B.L.D.E.A's V.P. Dr. P.G. Halakatti College of Enginering and Technology
Vijayapur-586103

Department of Electrical and Electronics Engineering

Question Papers Dec.2024/Jan.2025

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CBCS SCHEME

USN

18ELE13/23

First/Second Semester B.E. Degree Examination, Dec.2024/Jan.2025
Basic Electrical Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State and explain ohm's law and mention its limitations. **(06 Marks)**

b. For an alternating quantity, define :
   (i) Frequency.
   (ii) Average value.
   (iii) Form factor.
   (iv) Peak factor. **(06 Marks)**

c. Find the currents in the various branches of the given network shown below :

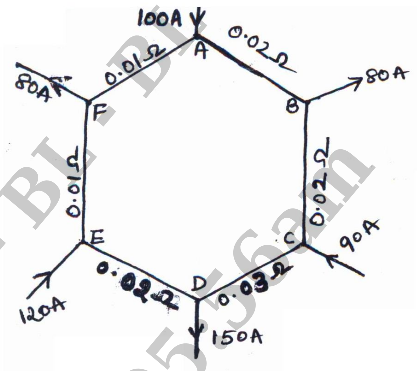

Fig. Q1 (c) **(08 Marks)**

OR

2 a. State and explain Kirchoff's laws with an example. **(06 Marks)**

b. For the circuit shown in Fig. Q2 (b), find
   (i) Current in 20 Ω and 30 Ω
   (ii) Voltage across whole circuit.
   (iii) The total power and power consumed in all resistors.

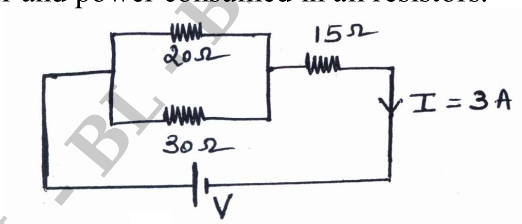

Fig. Q2 (b) **(06 Marks)**

c. Derive an expression for Average value and RMS value of sinusoidal varying quantities. **(08 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. Show that power consumed by a pure inductor is zero. Draw the voltage, current and power waveforms. **(06 Marks)**

b. Mention the advantages of 3 phase system over single phase system. **(06 Marks)**

c. A series circuit with resistance of 10 Ω, inductance of 0.2 H and capacitance of 40 μF is supplied with a 100 V at 50 Hz. Find the current, power, power factor of the circuit. **(08 Marks)**

OR

4 a. In a 3 phase star connection, find the relationship between line and phase values of current and voltage. **(06 Marks)**

b. Two impedances $Z_1 = (10 + j15)\Omega$ and $Z_2 = (6 - j8)\Omega$ are connected in parallel. If the total current is 15 A, find
(i) branch currents (ii) power taken by each branch (iii) Supply voltage. **(08 Marks)**

c. Three similar coils are connected in delta across a 3 phase supply. The 2 wattmeters connected to measure the input power indicate 12 kW and 7 kW. Calculate the
(i) Power input
(ii) Power factor **(06 Marks)**

Module-3

5 a. Derive emf equation of transformer. **(06 Marks)**

b. Find :
(i) The number of turns on primary and secondary side
(ii) The primary and secondary full load currents of a 20 KVA, 4400 V/230 V, 50 Hz, 1 phase transformer if the net area of cross section of the core is 30 cm^2 and the flux density is $2wb/m^2$. **(06 Marks)**

c. With a neat circuit diagram and truth table, explain the working of 2-way and 3-way control of lamp. **(08 Marks)**

OR

6 a. Explain the various losses that occur in a transformer. **(06 Marks)**

b. Explain necessity of earthing. Explain any pipe earthing a neat diagram. **(08 Marks)**

c. The maximum efficiency at full load and unity power factor of a 1 phase, 25 KVA, 500/1000 V, 50 Hz transformer is 98%. Determine its efficiency at 25% of the load and 0.8 pf. **(06 Marks)**

Module-4

7 a. Derive EMF equation of D.C. Generator. **(06 Marks)**

b. List out the applications of shunt and series DC motors. **(06 Marks)**

c. A 4 pole DC shunt motor takes 22.5 A from a 250 V supply. $R_a = 0.5\ \Omega$ and $R_{sh} = 125\ \Omega$. The armature is wave wound with 300 conductors. If the flux per pole is 0.02 wb. Calculate (i) Speed (ii) Torque developed (iii) Power developed. **(08 Marks)**

OR

8 a. Derive an expression for the armature torque developed in a dc motor. **(06 Marks)**

b. Explain with neat sketch the constructional features of a DC generator and mention the function of each part. **(08 Marks)**

c. An 8 pole DC generator has 500 armature conductors and has useful flux per pole of 0.065 wb. What will be emf generated if it is lap connected and runs at 1000 rpm? What must be speed at which it is to be driven to produce the same emf if it is wave connected? **(06 Marks)**

Module-5

9 a. Derive an EMF equation of the alternator. **(08 Marks)**

b. With neat figure, compare squirrel cage and slip ring type of rotor. **(06 Marks)**

c. A 2 pole, 3 phase alternator running at 3000 rpm has 42 armature slots with 2 conductors in each slot. Calculate (i) Frequency (ii) Flux/pole required to generate a phase voltage of 1100 V. Assume $K_d = 0.97$ and full pitch winding. **(06 Marks)**

OR

10 a. Explain the concept of rotating magnetic field in a 3 phase induction motor. **(08 Marks)**

b. With a neat figure, compare salient pole and non-salient pole type of Rotor. **(06 Marks)**

c. A 3 phase Induction motor is wound for 4 poles and is supplied from 50 Hz supply. Calculate : (i) Synchronous speed
(ii) The speed of the rotor when the slip is 4%
(iii) The rotor frequency when the speed of the rotor is 1450 rpm. **(06 Marks)**

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CBCS SCHEME

USN | | | | | | | | | |

18ELE13/23

First/Second Semester B.E. Degree Examination, Dec.2024/Jan.2025
Basic Electrical Engineering

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

Module-1

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   (i) Frequency.
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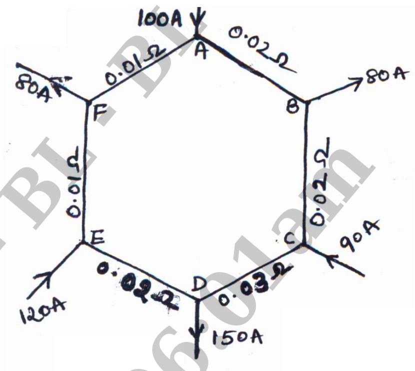

Fig. Q1 (c) **(08 Marks)**

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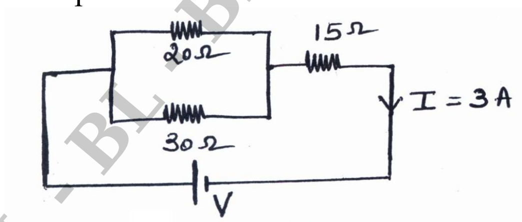

Fig. Q2 (b) **(06 Marks)**

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CBCS SCHEME

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

18ELN14/24

First/Second Semester B.E. Degree Examination, Dec.2024/Jan.2025
Basic Electronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With a circuit diagram and waveform, explain the working of center tap full wave rectifier. Show that the efficiency of full wave rectifier = 81%. **(08 Marks)**

b. For the circuit shown in Fig. Q1 (b), find the currents and voltages in the circuit for $R_L = 450\ \Omega$. Assume $V_2 = 10\,V$. **(08 Marks)**

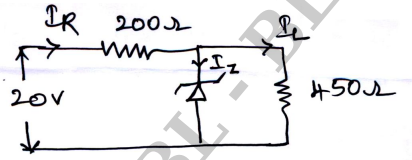

Fig. Q1 (b)

c. Explain the working of photo diode. **(04 Marks)**

OR

2 a. Explain the VI characteristics of PN junction diode (both forward and reverse). **(08 Marks)**

b. A half wave rectifier uses a diode whose internal resistance is 30 Ω to supply power to 1.1 KΩ load from 110 V (rms) source of supply. Calculate
(i) DC load voltage (ii) DC load current (iii) Percentage regulation **(06 Marks)**

c. Explain the working of Light emitting diode. **(06 Marks)**

Module-2

3 a. With a neat diagram, explain the construction and characteristics of n-channel JFET. **(10 Marks)**

b. With a neat diagram, explain the operation and characteristics of enhancement type n-channel MOSFET. **(10 Marks)**

OR

4 a. Explain the VI characteristics of SCR. **(10 Marks)**

b. Compare BJT and FET. **(05 Marks)**

c. Define Latching (I_L) and Holding current (I_H) with respect to SCR. **(05 Marks)**

Module-3

5 a. Write ideal characteristics of op-amp. **(08 Marks)**

b. Derive the output voltage for the following :
(i) Differentiator (ii) Voltage follower **(08 Marks)**

c. Fig. Q5 (c) shows circuit of Summing amplifier. Determine the value of output voltage for this circuit. **(04 Marks)**

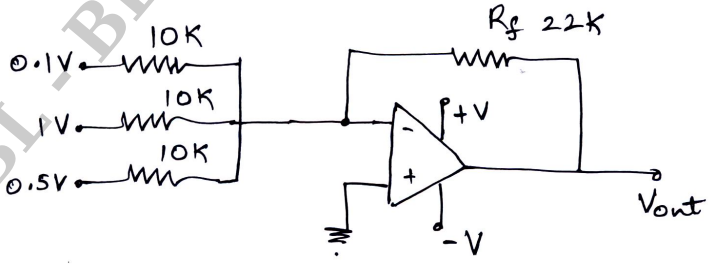

Fig. Q5 (c)

OR

6 a. Explain the following terms related to opamp (i) CMRR (ii) Gain bandwidth product. **(04 Marks)**

b. For a circuit shown in Fig. 6 (b), determine the output voltage V_{01} and V_{02}. Write function of each op amp. **(06 Marks)**

Fig. Q6 (b)

c. Derive the output voltages of inverting amplifier and integrator. **(10 Marks)**

Module-4

7 a. Explain the operation of BJT as amplifier. **(06 Marks)**

b. Explain Barkhausen's criteria for sustained oscillations. **(06 Marks)**

c. Explain the working of Astable multivibrator constructed using IC-555 timer. **(08 Marks)**

OR

8 a. Define feedback amplifier. Mention the ways of connecting the feedback signal. **(06 Marks)**

b. Explain the operation of transistor switch circuit to switch ON/OFF an LED. **(06 Marks)**

c. Define an oscillator. With necessary equations, explain the working of Wein Bridge Oscillator. **(08 Marks)**

Module-5

9 a. Perform the following :

(i) Convert $(398)_{10} = (?)_b = (?)_8 = (?)_{16}$

(ii) Subtract $(1111)_2 - (1100)_2$ using 1's complement. **(05 Marks)**

b. Realize basic gates using NAND gate. **(05 Marks)**

c. Explain the working of 4 : 1 multiplexer. **(05 Marks)**

d. With a block diagram, explain communication system. **(05 Marks)**

OR

10 a. Design full adder using three variables and implement it using two half adders. **(08 Marks)**

b. Simplify the following Boolean expression and implement using basic gates :

(i) $y = \overline{a(b+c)} + \bar{a}b + \bar{c}(\overline{a+b})$

(ii) $y = (\bar{A}+B+C)(A+B+C)$ **(06 Marks)**

c. With the help of logic diagram and truth table explain the working of clocked SR flip flop. **(06 Marks)**

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CBCS SCHEME

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

18ELN14/24

First/Second Semester B.E. Degree Examination, Dec.2024/Jan.2025
Basic Electronics

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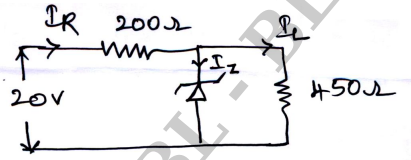

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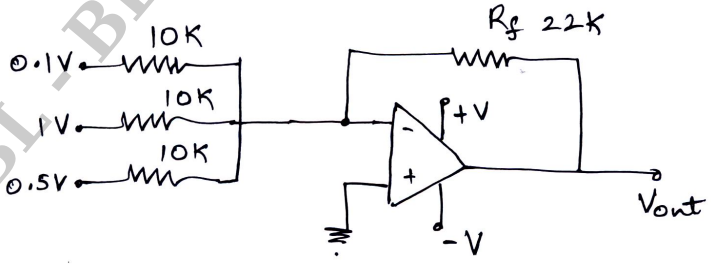

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10 a. Design full adder using three variables and implement it using two half adders. **(08 Marks)**

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(i) $y = a\overline{(b+c)} + \bar{a}b + \bar{c}\overline{(a+b)}$

(ii) $y = (\bar{A}+B+C)(A+B+C)$ **(06 Marks)**

c. With the help of logic diagram and truth table explain the working of clocked SR flip flop. **(06 Marks)**

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CBCS SCHEME

USN | | | | | | | | | |

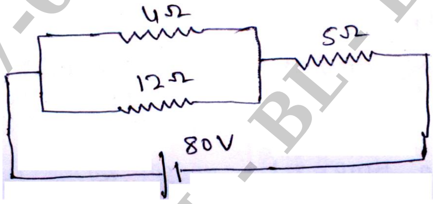
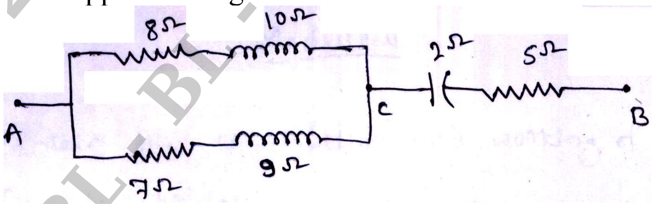
BEEE103/203

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

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 law as applied to D.C. circuits.	**7**	**L1, L2**	**CO1**
	b.	For a network shown in Fig.Q.1(b), determine: i) The voltage drop in each resistor ii) The current in each resistor.  Fig.Q.1(b)	**6**	**L3**	**CO1, CO3**
	c.	State and explain the Ohm's law. Mention its limitations.	**7**	**L1, L2**	**CO1**
		OR			
Q.2	**a.**	Explain statically and dynamically induced e.m.f.'s.	**8**	**L1, L2**	**CO1**
	b.	Two coupled coils of self-inductances 0.8H and 0.2 H have a co-efficient of coupling 0.9. Find the mutual inductance and turns ratio.	**6**	**L3**	**CO1**
	c.	Derive the energy stored in the magnetic field.	**6**	**L1, L2**	**CO1**
		Module – 2			
Q.3	**a.**	Define form factor, peak factor obtain its value for a sinusoidal voltage.	**6**	**L1**	**CO2**
	b.	Derive an expression for power in pure inductance circuit and draw voltage, current and power waveforms.	**6**	**L1, L2**	**CO2, CO3**
	c.	In the Fig.Q.3(b) shown below calculate the impedances of AB and the phase angle between voltage and current. Also calculate the total power consumed if the applied voltage between A and B is $200\angle 30°$ volts.  Fig.Q.3(b)	**8**	**L3**	**CO2, CO3**

