

CBCS SCHEME

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BBEE103/203

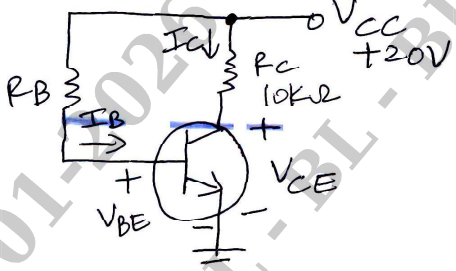
First/Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Basic Electronics

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.	Explain the forward and reverse characteristics of a PN junction diode.	8	L2	CO1
	b.	Explain the working of Zener diode as a voltage regulator.	7	L2	CO1
	c.	A diode with $V_F = 0.7V$ is connected as a half wave rectifier. The load resistance is 500Ω and the (rms) AC input is 22V. Determine the peak output voltage, the peak load current and the diode peak reverse voltage.	5	L3	CO1
OR					
2	a.	Explain the working of full wave rectifier reservoir capacitor circuit with waveforms.	8	L2	CO2
	b.	Explain the DC load line analysis of a PN junction diode.	7	L2	CO1
	c.	A Zener diode with $V_Z = 4.3V$ has Z_Z equal to 22Ω when $I_Z = 20mA$. Calculate the upper and lower limits of V_Z when I_Z changes by $\pm 5mA$.	5	L3	CO1
Module – 2					
3	a.	Draw the DC Load line for the circuit shown in Fig.Q3(a), when $R_C = 12K\Omega$.	5	L3	CO2
		 <p style="text-align: center;">Fig.Q3(a)</p>			
	b.	Explain the working of BJT as an amplifier.	7	L2	CO2
	c.	Explain the common emitter input and output characteristics.	8	L2	CO2
OR					
4	a.	Explain the construction, working and characteristics of an n-channel depletion – enhancement MOSFET.	10	L2	CO2
	b.	Explain the construction, working and characteristics of on n–channel JFET.	10	L2	CO2

Module – 3

5	a.	List the ideal characteristics of an Op-Amp.	5	L2	CO2
	b.	Explain the following Op-Amp parameters. i. Input offset current ii. Slew rate iii. PSRR iv. CMRR.	8	L2	CO2
	c.	Explain the operation of Op-Amp with the help of a block diagram.	7	L2	CO2

OR

6	a.	Design an adder circuit using Op-Amp to obtain an output voltage, $V_0 = -[2V_1 + 3V_2 + 5V_3]$, Assume $R_F = 10\text{ K}\Omega$.	6	L3	CO2
	b.	Explain the working of Op-Amp as a non-inverting operational amplifier.	7	L2	CO2
	c.	Explain the working of Op-Amp as an integrator.	7	L2	CO2

Module – 4

7	a.	State and prove Demorgan's theorem.	4	L2	CO3
	b.	Perform the following conversions : i. $(1234.56)_8 = (?)_{10}$ ii. $(10110101001.101011)_2 = (?)_{16}$ iii. $(988.86)_{10} = (?)_2$ iv. $(532.65)_{10} = (?)_{16}$ v. $(ABCD.EF)_{16} = (?)_8$.	10	L3	CO3
	c.	Subtract using 2's complement representation. $(15)_{10} - (28)_{10}$.	6	L3	CO3

OR

8	a.	Simplify the following Boolean expression : $\overline{XY + XYZ + X(Y + XY)}$.	6	L3	CO3
	b.	Explain the following gates : i) X – NOR ii) NAND iii) OR.	6	L2	CO3
	c.	Explain the working of full adder with circuit diagram and truth table.	8	L2	CO3

Module – 5

9	a.	Explain the elements of a communication system.	8	L2	CO4
	b.	Explain the working of Resistive transducer with neat circuit diagram.	7	L2	CO5
	c.	Explain about thermal transducers.	5	L2	CO5

OR

10	a.	Explain the working of piezoelectric transducer with circuit diagram.	8	L2	CO5
	b.	Explain about inductive transducers.	6	L2	CO5
	c.	Define Modulation. Explain the need for modulation.	6	L2	CO4

CBGS SCHEME

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BCHEE102/202

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Chemistry for EES

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.
3. VTU Formula Hand Book is permitted.*

Module – 1			M	L	C
Q.1	a.	Explain classification of materials as conductors insulators and semi conductors on the basis of band theory.	7	L2	CO1
	b.	Explain the production of electronic grade silicon by Float Zone (F2) method.	6	L2	CO1
	c.	What is Electroless Plating? Describe electroless plating of copper in the manufacture of double – sided PCB.	7	L2	CO1
OR					
Q.2	a.	A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions. 2g of 2000 molecular weight, 3g of 3000 molecular weight and 5g of 5000 molecular weight. Determine number average and weight average molecular weight. Find the index of polydispersity.	7	L3	CO1
	b.	Explain the preparation , properties and commercial applications of graphene oxide.	7	L2	CO1
	c.	What are Conducting Polymers? Explain the synthesis and mechanism of polyacetylene.	6	L2	CO1
Module – 2					
Q.3	a.	What are Batteries? Explain the classification of batteries with suitable example.	7	L2	CO2
	b.	Explain the construction and working of Lithium – Polymer battery. Mention its applications.	7	L2	CO2
	c.	What are Photovoltaic Cell? Describe the construction and working of a photovoltaic cell. Mention its advantages and disadvantages.	6	L2	CO2
OR					
Q.4	a.	What are Fuel cells? Explain the construction and working of methanol – oxygen fuel cell.	7	L2	CO2
	b.	What are Flow Batteries? Explain the construction and working of vanadium redox flow battery. Mention its applications.	7	L2	CO2

	c.	Explain the construction and working of sodium – ion battery. Mention its applications.	6	L2	CO2
Module – 3					
Q.5	a.	What is Metallic Corrosion? Explain electrochemical theory of corrosion taking iron as an example.	7	L2	CO3
	b.	Write a note on : i) Differential Metal Corrosion ii) Differential Aeration Corrosion	6	L2	CO3
	c.	What is E – waste? Explain the methods of e – waste disposal (any 3).	7	L2	CO3
OR					
Q.6	a.	Describe the extraction of copper and gold for e – waste.	7	L2	CO3
	b.	Explain the anodization process of corrosion protection.	6	L2	CO3
	c.	What is CPR? A sheet of corroded steel vessel was found in a submerged vessel. It was estimated that the original area of the plate was 10 inch ² and that approximately 2.6 kg has corroded away during the submersion. Assuming a corrosion penetration rate of 200 mpy for this metal in sea water, estimate the time of submersion in gears (Density of the metal is 7.9 g/cm ³).	7	L3	CO3
Module – 4					
Q.7	a.	What are Nano Materials? Explain any two size dependent properties of nano materials.	7	L2	CO4
	b.	Describe the synthesis of Nano materials by sol – gel method with example.	7	L2	CO4
	c.	Write a note on Nano fibers and Nano sensors.	6	L2	CO4
OR					
Q.8	a.	What are Liquid Crystals? Explain the classification and properties of liquid crystals.	7	L2	CO4
	b.	What are Perovskite Materials? Give the properties and applications of perovskite materials in optoelectronic devices.	7	L2	CO4
	c.	Describe the synthesis of nano materials by co-precipitation method with example.	6	L2	CO4

Module – 5					
Q.9	a.	What are Reference Electrodes? Describe construction and working of calomel electrode.	7	L2	CO5
	b.	What is ion selective electrode? Explain the construction and working of glass electrode.	6	L2	CO5
	c.	Explain the principle , instrumentation and the application of potentiometric sensor in the estimation of Iron.	7	L3	CO5
OR					
Q.10	a.	Explain the principle , instrumentation and application of Colorimetric sensor in the estimation of copper.	7	L3	CO5
	b.	Explain how the strength of weak acid determined using a conductometric sensor.	7	L2	CO5
	c.	What are concentration cells? The EMF of the cell $\text{Cd} \text{Cd}^{2+} (0.0093 \text{ M}) \text{Cd}^{2+} (x \text{ M}) \text{Cd}$ is 0.086 V at 25°C. Find the value of 'x'.	6	L3	CO5

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BEEE103/203

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Elements of Electrical Engineering

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	State and explain Kirchoff's laws.	6	L2	CO1
	b.	A circuit consists of two parallel resistors having resistances of 20 Ω and 30 Ω respectively connected in series with 15 Ω. If the current through 15 Ω resistor is 3 A. Find (i) Current in 20 Ω and 30 Ω resistors. (ii) The voltage across the whole circuit (iii) The total power and power consumed in all resistances.	8	L3	CO3
	c.	State and explain Fleming's Rules.	6	L2	CO1
OR					
Q.2	a.	Define the co-efficient of coupling. Develop the relation between Self-inductances, mutual inductance with the co-efficient of coupling.	8	L2	CO1
	b.	A coil consists of 600 turns and a current of 10 A in the coil gives rise to a magnetic flux of 1 mWb. Determine (i) Self Inductance (ii) The emf induced (iii) Energy stored when the current is reversed in 0.01 sec.	6	L3	CO3
	c.	State and explain Ohm's law. List its limitations.	6	L1	CO1
Module – 2					
Q.3	a.	Develop the expression for effective value of an Alternating current which is sinusoidally varying.	6	L3	CO2
	b.	Given $V = 200 \sin 377t$ volts, $i = 8 \sin(377t - 30^\circ)$ Amps, for an AC circuit. Determine (i) Power factor (ii) True power (iii) Apparent power (iv) Reactive power.	8	L3	CO2
	c.	Justify with relevant circuit, waveform and phasor diagram, a pure inductor does not consume any power.	6	L3	CO2
OR					
Q.4	a.	Develop the expression for Real power in a series R-L circuit with necessary phasor diagram and equations.	6	L3	CO2
	b.	In a series-parallel circuit, the two parallel branches A and B are in series with C. The impedances are $Z_A = (10 - j8)\Omega$, $Z_B = (9 - j6)\Omega$, $Z_C = (3 + j2)\Omega$. The voltage across branch 'C' is 100 V. Find the currents I_A and I_B , and phase difference between them.	8	L3	CO3

	c.	Define the following terms with respect to A.C. circuits : (i) Frequency (ii) Time period (iii) Form factor (iv) Peak factor.	6	L1	CO2
Module – 3					
Q.5	a.	List the advantages of Three-phase system over single-phase system.	6	L2	CO2
	b.	Develop the relationship between the phase and line values of voltages and currents in a balanced delta connected system.	8	L3	CO2
	c.	A three phase, 230 V, supply is given to a balanced load which is delta connected. Impedance in each phase of the load is $(8+j6) \Omega$. Determine the phase current and total power consumed.	6	L3	CO2
OR					
Q.6	a.	Justify with relevant phasor diagram, that only two wattmeters are sufficient to measure three phase power.	8	L3	CO2
	b.	A balanced three phase star connected load draws power from 440 V supply. The two wattmeters connected indicate $W_1 = 5 \text{ kW}$, $W_2 = 1.2 \text{ kW}$. Find power, power factor, current in the circuit.	6	L3	CO2
	c.	Define phase sequence, balanced load, balanced supply with respect to three phase a.c. circuits.	6	L1	CO2
Module – 4					
Q.7	a.	Explain the construction and working principle of Wheatstone Bridge.	8	L2	CO4
	b.	Elaborate two-way and three-way control of load with relevant circuit and truth table.	6	L2	CO4
	c.	Compare between current transformer and potential transformer.	6	L2	CO4
OR					
Q.8	a.	Explain casing, capping type of wiring.	6	L2	CO5
	b.	Give an outline on Megger.	8	L2	CO5
	c.	Explain Schering Bridge used for measuring capacitance.	6	L2	CO5
Module – 5					
Q.9	a.	Explain the working principle of a Fuse. List its merits and demerits.	8	L2	CO5
	b.	Define Electric Shock. List the precautions to avoid shock.	6	L1	CO5
	c.	Elaborate Two-part tariff in electricity.	6	L2	CO5
OR					
Q.10	a.	Define Earthing. With neat sketch, explain plate Earthing.	8	L2	CO5
	b.	Give an outline on Earth Leakage Circuit Breaker (ELCB).	6	L2	CO5

