recovery management scheme. **(10 Marks)**

b. Write the advantages and disadvantages of waste recycling. **(06 Marks)**

c. Discuss the recycling of plastics. **(04Marks)**

Module-4

7 a. With a neat sketch, explain updraft and down draft gasifiers. **(10 Marks)**

b. Explain the advantages and uses of biogas. **(10 Marks)**

OR

8 a. Explain the single basin and two basin systems of tidal power harnessing. **(10 Marks)**

b. With a neat diagram floating dome type biogas plant. **(10 Marks)**

Module-5

9 a. Explain the various devices for harnessing wave energy. **(08 Marks)**

b. Explain open cycle and closed cycle OTEC techniques. **(12 Marks)**

OR

10 a. Write the advantages and disadvantages of wave power. **(08 Marks)**

b. Discuss application of OTEC in addition to produce electricity. **(08 Marks)**

c. Distinguish between land based OTEC and floating OTEC power plant. **(04 Marks)**

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21EE71

Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025
High Voltage and Power System Protection

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is Paschen's law? How do you account for the minimum voltage for breakdown under a given "pxd" condition? **(08 Marks)**

b. Derive an expression for the current in the air gap that is $I = I_o e^{\alpha d}$ considering Town send's first ionization co-efficient. **(07 Marks)**

c. In an experiment in a certain gas it was found that the steady state current is 5.5×10^{-8} A at 8 kV at a distance of 0.4 cm between the plane electrodes. Keeping the field constant and reducing the distance to 0.1 cm results in a current of 5.5×10^{-9}A. Calculate Townsend's primary ionization coefficient α. **(05 Marks)**

OR

2 a. Explain the following breakdown mechanism in solid:
i) Electromechanical breakdown
ii) Thermal breakdown. **(08 Marks)**

b. Explain briefly suspended particle theory of breakdown in liquid dielectric. **(06 Marks)**

c. Explain streamer theory. **(06 Marks)**

Module-2

3 a. Explain with a neat sketch, how 3-stage cascaded transformer generates HVAC. **(08 Marks)**

b. Explain the principle of a resonant transformer. **(06 Marks)**

c. With a neat sketch, explain the Marx circuit arrangement for multistage impulse generator. **(06 Marks)**

OR

4 a. Explain the principle of operation of an electrostatic voltmeter for measurement of very high dc and ac voltages. **(07 Marks)**

b. With a neat sketch, explain the working of Rogowiski coil for high impulse current measurement. **(06 Marks)**

c. Explain discharge detection using straight detectors for partial discharge measurement. **(07 Marks)**

Module-3

5 a. Draw the schematic diagram of numerical relay and briefly explain the functions of its various components. **(06 Marks)**

b. Briefly explain the essential qualities of a protective relays. **(05 Marks)**

c. Derive an expression for torque produced by an induction relay. **(09 Marks)**

OR

6 a. Explain the various time-current characteristics of over current relays. **(08 Marks)**

b. Discuss a protective scheme for ring main feeders. **(06 Marks)**

c. Explain the operating principle of reverse power or directional relay with neat diagram. **(06 Marks)**

Module-4

7 a. With a neat sketch, explain the principle of operation, torque equation and operating characteristics of impedance relay. **(08 Marks)**

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

c. Explain the MHO relay characteristics in the R-X diagram. **(04 Marks)**

OR

8 a. Explain the protection of a generator against:

i) Stator inter turn fault

ii) Loss of excitation. **(08 Marks)**

b. With schematic diagram, explain balanced (opposed) voltage differential protection. **(06 Marks)**

c. Give notes on frame leakage protection. **(06 Marks)**

Module-5

9 a. Define: i) Restriking voltage ii) Recovery voltage. Derive the expression for restriking voltage and rate of rise of restriking voltage. **(10 Marks)**

b. With the help of neat diagram, explain the working of cross-blast and axial-blast circuit breakers. **(10 Marks)**