		OR			
Q.4	**a.**	Derive the expression for R.M.S. value of current of a sinusoidally varying quantity.	**6**	**L1, L2**	**CO2**
	b.	Define power factor and mention its practical importance.	**7**	**L1, L2**	**CO2**
	c.	A series circuit with R = 10 Ω, L = 50 mH and C = 100 μF is supplied with 200 V, 50 Hz. Find: i) The impedance ii) Current iii) Power iv) Power factor.	**7**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Mention the advantages of three-phase system over single phase system.	**5**	**L2**	**CO2**
	b.	Obtain the relationship between line and phase, voltage and current in a three phase balanced star connected system.	**7**	**L1, L2**	**CO3, CO2**
	c.	A balanced 3-phase, star connected load of 150 kW takes a leading current of 100 A with line voltage of 1100 V, 50 Hz. Find the circuit constants of a load per phase.	**8**	**L3**	**CO2, CO3**
		OR			
Q.6	**a.**	Show that the two Wattmeter's are sufficient to measure three phase power. Hence derive the expression for the power factor in terms of Wattmeter readings.	**8**	**L1, L2**	**CO2**
	b.	Establish the relationship between the line and phase currents and voltages in a three phase balanced delta connected system.	**6**	**L1, L2**	**CO2, CO3**
	c.	A balanced delta-connected load of (8 + j6) Ω per phase is supplied from a 3-phase 440 V source. Find line current, power factor, power per phase and total power.	**6**	**L3**	**CO2, CO3**
		Module – 4			
Q.7	**a.**	Explain the construction and working of Kelvin's double bridge.	**8**	**L1, L2**	**CO4**
	b.	Explain two way and three way control of lamp with truth table.	**6**	**L1, L2**	**CO5**
	c.	Explain the construction and working of megger.	**6**	**L1, L2**	**CO5**
		OR			
Q.8	**a.**	Mention the difference between the current transformer and potential transformer.	**6**	**L1, L2**	**CO4**
	b.	Explain the construction of Schering's bridge and derive the expression for the unknown capacitance.	**8**	**L1, L2**	**CO4**
	c.	Write a short note on casing and capping wiring.	**6**	**L1, L2**	**CO5**
		Module – 5			
Q.9	**a.**	What is electric shock? Give the list of preventive measures against the shock.	**6**	**L1, L2**	**CO5**

	b.	Define tariff. Explain briefly the two part tariff with its advantage and disadvantage.	**6**	**L1, L2**	**CO5**
	c.	What is earthing? With neat diagram, explain pipe earthing.	**8**	**L1, L2**	**CO5**
		OR			
Q.10	**a.**	With neat diagram, explain the working of RCCB and ELCB.	**8**	**L1, L2**	**CO5**
	b.	Write a short note on fuse.	**5**	**L1, L2**	**CO5**
	c.	In a residential house the following loads are connected : i) Six lamps of 40 W each, switched on for 5 hr a day. ii) Two fans of 60 W each, switched on for 12 hr a day. iii) One 1000 W (1 kW) heater working for 2 hr per day. iv) One refrigerator of 250 W working for 10 hr per day. If each unit of energy costs Rs.1.90 what will be the total cost in the month of September.	**7**	**L3**	**CO5**

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CBCS SCHEME

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

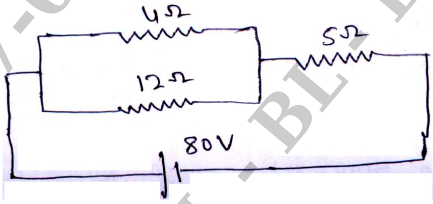
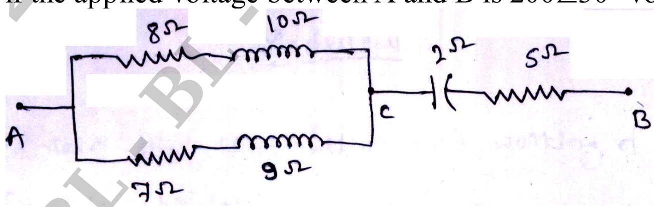
BEEE103/203

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

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 law as applied to D.C. circuits.	**7**	**L1, L2**	**CO1**
	b.	For a network shown in Fig.Q.1(b), determine: i) The voltage drop in each resistor ii) The current in each resistor.  Fig.Q.1(b)	**6**	**L3**	**CO1, CO3**
	c.	State and explain the Ohm's law. Mention its limitations.	**7**	**L1, L2**	**CO1**
		OR			
Q.2	**a.**	Explain statically and dynamically induced e.m.f.'s.	**8**	**L1, L2**	**CO1**
	b.	Two coupled coils of self-inductances 0.8H and 0.2 H have a co-efficient of coupling 0.9. Find the mutual inductance and turns ratio.	**6**	**L3**	**CO1**
	c.	Derive the energy stored in the magnetic field.	**6**	**L1, L2**	**CO1**
		Module – 2			
Q.3	**a.**	Define form factor, peak factor obtain its value for a sinusoidal voltage.	**6**	**L1**	**CO2**
	b.	Derive an expression for power in pure inductance circuit and draw voltage, current and power waveforms.	**6**	**L1, L2**	**CO2, CO3**
	c.	In the Fig.Q.3(b) shown below calculate the impedances of AB and the phase angle between voltage and current. Also calculate the total power consumed if the applied voltage between A and B is $200\angle 30°$ volts.  Fig.Q.3(b)	**8**	**L3**	**CO2, CO3**

		OR			
Q.4	**a.**	Derive the expression for R.M.S. value of current of a sinusoidally varying quantity.	**6**	**L1, L2**	**CO2**
	b.	Define power factor and mention its practical importance.	**7**	**L1, L2**	**CO2**
	c.	A series circuit with R = 10 Ω, L = 50 mH and C = 100 μF is supplied with 200 V, 50 Hz. Find: i) The impedance ii) Current iii) Power iv) Power factor.	**7**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Mention the advantages of three-phase system over single phase system.	**5**	**L2**	**CO2**
	b.	Obtain the relationship between line and phase, voltage and current in a three phase balanced star connected system.	**7**	**L1, L2**	**CO3, CO2**
	c.	A balanced 3-phase, star connected load of 150 kW takes a leading current of 100 A with line voltage of 1100 V, 50 Hz. Find the circuit constants of a load per phase.	**8**	**L3**	**CO2, CO3**
		OR			
Q.6	**a.**	Show that the two Wattmeter's are sufficient to measure three phase power. Hence derive the expression for the power factor in terms of Wattmeter readings.	**8**	**L1, L2**	**CO2**
	b.	Establish the relationship between the line and phase currents and voltages in a three phase balanced delta connected system.	**6**	**L1, L2**	**CO2, CO3**
	c.	A balanced delta-connected load of (8 + j6) Ω per phase is supplied from a 3-phase 440 V source. Find line current, power factor, power per phase and total power.	**6**	**L3**	**CO2, CO3**
		Module – 4			
Q.7	**a.**	Explain the construction and working of Kelvin's double bridge.	**8**	**L1, L2**	**CO4**
	b.	Explain two way and three way control of lamp with truth table.	**6**	**L1, L2**	**CO5**
	c.	Explain the construction and working of megger.	**6**	**L1, L2**	**CO5**
		OR			
Q.8	**a.**	Mention the difference between the current transformer and potential transformer.	**6**	**L1, L2**	**CO4**
	b.	Explain the construction of Schering's bridge and derive the expression for the unknown capacitance.	**8**	**L1, L2**	**CO4**
	c.	Write a short note on casing and capping wiring.	**6**	**L1, L2**	**CO5**
		Module – 5			
Q.9	**a.**	What is electric shock? Give the list of preventive measures against the shock.	**6**	**L1, L2**	**CO5**

	b.	Define tariff. Explain briefly the two part tariff with its advantage and disadvantage.	**6**	**L1, L2**	**CO5**
	c.	What is earthing? With neat diagram, explain pipe earthing.	**8**	**L1, L2**	**CO5**
		OR			
Q.10	**a.**	With neat diagram, explain the working of RCCB and ELCB.	**8**	**L1, L2**	**CO5**
	b.	Write a short note on fuse.	**5**	**L1, L2**	**CO5**
	c.	In a residential house the following loads are connected : i) Six lamps of 40 W each, switched on for 5 hr a day. ii) Two fans of 60 W each, switched on for 12 hr a day. iii) One 1000 W (1 kW) heater working for 2 hr per day. iv) One refrigerator of 250 W working for 10 hr per day. If each unit of energy costs Rs.1.90 what will be the total cost in the month of September.	**7**	**L3**	**CO5**

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CBCS SCHEME

USN | | | | | | | | | |

BMATE101

First Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Mathematics - I for EEE Stream

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 Handbook is permitted.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	With usual notations , prove that $\tan\phi = r.\ d\theta/dr$.	**6**	**L2**	**CO1**
	b.	Show that the curves $r = a(1 + \cos\theta)$ and $r = b\ (1 - \cos\theta)$ intersects orthogonally.	**7**	**L2**	**CO1**
	c.	Find the radius of curvature for the curve $x^3 + y^3 = 3axy$ at $\left(3a/2\ ,3a/2\right)$.	**7**	**L3**	**CO1**
		OR			
Q.2	**a.**	Find the angle of intersection between curves $r^n = a^n \cos n\theta$ and $r^n = b^n \sin n\theta$.	**7**	**L2**	**CO1**
	b.	Find the pedal equation of the curve $r^m = a^m (\cos m\theta + \sin m\theta)$.	**8**	**L2**	**CO1**
	c.	Using modern mathematical tool, write a program to plot the curve $r = 2\lvert\cos 2\theta\rvert$.	**5**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Expand $\sqrt{1+\sin 2x}$ using Maclaurin's series expansion upto terms containing x^6.	**6**	**L2**	**CO1**
	b.	If $u = f\left(x/y\ ,\ y/z\ ,\ z/x\right)$ then prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}=0$.	**7**	**L2**	**CO1**
	c.	Show that the function $f(x.y) = x^3 + y^3 - 3xy + 1$ is minimum at the point (1, 1).	**7**	**L3**	**CO1**
		OR			
Q.4	**a.**	If $u = xy/z$, $v = yz/x$ and $w = xz/y$ then show that $J\left(\frac{u,v,w}{x,y,z}\right) = 4$.	**7**	**L2**	**CO1**
	b.	Find the extreme values of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20$.	**8**	**L3**	**CO1**
	c.	Using modern tool write a program to evaluate $\lim_{x\to\infty}\left(1+1/x\right)^x$.	**5**	**L3**	**CO5**

		Module – 3			
Q.5	**a.**	Solve $x\frac{dy}{dx} + y = x^3y^6$.	**6**	**L2**	**CO2**
	b.	Find the orthogonal trajectories of a family of curves $\frac{2a}{r} = 1 - \cos\theta$.	**7**	**L3**	**CO2**
	c.	Solve $xy(p^2) - (x^2 + y^2)p + xy = 0$.	**7**	**L2**	**CO2**
		OR			
Q.6	**a.**	Solve $(x^2 + y^2 + x)dx + xy\,dy = 0$.	**6**	**L2**	**CO2**
	b.	A series circuit with resistance R, inductance L and electromotive force E is governed by the differential equation $L\frac{di}{dt} + Ri = E$, where L and R are constants and initially the current i is zero. Find the current at any time t.	**7**	**L3**	**CO2**
	c.	Solve $(px - y)(py + x) = a^2p$ by reducing into Clairaut's form using the substitution $X = x^2$ and $Y = y^2$.	**7**	**L2**	**CO2**
		Module – 4			
Q.7	**a.**	Evaluate $\int_{-1}^{+1}\int_{0}^{z}\int_{x-z}^{x+z}(x + y + z)\,dy\,dx\,dz$.	**6**	**L2**	**CO3**
	b.	Change the order of integration and evaluate $\int_{0}^{1}\int_{x}^{\sqrt{x}} xy\,dy\,dx$.	**7**	**L2**	**CO3**
	c.	Prove that $\beta(m, n) = \frac{\sqrt{m}.\sqrt{n}}{\sqrt{m+n}}$.	**7**	**L2**	**CO3**
		OR			
Q.8	**a.**	Evaluate $\int_{0}^{\infty}\int_{0}^{\infty} e^{-(x^2+y^2)}\,dxdy$ by changing into polar coordinates.	**6**	**L2**	**CO3**
	b.	Evaluate $\int_{0}^{\pi/2}\sqrt{\text{Cot}\theta}\,d\theta$ by expressing in terms of gamma functions.	**7**	**L2**	**CO3**
	c.	Using double integration find the area between the curves $y^2 = 4ax$ and $x^2 = 4ay$.	**7**	**L3**	**CO3**

		Module – 5			
Q.9	**a.**	Find the rank of the matrix $A = \begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$.	**6**	**L2**	**CO4**
	b.	Investigate the values of λ and μ such that the system of equations $x + y + z = 6$, $x + 2y + 3z = 10$ and $x + 2y + \lambda z = \mu$ may have i) Unique solution ii) Infinite solution iii) No solution.	**7**	**L3**	**CO4**
	c.	Using Rayleigh's power method find the largest eigen value and the corresponding eigen vector of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by taking $[1, 1, 1]^T$ as initial eigen vector.	**7**	**L3**	**CO4**
		OR			
Q.10	**a.**	Solve by using Gauss – Jordan method $x + y + z = 9$, $x - 2y + 3z = 8$ and $2x + y - z = 3$.	**7**	**L2**	**CO4**
	b.	Solve by using Gauss – Siedel method $20x + y - 2z = 17$, $3x + 20y - z = -18$ and $2x - 3y + 20z = 25$.	**8**	**L2**	**CO4**
	c.	Using modern mathematical model, write a program to test the consistency of the equations $x + 2y - z = 1$, $2x + y + 4z = 2$ and $3x + 3y + 4z = 1$.	**5**	**L3**	**CO5**