	<p>c. Estimate the electricity bill amount for a month of 31 days. If the following devices are used as specified.</p> <p>(i) 3 bulbs of 40 W for 6 hrs</p> <p>(ii) 4 tube lights of 50 W for 8 hrs.</p> <p>(iii) A TV of 120 W for 6 hrs.</p> <p>Give rate of electricity = Rs.2.50 / watt</p>	6	L3	CO5
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CBCS SCHEME

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BESCK104B

First Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Introduction to Electrical Engineering

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	Write the general structure of electrical power system using single line diagram approach and explain briefly.	06	L2	CO5
	b.	With neat diagram, explain Hydro-electric power plant.	08	L2	CO1
	c.	The current in $6\ \Omega$ resistance of network shown in Fig.Q1(c) is 2A. Determine current in all branches and applied voltage.	06	L3	CO2
<p style="text-align: center;">Fig.Q1(c)</p>					
OR					
Q.2	a.	What are conventional and non conventional energy resources? Explain briefly.	06	L2	CO1
	b.	With neat diagram explain Nuclear Power Plant.	08	L2	CO1
	c.	For the network shown in Fig. Q2(c), find current in all branches and power consumed in all resistances.	06	L3	CO2
<p style="text-align: center;">Fig. Q2(c)</p>					
Module – 2					
Q.3	a.	Define (i) Power Factor (ii) Reactive Power (iii) Apparent Power and write their equations.	06	L2	CO2
	b.	Derive Equation for power in R-L series circuit excited by sinusoidal wave form.	08	L2	CO2

	c.	Find number of turns on primary and secondary side of a 440/230 V, 50 Hz, 1- ϕ transformer, if the net area of X-section of core is 30 cm ² and maximum value of flux density is 1 wb/m ² .	06	L3	CO4
OR					
Q.8	a.	Explain concept of rotating magnetic field in 3- ϕ , induction motor.	08	L2	CO4
	b.	Explain with neat diagram, construction of squirrel cage and wound rotor.	06	L2	CO4
	c.	A 3- ϕ 4-pole, 440 V, 50 Hz induction motor runs with slip of 4%. Find the rotor speed and frequency of rotor current.	06	L3	CO4
Module – 5					
Q.9	a.	With neat diagram and truth table, explain 2-way control of lamp.	06	L2	CO5
	b.	What is earthing? Explain pipe earthing.	08	L2	CO5
	c.	Mention safety precaution to avoid shock.	06	L2	CO5
OR					
Q.10	a.	What is tariff? Explain 2-part tariff.	06	L1	CO5
	b.	Explain working of FUSE and MCB.	06	L1	CO5
	c.	What is wiring? List the types of wiring. Give the advantages and disadvantages of casing and capping wiring.	08	L1	CO5

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BBEE103/203

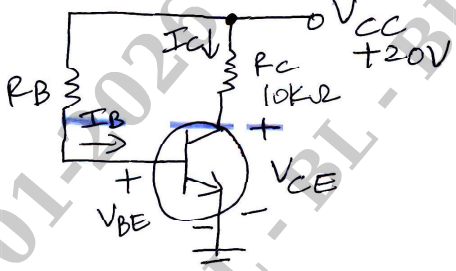
First/Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Basic Electronics

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.	Explain the forward and reverse characteristics of a PN junction diode.	8	L2	CO1
	b.	Explain the working of Zener diode as a voltage regulator.	7	L2	CO1
	c.	A diode with $V_F = 0.7V$ is connected as a half wave rectifier. The load resistance is 500Ω and the (rms) AC input is 22V. Determine the peak output voltage, the peak load current and the diode peak reverse voltage.	5	L3	CO1
OR					
2	a.	Explain the working of full wave rectifier reservoir capacitor circuit with waveforms.	8	L2	CO2
	b.	Explain the DC load line analysis of a PN junction diode.	7	L2	CO1
	c.	A Zener diode with $V_Z = 4.3V$ has Z_Z equal to 22Ω when $I_Z = 20mA$. Calculate the upper and lower limits of V_Z when I_Z changes by $\pm 5mA$.	5	L3	CO1
Module – 2					
3	a.	Draw the DC Load line for the circuit shown in Fig.Q3(a), when $R_C = 12K\Omega$.	5	L3	CO2
		 <p style="text-align: center;">Fig.Q3(a)</p>			
	b.	Explain the working of BJT as an amplifier.	7	L2	CO2
	c.	Explain the common emitter input and output characteristics.	8	L2	CO2
OR					
4	a.	Explain the construction, working and characteristics of an n-channel depletion – enhancement MOSFET.	10	L2	CO2
	b.	Explain the construction, working and characteristics of on n–channel JFET.	10	L2	CO2

Module – 3

5	a.	List the ideal characteristics of an Op-Amp.	5	L2	CO2
	b.	Explain the following Op-Amp parameters. i. Input offset current ii. Slew rate iii. PSRR iv. CMRR.	8	L2	CO2
	c.	Explain the operation of Op-Amp with the help of a block diagram.	7	L2	CO2

OR

6	a.	Design an adder circuit using Op-Amp to obtain an output voltage, $V_0 = -[2V_1 + 3V_2 + 5V_3]$, Assume $R_F = 10\text{ K}\Omega$.	6	L3	CO2
	b.	Explain the working of Op-Amp as a non-inverting operational amplifier.	7	L2	CO2
	c.	Explain the working of Op-Amp as an integrator.	7	L2	CO2

Module – 4

7	a.	State and prove Demorgan's theorem.	4	L2	CO3
	b.	Perform the following conversions : i. $(1234.56)_8 = (?)_{10}$ ii. $(10110101001.101011)_2 = (?)_{16}$ iii. $(988.86)_{10} = (?)_2$ iv. $(532.65)_{10} = (?)_{16}$ v. $(ABCD.EF)_{16} = (?)_8$.	10	L3	CO3
	c.	Subtract using 2's complement representation. $(15)_{10} - (28)_{10}$.	6	L3	CO3

OR

8	a.	Simplify the following Boolean expression : $\overline{XY + XYZ + X(Y + XY)}$.	6	L3	CO3
	b.	Explain the following gates : i) X – NOR ii) NAND iii) OR.	6	L2	CO3
	c.	Explain the working of full adder with circuit diagram and truth table.	8	L2	CO3

Module – 5

9	a.	Explain the elements of a communication system.	8	L2	CO4
	b.	Explain the working of Resistive transducer with neat circuit diagram.	7	L2	CO5
	c.	Explain about thermal transducers.	5	L2	CO5

OR

10	a.	Explain the working of piezoelectric transducer with circuit diagram.	8	L2	CO5
	b.	Explain about inductive transducers.	6	L2	CO5
	c.	Define Modulation. Explain the need for modulation.	6	L2	CO4

CBCS SCHEME

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BEEE103/203

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Elements of Electrical Engineering

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	State and explain Kirchoff's laws.	6	L2	CO1
	b.	A circuit consists of two parallel resistors having resistances of 20 Ω and 30 Ω respectively connected in series with 15 Ω. If the current through 15 Ω resistor is 3 A. Find (i) Current in 20 Ω and 30 Ω resistors. (ii) The voltage across the whole circuit (iii) The total power and power consumed in all resistances.	8	L3	CO3
	c.	State and explain Fleming's Rules.	6	L2	CO1
OR					
Q.2	a.	Define the co-efficient of coupling. Develop the relation between Self-inductances, mutual inductance with the co-efficient of coupling.	8	L2	CO1
	b.	A coil consists of 600 turns and a current of 10 A in the coil gives rise to a magnetic flux of 1 mWb. Determine (i) Self Inductance (ii) The emf induced (iii) Energy stored when the current is reversed in 0.01 sec.	6	L3	CO3
	c.	State and explain Ohm's law. List its limitations.	6	L1	CO1
Module – 2					
Q.3	a.	Develop the expression for effective value of an Alternating current which is sinusoidally varying.	6	L3	CO2
	b.	Given $V = 200 \sin 377t$ volts, $i = 8 \sin(377t - 30^\circ)$ Amps, for an AC circuit. Determine (i) Power factor (ii) True power (iii) Apparent power (iv) Reactive power.	8	L3	CO2
	c.	Justify with relevant circuit, waveform and phasor diagram, a pure inductor does not consume any power.	6	L3	CO2
OR					
Q.4	a.	Develop the expression for Real power in a series R-L circuit with necessary phasor diagram and equations.	6	L3	CO2
	b.	In a series-parallel circuit, the two parallel branches A and B are in series with C. The impedances are $Z_A = (10 - j8)\Omega$, $Z_B = (9 - j6)\Omega$, $Z_C = (3 + j2)\Omega$. The voltage across branch 'C' is 100 V. Find the currents I_A and I_B , and phase difference between them.	8	L3	CO3

	c.	Define the following terms with respect to A.C. circuits : (i) Frequency (ii) Time period (iii) Form factor (iv) Peak factor.	6	L1	CO2
Module – 3					
Q.5	a.	List the advantages of Three-phase system over single-phase system.	6	L2	CO2
	b.	Develop the relationship between the phase and line values of voltages and currents in a balanced delta connected system.	8	L3	CO2
	c.	A three phase, 230 V, supply is given to a balanced load which is delta connected. Impedance in each phase of the load is $(8+j6) \Omega$. Determine the phase current and total power consumed.	6	L3	CO2
OR					
Q.6	a.	Justify with relevant phasor diagram, that only two wattmeters are sufficient to measure three phase power.	8	L3	CO2
	b.	A balanced three phase star connected load draws power from 440 V supply. The two wattmeters connected indicate $W_1 = 5 \text{ kW}$, $W_2 = 1.2 \text{ kW}$. Find power, power factor, current in the circuit.	6	L3	CO2
	c.	Define phase sequence, balanced load, balanced supply with respect to three phase a.c. circuits.	6	L1	CO2
Module – 4					
Q.7	a.	Explain the construction and working principle of Wheatstone Bridge.	8	L2	CO4
	b.	Elaborate two-way and three-way control of load with relevant circuit and truth table.	6	L2	CO4
	c.	Compare between current transformer and potential transformer.	6	L2	CO4
OR					
Q.8	a.	Explain casing, capping type of wiring.	6	L2	CO5
	b.	Give an outline on Megger.	8	L2	CO5
	c.	Explain Schering Bridge used for measuring capacitance.	6	L2	CO5
Module – 5					
Q.9	a.	Explain the working principle of a Fuse. List its merits and demerits.	8	L2	CO5
	b.	Define Electric Shock. List the precautions to avoid shock.	6	L1	CO5
	c.	Elaborate Two-part tariff in electricity.	6	L2	CO5
OR					
Q.10	a.	Define Earthing. With neat sketch, explain plate Earthing.	8	L2	CO5
	b.	Give an outline on Earth Leakage Circuit Breaker (ELCB).	6	L2	CO5