OR

10 a. Explain the lighting phenomena with the help of relevant diagrams. **(06 Marks)**

b. Write short notes on:

i) Klydonograph

ii) Magnetic link. **(06 Marks)**

c. Explain the term insulation coordination. Describe the construction of volt-time curve and terminology associated with impulse testing. **(08 Marks)**

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21EE72

Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025
Power System Operation and Control

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What are the operating states of a power system? Explain them in brief showing transition of states with a block diagram. **(10 Marks)**

b. List and briefly explain any five key concepts of reliable operation of power systems. **(05 Marks)**

c. Explain the major components of energy management center. **(05 Marks)**

OR

2 a. With a neat diagram, explain the general configuration and major components of SCADA system. **(10 Marks)**

b. List and briefly explain the classification of SCADA systems with relevant diagrams. **(10 Marks)**

Module-2

3 a. With a schematic diagram, explain the frequency and excitation voltage regulators of turbo generators. **(10 Marks)**

b. Explain function of proportional plus integral controller in Automatic Generation Control (AGC) with relevant block diagram. **(10 Marks)**

OR

4 a. Derive the generator model, load model and combined generator load model of automatic load frequency control system. **(10 Marks)**

b. Given a control area with 3 generating units with following ratings:

Unit	Rating (MVA)	%R (on machine base)
1	200	0.01
2	500	0.025
3	750	0.04

The units are loaded as follows: P_1 = 100 MW, P_2 = 400 MW and P_3 = 600 MW. If load increased by 200 MW, what are new generations if D = 0? Repeat for D = 1.0. **(10 Marks)**

Module-3

5 a. Explain optimal two area load frequency control by state variable. **(10 Marks)**

b. Two control areas are connected via a tie line with the following characteristics:
Area 1 : R_1 = 1%, D_1 = 0.8, Base MVA = 500
Area 2 : R_2 = 2%, D_2 = 1.0, Base MVA = 500
If a load increase of 100 MW occurs in Area 1, what is the new steady state frequency and the change in tie line flow if the nominal frequency is 50 Hz? Repeat if the load change occurs in Area 2. **(10 Marks)**

OR

6 a. With a neat schematic diagram, explain automatic voltage control of generator. **(08 Marks)**

b. Explain in detail speed governor dead band and its effect on AGC. **(06 Marks)**

c. Two control areas of capacity 1500 MW and 10,000 MW are interconnected through a tie-line. The parameters of each area on its own capacity are R = 1 Hz/pu MW and D = 0.02 pu MW/HZ. There is an increase of 200 MW in load of area 2. Determine the steady-state frequency deviation and change in tie-line power. **(06 Marks)**

Module-4

7 a. Explain the different methods of voltage control by transformers. **(10 Marks)**

b. Three generating stations are connected to a common bus X as shown in Fig.Q.7(b) below. For a particular load, the line voltage at the bus bar falls by 2 KV. Calculate the reactive power injection required to bring back the voltage to original value. All are in pu values on base of a 500 MVA. **(10 Marks)**

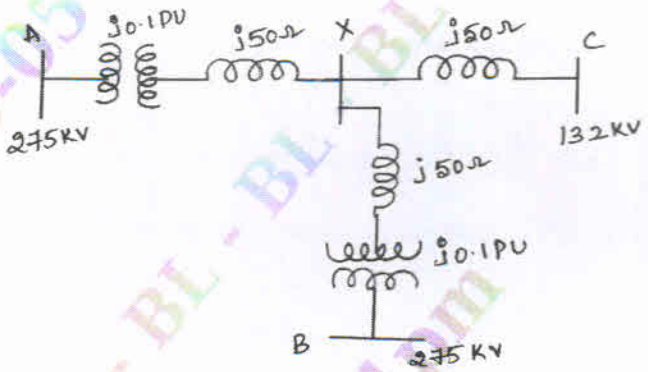

Fig.Q.7(b)