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CBCS SCHEME

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BMATE201

Second Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Mathematics – II for EEE stream

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.	If $\vec{F} = \nabla(xy^3z^2)$ find div $\vec{F}$ and curl $\vec{F}$ at the points (1, -1, 1).	7	L2	CO1
	b.	Show that $\vec{F} = (y+z)i + (z+x)j + (x+y)k$ is irrotational. Also find a scalar function ϕ such that $\vec{F} = \nabla\phi$.	7	L3	CO1
	c.	Using Green's theorem, evaluate $\oint_C (xy + y^2)dx + x^2dy$ over the region bounded by the curves $y = x$ and $y = x^2$.	6	L3	CO1
		OR			
Q.2	a.	Find the directional derivatives of $\phi = x^2yz + 4xz^2$ at (1, -2, -1) along $2i - j - 2k$.	7	L2	CO1
	b.	If $\vec{F} = xyi + yzj + zxk$, evaluate $\int_C \vec{F} \cdot d\vec{r}$ where C is the curve represented by $x = t, y = t^2, z = t^3, -1 \le t \le 1$.	7	L2	CO1
	c.	Using modern mathematical tools, write the code to find gradient of $\phi = x^2y + 2xz - 4$.	6	L3	CO5
		Module – 2			
Q.3	a.	Define Vector space, Subspace and Linear dependent.	7	L2	CO2
	b.	Find the dimension and basis of the subspace spanned by the vectors, (2, 4, 2), (1, -1, 0), (1, 2, 1) and (0, 3, 1) in V_3R.	7	L2	CO2
	c.	Prove that the following functions are linear transformation, $T: R^3 \to R^2$ defined by T(x, y, z) = (y, -x, -z).	6	L2	CO2
		OR			
Q.4	a.	Determine whether the vectors V_1 = (1, 2, 3), V_2 = (3, 1, 7) and V_3 = (2, 5, 8) are linearly dependent or linearly independent.	7	L2	CO2
	b.	Let $T: V \to W$ be a linear transformation defined by, T(x, y, z) = (x+y, x-y, 2x+z). Find the range, null space, rank, nullity and hence verify the rank nullity theorem.	7	L2	CO2

			Marks	Level	CO
	c.	Using the modern mathematical tool, write a code to verify whether the following vectors (2, 1, 5, 4) and (3, 4, 7, 8) are orthogonal.	6	L3	CO5
		Module – 3			
Q.5	a.	Find the Laplace transform of, $2^t + \frac{\cos 2t - \cos 3t}{t} + t\sin t$.	7	L2	CO3
	b.	Given $f(t) = \begin{cases} E, & 0 < t < \frac{a}{2} \\ -E, & \frac{a}{2} < t < a \end{cases}$ where f(t+a) = f(t), show that $L[(f(t)] = \frac{E}{S}\tanh\left(\frac{aS}{4}\right)$.	7	L3	CO3
	c.	Express $f(t) = \begin{cases} \sin t, & 0 \le t < \pi \\ \sin 2t, & \pi \le t < 2\pi \\ \sin 3t, & t \ge 2\pi \end{cases}$ in terms of the Heaviside unit step function and hence find L[f(t)].	6	L3	CO3
		OR			
Q.6	a.	Find the inverse Laplace transform of, $\frac{1}{s(s+1)(s+2)(s+3)}$.	7	L2	CO3
	b.	Find $L^{-1}\left[\frac{S}{(S^2+a^2)^2}\right]$ using convolution theorem.	7	L3	CO3
	c.	Employ Laplace transform to solve the equation : $y'' + 5y' + 6y = 5e^{2t}$, $y(0) = 2,\ y'(0) = 1$.	6	L3	CO3
		Module – 4			
Q.7	a.	Using Newton-Raphson method, find the root that lies near x = 4.5 of the equation $\tan x = x$. Correct to four decimal places.	7	L2	CO4
	b.	The area of a circle (A) corresponding to diameter (D) is given below, (table below) Find the area corresponding to diameter 105 using an appropriate interpolation formula.	7	L3	CO4
	c.	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's $\frac{1}{3}^{rd}$ rule taking four equal parts.	6	L3	CO4
		OR			
Q.8	a.	Find the real root of $x\log_{10} x - 1.2 = 0$ by the method of False position. Carry out three iterations.	7	L2	CO4

Table for Q.7 b.:

D	80	85	90	95	100
A	5026	5674	6362	7088	7854

	b.	Use Lagrange's interpolation formula to find y at x = 10 given, x: 5, 6, 9, 11 y: 12, 13, 14, 16	7	L2	CO4
	c.	Evaluate $\int_0^1 \frac{dx}{1+x}$ taking seven ordinates by applying Simpson's $\frac{3}{8}^{th}$ rule.	6	L3	CO4
		Module – 5			
Q.9	a.	Use Taylor's series method to find y at x = 0.1 considering upto the third degree given that $\frac{dy}{dx} = x^2 + y^2$ and y(0) = 1.	7	L2	CO4
	b.	Given $\frac{dy}{dx} = 3x + \frac{y}{2}$, y(0) = 1. Compute y(0.2) by taking h = 0.2, using Runge-Kutta method of fourth order.	7	L2	CO4
	c.	Given that $\frac{dy}{dx} = x - y^2$ and the data y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762. Compute y at x = 0.8 by using Milne's method.	6	L2	CO4
		OR			
Q.10	a.	Using modified Euler's formula, compute y at x = 0.2 given that $\frac{dy}{dx} = x + y$, y(0) = 1 and h = 0.2	7	L3	CO4
	b.	Use fourth order Runge-Kutta method to compute y(1.1) given that $\frac{dy}{dx} = xy^{\frac{1}{3}}$, y(1) = 1 and h = 0.1	7	L2	CO4
	c.	Using modern mathematical tools, write the code to find the solution of $\frac{dy}{dx} = 1 + \frac{y}{x}$ at y(2) taking h = 0.2 and y(1) = 2 by Runge-Kutta method of order four.	6	L3	CO5

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CBCS SCHEME

USN | | | | | | | | | | **18EE32**

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
Electric Circuit Analysis

Time: 3 hrs. Max. Marks: 100

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

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-1

1 a. Differentiate between :
- i) Active and passive elements
- ii) Unilateral and bilateral elements
- iii) Linear and non-linear elements
- iv) Independent and dependent sources
- v) Ideal and practical sources. **(10 Marks)**

b. Find the current through the 4Ω resistor using source transformation technique and hence determine the power absorbed in it for the circuit given in Fig.Q1(b).

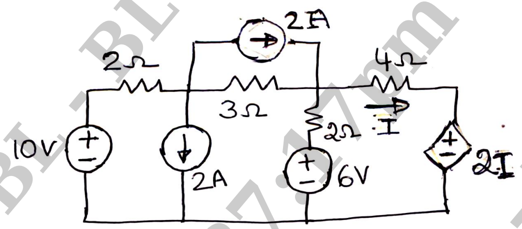

Fig.Q1(b) **(10 Marks)**

OR

2 a. What is Supernode? **(03 Marks)**

b. Find the equivalent RPQ between P and Q for the circuit given in Fig.Q2(b).

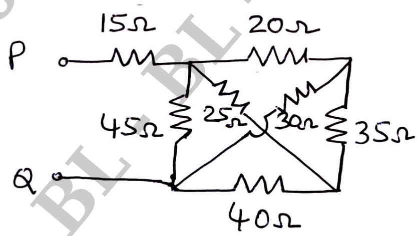

Fig.Q2(b) **(08 Marks)**

c. Find the Mesh currents for the circuit shown in Fig.Q2(c).

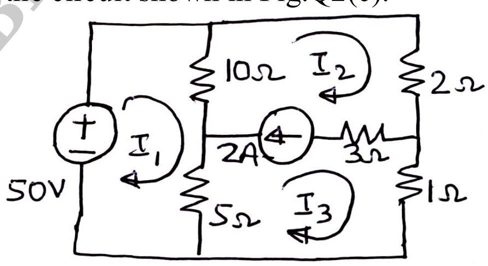

Fig.Q2(c) **(09 Marks)**

Module-2

3 a. State and explain superposition theorem. **(05 Marks)**

b. Find the current through the 24Ω resistor using thevenin theorem of the circuit shown in Fig.Q3(b).

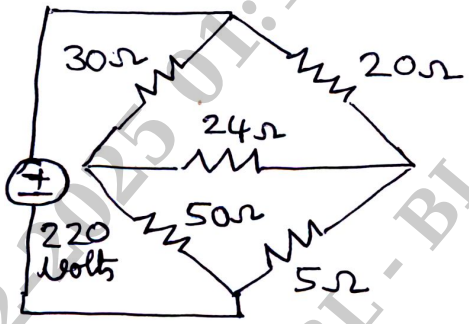

Fig.Q3(b) **(08 Marks)**

c. Determine the value of Z_L for which power transferred form the source is maximum for the circuit shown in Fig.Q3(c).

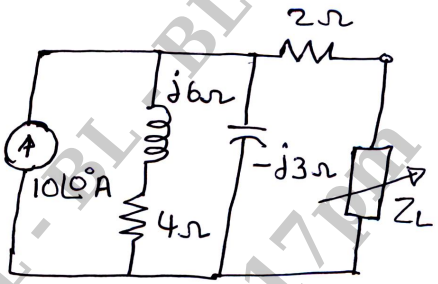

Fig.Q3(c) **(07 Marks)**

OR

4 a. Find the current through the 10Ω resistor for the circuit shown in Fig.Q4(a). Use Millman's theorem.

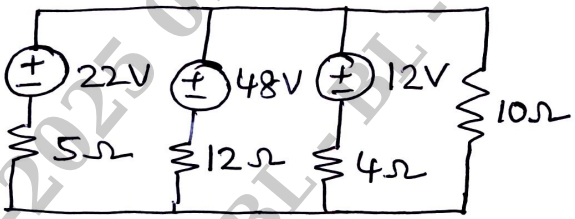

Fig.Q4(a) **(06 Marks)**

b. Use Norton's theorem to find I_x for the circuit shown in the Fig.Q4(b).

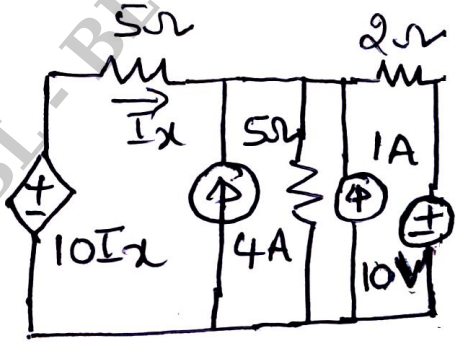

Fig.Q4(b) **(08 Marks)**

c. State and explain reciprocity theorem. **(06 Marks)**

Module-3

5 a. Show that the resonance frequency is the geometric mean of the two half power frequencies. **(06 Marks)**

b. An impedance coil having a resistance of 20Ω and an inductance of 0.02H is connected in series with capacitance of 0.01μF. Calculate :
i) Q-factor
ii) Resonant frequency
iii) The half power frequencies. **(06 Marks)**

c. In the circuit shown in the Fig.Q5(c), the switch is closed at t = 0. Assuming all initial conditions as zero, find i(t), $\frac{di(t)}{dt}$ and $\frac{d^2i(t)}{dt^2}$ at $t = 0^+$.

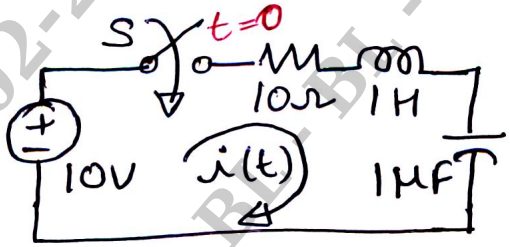

Fig.Q5(c) **(08 Marks)**

OR

6 a. Determine the resonance frequency for the parallel circuit given in Fig.Q6(a).

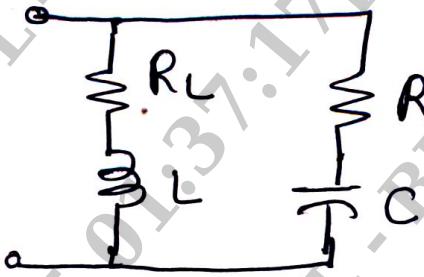

Fig.Q6(a) **(06 Marks)**

b. In the networks shown in Fig.Q6(b), the switch S is moved from the position 1 to the position 2 at t = 0, steady state condition having reached before switching. Find i(t), $\frac{di(t)}{dt}$ and $\frac{d^2i(t)}{dt^2}$ at $t = 0^+$. **(10 Marks)**

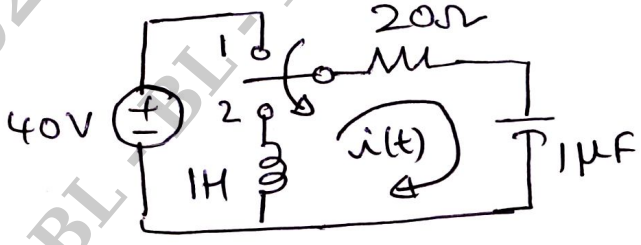

Fig.Q6(b)

c. Define and derive the expression for dynamic impedance. Refer Fig.Q6(b). **(04 Marks)**

Module-4

7 a. State and explain initial and final value theorem. **(10 Marks)**

b. Find the Laplace transforms of : i) sinh wt ii) cos wt. **(04 Marks)**

c. State and explain first shifting theorem. **(06 Marks)**

OR

8 a. Find the Lapalce transform of the periodic waveform shown the Fig.Q8(a).

Fig.Q8(a) **(10 Marks)**

b. Find the initial value of : i) $10e^{5t}$ ii) $5 - e^{-3t}$. **(05 Marks)**

c. Find the inverse Lapalce therefore of :

$$F(s) = \frac{5}{s^2 - 5s + 6}.$$ **(05 Marks)**

Module-5

9 a. A 400 V, 3-phase supply feeds an unbalanced 3-wire star connected load consisting of impedances $Z_R = 7\angle 10°\Omega$, $Z_Y = 8\angle 30°\Omega$ and $Z_B = 8\angle 50°\Omega$. Assume phase sequence as RYB. Determine the line currents. **(10 Marks)**

b. Define Y-parameters and express Z-parameters in terms of Y- parameters. **(10 Marks)**

OR

10 a. In the network shown in Fig.Q10(a), find the Y and Z- parameters.