	<p>c. Estimate the electricity bill amount for a month of 31 days. If the following devices are used as specified.</p> <p>(i) 3 bulbs of 40 W for 6 hrs</p> <p>(ii) 4 tube lights of 50 W for 8 hrs.</p> <p>(iii) A TV of 120 W for 6 hrs.</p> <p>Give rate of electricity = Rs.2.50 / watt</p>	6	L3	CO5
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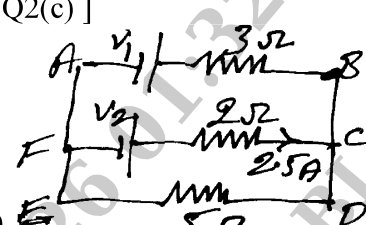
BESCK204B

Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Introduction to Electrical Engineering

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
1	a.	Explain with block diagram power generation in solar power plant.	6	L1	CO1
	b.	Using single line diagram explain general structure of electrical power system.	6	L2	CO5
	c.	A 8 ohms resistor is in series with parallel combination of two resistors 60 ohms and 12 ohms. If the current in the 6 ohms resistor is 5A, determine the total power dissipated in the circuit. i. Find current in each resistor ii. Power dissipated in each resistor iii. Total power dissipated in the circuit.	8	L3	CO2
OR					
2	a.	State Ohm's law, KCL and KVL. Also write limitations of Ohm's law.	6	L1	CO2
	b.	Explain with block diagram, power generation in nuclear power plant.	7	L2	CO1
	c.	Determine the magnitude and direction of current through 3 Ohms resistance and calculate the value of V_1 and V_2 . When the power dissipated in 5 ohms resistor is 125 W. [Refer Fig.Q2(c)]	7	L3	CO2
 <p style="text-align: center;">Fig.Q2(c)</p>					
Module – 2					
3	a.	Define the term : i) RMS value ii) Average value iii) Form factor iv) Crest value v) Frequency.	5	L1	CO2
	b.	For 1- ϕ AC series circuit consists of R and C, draw the phasor diagram and obtain the relation for voltage current and power.	10	L2	CO2
	c.	Obtain the relation for line voltage current and phase voltage and current in star connection.	5	L2	CO2
OR					
4	a.	A series circuit with a resistor of 100 Ω , capacitor of 25 μ f and inductance of 0.15H is connected across 220V, 50Hz supply. Calculate : i) Impedance ii) Current iii) Power iv) Power factor of circuit.	10	L3	CO2
	b.	State the advantages and limitations of generation of 3 ϕ AC over 1 ϕ AC quantity.	5	L1	CO2
	c.	Explain active power, reactive power and apparent power with equation and units for 1-phase AC quantity.	5	L2	CO2

Module – 3

5	a.	With usual notation derive the emf equation of a DC generator.	4	L2	CO3
	b.	A 4-pole, DC shunt motor takes 22A from 220 V supply, The armature and field resistors are respectively 0.5Ω and 100Ω . The armature is lap connected with 300 conductor. If the flux per pole is 20 MWb calculate the speed and gross torque.	8	L3	CO3
	c.	Explain the various characteristics of DC series motor and give its applications.	8	L3	CO4

OR

6	a.	Obtain the torque equation for DC motor.	6	L2	CO3
	b.	With circuit diagram give the relationship between induced emf and terminal voltage for DC shunt generator.	6	L3	CO3
	c.	Give the characteristics of DC shunt motor and its applications.	8	L3	CO4

Module – 4

7	a.	Derive the emf equation of a transformer.	6	L2	CO3
	b.	Find the number of turns on the primary and secondary side of a 440/230V, single phase transformer, if the net cross sectional area is 30 cm^2 and the flux density is 1 wb/m^2 .	7	L3	CO4
	c.	Name the types of 3ϕ induction motor and give the difference between its types.	7	L2	CO4

OR

8	a.	With phasor diagram explain the concept of Rotating Magnetic Field (RMF).	7	L2	CO3
	b.	What are the different losses in transformer and how to overcome it?	7	L2	CO3
	c.	Find the $\eta\%$ of 150 KVA, transformer at i. Full load, UPf ii. 50% of full load, 0.8 pf, If the constant losses is 1400 W and variable losses is 1600 W.	6	L3	CO4

Module – 5

9	a.	With Truth table explain the two-way and three-way control of lamp.	7	L3	CO5
	b.	What is Tariff? Explain two-part Tariff?	6	L2	CO5
	c.	Explain the Plate Earthing with diagram.	7	L1	CO5

OR

10	a.	With neat diagram explain Pipe Earthing.	7	L1	CO5
	b.	Write short notes on fuse and MCB.	7	L2	CO5
	c.	Explain different types of domestic wiring.	6	L1	CO5

CBCS SCHEME

USN

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BEE/BMATE301

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 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. M : Marks , L: Bloom's level , C: Course outcomes.
3. VTU Handbook is permitted.*

Module – 1			M	L	C																					
Q.1	a.	Solve $(D^4 + 8D^2 + 16)y = 0$.	6	L2	CO1																					
	b.	Solve $x^2y'' - 3xy' + 5y = 3 \sin(\log x)$.	7	L2	CO1																					
	c.	Solve $y'' - 4y' + 4y = 8 \cos 2x$.	7	L2	CO1																					
OR																										
Q.2	a.	Solve $(D^2 + 5D + 6)y = x^2$	6	L2	CO1																					
	b.	Solve $(1+x)^2 y'' + (1+x)y' + y = 2 \sin(\log(1+x))$.	7	L3	CO1																					
	c.	Solve $(D^2 - 3D + 2)y = 2 \sin hx$.	7	L2	CO1																					
Module – 2																										
Q.3	a.	Fit a Second degree parabola of the form $y = a + bx + cx^2$ to the following data : <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">x</td> <td style="padding: 2px 5px;">0</td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> </tr> <tr> <td style="padding: 2px 5px;">y</td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">1.8</td> <td style="padding: 2px 5px;">1.3</td> <td style="padding: 2px 5px;">2.5</td> <td style="padding: 2px 5px;">2.3</td> </tr> </table>	x	0	1	2	3	4	y	1	1.8	1.3	2.5	2.3	6	L2	CO2									
	x	0	1	2	3	4																				
	y	1	1.8	1.3	2.5	2.3																				
b.	Ten students got the following ranks in two subjects Maths and Physics : <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">Maths</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">7</td> <td style="padding: 2px 5px;">10</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">5</td> </tr> <tr> <td style="padding: 2px 5px;">Physics</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">10</td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">7</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">6</td> </tr> </table> Find the Rank Correlation Coefficient.	Maths	3	8	9	2	7	10	4	6	1	5	Physics	5	9	10	1	8	7	3	4	2	6	7	L3	CO2
Maths	3	8	9	2	7	10	4	6	1	5																
Physics	5	9	10	1	8	7	3	4	2	6																
c.	Fit a least geometric curve $y = a x^b$ for the data : <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">x</td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> </tr> <tr> <td style="padding: 2px 5px;">y</td> <td style="padding: 2px 5px;">0.5</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">4.5</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">12.5</td> </tr> </table>	x	1	2	3	4	5	y	0.5	2	4.5	8	12.5	7	L2	CO2										
x	1	2	3	4	5																					
y	0.5	2	4.5	8	12.5																					
OR																										
Q.4	a.	Calculate the coefficient of correlation and hence find the lines of regression : <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">x</td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">7</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">9</td> </tr> <tr> <td style="padding: 2px 5px;">y</td> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">10</td> <td style="padding: 2px 5px;">12</td> <td style="padding: 2px 5px;">11</td> <td style="padding: 2px 5px;">13</td> <td style="padding: 2px 5px;">14</td> <td style="padding: 2px 5px;">16</td> <td style="padding: 2px 5px;">15</td> </tr> </table>	x	1	2	3	4	5	6	7	8	9	y	9	8	10	12	11	13	14	16	15	6	L2	CO2	
	x	1	2	3	4	5	6	7	8	9																
y	9	8	10	12	11	13	14	16	15																	
b.	Fit a Straight line $y = ax + b$ for the following data : <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">x</td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">11</td> <td style="padding: 2px 5px;">14</td> </tr> <tr> <td style="padding: 2px 5px;">y</td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">7</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">9</td> </tr> </table>	x	1	3	4	6	8	9	11	14	y	1	2	4	4	5	7	8	9	7	L1	CO2				
x	1	3	4	6	8	9	11	14																		
y	1	2	4	4	5	7	8	9																		

	c.	In a partially destroyed lab record, only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$ respectively. Calculate i) Mean of x and y ii) Correlation coefficient between x and y.	7	L3	CO2																		
Module – 3																							
Q.5	a.	Obtain the Fourier series of $f(x) = \frac{\pi - x}{2}$ in $0 < x < 2\pi$.	6	L2	CO3																		
	b.	Find the Half range cosine series of $f(x) = x(\ell - x)$, $0 \leq x \leq \ell$.	7	L2	CO3																		
	c.	Obtain the constant term and the first cosine and sine terms of Fourier series of y from the following data :	7	L3	CO3																		
<table border="1"> <tbody> <tr> <td>x°</td> <td>0</td> <td>45</td> <td>90</td> <td>135</td> <td>180</td> <td>225</td> <td>270</td> <td>315</td> </tr> <tr> <td>y</td> <td>2</td> <td>$\frac{3}{2}$</td> <td>1</td> <td>$\frac{1}{2}$</td> <td>0</td> <td>$\frac{1}{2}$</td> <td>1</td> <td>$\frac{3}{2}$</td> </tr> </tbody> </table>			x°	0	45	90	135	180	225	270	315	y	2	$\frac{3}{2}$	1	$\frac{1}{2}$	0	$\frac{1}{2}$	1	$\frac{3}{2}$			
x°	0	45	90	135	180	225	270	315															
y	2	$\frac{3}{2}$	1	$\frac{1}{2}$	0	$\frac{1}{2}$	1	$\frac{3}{2}$															
OR																							
Q.6	a.	Find the Fourier series expansion of the function : $f(x) = \begin{cases} x & \text{in } (0, \pi) \\ x - 2\pi & \text{in } (\pi, 2\pi) \end{cases}$ and hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \dots$	6	L2	CO3																		
	b.	Obtain the Sine Half range Fourier series of $f(x) = x^2$ in $0 < x < \pi$.	7	L2	CO3																		
	c.	Obtain the First Harmonic of Fourier series of $f(x)$ from the given data :	7	L3	CO3																		
<table border="1"> <tbody> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>y</td> <td>9</td> <td>18</td> <td>24</td> <td>28</td> <td>26</td> <td>20</td> </tr> </tbody> </table>			x	0	1	2	3	4	5	y	9	18	24	28	26	20							
x	0	1	2	3	4	5																	
y	9	18	24	28	26	20																	
Module – 4																							
Q.7	a.	Find the Complex Fourier transform of $f(x) = \begin{cases} 1 & x \leq a \\ 0 & x > a \end{cases}$ Hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$	6	L2	CO4																		
	b.	Find the Fourier Sine transform of $f(x) = \frac{e^{-ax}}{x}$, $a > 0$	7	L2	CO4																		
	c.	Find the Z-transform of the following : i) $\sin(3n + 5)$ ii) $(2n - 1)^2$	7	L2	CO4																		
OR																							