OR

8 a. Write a short note on absorption of reactive power and sensitivity of voltage. **(10 Marks)**

b. Explain the different methods of voltage control by reactive power injection. **(10 Marks)**

Module-5

9 a. Explain the power system security levels and major factors affecting security. **(10 Marks)**

b. Explain IPIQ method for contingency raking. Also explain the contingency processing using AC load flow analysis with a flow chart. **(10 Marks)**

OR

10 a. Explain the formulation and state estimate using linear square estimation. **(10 Marks)**

b. Explain with neat flowchart contingency analysis for line outage, using outage distribution factors. **(10 Marks)**

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21EE744

Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025
Industrial Drives and Applications

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With relevant block diagram, explain the essential parts of electric drive. **(06 Marks)**

b. Obtain expressions for equivalent load torque and equivalent moment of inertia of a motor drive with (i) Rotational Motion (ii) Translational motion loads. **(08 Marks)**

c. A motor equipped with a flywheel is to supply a load torque of 1000 N-m for 10 sec followed by a light load period of 200 N-m long enough for the fly wheel to regain its steady state speed. It is decided to limit the motor torque to 700 N-m. What should be the moment of inertia of flywheel? Motor has an inertia of 100 kg m^2. Its no load speed is 500 rpm and the slip at a torque of 500 Nm is 5%. Assume speed torque characteristic of motor to be a straight line in the region of interest. **(06 Marks)**

OR

2 a. Explain the speed torque conventions and multi-quadrant operation of hoist load. **(08 Marks)**

b. A weight of 500 kg being lifted up at a uniform speed of 1.5 m/sec by a winch driven by a motor running at a speed of 1000 rpm. The moment of inertia of the motor and winch are 0.5 and 0.3 kg m^2 respectively. Calculate the motor torque and equivalent MI referred to the motor shaft. In the absence of weight the motor develops a torque of 100 N-m when running at 1000 rpm. **(08 Marks)**

c. With relevant block diagram, discuss the operation of closed loop position control. **(04 Marks)**

Module-2

3 a. Explain the single phase fully controlled rectifier control of separately excited DC motor. Also obtain equations for average output voltage V_a and speed W_m. Assume discontinuous conduction mode. **(08 Marks)**

b. Explain chopper control of separately excited dc motor for regenerative braking. **(06 Marks)**

c. A 220 V, 70A dc series motor has combined resistance of armature and field of 0.12 Ω. Running on no load with the field winding connected to a separate source it gave the following magnetization characteristic at 600 rpm.

Field current, A	10	20	30	40	50	60	70	80
Terminal voltage, V	64	118	150	170	184	194	202	210

Motor is controlled by a chopper with a source voltage = 220 V.
Calculate (i) Motor speed for a duty ratio 0.6 and motor current of 60 A. (ii) Torque for a speed of 400 rpm and duty ratio of 0.65 **(06 Marks)**

OR

4 a. Explain the multi-quadrant operation of DC separately excited motor using single phase fully controlled rectifier with reversing switch. **(08 Marks)**

b. A 220 V, 960 rpm, 12.8 A separately excited dc motor has armature circuit resistance and inductance 2 Ω and 150 mH respectively. It is fed from a single phase half controlled rectifier with an ac source voltage of 230 V, 50 Hz calculate
(i) Motor torque for $\alpha = 60°$ and speed = 600 rpm
(ii) Motor speed for $\alpha = 60°$ and T = 20 N-m **(08 Marks)**

c. Explain chopper control of series motor for regenerative braking. **(04 Marks)**

Module-3

5 a. Explain the effect of unbalanced source voltages and single phasing on 3ϕ Induction Motor. **(08 Marks)**

b. Explain the reverse voltage braking of an IM. **(06 Marks)**

c. A 2200 V, 50 Hz, 3 phase, 6 pole star connected squirrel cage induction motor has the following parameters. $R_s = 0.075\ \Omega$, $R'_r = 0.12\ \Omega$, $X_s = X'_r = 0.5\ \Omega$. The combined inertia of motor and load is 100 kg m^2.
(i) Calculate time taken and energy dissipated in the motor during starting.
(ii) Time taken to stop motor by plugging. **(06 Marks)**