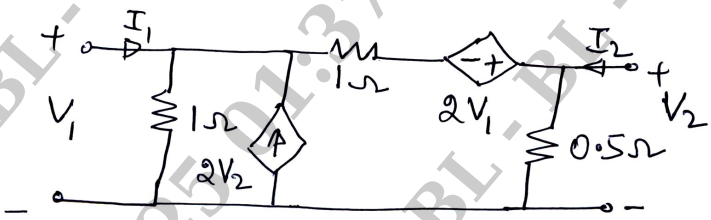

Fig.Q10(a) **(10 Marks)**

b. Define ABCD parameters. Establish the relationship between ABCD and Z- parameters given ABCD parameters. **(10 Marks)**

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18EE33

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
Transformers and Generators

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Draw and explain the full load phasor diagrams of single phase transformer for lagging, leading and unity power factor loads. **(10 Marks)**

b. A 4 KVA, 200/400 V, single phase transformer has the following OC/SC test results.
OC test : 200 V, 0.7 A, 65 W SC Test : 15 V, 10 A, 75 W(LV side).
Calculate the full load efficiency at UPF and regulation at 0.8 pf lagging. **(06 Marks)**

c. What is all day efficiency of transformer? How to calculate it? **(04 Marks)**

OR

2 a. Show that open delta connection has a KVA rating of 58% of the rating of the normal delta delta connection. Also list the limitations of open delta connection. **(08 Marks)**

b. Two electric furnaces are supplied with single phase current at 80 V from a 3 ϕ, 11000 V systems by means of two single phase Scott connected transformers with similar secondary windings. When the load on one furnace is 500 kW (teaser secondary) and on other 800 kW (main secondary) what will flow in each on the 3 lines at UPF and 0.8 pf lagging. **(08 Marks)**

c. State the advantages of single 3-phase unit transformer over bank of single phase transformers. **(04 Marks)**

Module-2

3 a. With a neat circuit diagram, explain in detail Sumpner's test for determining the efficiency and voltage regulation of transformer. **(08 Marks)**

b. Derive an expression for the currents and load shared by two transformers connected in parallel supplying a common load when no load of these are equal. **(06 Marks)**

c. Two 1 ϕ transformers rated at 250 KVA each are operated in parallel on both sides. Impedances of transformers are $(1 + j6)\Omega$ and $(1.2 + j4.8)\Omega$ respectively. Find the load shared by each when the total load is 500 KVA at 0.8 pf lagging. **(06 Marks)**

OR

4 a. What is an auto transformer? Derive an expression for the saving of copper in an auto transformer as compared to an equivalent two winding transformer. What are the advantages and limitations? **(10 Marks)**

b. With the help of sketches, explain the working of on load tap changer. **(06 Marks)**

c. What are the conditions to be satisfied for parallel operation of two transformers? **(04 Marks)**

Module-3

5 a. What is three winding transformer? Explain how the stabilization is achieved due to the tertiary winding. **(07 Marks)**

b. What is commutation? Explain practical commutation with neat diagram of DC machine. **(08 Marks)**

c. Derive emf equation of alternators. **(05 Marks)**

OR

6 a. What is armature reaction? With neat figures explain armature reaction in DC machine under normal working conditions. **(08 Marks)**

b. Explain the methods used to reduce harmonics in 3 ϕ alternators. **(06 Marks)**

c. A 4 pole, 3 ϕ, 50 Hz star connected alternator has 60 slots with 4 conductors/slot. The coils are short pitched by 3 slots. If the phase speed is 60º, find the phase voltage induced for a flux/pole 0.943Wb sinusoidally distributed in space. All the turns/phase are in series. **(06 Marks)**

Module-4

7 a. Discuss the effect of change of excitation at constant load. **(06 Marks)**

b. Name the various methods for determining the voltage regulation for 3 ϕ alternator. Explain EMF method in detail. **(08 Marks)**

c. What is short circuit ratio? Explain the significance of SCR. **(06 Marks)**

OR

8 a. With a neat sketch, explain OCC and SCC characteristics of an alternator. **(06 Marks)**

b. Differentiate between synchronous reactance, adjusted synchronous reactance and Potier reactance. **(06 Marks)**

c. The following test results are obtained on a 6600 V alternator :

Open circuit voltage	3100	5000	6600	7500	8300
Field current (Amps)	16	25	37.5	50	70

A field current of 20 A is found necessary to circulate full load current on short circuit of the armature. Using ampere-turn method, find the full load regulation at 0.8 pf lagging. Neglect resistance and leakage reactance. **(08 Marks)**

Module-5

9 a. With a neat circuit diagram, explain slip test to determine direct axis reactance and quadrature axis reactance of an salient pole synchronous generator. **(08 Marks)**

b. Derive the expression for synchronizing power. **(06 Marks)**

c. A 3ϕ star connected synchronous generator supplies current of 10 A having phase angle of 20 degree lagging at 400 V. Find the load angle and components of armature current I_d and I_q.If X_d = 10Ω and X_q = 6.5 Ω. Armature resistance to be negligible. Also find voltage regulation. **(06 Marks)**

OR

10 a. Write a note on capability curve of synchronous generator. **(06 Marks)**

b. What is hunting in synchronous machines? Explain the role of damper winding. **(06 Marks)**

c. Two identical 2000 KVA alternators operate in parallel. The governor of first machine is such that the frequency drops uniformly from 50 Hz on no load to 48 Hz on full load. The corresponding uniform speed drop of the second machine is 50 Hz to 47.5 Hz.
   i) How will the two machines share a load of 3000 kW?
   ii) What is the maximum load at UPF that can be delivered without overloading either machine? **(08 Marks)**

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CBCS SCHEME

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18EE34

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
Analog Electronic Circuits

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Write a Diode circuit which clips the voltage above +7V and below +4V. Explain its operation with input voltage of 15 sinwt. Write input and output voltage waveform and also transfer characteristics. Assume Ideal Diode. **(06 Marks)**

b. Analyze collector-to-base Bias circuit to obtain expressions for I_B, I_c and V_{CE} and there by derive an expression for S_{ICO}. **(06 Marks)**

c. A voltage divider Bias circuit has upper Resistor R_1 = 18 kΩ, lower Resistor R_2 = 2 kΩ, R_C = 10 kΩ, R_E = 1 kΩ, V_{CC} = 20 V, and β = 100. Using exact analysis, find V_C, V_{CE}, I_C and V_{CB}. Indicate the operating region. **(08 Marks)**

OR

2 a. Write the circuit which clamps Negative peak of 16V peak-to-peak square wave to -2V. Explain its operation with input and output waveforms. Assume Ideal Diode. **(06 Marks)**

b. Design Emitter stabilized bias circuit using V_{CC} = 20V, V_{CEQ} = ½ V_{CC}, I_{CQ} = 3mA, β = 100, $R_C = 5R_E$. Write the circuit. **(07 Marks)**

c. Write transistor switching circuit and explain the switching characteristics of transistor with graph. **(07 Marks)**

Module-2

3 a. Using h-parameter equation, define h-parameter for a 2-port network and write h-model. **(06 Marks)**

b. State and prove Miller's Theorem. **(06 Marks)**

c. Transistor used in amplifier circuit show in Fig Q3(c), has h_{ie} = 1.1 kΩ, h_{fe} = 50, h_{ce} = 0, h_{re} = 0. Find A_I, Z_{in}, Z_0 $A_V = \frac{V_0}{V_{in}}$ & $A_{VS} = \frac{V_0}{V_S}$.

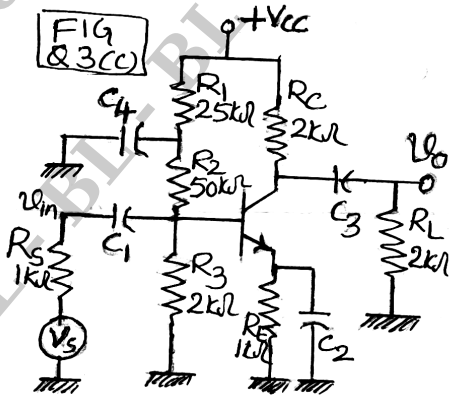

Fig Q3(c) **(08 Marks)**

OR

4 a. For the 2-port network shown in Fig Q4(a), derive an expression for A_I, Z_{in} A_V and Z_0 interms of h-parameters, R_S and R_L.

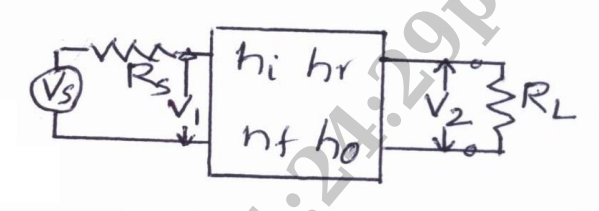

Fig Q4(a) **(06 Marks)**

b. Using simplified (approx) h-model of CE configuration, analyze common base amplifier to derive an expression for A_I, Z_{in}, A_V and Z_0. **(07 Marks)**

c. Transistor used in RC coupled CE amplifier with fixed Bias has h_{ie} = 1 kΩ, h_{fe} = 60, h_{oe} = 15 μA/V, h_{re} = $2*10^{-4}$. Calculate has R_S = 1 kΩ, R_B = 56 kΩ, R_C = 10 kΩ and R_L = 10 kΩ. Find A_I, A_{IS} Z_{in} and Z_0. **(07 Marks)**

Module-3

5 a. Explain why cascading is required. Write Block diagram of 4-stage cascaded amplifier and derive an expression for overall gain of the system in-terms of individual gains. **(06 Marks)**

b. With the help of circuit diagram and waveforms explain Darlington Emitter follower. Mention two important features of this circuit. **(06 Marks)**

c. With the help of block diagram, briefly explain Negative Feed Back System. What are the advantages of Negative Feed Back in Amplifier? **(08 Marks)**

OR

6 a. Derive an expression for output impedance in voltage shunt Feed Back and Input Impedance in voltage series Feed Back amplifiers. **(08 Marks)**

b. An amplifier with Negative Feed Back has closed loop gain of 20. An input of 50 mV is required to produce certain output without Feedback, write 0.5V input is required to produce same output with Negative Feedback. Find open loop gain and Feed Back factor. **(05 Marks)**

c. Two amplifiers are cascaded with R_L = 20 kΩ, R_S = 2 kΩ
Stage 1 : No load Gain = 1, Input Impedance = 500 kΩ, Output Impedance = 1 kΩ
Stage 2 : No-load gain = 300, Input Impedance = 1 kΩ, output Impedance = 50 kΩ
Find i) loaded gain of each stage ii) current gain of cascaded system iii) total overall voltage gain of cascaded system with $R_S(V_L/V_S)$. **(07 Marks)**

Module-4

7 a. With a circuit, Graph/waveform, explain the operation of class 'B' push pull amplifier. Show that maximum conversion efficiency is 78.5%. **(08 Marks)**

b. A series fed class A power amplifier shown in Fig Q7(b) has input voltage generating ac base current of 12mA (Max). Find input power, output power, efficiency and power dissipated.

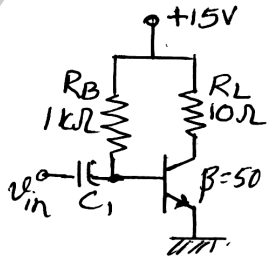

Fig Q7(b) **(05 Marks)**

c. Write the circuit of Wien Bridge oscillator and derive an expression for output frequency. **(07 Marks)**

OR

8 a. State Barkahusen criterion for sustained oscillations. Explain with circuit, how Barkhausen criterion is met in RC-phase shift oscillator. **(08 Marks)**

b. Class B complementary power amplifier has a supply of $\pm 15V$ and load of $R_L = 10\Omega$. Find :

i) Maximum ac power developed and the efficiency under maximum ac power condition

ii) Maximum power dissipated per transistor and the efficiency under Max. Power dissipation condition. **(06 Marks)**

c. Briefly explain electrical equivalent of a crystal. A crystal has L = 1 H, C = 0.01 pF, C_m = 1 pF, R = 2 kΩ. Find series and parallel Resonant frequency and Q-factor. **(06 Marks)**

Module-5

9 a. With circuit and small signal model of common source JFET amplifier using Fixed bias, derive an expression for Z_{in}, Z_0 and A_V. **(06 Marks)**

b. Explain the construction, working and characteristics of n-channel depletion type MOSFET. **(08 Marks)**

c. For circuit shown in Fig Q9(c), find $V_{GS(Q)}$, V_{DSQ} V_S, V_G, I_{DQ} and V_D.