Q.8	a.	Solve by using Z – transform $Y_{n+2} - 4Y_n = 0$ given that $Y_0 = 0, Y_1 = 2$.	6	L2	CO4																		
	b.	Find the Fourier Sine and Cosine transform of $f(x) = \begin{cases} x & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$	7	L3	CO4																		
	c.	Find the inverse Z transform of $\frac{5z}{(2-z)(3z-1)}$	7	L3	CO4																		
Module – 5																							
Q.9	a.	Find the Mean and Variance of the probability distribution of the following table : <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>x</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>f(x)</td> <td>0.2</td> <td>0.35</td> <td>0.25</td> <td>0.15</td> <td>0.05</td> </tr> </tbody> </table>	x	1	2	3	4	5	f(x)	0.2	0.35	0.25	0.15	0.05	6	L2	CO5						
x	1	2	3	4	5																		
f(x)	0.2	0.35	0.25	0.15	0.05																		
	b.	Given that 2% of the fuses manufactured by a firm are defective. Find the probability that a box containing 200 fuses has i) atleast one defective ii) 3 or more defective.	7	L2	CO5																		
	c.	Define the terms : i) Type I and Type II error ii) Confidence interval iii) Level of significance.	7	L1	CO5																		
OR																							
Q.10	a.	In a normal distribution 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation. Given $A(0.5) = 0.19$ and $A(1.4) = 0.42$.	6	L3	CO5																		
	b.	Ten individuals are chosen at random from a population and their heights in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. Test the Hypothesis that the mean height of the universe is 66 inches [$t_{0.05} = 2.262$] for 9 d.f.	7	L3	CO5																		
	c.	The following table gives the number of accidents that occurred in a large city during the various days of a week. Find whether accidents are uniformly distributed over the week. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Day</th> <th>Sun</th> <th>Mon</th> <th>Tue</th> <th>Wed</th> <th>Thur</th> <th>Fri</th> <th>Sat</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>No. of Accidents</td> <td>14</td> <td>16</td> <td>8</td> <td>12</td> <td>11</td> <td>9</td> <td>14</td> <td>84</td> </tr> </tbody> </table> [The number of degrees of freedom for χ^2 is 6.]	Day	Sun	Mon	Tue	Wed	Thur	Fri	Sat	Total	No. of Accidents	14	16	8	12	11	9	14	84	7	L3	CO5
Day	Sun	Mon	Tue	Wed	Thur	Fri	Sat	Total															
No. of Accidents	14	16	8	12	11	9	14	84															

CBCS SCHEME

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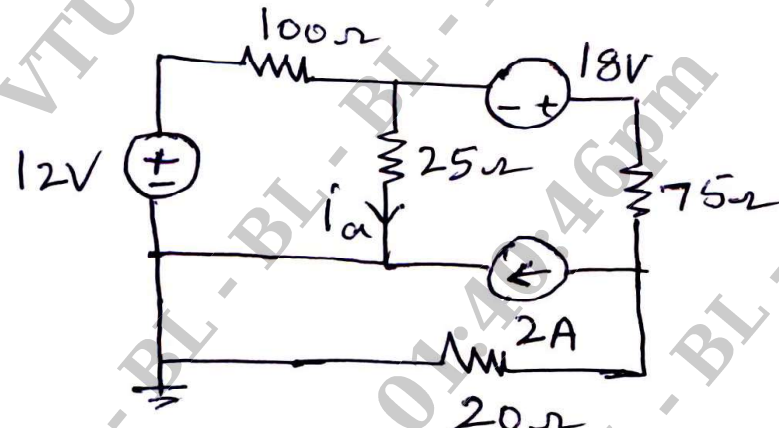
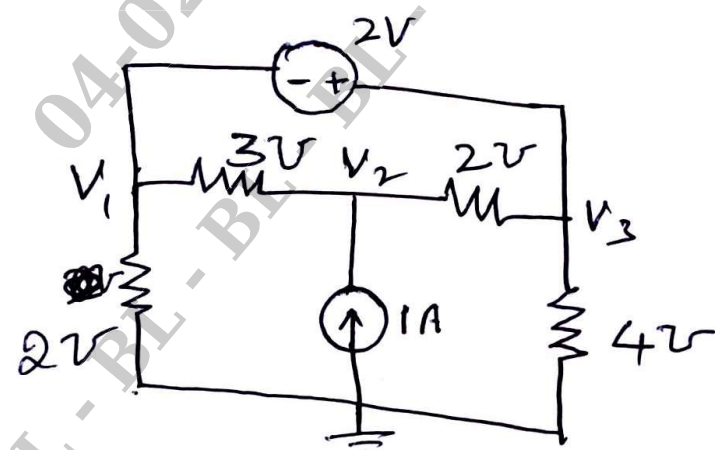
BEE302

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 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	<p>a. Distinguish between :</p> <p>i) Active and Passive elements</p> <p>ii) Ideal and Practical sources.</p>	6	L1	CO1
	<p>b. Using Mesh current method, determine the current i_a in the network as shown in the Fig.Q1(b).</p> <div style="text-align: center;">  <p>Fig.Q1(b)</p> </div>	7	L3	CO1
	<p>c. Find the voltages at nodes V_1, V_2 and V_3 for the network shown in Fig.Q1(c) using nodal analysis.</p> <div style="text-align: center;">  <p>Fig.Q1(c)</p> </div>	7	L3	CO1

OR

Q.2	a.	Explain the concept of super node analysis with a suitable circuit diagram.	6	L3	CO1
	b.	Determine the equivalent resistance between X, Y in the network shown in Fig.Q2(b) using Star – delta conversion.	7	L1	CO1

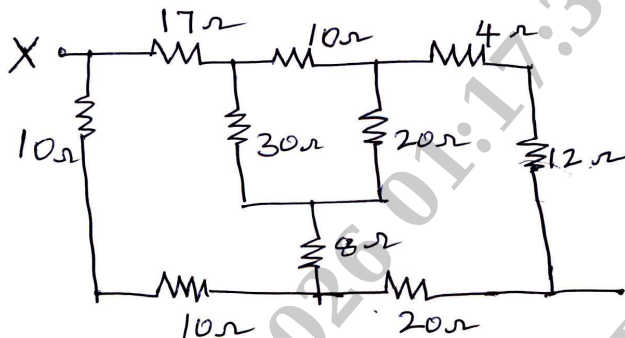


Fig.Q2(b)

	c.	Find the voltage at node V_1 for the network shown in Fig.Q2(c) and current I_1 .	7	L3	CO1
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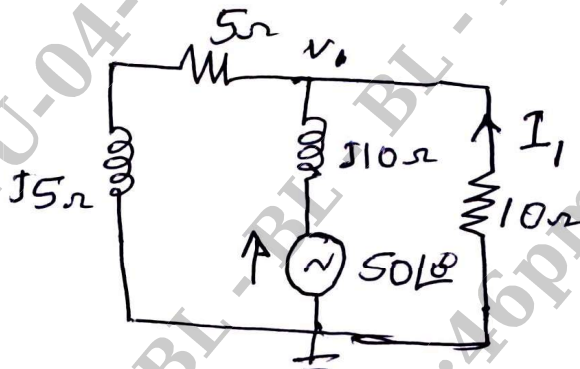


Fig.Q2(c)

Module – 2

Q.3	a.	State and explain Super Position Theorem.	6	L1	CO2
	b.	Using the superposition theorem find the current I in the network shown in Fig.Q3(b).	7	L3	CO2
	c.	Find the current I in the circuit shown in the Fig.Q3(c) by using Norton's theorem.	7	3	CO2

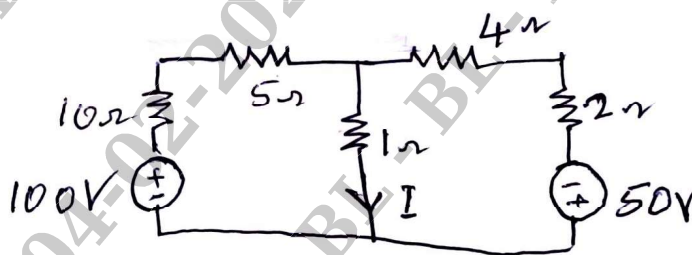


Fig.Q3(b)

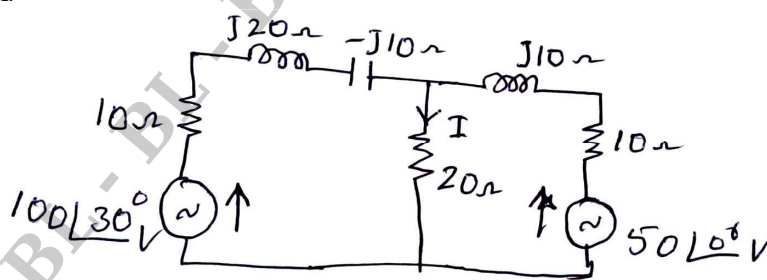


Fig.Q3(c)

OR

Q.4	a. State and explain the Norton's theorem.	6	L1	CO2
	b. What will be the value of R_L to get maximum power delivered to it? What is the value of this power refer the network shown in the Fig.Q4(b).	7	L3	CO2
Fig.Q4(b)				
	c. Using Thevenin's theorem. Determine the current in a $1\ \Omega$ resistor connected to terminals A, B of the network shown in Fig.Q4(c).	7	L3	CO2
Fig.Q4(c)				

Module - 3

Q.5	a. Derive an expression for resonant frequency in the geometric mean of the two half power frequencies.	6	L3	CO3
	b. A series connected RLC circuit has $R = 15\ \Omega$, $L = 40\ \text{mH}$ and $C = 40\ \mu\text{F}$. Determine the resonant frequency and under resonant condition. Calculate the current, power the voltage drops across various elements, if the applied voltage is 75 volts.	7	L3	CO3
	c. Find the equation of the current. If the switch is closed at $t = 0$, find also the voltages across L and R the current at $t = 0.1\ \text{sec}$ and the time at which the voltages across L and R are equal as in Fig.Q5(c).	7	L3	CO3
Fig.Q5(c)				

OR

Q.6	a.	Derive expressions for resonant frequency in parallel circuit.	6	L3	CO3
	b.	A series circuit consisting of a capacitor and a coil takes a maximum current of 0.314 A at 200 V, 50 Hz. If the voltage across the capacitor is 300V at resonance, determine the Capacitance, Inductance, Resistance and the 'Q' of the coil.	8	L	CO3
	c.	Find the expression for the current $i(t)$ if the switch is closed at $t = 0$, there is an initial charge of $500 \mu\text{C}$ on the capacitor with polarity as shown in Fig.Q6(c).	6	L3	CO3