OR

6 a. Explain ac dynamic braking of 3ϕ IM with (i) Two lead (ii) Three lead connections. **(10 Marks)**

b. Explain variable voltage frequency control technique of controlling speed of IM. **(10 Marks)**

Module-4

7 a. Explain the operation of voltage source inverter fed induction motor drives. Also sketch various schemes of VSI fed induction motor drive. **(08 Marks)**

b. Explain the closed loop control for VIS controlled 3ϕ IM. **(06 Marks)**

c. A star connected squirrel cage IM has the following rating and parameters : 400 V, 50 Hz, 4 pole , 1370 rpm. $R_s = 2\ \Omega$, $R'_r = 3\ \Omega$, $X_s = X'_r = 3.5\ \Omega$, $X_m = 55\ \Omega$. It is controlled by a current source inverter at a constant flux. Determine motor torque, speed and stator current when operating at 30 Hz and rated slip speed. **(06 Marks)**

OR

8 a. Explain the 3ϕ IM fed from a variable frequency CSI. What are its advantages and disadvantages? **(08 Marks)**

b. Explain the closed loop control for CSI controlled 3ϕ IM. **(06 Marks)**

c. With schematic diagram explain the variable frequency control of multiple synchronous motors. **(06 Marks)**

Module-5

9 a. Explain the self controlled synchronous motor drive employing load commutated thysistor inverter. **(10 Marks)**

b. Explain brushless dc motor drive for servo application. **(10 Marks)**

OR

10 a. With necessary circuit, analyse the operation of inverter fed brushless dc motor drive. **(08 Marks)**

b. What is stepper motor? Discuss the important features and disadvantages of stepper motor. **(06 Marks)**

c. With the schematic diagram, explain various stages of textile mill in brief. **(06 Marks)**

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21EE755

Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025
Energy Conservation and Audit

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State the salient features of energy conservation Act 2001. **(10 Marks)**

b. "Energy saved is energy conserved", Justify the statement. **(10 Marks)**

OR

2 a. "Increase in energy demand raises air pollution which leads to climate change" – Elaborate. **(10 Marks)**

b. i) Explain commercial and non-commercial sources of energy. **(05 Marks)**
ii) Explain renewable and non-renewable sources of energy. **(05 Marks)**

Module-2

3 a. How energy efficient is achieved in transformers, motors and soft starters? **(10 Marks)**

b. Explain the importance of electrical load management, maximum demand control and power factor improvement. **(10 Marks)**

OR

4 a. i) How energy efficient lighting is achieved? **(06 Marks)**
ii) List the measures of energy efficiency in lighting system. **(04 Marks)**

b. Explain energy conservation opportunities in fans and pumps. **(10 Marks)**

Module-3

5 a. Explain in detail different types of measuring equipment used in energy audit. **(10 Marks)**

b. Define energy audit as per Indian energy conservation act 2001. Explain its importance. **(10 Marks)**

OR

6 a. Explain 10-step methodology for detailed energy audit. **(10 Marks)**

b. What are the different types of audits? Explain. **(10 Marks)**

Module-4

7 a. Nowadays why electricity is considered as a commodity? Explain its distinguishing features. **(10 Marks)**

b. Explain :
i) Scheduling and dispatch **(05 Marks)**
ii) Congestion management. **(05 Marks)**

OR

8 a. Explain the 4-pillars of market design. **(10 Marks)**

b. What is ABT? What are the broad features of ABT? **(10 Marks)**

Module-5

9 a. Explain how energy saving is achieved in new and existing buildings. **(10 Marks)**

b. How Demand Side Management (DSM) strategy is applied to load management? **(10 Marks)**

OR

10 a. Explain the methodology of water audit. **(10 Marks)**

b. Explain the tariff options for DSM. **(10 Marks)**

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