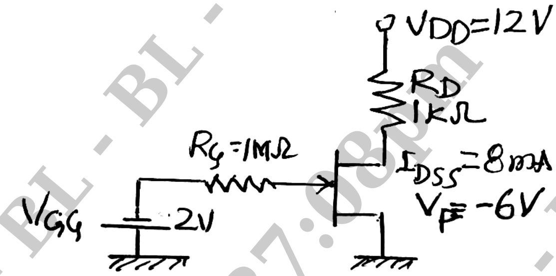

Fig Q9(c) **(06 Marks)**

OR

10 a. Compare JFET over MOSFET and BJT over MOSFET. **(06 Marks)**

b. Explain the construction, working and characteristics of n-channel JFET with neat sketch and graph. **(07 Marks)**

c. For the circuit, shown in Fig Q10(c), find g_m, r_d, z_{in}, z_0, A_v. Write small signal model. Take $V_{GS(Q)} = V_{GG} = -2V$

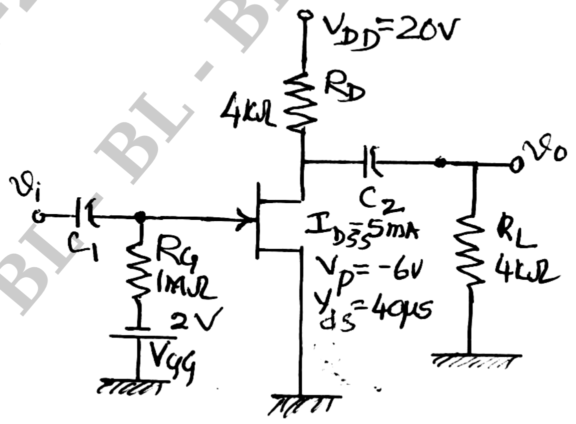

Fig Q10(c) **(07 Marks)**

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CBCS SCHEME

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Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
Digital System Design

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Deduce the following in the proper canonical form as mentioned :
i) $F = AB + \bar{C}D + A\bar{B}C$ into standard SOP form
ii) Z = Wo(W + X + Y) into standard SOP form. **(10 Marks)**

b. Reduce the following expression using K –map and implement the same using basic gates.
i) $f(a, b, c, d) = \sum m(3, 4, 6, 9, 11, 12, 13, 14, 15)$
ii) $f(a, b, c, d) = \Pi m (0, 2, 4, 5, 6, 7, 9, 11)$. **(10 Marks)**

OR

2 a. Simplify $f(a, b, c, d) = \sum m(0, 2, 3, 6, 7, 8, 10, 12, 13)$ using Quine-McClusky method, find prime implicants and essential prime implicants. **(12 Marks)**

b. Reduce the following boolean expression using 5 variable K-map
$f(a, b, c, d, e) = \sum m(0, 2, 4, 5, 6, 7, 13, 15, 16, 18, 20, 21, 22, 23, 29, 31)$. **(08 Marks)**

Module-2

3 a. Design a combinational circuit to find the 9's complement of a single digit BCD number. Realize the equation using logic gates. **(10 Marks)**

b. What is comparator? Design a 2-bit magnitude comparator. **(10 Marks)**

OR

4 a. What is priority encoder? Design 4 input D_0, D_1, D_2 and D_3 encoder with there outputs Y_1, Y_0 and valid input. **(10 Marks)**

b. Implement $F(A,B,C,D) = \bar{A}B\bar{D} + ACD + \bar{B}CD + \bar{A}\bar{C}D$ using 8 to 1 multiplexer. **(10 Marks)**

Module-3

5 a. Explain the operation of master salve J-K flip-flop with logic diagram, truth table, symbol and timing diagram. **(12 Marks)**

b. Derive the characteristic equation of SR flip-flop, J-K flip-flop, T-flip-flop and D-flip-flop. **(08 Marks)**

OR

6 a. Explain the operation of gated SR flip-flop using NAND logic. **(10 Marks)**

b. Construct T-flip-flop using :
i) J-K flip-flop
ii) SR flip-flop. **(10 Marks)**

Module-4

7 a. Mention the four different modes of shift register. With a neat block diagram, explain parallel in serial out shift register. **(10 Marks)**

b. Design asynchronous 3-bit up/down counter using J-K flip-flop. **(10 Marks)**

OR

8 a. Design synchronous Mod-6 counter using D flip-flop. **(10 Marks)**

b. Explain 4-bit universal shift register using 4 to 1 multiplexer with the help of logic diagram. Write a mode control table. **(10 Marks)**

Module-5

9 a. Distinguish between mealy and Moore model with block diagram. Define state variable and excitation variable. **(10 Marks)**

b. Explain flash memory concept in detail. Mention its advantages and drawbacks. **(10 Marks)**

OR

10 a. What is ROM? What are various types of ROM? Explain. **(10 Marks)**

b. Design a clocked sequential circuit that operates according to the state diagram shown in Fig.Q10(b), implement the circuit using D- flip-flop. **(10 Marks)**

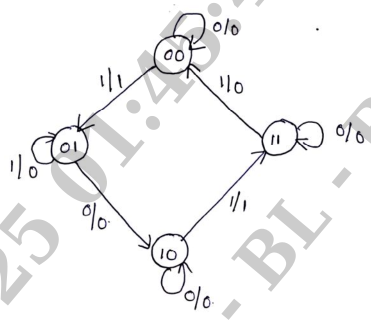

Fig.Q10(b)

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CBCS SCHEME

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Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
Electrical and Electronic Measurements

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Draw Wheatstone's bridge and derive balance equation. **(10 Marks)**
b. Draw a neat circuit diagram and explain Kelvin's double bridge and derive relevant equation. **(10 Marks)**

OR

2 a. Explain fall of potential method of measuring earth resistance. **(10 Marks)**
b. With neat diagram, explain Anderson's bridge. Write advantage and disadvantages. **(10 Marks)**

Module-2

3 a. Explain the construction and working of a single phase dynamometer type power factor meter. **(10 Marks)**
b. Explain :
i) Weston frequency meter
ii) Phase sequence indicator. **(10 Marks)**

OR

4 a. Derive the torque equation of a dynamometer type of wattmeter. **(07 Marks)**
b. Explain the errors in wattmeter. **(07 Marks)**
c. A 3 phase, 400 volts load has power factor of 0.6 lagging. The two wattmeters read a total input power of 20 kW. Find the reading of each wattmeter. **(06 Marks)**

Module-3

5 a. Explain in detail the construction of current transformer and potential transformer. **(12 Marks)**
b. What are the characteristic of current transformer? **(08 Marks)**

OR

6 a. Explain the Silsbee's method of testing current transformer. **(10 Marks)**
b. In detail explain measurement of flux density and magnetizing force. **(10 Marks)**

Module-4

7 a. Draw the block diagram of a electronic energy meter and explain its working. **(10 Marks)**
b. What are ramp type digital voltmeter? **(10 Marks)**

OR

8 a. Explain the working principle of Q meter. **(08 Marks)**
b. Write a brief note:
i) Advantage of electronic voltmeter
ii) Integrating type digital voltmeter. **(12 Marks)**

Module-5

9 a. Write a short note on:
   i) Light Emitting Diode (LED)
   ii) Liquid Crystal Diode (LCD) **(12 Marks)**

   b. Explain the segmental display and dot matrix. **(08 Marks)**

OR

10 Explain in detail the following devices:
   a. Strip chart recorder
   b. Galvanometer type recorder
   c. X-Y recorder. **(20 Marks)**

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CBCS SCHEME

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21EE34

Third Semester B.E. Degree Examination, June/July 2024
Transformers and Generators

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the operation of 1-ph transformer under no-load condition. **(06 Marks)**

b. Draw the equivalent circuit of 1-phase transformer referred to primary side. **(06 Marks)**

c. A transformer has its maximum efficiency of 0.98 at 15 KVA at unity p.f. During a day it is loaded as follows:

12 Hours 2 kW at 0.8 p.f
6 Hours 12 kW at 0.8 p.f
6 Hours 18 kW at 0.9 p.f

Find the all-day efficiency. **(08 Marks)**

OR

2 a. With neat schematic diagram, explain the construction of three phase transformer. **(06 Marks)**

b. With circuit diagram, explain the working principle of scott connection for three to two phase conversion. **(06 Marks)**

c. Consider a 4 KVA, 200/400 V single phase transformer supplying full load current at 0.8 lagging power factor. The OC/SC Tests results are as follows :

OC Test : 200 V, 0.8 A, 70 W (LV side)
SC Test : 20 V, 10 A, 60 W (HV side)

(i) Calculate efficiency, secondary voltage and current into primary at the above load.
(ii) Calculate the load at unity power factor corresponding to maximum efficiency. **(08 Marks)**

Module-2

3 a. Explain the necessity and conditions for parallel operation of 1-phase transformers. **(06 Marks)**

b. Show that how two transformers will share the load with equal ratios. **(06 Marks)**

c. Two 100-KW, single phase transformers are connected in parallel both on the primary and secondary. One transformer has an ohmic drop of 0.5% at full load and an inductive drop of 8% at full load current. The other has an ohmic drop of 0.75% and inductive drop of 2%. Show how will they share a load of 180 kW at 0.9 power factor. **(08 Marks)**

OR

4 a. Discuss the necessary conditions for parallel operation of 3-phase transformers. **(06 Marks)**

b. With neat circuit connection, explain the working principle of Auto Transformer. **(06 Marks)**

c. A two winding transformer is rated at 2400/240 V, 50 KVA. It is re-connected as a step-up auto-transformer, with 2400 V input. Calculate the rating of auto-transformer and the inductively and conductively transferred powers while delivering the rated output at unity power factor. **(08 Marks)**

Module-3

5 a. Discuss the advantages of three winding transformer. **(06 Marks)**

b. Explain the process of Armature reaction in D.C. Generators. **(06 Marks)**

c. Determine per pole the number, (i) of cross-magnetising ampere-turns (ii) of back ampere turns and (iii) of series turns to balance the back ampere-turns in the case of a dc generator having the following data:

500 conductors, total current 200 A, 6 poles, 2-circuit wave winding, angle of load = 10°, leakage coefficient = 1.3 **(08 Marks)**

OR

6 a. Explain the following terms :
(i) Demagnetising Ampere-turns
(ii) Cross magnetizing Ampere-turns. **(06 Marks)**

b. Explain the following terms :
(i) Distribution or Breadth factor
(ii) Winding factor or Spread factors. **(06 Marks)**

c. Calculate the RMS value of the induced e.m.f per phase of a 10-pole 3-ph 50 Hz alternator with 2 slots per pole per phase and 4-conductors per slot in two layers. The coil span is 150°. The flux per pole has a fundamental component of 0.12 wb and a 20% third component. **(08 Marks)**

Module-4

7 a. Explain the method determining the Regulation by synchronous impedance method. **(10 Marks)**

b. In a 50 KVA, star connected, 440 V, 3-phase, 50 Hz alternator, the effective armature resistance is 0.25 ohm per phase, the synchronous reactance is 3.2 Ω per phase and leakage reactance is 0.5 Ω per phase. Determine at rated load and unity power factor.
(i) Internal emf
(ii) No-load emf E_O.
(iii) Percentage Regulation on full load.
(iv) Value of synchronous reactance which replaces armature reaction. **(10 Marks)**

OR

8 a. Explain the method finding the voltage regulation by zero-power factor or Potier method. **(10 Marks)**

b. The open and short circuit test readings for a 3-d star-connected, 1000 KVA, 2000 V, 50 Hz synchronous generators are,

Field amps :	10	20	25	30	40	50
OC Testinal :	800	1500	1760	2000	2350	2600
SC armature current :	-	200	250	300	-	-

The armature effective resistance is 0.2 Ω per phase. Draw the characteristic curves and estimate the full-load percentage regulation at,
(i) 0.8 pf lagging
(ii) 0.8 pf leading **(10 Marks)**

Module-5

9 a. Explain the necessity and advantages of parallel operation and explain the condition for proper synchronization of alternators. **(10 Marks)**

b. A 3-phase, 50 Hz, 2 pole alternator is excited to generate the bus bar voltage of 11 KV at no-load. Calculate synchronizing power per degree of mechanical displacement of the rotor. The machine in star connected and the short circuit current for this excitation is 1200 A. Neglect armature winding resistance. **(10 Marks)**

OR

10 a. Explain the method of finding X_d and X_q of synchronous machine (slip test). **(10 Marks)**

b. Explain the power angle characteristics of salient pole synchronous machines under loaded condition. **(10 Marks)**

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CBCS SCHEME

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BMATE/BEE301

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

Time: 3 hrs. Max. Marks: 100

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

		Module – 1	M	L	C
Q.1	a.	Solve: $(D^4 - 2D^3 + 5D^2 - 8D + 4)y = 0$	06	L2	CO1
	b.	Solve: $(D^2 - 10D + 25)y = 2e^{5x} + \cos x + 5$	07	L3	CO1
	c.	Solve: $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 2\log x$.	07	L3	CO1
		OR			
Q.2	a.	Solve $(D^3 - 4D^2 + 5D - 2)y = 0$.	06	L2	CO1
	b.	Solve $(1+x)^2y'' + (1+x)y' + y = 2\sin\log(1+x)$	07	L3	CO1
	c.	In L-C-R circuit, the charge q on a plate of a consider is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = E\sin pt$. The circuit is tuned to resonance so that $p^2 = \frac{1}{LC}$, if initially the current I and the charge q be zero, show that, for small values of R/L, the current in the circuit at time t is given by $\left(\frac{Et}{2L}\right)\sin pt$.	07	L3	CO1
		Module – 2			
Q.3	a.	Fit a straight line y = ax + b in the Least Square Method to the following data: x: 50, 70, 100, 120 y: 12, 15, 21, 25	06	L2	CO2
	b.	Find the correlation coefficient and hence find the regression lines for the data: x: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 y: 10, 12, 16, 28, 25, 36, 41, 49, 40, 50	07	L3	CO2
	c.	Given the equation of the regression lines x = 19.13 – 0.87y and y = 11.64 – 0.5x. Compute the mean of x's, mean of y's and the coefficient of correlation.	07	L3	CO2
		OR			
Q.4	a.	Fit a parabola $y = ax^2 + bx + c$ by the method of least squares for the data: x: 2, 4, 6, 8, 10 y: 3.07, 12.85, 31.47, 57.38, 91.29	06	L2	CO2
	b.	Obtain the lines of Regression and hence find the coefficient of correlation for the data: x: 1, 3, 4, 2, 5, 8, 9, 10, 13, 15 y: 8, 6, 10, 8, 12, 16, 16, 10, 32, 32	07	L3	CO2

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

Module – 3

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

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

OR

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

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

Module – 4

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

OR

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

Module – 5

Q.9 a. The probability density function of a variable x is given by the following table: (06, L2, CO5)

x	0	1	2	3	4	5	6
p(x)	K	3K	5K	7K	9K	11K	13K

for what value of K this represents a valid probability distribution? Also find $P(x \geq 5)$ and $P(3 < x \leq 6)$.

b. If the mean and standard deviation of the number of correctly answered questions in a test given to 4096 students are 2.5 and $\sqrt{1.875}$. Find an estimate number of candidates answering correctly: (07, L3, CO5)
(i) 8 or more questions (ii) 2 or less (iii) 5 questions

c. In a normal distribution 31% of the items are under 45 and 8% of the items are over 64. Find the mean and standard deviation of the distribution. (07, L3, CO5)

OR

Q.10 a. Explain the terms: (06, L1, CO5)
(i) Type I and Type II error
(ii) Alternative hypothesis
(iii) Significance level

b. A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure 5, 2, 8, –1, 3, 0, 6, –2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure. $[t_{0.05}(11) = 2.201]$ (07, L3, CO5)

c. 4 coins are tossed 100 times and the following results were obtained. Fit a binomial distribution for the data and test the goodness of fit. $[\chi^2_{0.05} = 9.49]$ (07, L3, CO5)

* * * * *

CBCS SCHEME

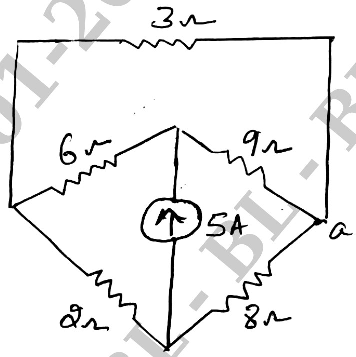
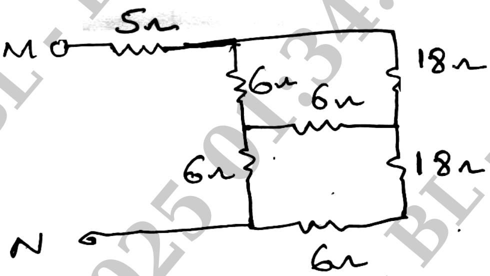
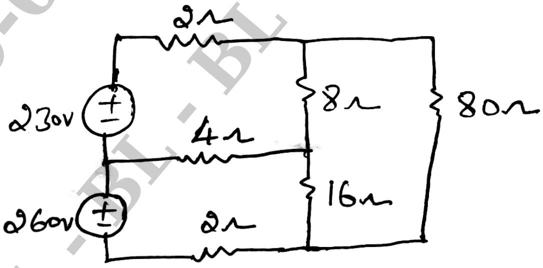
USN | | | | | | | | | | |

BEE302

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Electric Circuit Analysis

Time: 3 hrs. Max. Marks: 100

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

		Module – 1	M	L	C
Q.1	a.	Use source mobility of sources transformation to reduce the given network, shown in Fig Q1(a) into a single voltage source in series with a resistor between points a b.  Fig Q1(a)	6	L3	CO1
	b.	Determine the equivalent resistance between the terminals MN for the networks shown in Fig Q1(b).  Fig Q1(b)	6	L3	CO1
	c.	Use Mesh current analysis to find the power dissipated in the 80Ω resistor of circuit shown in Fig Q1(c).  Fig Q1(c)	8	L3	CO1

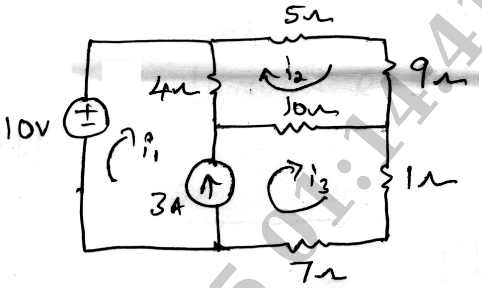
<table>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.2</td><td>a.</td><td>Determine the circuit i_1, i_2, and i_3 in the circuit of Fig Q2(a), using mesh current method.
 