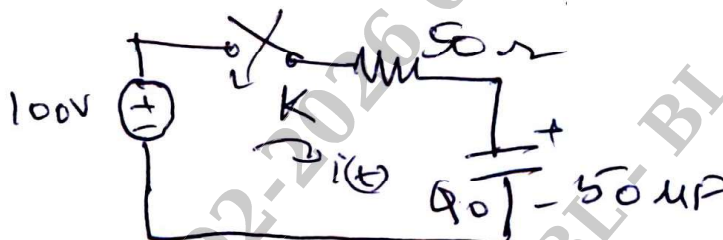


Fig.Q6(c)

Module – 4

Q.7	a.	State and explain the initial value theorem and final value theorem.	10	L3	CO4
	b.	Find the Laplace transform of the signals : i) Step ii) ramp iii) Impulse.	10	L2	CO4

OR

Q.8	a.	Find the Laplace transform of the following : i) e^{at} ii) $\cos \omega t$ iii) $\sin \omega t$.	10	L4	CO4
	b.	Find the inverse Laplace transform of the following functions : i) $\frac{1}{s(s+1)}$ ii) $\frac{1}{(s-a)^2}$.	10	L4	CO4

Module – 5

Q.9	a.	Determine the Z-parameters in terms of Y-parameters.	10	L3	CO5
	b.	Three impedances of $(7 + j4)\Omega$, $(3 + j2)\Omega$ and $(9 + j2)\Omega$ are connected between the neutral and RYB phase respectively of a 3-phase, 4-wire system. The line voltage is 440 V. calculate : i. The current in each line ii. The current in the neutral wire.	10	L3	CO5

OR

Q.10	a.	Determine the Y – parameters in terms of T – parameters.	10	L3	CO5
	b.	Find the Y and T parameters for the network shown in the Fig.Q10(b).	10	L3	CO5

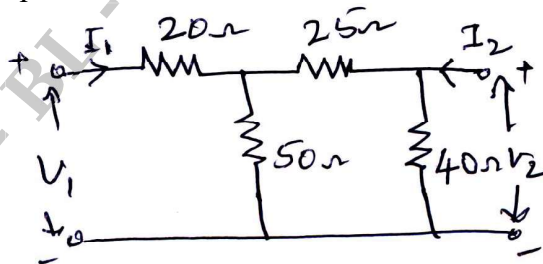


Fig.Q10(b)

CBCS SCHEME

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BEE401

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 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
Q.1	a.	A 4 pole DC motor is lap wound with 400 conductors. The flux per pole is 0.0188 wb. Find the torque and gross mechanical power developed when the motor is drawing 25 A and running at 1500 rpm.	10	L3	CO1
	b.	With power flow diagram, explain the losses in DC Motors and derive the condition for maximum efficiency.	10	L3	CO1
OR					
Q.2	a.	Identify the procedure to control the speed of DC motor, above and below rated speed with necessary circuit diagrams.	10	L3	CO1
	b.	Identify the suitable test that is conducted with two identical shunt machines to calculate the efficiency of machines. With its circuit diagram and related formulas write the procedure to conduct the test.	10	L3	CO1
Module – 2					
Q.3	a.	Compare the squirrel cage induction motor with slip ring induction motor.	10	L4	CO2
	b.	Derive the torque equation of three phase induction motor and obtain the condition for maximum torque.	10	L4	CO3
OR					
Q.4	a.	Discuss the torque – slip characteristics of a three phase induction motor with its different regions of operation.	10	L4	CO3
	b.	A 6 pole, 50 Hz, 3 phase induction motor has a rotor resistance of 0.25 Ω per phase and a maximum torque of 10 N. m at 875 rpm. Calculate: i) Synchronous speed ii) Slip at maximum torque iii) Rotor reactance iv) Rotor emf v) the torque when the slip is 5%	10	L4	CO3
Module – 3					
Q.5	a.	Obtain the equivalent circuit parameters of the circuit modes of induction motor using no load and blocked rotor test and sketch the circuit.	10	L3	CO3
	b.	What do you mean by cogging and crawling in case of three phase induction motor, write the effects and remedy for the same.	10	L2	CO3
OR					
Q.6	a.	Give the comparison between deep bar and double cage rotor.	10	L2	CO1
	b.	With neat diagram explain the procedure to conduct load test on three phase induction motor.	10	L2	CO3

Module – 4

Q.7	a.	Explain the operation of star – delta starter with neat diagram.	10	L2	CO4
	b.	Explain the principle of operation of capacitor start split phase motor with necessary circuit and torque speed characteristics.	10	L2	CO4

OR

Q.8	a.	Explain the operation of auto transformer starter with neat diagram.	10	L2	CO4
	b.	Explain the principle of operation of two value capacitor motor with necessary circuit and torque speed characteristics.	10	L2	CO4

Module – 5

Q.9	a.	Explain the V curve and Inverted V curve of synchronous motor and draw the experimental setup to obtain the curves.	10	L2	CO5
	b.	Explain the construction and operation of Synchronous Reluctance Motor.	10	L2	CO6

OR

Q.10	a.	Explain the principle of operation of synchronous motor and explain when it is operated as synchronous condenser with its applications.	10	L2	CO6
	b.	Explain the construction and operation of universal motor.	10	L2	CO6

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21EE51

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 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. What are the advantages of high voltage transmission? Explain. (07 Marks)
- b. The tower of height 30 m and 90 m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 500 m. If the tension in the conductor is 1600 kg, find the minimum clearance of the conductor and water and clearance midway between the supports. Weight of conductor is 1.5 kg/m. Bases of the towers can be considered to be at water level. (07 Marks)
- c. List the methods of improving string efficiency and explain any one method with a neat sketch. (06 Marks)

OR

- 2 a. With a neat diagram, explain feeders, distributors and service main of a distribution system. (07 Marks)
- b. A 3-phase overhead transmission line is supported by 3 suspension type insulators. The potential across first and second insulators are 8 KV and 11 KV respectively. Calculate :
 - i. Ratio of self to shunt capacitance
 - ii. Line voltage
 - iii. String efficiency. (07 Marks)
- c. Write short notes on vibration of conductors. (06 Marks)

Module-2

- 3 a. Derive an expression for the inductance of a conductor due to internal flux. (05 Marks)
- b. The three conductors of a 3-phase transmission line are arranged in a horizontal plane and are 3 meters apart. The diameter of each conductor is 4 cm. determine the inductance per km of each phase. Assume balanced load and R, Y B phase sequence. (07 Marks)
- c. The three conductors of a 3-phase line are arranged at the corners of a triangle of sides 2m, 2.5m and 4.5 m. Calculate the inductance per km of line when the conductors are regularly transposed. The diameter of each conductor is 1.24 cm. (08 Marks)

OR

- 4 a. Derive an expression for the line to neutral capacitance for a 3-phase over head transmission line when the conductors are unsymmetrizally speed. (10 Marks)
- b. If the double circuit 3-phase line has conductors of diameter 2 cm and are separated with 2 m in hexagonal spacing arrangement. Calculate phase to neutral capacitance for 100 km line. (05 Marks)

- c. A 3 ϕ , 50 Hz, 66 kV overhead line conductors are placed in a horizontal plane as shown in Fig.Q4(c). The conductor diameter is 1.25cm. If the line length is 100 km. Calculate :
- Capacitance per phase
 - Charging current per phase
- Assuming complete transposition of the line.
Given $\epsilon_0 = 8.854 \times 10^{-12}$ F/m.

(05 Marks)

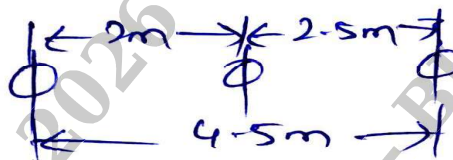


Fig.Q4(c)

Module-3

- 5 a. Explain the nominal π method for obtaining the performance calculations of medium transmission line. Draw the corresponding vector diagram. (10 Marks)
- b. A 3-phase, 50 Hz overhead transmission line of 100 km has the following constants. Resistance per km per phase is 0.1Ω , inductance reactance per km per phase is 0.2Ω , capacitance susceptance per km per phase is $0.4 \times 10^{-14} \text{ S}$. Find 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 with a lagging p.f of 0.8. Use nominal T – method. (10 Marks)

OR

- 6 a. Derive an expression for ABCD constants of a medium transmission line using nominal T – method. Show that $AD - BC = 1$. (10 Marks)
- b. Derive an expression for sending end voltage and current for long transmission line using rigorous solution. (10 Marks)

Module-4

- 7 a. Derive an expression for critical disruptive voltage and visual critical voltage with reference to corona. (10 Marks)
- b. A 132 KV line with 1.956 diameter conductor is built so that corona takes place if the line voltage exceeds 210 KV (rms). If the value of potential gradient at which ionization occurs can be taken as 30 KV per cm, find the spacing between the conductors. Assume 3 phase. (05 Marks)
- c. Explain the factors affecting corona in brief. (05 Marks)

OR

- 8 a. What are the methods of grading of cables? Explain inter sheath grading of cable. (10 Marks)
- b. A single cone cable of conductor diameter 2 cm and lead sheath of diameter 5.3 cm is to be used on a 66 KV, 3 – phase system. Two inter sheaths of diameter 3.1 cm and 4.2 cm are introduced between the cone and lead sheath. If the maximum stress in the layers is the same, find the voltages on the inter sheath. (10 Marks)

Module-5

- 9 a. Briefly explain radial and ring main distributors. (10 Marks)
- b. The loading on a distributor is shown in Fig. Q9(b). The distributor is a 2 core cable for which the resistance and reactance are 0.35Ω and 0.185Ω per 1200 m of cable run respectively. What should be the voltage at point A to maintain 420V at point D if the power factor is referred to the far end voltage at D? (10 Marks)

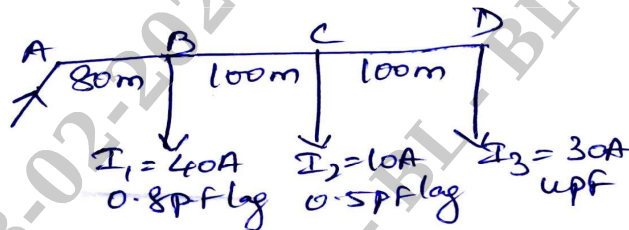


Fig. Q9(b)

OR

- 10 a. Write a note on power quality. (05 Marks)
- b. Define : i) Reliability ii) Availability iii) Adequacy (10 Marks)
- iv) Security v) Failure rate. (05 Marks)
- c. Write a note on limitation of distribution system.

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21EE52

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 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. Write the comparison between open and closed Loop Control System with example. (06 Marks)
- b. For the mechanical systems shown in fig. Q. 1 (b). Draw the electrical equivalent network based on torque – voltage analogy.

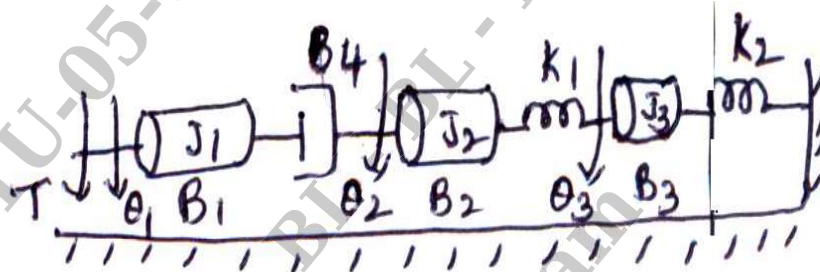


Fig. Q. 1(b)

(08 Marks)

- c. Define Transfer function. Also derive the transfer function relating displacement and excitation voltage drop for the armature controlled DC motor. (06 Marks)

OR

- 2 a. For the mechanical system shown in fig. Q.2 (a), write the differential equation relating to the Force $F(t)$. Also obtain the analogous electrical circuits based on : (10 Marks)
 - i) Force – current analogy
 - ii) Force – Voltage analogy.