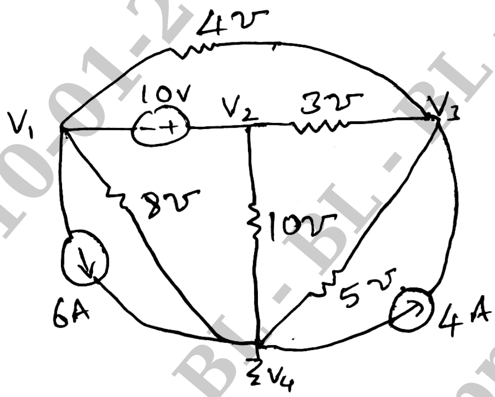
Fig Q2(a)</td><td>6</td><td>L3</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Find the node voltages for the circuit of Fig Q2(b), using nodal analysis.
 

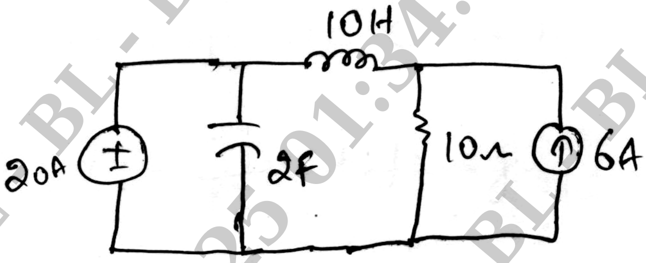
Fig Q2(b)</td><td>8</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>Define Duality. Draw the dual of the network shown in Fig Q2(c).
 

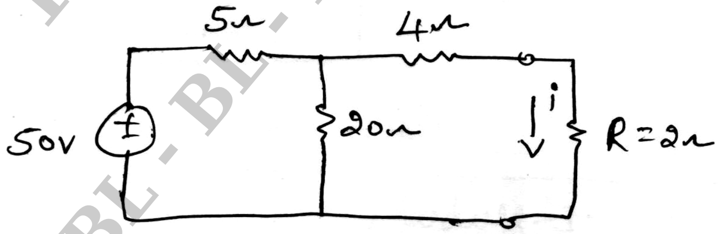
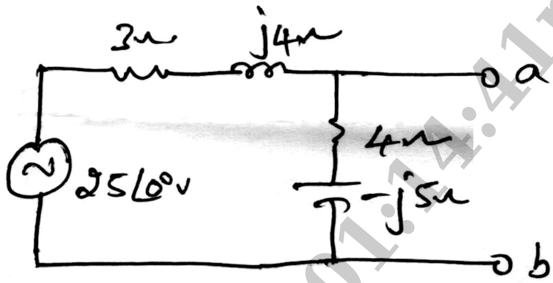
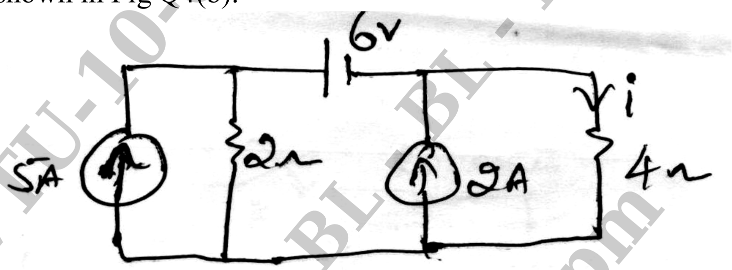
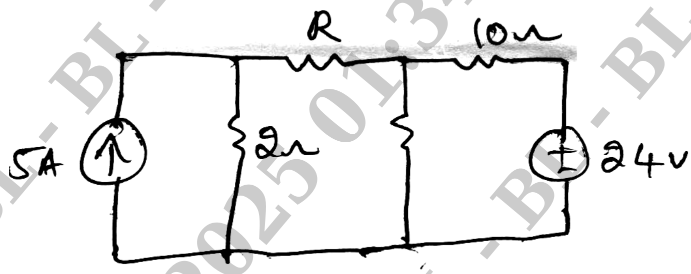
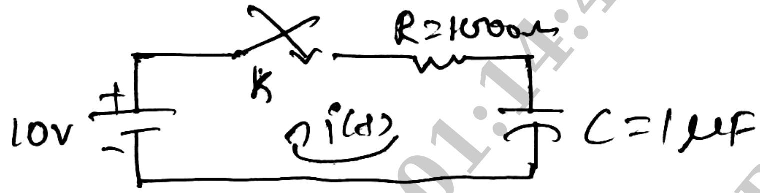
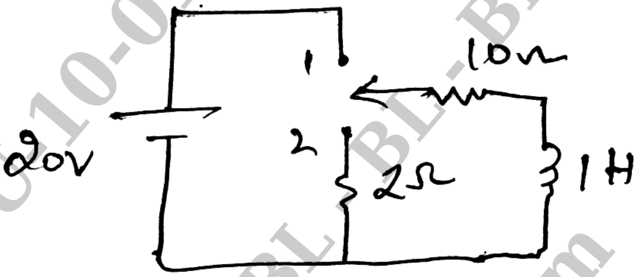
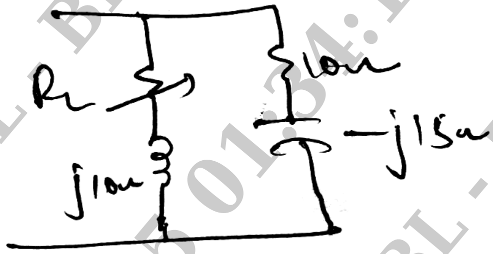
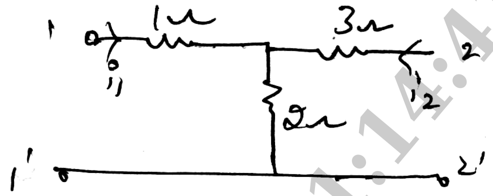
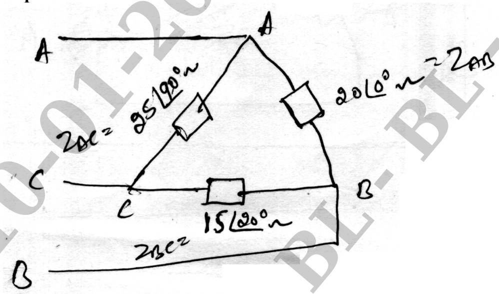
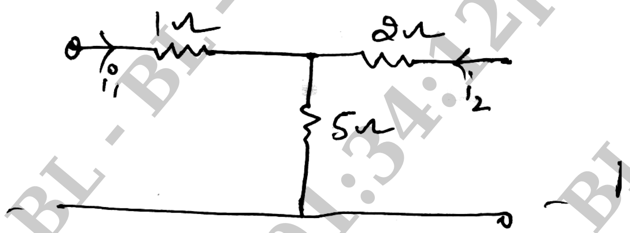
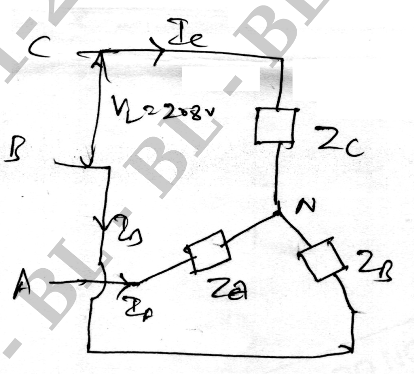
Fig Q2(c)</td><td>6</td><td>L3</td><td>CO1</td></tr>
<tr><td colspan="6" align="center">Module – 2</td></tr>
<tr><td>Q.3</td><td>a.</td><td>State and prove super position theorem.</td><td>8</td><td>L1</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>For the network shown in Fig Q3(b), find the current i though R = 2Ω using the Thevenin's theorem.
 

Fig Q3(b)</td><td>6</td><td>L3</td><td>CO2</td></tr>
</table>

	c.	Obtain the Norton's equivalent for the circuit shown in Fig Q3(c), between point a of b.  Fig Q3(c)	**6**	**L3**	**CO2**
		OR			
Q.4	**a.**	State and explain maximum power transfer theorem for DC circuit (Resistive Load).	**6**	**L1**	**CO2**
	b.	Find the current through 4Ω resistor using super position theorem for the circuit shown in Fig Q4(b).  Fig Q4(b)	**8**	**L3**	**CO2**
	c.	Determine the value of R for the circuit shown in Fig Q4(c) and also determine the maximum power transfer.  Fig Q4(c)	**6**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Explain with circuit diagram how to determine of resonant frequency, bandwidth and Q of a series circuit.	**10**	**L2**	**CO2**
	b.	For the network elements R, L and C, write the equivalent circuit A + t = 0^+[initial condition] A + t = ∞ [find condition]	**4**	**L2**	**CO4**
	c.	A series RLC circuit has R = 4Ω, L = 1mH an C = 10μF, calculate Q-factor, bandwidth, resonant frequency and half frequencies.	**6**	**L3**	**CO2**

		OR			
Q.6	**a.**	In the network shown in Fig Q6(a), the switch K is closed at t = 0 with the capacitor uncharged. Find the values for i, di/dt and $\frac{d^2i}{dt^2}$ at $t = 0^+$.  Fig Q6(a)	**8**	**L3**	**CO4**
	b.	Determine $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$, when the switch K is moved from position 1 to 2 at t = 0 for the Fig Q6(b) shown steady state having reached before switching.  Fig Q6(b)	**8**	**L3**	**CO4**
	c.	Find the value of R_L for the circuit shown in Fig Q6(c)  Fig Q6(c)	**4**	**L3**	**CO**
		Module – 4			
Q.7	**a.**	State and prove initial and final Value theorem.	**10**	**L1**	**CO5**
	b.	Find the laplace transform of the following : i) sinwt ii) coswt iii) e^{-at}sinwt iv) e^{-at} coswt.	**10**	**L2**	**CO5**
		OR			
Q.8	**a.**	Obtain the Laplace transform of i) u(t) ii) r(t) iii) δ(t).	**10**	**L2**	**CO5**
	b.	Apply the initial value and find and final valve theorem respectively to the S-domain equation of $I_1(s)$t of $I_2(s)$ given i) $I_1(s) = \frac{6.67(s+250)}{s(s+166.7)}$ ii) $I_2(s) = \frac{6.67}{s+166.7}$	**10**	**L2**	**CO5**

Module – 5					
Q.9	**a.**	Determine the z-parameter of y-parameter for the circuit shown in Fig Q9(a).  Fig Q9(a)	**10**	**L3**	**CO3**
	b.	A 3ϕ supply with line voltage of 250V has a unbalanced delta connected load as shown in Fig Q9(b). Determine line currents active and reactive power for phase sequence ABC.  Fig Q9(b)	**10**	**L3**	**CO3**
OR					
Q.10	**a.**	Find the transmission parameters for the circuit shown in Fig Q10(a)  Fig Q10(a)	**10**	**L3**	**CO3**
	b.	3ϕ, 4 wire 208V CBA system as shown in Fig Q10(b) has a star connected load with $Z_A = 5\angle 0^\circ\ \Omega$, $Z_B = \angle 30^\circ\ \Omega$ and $Z_c = 10\angle -60^\circ\ \Omega$. Obtain the phase current, line currents and current through neutral wire.  Fig Q 10(b)	**10**	**L3**	**CO3**

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CBCS SCHEME

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

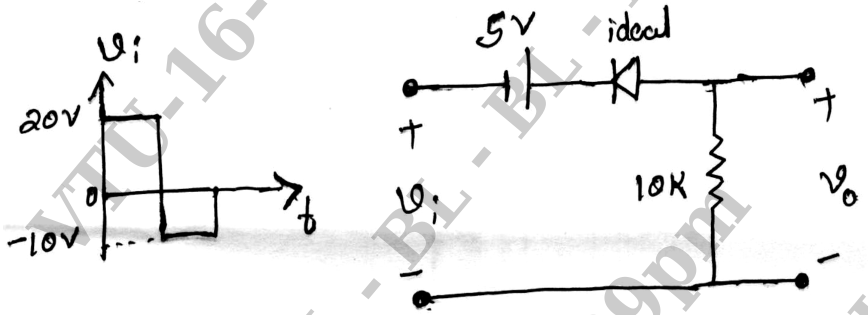
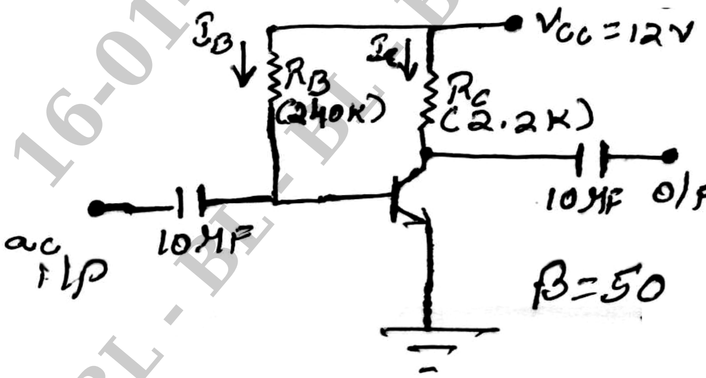
BEE303

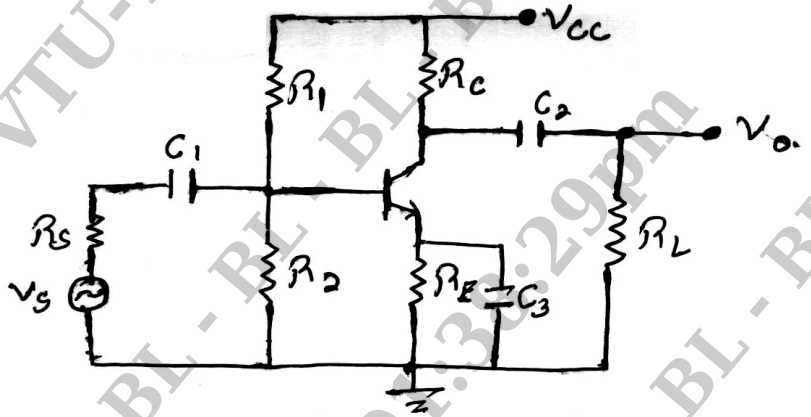
Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

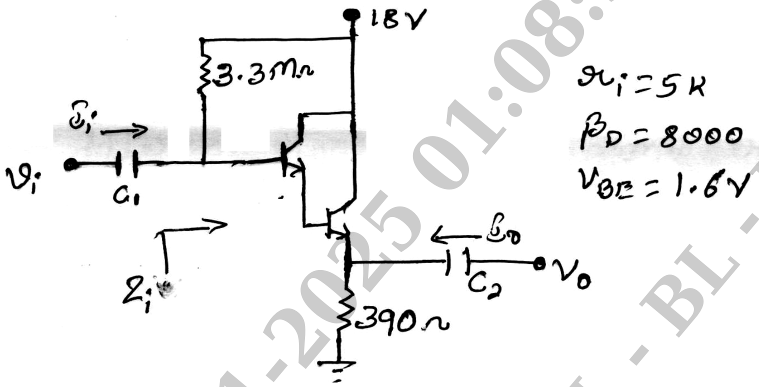
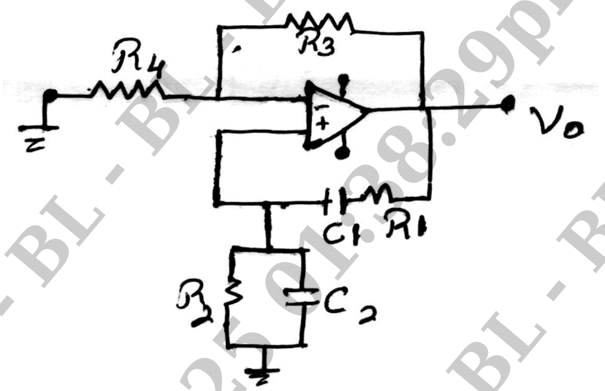
Analog Electronic Circuits

Time: 3 hrs. Max. Marks: 100

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

		Module – 1	M	L	C
Q.1	**a.**	Explain the operation of positive shunt clipper.	**8**	**L2**	**CO1**
	b.	Derive an expression for the stability factor $S_{(VBE)}$ and $S_{(ICO)}$ for fixed bias circuit.	**6**	**L3**	**CO1**
	c.	For the circuit shown in Fig Q1(c), sketch the output voltage waveform.  Fig Q1 (c)	**6**	**L3**	**CO1**
		OR			
Q.2	**a.**	With circuit diagram, explain voltage divider biasing circuit. Also derive the I_B and V_{CE}.	**8**	**L2,3**	**CO1**
	b.	Draw and explain the working of negatives peak clamper.	**6**	**L1,2**	**CO1**
	c.	Determine the following for the fixed bias configuration shown in Fig Q2(c). i) I_{BQ} and I_{CQ} ii) V_{CEQ} iii) V_B and V_C iv) V_{BC}  Fig Q2(c)	**6**	**L3**	**CO1**

Module – 2					
Q.3	**a.**	State and prove dual of miller's theorem.	**6**	**L1,4**	**CO2**
	b.	Define h-parameters. Draw the h-parameter model of a transistor in CE mode.	**6**	**L1,2**	**CO2**
	c.	Obtain midband analysis of BJT single stage amplifier. Derive expression for current gain and input impendence.	**8**	**L3,4**	**CO2**
OR					
Q.4	**a.**	Mention various capacitors effects on frequency response. Derive equations for miller input capacitors and miller output capacitance.	**10**	**L1,3**	**CO2**
	b.	Consider a single stage CE amplifier with R_s = 1K, R_1 = 50K, R_2 = 2K, R_c = 2K, R_L = 2D, h_{fe} = 50, h_{ie} = 1.1K, h_{oe} = 25 r A/V and $h_{re} = 2.5 \times 10^{-4}$ as shown in Fig Q4(b). Find A_i, R_i, R_o, A_v.  Fig Q4(b)	**10**	**L3**	**CO2**
Module – 3					
Q.5	**a.**	Explain the need of a cascading amplifier. Draw and explain to block diagram of two stage cascade amplifier.	**8**	**L2**	**CO3**
	b.	For voltage series feedback amplifier, derive an expression for input impedance and output impedance.	**8**	**L3**	**CO3**
	c.	A feedback amplifier has a gain of 1000 without feedback. Find the gain with feedback for a negative feedback of 10% (gain in dB).	**4**	**L3**	**CO3**
OR					
Q.6	**a.**	Draw a feedback amplifier in block diagram form. Identify each block and explain its function.	**10**	**L1,2**	**CO3**

	b.	For the Darlington emitter – follower shown in Fig Q6(b), calculate i) The DC bias voltage V_B, V_E, V_C and current and I_B and I_C ii) The input and output impedances iii) The voltage and current gains iv) The ac output voltage for V_i = 120mV.  Fig Q6(b)	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Ananlyze the working of series fed directly coupled class A power amplifier with respect to efficiency.	**8**	**L4**	**CO4**
	b.	Design the component values of wein bridge oscillator of Fig Q7(b) for a frequency of oscillations of 4 KHz.  Fig Q7(b)	**4**	**L4**	**CO4**
	c.	Explain the characteristics of crystal with neat diagram, explain the crystal oscillation in series resonances circuit.	**8**	**L2**	**CO4**
		OR			
Q.8	**a.**	Examine the basic principle of oscillators.	**6**	**L4**	**CO4**
	b.	An ideal class B push pull power amplifier with input is output transformers has V_{cc} = 20V, N_2 = $2N_1$ and R_L = 20Ω. The transistors has h_{FE} = 20. Let the input be sinusoidal. For maximum output signal at $V_{CE(P)}$ = V_{CC}. Determine : i) The output signal power ii) The collector dissipation in each transistor iii) Conversion efficiency	**6**	**L3**	**CO4**

	c.	Discuss the different types of power amplifiers.	**8**	**L4**	**CO4**
		Module – 5			
Q.9	**a.**	Explain the basic operation and characteristics of n-channel depletion type MOSFET.	**10**	**L2**	**CO4**
	b.	Derive expression for z_i, z_0, A_v for voltage divider bias circuit using FET.	**10**	**L3**	**CO4**
		OR			
Q.10	**a.**	With neat diagram, explain the construction of n channel JFET.	**10**	**L2**	**CO5**
	b.	Data sheet for a JFET indicates that I_{DSS} = 10mA and $V_{GS(off)}$ = -4V. Determine the drain current for V_{GS} = 0V, -1V and -4V.	**6**	**L3**	**CO5**
	c.	Discuss the difference between JFET and MOSFET.	**4**	**L4**	**CO5**

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CBCS SCHEME

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BEE304

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Transformers and Generators

Time: 3 hrs. Max. Marks: 100

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

		Module – 1	M	L	C
Q.1	**a.**	With the help of phasor diagram explain the operation of practical transformer on load.	**8**	**L1**	**CO1**
	b.	A 5 KVA, 500/250 V, 50 Hz, 1-ϕ transformer gave the following readings. OC Test : 500 V, 1 A, 50 W (LV side open) SC Test : 25 V, 10 A, 60 W (LV side shorted) Determine: i) The efficiency on full load 0.8 lagging p.f. ii) Voltage regulation on full load 0.8 leading p.f iii) The efficiency on 60% of full load 0.8 leading p.f.	**12**	**L2**	**CO1**
		OR			
Q.2	**a.**	With a neat circuit diagram, explain in detail Sumpner's test for determining efficiency of transformer. Mention its advantages and disadvantages.	**10**	**L3**	**CO1**
	b.	In a Sumpner's test on two identical 1-ϕ transformers rated 500 KVA, 11/0.4 KV, 50 Hz the wattmeter reading on HV side is 6000 W and on LV side is 15000 W. Find the efficiency of each transformer on half full load of 0.8 p.f.	**10**	**L4**	**CO1**
		Module – 2			
Q.3	**a.**	With the help of a neat circuit diagram and phasor diagram. Explain the operation of a 3-ϕ star-delta transformer.	**6**	**L1**	**CO2**
	b.	Discuss the necessary condition for the parallel operation of 2-transformers.	**6**	**L1**	**CO2**
	c.	The primary and secondary voltages of an auto transformer are 230 V and 75 V respectively. Calculate the currents in different parts of the winding when the load current is 200 A. Also calculate the saving of copper.	**8**	**L3**	**CO2**
		OR			
Q.4	**a.**	What is an auto transformer? Derive an expression for the saving of copper in an auto transformer as compared to an equivalent 2-winding transformer.	**6**	**L3**	**CO2**
	b.	Explain the working of tap changing transformer.	**6**	**L3**	**CO2**
	c.	Two 1-ϕ transformers share a load of 400 KVA at power factor of 0.8 lag. Their equivalent impedances referred to secondary winding are (1 + j2.5) Ω and (1.5 + j3)Ω respectively. Calculate the load shared by each transformer.	**8**	**L3**	**CO2**

		Module – 3			
Q.5	**a.**	Derive an equation for the emf induced in an alternator. Also derive expression for pitch factor and distribution factor.	**10**	**L1**	**CO3**
	b.	A 3-ϕ star connected alternator is rated at 1600 KVA, 13500 volts. The armature resistance and synchronous reactance are 1.5 Ω and 30 Ω respectively per phase. Calculate the percentage regulation for a load of 1280 KW at a p.f 0.8 lag, upf.	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	Name the various methods of determining the voltage regulation for a 3-ϕ alternator and describe any one method in detail.	**10**	**L4**	**CO3**
	b.	A 2300 V, 50 Hz, 3 - ϕ star connected alternator has an effective armature resistance of 0.2 Ω. A field current of 35 A produces a current of 150 A on short circuit and open circuit Emf 780 V (line). Calculate the voltage regulation at 0.8 p.f lagging and 0.8 leading for the full load current of 25 A.	**10**	**L4**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the synchronizing of 3 - ϕ alternator by lamps dark method and also mention disadvantages.	**6**	**L2**	**CO3**
	b.	Write a short note on power angle characteristics of an alternator.	**4**	**L2**	**CO3**
	c.	The 1 - ϕ alternators operating in parallel have induced emf's on open circuit of 230 $\angle 0°$ and 230 $\angle 10°$ volts and respective reactances of j2 Ω and j3 Ω. Calculate: i) Terminal voltage ii) Current iii) Power delivered by each of the alternators to a load of impedance 6 Ω (resistive).	**10**	**L3**	**CO3**
		OR			
Q.8	**a.**	Explain the concept of two reaction theory in a salient pole synchronous machine.	**10**	**L3**	**CO3**
	b.	Write a short note on capability curves of synchronous generator.	**5**	**L3**	**CO3**
	c.	What is hunting in synchronous machine? Explain the role of damper winding.	**5**	**L3**	**CO3**
		Module – 5			
Q.9	**a.**	Write a brief note on the following: i) Wind energy site selection consideration. ii) The nature of wind.	**10**	**L1**	**CO4**
	b.	Discuss the advantages and disadvantages of PV systems.	**10**	**L2**	**CO4**
		OR			
Q.10	**a.**	With a neat diagram, explain Horizontal and vertical axis wind generators and mention their advantages and disadvantages.	**10**	**L2**	**CO4**
	b.	Write a note on the following: i) Applications of solar cell systems ii) I.V. characteristics of a solar cell.	**10**	**L3**	**CO4**

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CBCS SCHEME

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18EE43

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Prove that the volume of conductor required in a transmission system is inversely proportional to the square of voltage as well as power factor of the load. **(06 Marks)**

b. Mention the advantages and features of ACSR and AAAC. **(06 Marks)**

c. A transmission line conductors with diameter 19.5mm, weights 0.85 kg/mt, span is 275mt. The wind pressure is 39 kg/mt^2 of projected area with ice coating of 13 mm. The ultimate strength of conductor is 8000 kgs. Calculate the maximum sag, if the factor of safety is 2 and ice weight is 910 kg/mt^3. **(08 Marks)**

OR

2 a. With a neat diagram, explain feeders, distributor and service main of a distribution system. **(06 Marks)**

b. Derive the expression for the sag when the supports are at equal levels. **(07 Marks)**

c. A 33KV line is supported on a string of three similar insulators, the mutual capacitance of which across the units 9 times the shunt capacitance between the unit and earthed frame work. Compute the voltage across each insulator and string efficiency. **(07 Marks)**

Module-2

3 a. Derive an expression for the inductance fo a conductor due to internal and external flux. **(10 Marks)**

b. Find the inductance per phase per kilometer for the double circuit line whose conductors are at the corners of a regular hexagon of side 3 mts. Radius of the conductors 2.0 cm. **(10 Marks)**