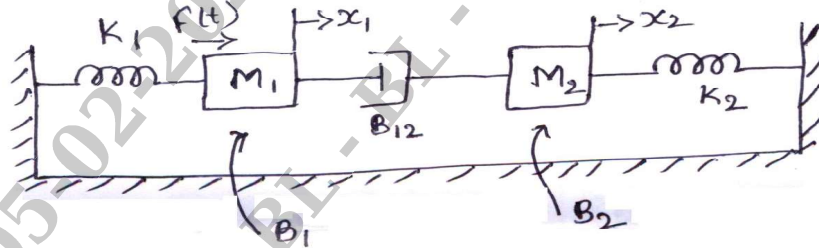


Fig. Q 2(a)

- b. Define servomotor. Compare AC servomotor and DC servomotor. (04 Marks)
- c. Show that the two systems in fig. Q 2 (c) are analogous by comparing the transfer function.

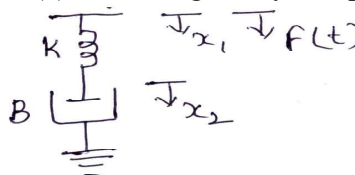
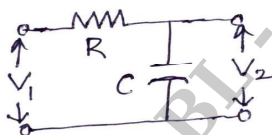


Fig. Q 2(c)

(06 Marks)

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

Module-2

- 3 a. Using block diagram reduction technique. Obtain transfer function $\frac{C(S)}{R(S)}$ whose block diagram shown in fig. Q. 3 (a). (10 Marks)

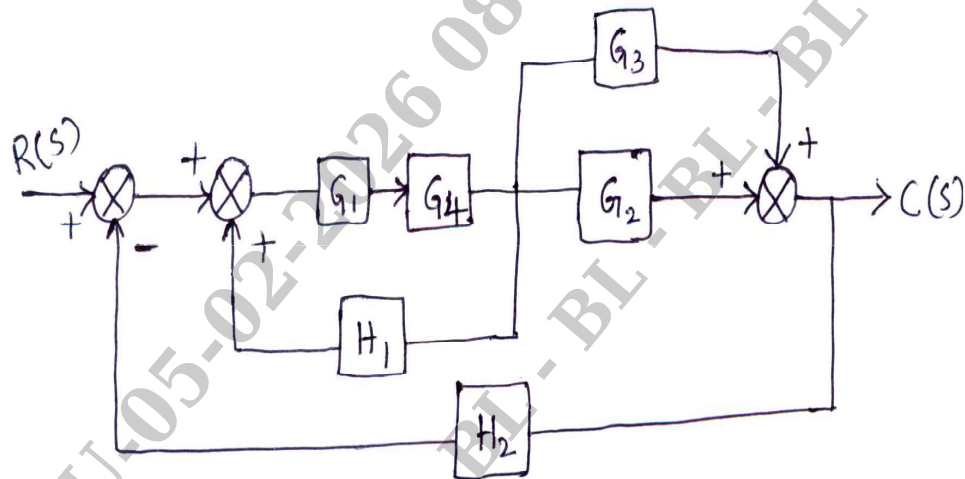
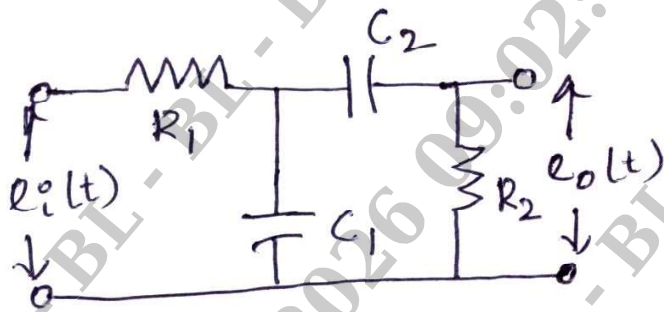


Fig. Q 3(a)

- b. Draw a block diagram for the electric circuit shown in Fig. Q. 3(b) and hence evaluates transfer function, $\frac{E_o(S)}{E_i(S)}$ using block diagram reduction technique. (10 Marks)



$R_1 = 100\text{ k}\Omega$
 $R_2 = 1\text{ M}\Omega$
 $C_1 = 10\text{ }\mu\text{F}$
 $C_2 = 1\text{ }\mu\text{F}$

Fig. Q.3 (b)

OR

- 4 a. Define : i) Source and sink node ii) Loop and Loop gain iii) Forward path (04 Marks)
 b. For the signal flow graph shown in Fig. Q 4(b). Determine the transfer function $\frac{C(S)}{R(S)}$ using Mason's gain formula. (08 Marks)

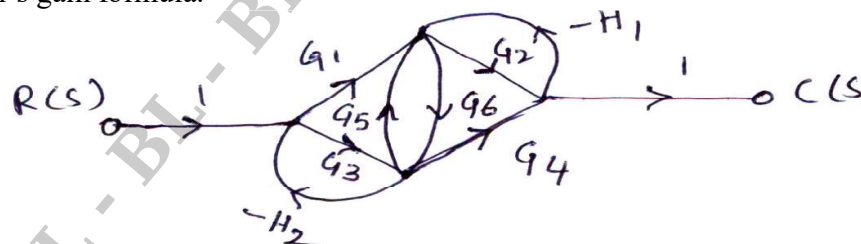


Fig. Q 4(b)
2 of 4

- c. Determine the transfer function for the block diagram shown in fig. Q. 4 (c) by using Mason's gain formula. (08 Marks)

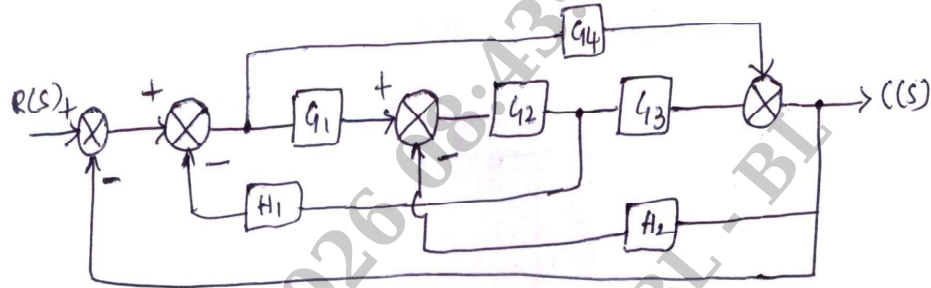


Fig.Q .4 (c)

Module-3

- 5 a. Define time domain specifications of the second order system with diagram. (05 Marks)
 b. A unity feedback control system is characterized by an open Loop transfer function

$$G(s) = \frac{k}{s(s + \alpha)}$$

, where k and α are positive constants. By what factor the amplifier gain 'K' should be reduced so that the peak overshoot of the unit step response of the system is reduced from 75% to 25%. (08 Marks)

- c. A certain feedback control system is described by the following transfer function

$$G(s) = \frac{k}{s^2(s + 20)(s + 30)}, \quad H(s) = 1$$

Determine order of system, type number, steady state error 8 unit due to input $r(t) = 1 + 10t + 30t^2$. (07 Marks)

OR

- 6 a. Explain Routh- Hurwitz criterion for determining the stability of the system and mention its limitations. (04 Marks)
 b. Define and derive the expression for :
 i) Rise time
 ii) Peak overshoot of an under damped second order control system subjected to step input. (08 Marks)
 c. A unity feedback control system is characterized by the open Loop transfer function.

$$G(s) = \frac{k(s + 13)}{s(s + 3)(s + 7)}$$

using R. H criteria
 i) Calculate the range of k for the system to be stable
 ii) Determine the value of k which will cause sustained frequency of oscillations in the Closed Loop System. What are the corresponding oscillation frequencies ? (08 Marks)

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 Marks)
 b. For a system having $G(s)H(s) = \frac{k}{s(s + 6)(s^2 + 4s + 13)}$. Find the angle of departure. (05 Marks)
 c. Explain : i) Angle of Asymptotes ii) Break away points (05 Marks)

OR

- 8 a. A unity feedback system with $G(s) = \frac{80}{s(s+2)(s+20)}$. Draw the bode plot. Determine GM, PM, wgc and wpc. Comment on the stability. (14 Marks)
- b. Define the following as applied to bode plots:
i) Gain Margin
ii) Phase margin
iii) Gain crossover frequency (06 Marks)

Module-5

- 9 a. What is controller? Explain the effect of P, I, PI and PID controller of a second order system. (10 Marks)
- b. Explain the step by step procedure of lag compensating network. (10 Marks)

OR

- 10 a. The open Loop transfer function of a control system is $G(s)H(s) = \frac{1}{s(s+2)(s+10)}$. Sketch the Nyquist plot and calculate the value of k. (14 Marks)
- b. State and explain Nyquist Stability Criterion. (06 Marks)

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BEE515B

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Power Electronics for Renewable Energy Systems

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 the switching operation of IGBT with the help of output characteristics.	10	L2	CO1
	b.	How energy sources are classified based on usability of energy, long – term availability and commercial applications. Explain each one in detail.	10	L2	CO1
OR					
Q.2	a.	Draw the VI characteristics of SCR and explain how it can be used as semi-controlled power switch.	10	L2	CO1
	b.	Explain the impact of energy generation process on the environment.	10	L2	CO1
Module – 2					
Q.3	a.	Draw the equivalent circuit of the photovoltaic cell and explain the output characteristics of PV cell.	10	L3	CO2
	b.	Explain the MPPT algorithms using hill climbing control and perturb and Observe Method.	10	L3	CO2
OR					
Q.4	a.	Explain the grid requirement for PV system that must comply to endure safety and efficient energy transfer.	10	L3	CO2
	b.	What are the common arrangements used in Grid Connected PV System.	10	L3	CO2
Module – 3					
Q.5	a.	Draw the block diagram of typical wind turbine and explain the operation.	10	L2	CO3
	b.	Explain the power electronics control implemented in grid side converter for DFIG with a neat block diagram.	10	L3	CO3
OR					
Q.6	a.	Explain the following control techniques of implemented in wind turbine i) Turbine Yawing ii) Pitch Control iii) Stall Control iv) Speed Variation	10	L2	CO3
	b.	With a neat circuit diagram explain the operation of Back – to – Back PWM VSI for full converter turbines.	10	L3	CO3
Module – 4					
Q.7	a.	Explain the working of open OTEC and closed OTEC systems.	10	L2	CO4
	b.	With a neat schematic diagram, explain updraft and down draft gasifier.	10	L2	CO4
1 of 2					

OR

Q.8	a.	With the neat diagram explain the fuel cell system and explain the function of subsystems.	10	L2	CO4
	b.	Explain the methods of hydrogen production technologies.	10	L2	CO4

Module – 5

Q.9	a.	Explain the DC – AC micro grid Architecture with solar hybrid photovoltaic – wind turbine system.	10	L2	CO5
	b.	With a neat diagram explain the operation of grid – forming power converter in AC microgrid.	10	L2	CO5

OR

Q.10	a.	Explain the schematics of off-grid connected solar PV and WT powered DC microgrid.	10	L2	CO5
	b.	Explain hierarchical control of microgrid with neat block diagram.	10	L2	CO5

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21EE61

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 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. Define "Management" precisely. Briefly explain levels of management. (06 Marks)
- b. Distinguish between Management and Administration. (04 Marks)
- c. What are the roles of manager? Explain. (10 Marks)

OR

- 2 a. Explain types of Decisions. (10 Marks)
- b. Differentiate between
(i) Strategic Planning and Tactical Planning
(ii) Single Use Plans and Standing Plans (10 Marks)

Module-2

- 3 a. What are the principles of organization? (10 Marks)
- b. Explain Line Organization. (05 Marks)
- c. Write advantages and disadvantages of Line Organization. (05 Marks)

OR

- 4 a. What are the main elements involved in Staffing? (10 Marks)
- b. Explain techniques of Selection. (10 Marks)

Module-3

- 5 a. Define Social Responsibility. What are social responsibilities of business towards different groups? (10 Marks)
- b. How are Entrepreneurs are classified? (10 Marks)

OR

- 6 a. Explain the term "Social Audit". What are its benefits and limitations? (10 Marks)
- b. What are qualities of an Entrepreneur? (10 Marks)

Module-4

- 7 a. Discuss the role of small scale industry in economic development. (10 Marks)
- b. What is the impact of liberalization, privatization and globalization on SSI in India? (10 Marks)

OR

- 8 a. Write a note on Single Window DIC Agency. (10 Marks)
b. What are the steps to start SSI? Explain. (10 Marks)

Module-5

- 9 a. What is meaning of Project? Briefly explain the contents of a good project report. (10 Marks)
b. What are the guidelines of planning commission for project report? (10 Marks)

OR

- 10 a. What is the importance of Network Analysis? (04 Marks)
b. What are the steps involved in PERT? Write any there advantages and limitations. (06 Marks)
c. Explain CPM. Write its advantages and limitations. (10 Marks)

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BEE654B

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Technologies of Renewable Energy Sources

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 the different types of energy resources.	3	L1	CO1
	b.	Discuss the causes of energy scarcity and factors to be considered for solving energy crunch problem.	10	L2	CO1
	c.	With a neat diagram, explain the layers of sun and explain factors affecting Solar Energy reaching the Earth's surface.	7	L2	CO1
OR					
Q.2	a.	Explain how solar thermal energy is used in different application. Provide examples of each application and discuss their benefits and limitations.	5	L2	CO1
	b.	Describe the Sun-Earth geometric relationship and its impact on the amount of solar energy received on the Earth's surface.	7	L2	CO1
	c.	Compare the advantages and disadvantages of different types of renewable energy resources.	8	L2	CO1
Module – 2					
Q.3	a.	Name any three types of solar thermal collectors.	3	L1	CO2
	b.	Describe the basic principle of operation of a stirling engine.	10	L2	CO2
	c.	Compare the advantages and disadvantages of series and parallel connection in solar panel arrays.	7	L2	CO2
OR					
Q.4	a.	How would you select materials for a solar collector to maximize efficiency and durability?	5	L3	CO2
	b.	Describe the importance of solar cell efficiency and its impact on system design.	7	L2	CO2
	c.	Analyze the impact of solar thermal system on building energy consumption and green house gas emission.	8	L4	CO2
Module – 3					
Q.5	a.	What are the benefits of using hydrogen energy?	3	L1	CO3
	b.	Describe the importance of wind resource assessment in wind turbine site selection.	10	L2	CO3
	c.	A local municipality wants to implement a waste recycling program. Considering the advantages (e.g conservation of natural resources energy saving reduced land fill waste) and disadvantages (e.g high upfront costs, contamination risks, limited market demand) of waste recycling, design a program that maximizes benefits while minimizing draw backs.	7	L3	CO3

OR					
Q.6	a.	Compare the advantages and disadvantages of different geothermal systems.	5	L3.	CO3
	b.	Describe the different methods of hydrogen storage.	7	L2	CO3
	c.	Write the comprehensive analysis of the environmental effects of geothermal energy production and recommend mitigation strategies.	8	L4	CO3
Module – 4					
Q.7	a.	List the Gasifier and their classification.	3	L1	CO4
	b.	Explain the difference between Updraft, downdraft, and crossdraft gasifier.	10	L2	CO4
	c.	Describe the cooling and cleaning of gasifier.	7	L2	CO4
OR					
Q.8	a.	What are the advantages of Tidal power?	5	L1	CO4
	b.	What factor influence the selection of a biogas plant model for a specific application.	7	L2	CO4
	c.	With a neat diagram, explain the two basin system.	8	L3	CO4
Module – 5					
Q.9	a.	What are the advantages and disadvantages of OTEC?	3	L1	CO5
	b.	Compare and contrast closed, open and hybrid cycles used in OTEC, highlighting their advantages and disadvantages.	10	L2	CO5
	c.	Evaluate the feasibility of the wave energy availability including its environmental impact economic viability.	7	L3	CO5
OR					
Q.10	a.	Evaluate the feasibility of an OTEC plant for a specific tropical location considering factors likes temperature difference, water flow rates and energy output.	5	L3	CO5
	b.	How do sea waves generate energy and what factors affect their power output?	7	L2	CO5
	c.	Briefly, explain the basic Rankine cycle and its working.	8	L2	CO5

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21EE744

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 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. Write the block diagram of an electrical drive and mention the function of each component of an electrical drive. (06 Marks)
- b. Obtain an expression for the equivalent load torque and equivalent moment of inertia for loads with rotational and translational motion. (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 flywheel to regain its steady state speed. It is desired to limit the motor torque to 700 N-m. What should be the moment of inertia of flywheel? Motor has an inertia of 10 kg-m². Its no load speed is 500 rpm and the slip at a torque of 500 N-m is 5%. Assume speed torque characteristic of motor to be a straight line in the region of interest. (06 Marks)

OR

- 2 a. With a neat diagram, explain the four quadrant operation of motor driving a hoist load. (06 Marks)
- b. Explain how a current limit control functions in a closed loop control of drives. (06 Marks)
- c. A drive has following parameters :
 $J = 10 \text{ kg-m}^2$, $T = 100 - 0.1 N$ N-m. Passive load torque $T_p = 0.05 N$ N-m, where N is the speed in rpm. Initially the drive is operating in steady state. Now it is to be reversed. For this motor characteristic is changed to $T = -100 - 0.1 N$, N-m. Calculate the time of reversal. (08 Marks)

Module-2

- 3 a. With circuit diagram and waveforms, explain half controlled rectifier control of separately excited motor for continuous conduction mode. (10 Marks)
- b. A 220 V, 1500 rpm, 50 A separately excited motor with armature resistance of 0.5 Ω , is fed from a 3-phase fully controlled rectifier. The ac source has a line voltage of 440 V, 50 Hz. 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 when motor is running at 1200 rpm and rated torque
 - (iii) Determine the value of firing angle when motor is running at -800 rpm and twice the rated torque. (10 Marks)

OR

- 4 a. Explain the chopper control of a separately excited DC motor with necessary equations and waveforms. (10 Marks)

- b. Explain the multiquadrant operation of DC separately excited motor fed from fully controlled rectifier for the following schemes :
- Single phase fully controlled rectifier with a reversing switch.
 - Dual converter
- (10 Marks)**

Module-3

- 5 a. Explain the behavior of 3-phase induction motor when fed from a non-sinusoidal voltage supply. **(06 Marks)**
- b. A 400 V, star connected 3-phase, 6-pole, 50 Hz induction motor has following parameters referred to stator, $R_s = R_r' = 1 \Omega$, $X_s = X_r' = 2 \Omega$. For regenerative braking operation, calculate the overhauling torque it can hold and range of speed operation. **(06 Marks)**
- c. With a neat diagram, explain the variable frequency control of induction motor. **(08 Marks)**

OR

- 6 a. Explain the ac dynamic braking of 3 phase induction motor with,
(i) Two lead (ii) Three lead connections. **(08 Marks)**
- b. With relevant equations, explain the operation of a 3 phase induction motor with unbalanced source voltages. **(08 Marks)**
- c. With a neat diagram, explain the working of star-delta starter. **(04 Marks)**

Module-4

- 7 a. Explain with relevant diagram, the Voltage Source Inverter (VSI) control of 3-phase inductor motor. What are the disadvantages of this method, how can they be minimized. **(08 Marks)**
- b. Explain the closed loop speed control of CSI drives with block diagram. **(06 Marks)**
- c. Explain the operation of synchronous motor fed from fixed frequency supply. **(06 Marks)**

OR

- 8 a. Explain the closed loop control for VSI controlled 3 phase induction motor. **(08 Marks)**
- b. What is meant by the term "pull in" in case of synchronous motor? Bring out the differences between true synchronous mode and self controlled mode. **(06 Marks)**
- c. With circuit diagram, explain the speed control of 3 phase induction motor by static rotor resistance control. **(06 Marks)**

Module-5

- 9 a. With circuit diagram, explain the self controlled synchronous motor drive employing load commutated thyristor inverter. **(10 Marks)**
- b. Explain brushless DC motor drive for servo-applications with a neat diagram, waveform and equations. **(10 Marks)**

OR

- 10 a. Explain the drive requirements for,
(i) Steel rolling mills.
(ii) Cranes and hoists
(iii) Machine tools **(10 Marks)**
- b. What are the advantages of stepper motor? With a neat diagram, explain permanent magnet stepper motor, compare it with Variable Reluctance type. **(10 Marks)**

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21EE752

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

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Write brief note on Roadways fundamentals. (06 Marks)
- b. Explain Newtons second law of motion in vehicle mechanics. (07 Marks)
- c. Write short notes on propulsion power and maximum gradability. (07 Marks)

OR

- 2 a. Explain in detail the constant FTR in level road condition with necessary equations. (10 Marks)
- b. Write detailed notes on vehicle kinetics with necessary graphs. (10 Marks)

Module-2

- 3 a. With neat block diagram, explain the essential components of electric vehicles. (08 Marks)
- b. With neat graph, briefly explain the traction motor characteristics of EV. (05 Marks)
- c. Detail the concept of hybrid electric vehicles and its architecture. (07 Marks)

OR

- 4 a. Explain series hybrid electric drive trains with neat sketch. (10 Marks)
- b. Explain parallel hybrid electric drive train with neat sketch. (10 Marks)

Module-3

- 5 a. Define the following battery parameters:
 - i) Discharge Rate
 - ii) State of charge
 - iii) State of discharge
 - iv) Depth of discharge(08 Marks)
- b. Draw and explain the basic structure of battery and its major components. (06 Marks)
- c. Briefly explain Lithium ion battery with neat sketch. (06 Marks)

OR

- 6 a. Write brief notes on fuel cell and explain its basic principle and operation. (08 Marks)
- b. List the types of fuel cells. Explain any two types with neat sketch. (06 Marks)
- c. Write short notes on super capacitor's (06 Marks)

Module-4

- 7 a. Explain the principle and operation of DC motor with neat sketch. Brief the two types of speed control in DC motor. (10 Marks)
- b. Explain the operation of induction motor. Brief the concept of slip in induction motor. (10 Marks)

OR

- 8 a. List the advantages of BLDC motor. Explain the construction, working and principle of operation of BLDC motor with neat diagram. (10 Marks)
b. Write detailed notes on sensor less control. Briefly explain the principle of regenerative braking. (10 Marks)

Module-5

- 9 a. Explain the power rating design of series hybrid electric drive train in detail. (10 Marks)
b. Elaborate the control strategies of series hybrid electric drive train in detail. (10 Marks)

OR

- 10 a. Design the engine power capacity of parallel hybrid electric drive train. (10 Marks)
b. Explain the control strategies of parallel hybrid electric drive train. (10 Marks)

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21EE755

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 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. Define primary and secondary energy and Renewable and Non-Renewable energy, with three examples each. (10 Marks)
b. List the salient features of Electricity Act 2003. (10 Marks)

OR

- 2 a. What is Energy conservation? Explain energy strategy for the future. (10 Marks)
b. Explain Indian energy scenario with relevant facts. (10 Marks)

Module-2

- 3 a. Explain electricity billing and mention the components present in tariff structure. (10 Marks)
b. Explain the location of capacitor bank for power factor improvement with neat diagram. (10 Marks)

OR

- 4 a. Explain how maximum demand controller works. (10 Marks)
b. Explain energy efficient lighting options and lamp controls. (10 Marks)

Module-3

- 5 a. Define energy audit and explain importance of energy audit. (10 Marks)
b. Explain ten step methodology for detailed energy auditing. (10 Marks)

OR

- 6 a. Explain various measurements required in energy auditing. (10 Marks)
b. What is energy use profile? What are the audits required to construct energy use profile. (10 Marks)

Module-4

- 7 a. What is Availability Based Tariff (ABT)? Explain availability based tariff with neat diagram. (10 Marks)
b. Define ancillary services and explain the types. (10 Marks)

OR

- 8 a. Explain briefly the four pillars of market design. (10 Marks)
b. Explain briefly about the framework of Indian power sector. (10 Marks)

Module-5

- 9 a. What are the energy saving measures in buildings explain them briefly. (10 Marks)
b. What are the tariff options in demand side management and explain. (10 Marks)

OR

- 10 a. What is demand side management? Explain the planning and implementation. (10 Marks)
b. What is water audit and explain the different steps. (10 Marks)

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

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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) Plunger 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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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 $J = 10 \text{ kg-m}^2$, $T = 15 + 0.05 N, N - m$ and $T_t = 5 + 0.06 N-m$ 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 $\alpha = 160^\circ$ 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 $R_1 = 0.08\Omega$, $R_2 = 0.1\Omega$, $X_1 = X_2 = 0.3\Omega$, $J = 10\text{ kg-m}^2$. 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, $R_s = 2\Omega$, $R_r = 3\Omega$, $X_s = X_r = 3.5\Omega$, $X_m = 55\Omega$. 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 motoring 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 0.2Ω , synchronous reactance of 8Ω 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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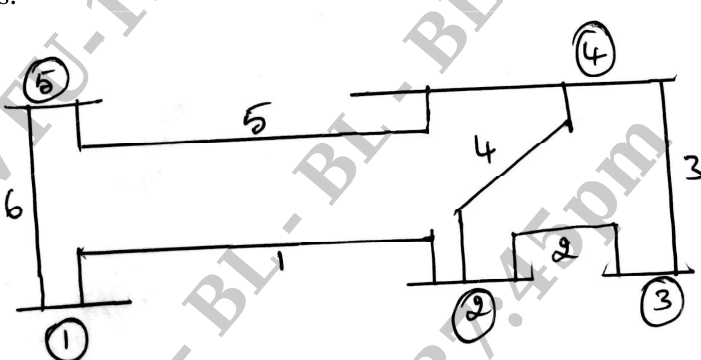
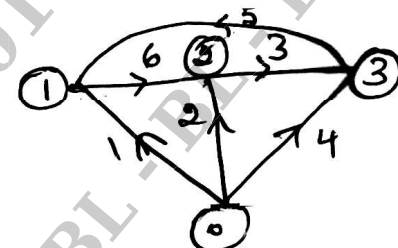
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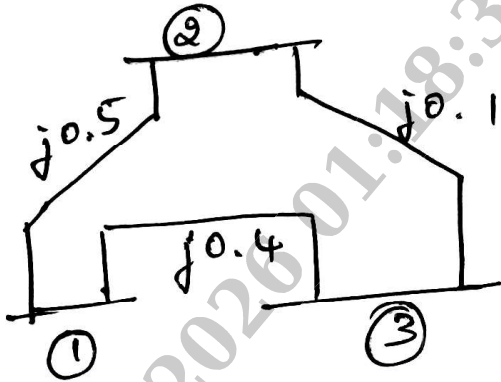
Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Power System Analysis – II

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.	8	L3	CO1
		 <p style="text-align: center;">Fig Q1(b)</p>			
	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 matrix C	6	L2	CO1
		 <p style="text-align: center;">Fig Q2(a)</p>			
	b.	Derive an expression for bus admittance matrix (Y_{Bus}) using singular transformation method.	8	L2	CO1

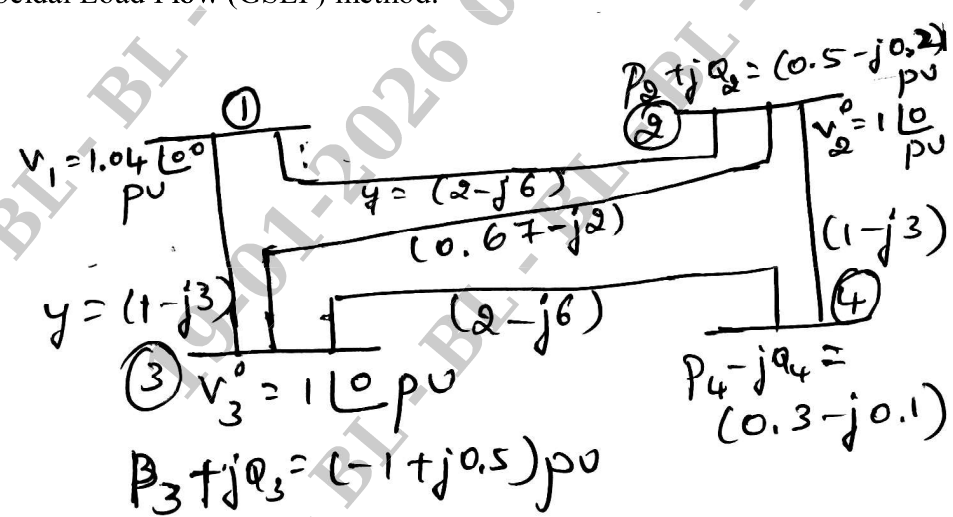
	<p>c. For the system shown in Fig.Q.2(c), obtain Y_{Bus} by inspection method. Take Bus ① as reference. The impedance marked are in P.U.</p>  <p style="text-align: center;">Fig.Q.2(c)</p>	6	L3	CO1
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Module – 2

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 algorithmic 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

	<p>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.</p>  <p style="text-align: center;">Fig.Q.4(c)</p>	10	L3	CO2
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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
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	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.	10	L3	CO5
<p style="text-align: center;">Fig.Q.9(b)</p>					
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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BEE755A

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

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 speed ratio and the performance of electric vehicle using speed power characteristics.	10	L2	CO1
	b.	Explain the concept of hybrid electric drive trains and list the different architectures of HEV.	10	L2	CO1
OR					
Q.2	a.	What are the factors that effects the vehicle performance.? And explain tractive effort.	10	L2	CO1
	b.	Describe the energy consumption in electric vehicle.	10	L2	CO1
Module – 2					
Q.3	a.	Explain various operating patterns of a series hybrid electric train for its optimal operation.	10	L2	CO2
	b.	Explain the power rating design of Traction Motor And engine generator in series HEV.	10	L2	CO2
OR					
Q.4	a.	Explain the control strategy of series hybrid electric drive train.	10	L2	CO2
	b.	With the block diagram explain overall control scheme of the parallel hybrid drive train.	10	L2	CO2
Module – 3					
Q.5	a.	Explain the following battery parameters. i. Battery capacity ii. Discharge rate iii. State of Charge (SoC) iv. Specific power v. State of Discharge (SoD).	10	L2	CO3
	b.	List the different types of fuel cells and explain the working of proton exchange membrane fuel cell.	10	L2	CO3

OR

Q.6	a.	Draw and explain the fuel cell characteristics.	10	L2	CO3
	b.	Explain the charging and cell discharge operation of a lead acid battery with chemical reaction equations.	10	L2	CO3

Module – 4

Q.7	a.	With a neat diagram explain power stages in three phase DC fast charger.	8	L2	CO4
	b.	What is microgrid and explain operations of hierarchical control?	8	L2	CO4
	c.	Compare the different AC and DC charging levels with respective power capabilities.	4	L2	CO4

OR

Q.8	a.	With a neat diagram explain the working of power electronic converter for V2H and H2V.	8	L2	CO4
	b.	Explain the coordinated control of solar PV generation, storage and PEV.	8	L2	CO4
	c.	Write short notes on impact of fast charger on power grid.	4	L2	CO4

Module – 5

Q.9	a.	Explain the working of vehicle supervisory controller.	10	L2	CO5
	b.	Explain series parallel 2×2 architecture of hybrid mode electric vehicle.	10	L2	CO5

OR

Q.10	a.	Explain any two possible modes of operation in mechanical power split hybrid vehicle.	10	L2	CO5
	b.	Explain regeneration mode of operation in hybrid electric vehicle.	10	L2	CO5

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BEE755B

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Energy Conservation and Audit

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 the need for energy management.	10	L2	CO1
	b.	Review the energy scenario in India in detail.	10	L2	CO1
OR					
Q.2	a.	Explain the salient features of Energy Conservation Act, 2001.	10	L2	CO1
	b.	Discuss the energy security and energy conservation and its importance.	10	L2	CO1
Module – 2					
Q.3	a.	Explain electrical load management and maximum demand control.	10	L2	CO2
	b.	Discuss the power factor and its benefits.	10	L2	CO2
OR					
Q.4	a.	Demonstrate briefly efficient operation of transformers and soft starters.	10	L2	CO2
	b.	Discuss briefly energy efficient motors and variable speed drive.	10	L2	CO2
Module – 3					
Q.5	a.	Explain in detail about energy audit and its applications.	10	L2	CO3
	b.	Discuss in brief about equipments used for energy audit.	10	L2	CO3
OR					
Q.6	a.	List out and explain the different types of audit.	10	L2	CO3
	b.	What are the measurements in energy audits? Explain.	10	L2	CO3
Module – 4					
Q.7	a.	Discuss the terms Imbalance and Scheduling.	10	L2	CO4
	b.	Explain in detail about availability based tariff.	10	L2	CO4
OR					
Q.8	a.	Write short notes on Electrical Energy character sites as a commodity.	10	L2	CO4
	b.	Explain four pillars of market design.	10	L2	CO4
Module – 5					
Q.9	a.	Write short notes on the concept of load management as a DSM strategy.	10	L2	CO5
	b.	Explain the tariff options which can promote DSM activities.	10	L2	CO5
OR					
Q.10	a.	With a help of block diagram explain about DSM planning and implementation.	10	L2	CO5
	b.	Write short notes on : i. Scope of DSM ii. End use energy conservation.	10	L2	CO5

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