OR

4 a. Develop an expression for the capacitance of a three phase line with unsymmetrical spaced line with transposed conductors. **(10 Marks)**

b. A 3-phase overhead transmission line has 100 kms length. The diameter is 0.75 cm. The conductors have been arranged in a horizontal plane with 4 mt distance between conductors. Calculate the line constants if the line is transposed. Assume $\rho = 1.73 \times 10^{-8}\ \Omega$ cm. **(10 Marks)**

Module-3

5 a. Mention the classification of transmission line based on the length and the operating voltages. **(04 Marks)**

b. Derive an expression for voltage regulation and efficiency of a short transmission line. Draw the vector diagram. **(08 Marks)**

c. A 3-phase, 50 Hz transmission line has resistance, inductance and capacitance per phase of 9.5 Ω, 0.1 H and 0.8 μF and delivers a load of 35 MW at 132 KV and 0.8 power factor lag. Determine the sending end voltage and current of the line using nominal – T method. **(08 Marks)**

OR

6 a. Derive an expression for sending end voltage and current for long transmission line using rigorous method. **(10 Marks)**

b. The ABCD constants of a three-phase transmission line are A = D = (0.936 + j0.016), B = (33.5 + j138)Ω and C = (–0.9280 + j901.223) × 10^{-6} mho. The load at the receiving and is 40 MW at 200 KV with power factor of 0.86 lagging. Find the magnitude of the sending end voltage, current, power and voltage regulation. Assume that the magnitude of the sending end voltage remains constant. **(10 Marks)**

Module-4

7 a. Explain the phenomenon of corona. What are the factors affecting corona? **(06 Marks)**

b. Sketch and label a cross-section of an insulated cable and explain the significance of the various layers. **(06 Marks)**

c. A single core lead sheathed cable is graded by using two dielectrics of relative permittivity 3.6(inner) and 2.5 (outer) the thickness of each being 1 cm. The core diameter is 1 cm, system voltage is 66 KV, 3-phase. Determine the maximum stress in the two dielectrics. **(08 Marks)**

OR

8 a. Derive an expression for critical disruptive voltage and visual critical voltage with reference to corona. **(06 Marks)**

b. Derive an expression for the insulation resistance of a single core cable. **(06 Marks)**

c. A 33 KV, 3-phase, 50 Hz UG cable line, 3.4 km long, uses three single – core cables. Each cable has a core diameter of 2.5 cm and the radial thickness of insulation is 0.5 cm. The relative permittivity of the dielectric is 3. Find maximum stress and total charging KVAR. **(08 Marks)**

Module-5

9 a. With distribution layout, explain 3-phase, 4-wire system of distribution of electrical power. **(06 Marks)**

b. Define failure rate. Mention different types of failure and explain. **(06 Marks)**

c. A 2-wire feeder ABC has a load of 120A at C and of 60A at B both at power factor 0.8 lag. The impedance AB is (0.04 + j0.08)Ω and that of BC is (0.08 + j0.12)Ω. If the voltage at the far end C is to be maintained at 400V, determine the voltage : i) at A ii) at B. **(08 Marks)**

OR

10 a. Explain the limitations of distribution system. **(08 Marks)**

b. A 3-phase ring distribution ABCD fed at A at 11 KV supplies balanced loads of 40 A at 0.8 p.f. lagging at B, 50 A at 0.707 p.f. lagging at C and 30 A at 0.8 p.f. lagging at D. The load currents are referenced to the supply voltage at A. The impedances of the various sections per phase are : Section AB = (1 + j2)Ω, Section BC = (2 + j3)Ω, Section CD = (2 + j1)Ω, Section DA = (3 + j4)Ω. Calculate the current in various sections and bus bar voltages at B, C and D. **(12 Marks)**

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CBCS SCHEME

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18EE44

Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Electric Motors

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive the torque equation of DC motor. **(06 Marks)**

b. What are the applications of shunt, series and compound motor? **(06 Marks)**

c. A 4-pole DC shunt motor takes 22A from 220 V supply. The armature and shunt field resistance are 0.5 Ω and 100Ω respectively. The armature is lap connected with 300 conductors. If the flux per pole is 20 mwb, calculate the speed and developed torque. **(08 Marks)**

OR

2 a. Derive an expression for the condition for maximum efficiency of DC motor. **(06 Marks)**

b. Explain with a neat sketch the working of three point starter. **(06 Marks)**

c. A 250V shunt motor has an armature resistance of 0.2 Ω. It draws an armature current of 60A and runs at a speed of 900 rpm at same load. It is required to raise the speed to twice this value. If the torque of the motor is constant, determine the percentage change in the flux. **(08 Marks)**

Module-2

3 a. Explain Back to Back test to determine efficiency in two identical shunt motors. **(10 Marks)**

b. A DC motor operating on 200 V mains takes 6 A on no load. The armature resistance is 0.5 Ω and the shunt field resistance is 250 Ω. Calculate the efficiency as
i) Generator, when the output is 5 kW
ii) Motor, when the input is 4 kW. **(10 Marks)**

OR

4 a. Derive an expression for full load torque, starting torque and maximum torque of three phase induction motor. **(10 Marks)**

b. Calculate the torque exerted by an 8-pole, 50 Hz, 3-phase induction motor operating with a 4% slip which develops a maximum torque of 150 Kg-m at a speed of 660 rpm. The resistance per phase of the rotor is 0.5 Ω. **(10 Marks)**

Module-3

5 a. Draw and explain the phasor diagram of a three phase induction motor. **(06 Marks)**

b. Derive an expression for the relationship between P_2, P_c and P_m. **(06 Marks)**

c. The full load power input to 4-pole, 50 Hz, 3-phase induction motor is 50 kW running at 1440 rpm. Calculate its full load efficiency if stator losses are 1000 W and frictional losses are 650 W. **(08 Marks)**

OR

6 a. Write a brief note on losses in induction motor. **(06 Marks)**

b. A 15 kW, 400 V, 4-pole, 50 Hz, 3-phase star connected induction motor gave the following test results. No load test (line values) : 400 V, 9A, 1310 W.
Blocked rotor Rest (line values) : 200 V, 50 A, 7100 W stator and rotor ohmic losses at stand still are assumed equal. Draw the induction motor circle diagram and calculate line current, power factor, sip torque (full load) and efficiency. **(14 Marks)**

Module-4

7 a. Explain the necessity of starter for three phase induction motor and briefly explain with neat sketch the working of direct online starter. **(10 Marks)**

b. Describe the various speed control methods of three phase induction motor. **(10 Marks)**

OR

8 a. Describe the construction and working of shaded pole induction motor. **(06 Marks)**

b. Explain with a neat circuit the working of spilt phase induction motor. **(06 Marks)**

c. A 250 W, 230 V, 50 Hz, single phase capacitor start induction motor has the following constraints for the main and auxiliary winding. Main winding $Z_m = (45 + j3.7)\Omega$, auxiliary winding $Z_a = (9.5 + j3.5)\Omega$. Determine the value of the capacitor that will place the main and auxiliary winding currents in quadrature at starting. **(08 Marks)**

Module-5

9 a. Explain briefly the various methods of starting synchronous motor. **(06 Marks)**

b. Explain the operation of synchronous motor at constant load variable excitation. **(08 Marks)**

c. Write a brief note on synchronous condenser. **(06 Marks)**

OR

10 a. Explain the construction, working, characteristics and applications of AC servomotor. **(10 Marks)**

b. Explain with neat diagram, the working of stepper motor and AC series motor. **(10 Marks)**

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CBCS SCHEME

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18EE45

Fourth Semester B.E. Degree Examination, June/July 2024
Electromagnetic Field Theory

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Given two vectors $\vec{R}_A = -\hat{a}_x - 3\hat{a}_y - 4\hat{a}_z$ and $\vec{R}_B = 2\hat{a}_x + 2\hat{a}_y + 2\hat{a}_z$ and point C(1, 3, 4). Find i) $\vec{R}_{AB}$ ii) $|\vec{R}_A|$ iii) $\hat{a}_A$ iv) an unit vector directed from C to A. **(08 Marks)**

b. Given the two coplanar vectors $\vec{A} = 3\hat{a}_x + 4\hat{a}_y + 3\hat{a}_z$ and $\vec{B} = -6\hat{a}_x + 2\hat{a}_y + 4\hat{a}_z$. Obtain the unit vector normal to the plane containing the vectors $\vec{A}$ and $\vec{B}$. **(06 Marks)**

c. Given two points A(x = 2 , y = 3 , z = 1) and B(r = 4 , θ = 25º , ϕ = 120º). Find
i) Spherical Coordinates of A ii) Cartesian Coordinates of B
iii) Distance between A and B. **(06 Marks)**

OR

2 a. Using cylindrical coordinate system approach, derive the electric field of an infinitely long line charge extending along Z axis. **(08 Marks)**

b. State and prove Gauss's law. **(06 Marks)**

c. Explain Coulomb's law of force between two point charges and find x, y, z components of forces on Q_1 if two point charges $Q_1 = 100\mu c$ and $Q_2 = 100\mu c$ are located at points (-1 , 1 , -3)m and (3, 1, 0)m respectively. **(06 Marks)**

Module-2

3 a. Determine the work done in moving a + 2C charge from (2, 0, 0)m to (0, 2, 0)m along the straight line path joining the two points if the field is $\vec{E} = 12x\hat{a}_x - 4y\hat{a}_y$ V/m. **(08 Marks)**

b. Show that electric field intensity is negative gradient of potential. **(06 Marks)**

c. An electrostatic potential is given by $V = \frac{60\sin\theta}{r^2}$ volts. Find $\vec{E}$ at (3, 60º , 25º). **(06 Marks)**

OR

4 a. Derive the boundary conditions at the interface between two dielectric with different permittivity's. **(08 Marks)**

b. Find the total current in outward direction from a cube of 1m, with one corner at the origin and edges parallel to the coordinate axes if $\vec{J} = 2x^2\hat{a}_x + 2xy^3\hat{a}_y + 2xy\hat{a}_z$ A/m². **(06 Marks)**

c. At the boundary between glass ($\varepsilon_r = 4$) and air, the lines of electric field make an angle of 40º with normal to boundary. If electric flux density in the air is 0.25μC/m², determine the orientation and magnitude of electric flux density in the glass. **(06 Marks)**

Module-3

5 a. Derive Poisson's and Laplace equation starting from point form of Gauss's law in Cartesian co-ordinates and write Laplace equation in Cylindrical and Spherical co-ordinates. **(08 Marks)**

b. Given the potential field $V = 3x^2yz + Ky^3z$ volts. Find
   i) K if potential field satisfies Laplace equation.
   ii) Find $\vec{E}$ at (1, 2, 3). **(06 Marks)**

c. Given the potential field $V = (A\rho^4 + B\rho^{-4}) \sin 4\phi$. Show that $\nabla^2 v = 0$. **(06 Marks)**

OR

6 a. State Ampere's Circuital law. Apply it to a co-axial cable with inner conductor of radius 'a' carrying current I. The outer conductor carries return current –I. the inner radius of outer conductor is 'b' and its outer radius is 'c'. Evaluate magnetic field intensity. **(08 Marks)**

b. Evaluate both sides of Stoke's theorem for the field $\vec{H} = 6xy\,\hat{a}_x - 3y^2\,\hat{a}_y$ A/m and rectangular path around the region, $2 \le x \le 5$, $-1 \le y \le 1$, $z = 0$. Le the positive direction of $d\vec{s}$ be $\hat{a}_z$. **(08 Marks)**

c. State and explain Biot – Savart law. **(06 Marks)**

Module-4

7 a. State and explain Lorentz force equation. Apply it to calculate the magnitude of force exerted on a point charge Q = 18nC, when $\vec{B}$ and $\vec{E}$ are acting together.
Given $\vec{E} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z$ KV/m and $\vec{B} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z$ mT. The point charge has a velocity of 5×10^6 m/s in the direction, $\hat{a}_v = 0.6\hat{a}_x + 0.75\hat{a}_y + 0.3\hat{a}_z$. **(08 Marks)**

b. Derive an expression for the magnetic force between two differential current elements. **(06 Marks)**

c. Derive the expression for the torque on a rectangular current loop carrying current 'I'. **(06 Marks)**

OR

8 a. Define Self inductance and Mutual inductance and derive the expression for inductance of a folenoid of 'N' turns carrying current 'I'. **(08 Marks)**

b. Obtain the expression for energy stored in magnetic field. **(06 Marks)**

c. Find the normal component of the magnetic field which traversed from medium 1 to medium 2, having $\mu_{r1} = 2.5$ and $\mu_{r2} = 4$. Given that $\vec{H}_1 = -30\hat{a}_x + 50\hat{a}_y + 70\hat{a}_z$ V/m. **(06 Marks)**

Module-5

9 a. Starting from Ampere's circuital law, derive the expression for displacement current density for time varying fields. **(08 Marks)**

b. Derive Maxwell's equation in point form from Gauss's law for electric and magnetic fields. **(06 Marks)**

c. For the given medium $\varepsilon = 4 \times 10^{-9}$ F/m and $\sigma = 0$. Find K such that following pair of field satisfies Maxwell's equations. $\vec{E} = (20y - Kt)\hat{a}_x$ V/m ; $\vec{H} = (y + 2 \times 10^6 t)\,\hat{a}_z$ A/m. **(06 Marks)**

OR

10 a. What is Uniform Plane Wave? Explain the propagation of uniform plane wave in free space with necessary equations. **(08 Marks)**

b. State and prove Poynting theorem. **(08 Marks)**

c. Define Skin depth. **(04 Marks)**

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CBCS SCHEME

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Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Operational Amplifiers and Linear ICs

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Standard resistance and capacitance data table may be used.

Module-1

1 a. Explain the ideal characteristics of op-amp. **(04 Marks)**

b. Explain the following terms:
i) Input offset voltage ii) Input offset current iii) CMRR iv) Slew rate. **(08 Marks)**

c. What is an instrumentation amplifier? For instrumentation amplifier using transducer bridge obtain an expression for output voltage V_O interms of change in resistance ΔR of the transducer. Draw the circuit diagram. **(08 Marks)**

OR

2 a. Design a summing amplifier to add three dc voltages. The output of this circuit must be equal to two times the negative sum of the inputs. **(08 Marks)**

b. Design an averaging circuit for four DC voltages. Use non-inverting op-amp configurations. Derive the necessary equations. **(08 Marks)**

c. In the circuit of AC inverting amplifier as shown in Fig.Q.2(c), $R_{in} = 50\Omega$, $C_i = 0.1\mu f$, $R_1 = 100\Omega$, $R_F = 1K\Omega$, $R_L = 10K\Omega$ and supply voltages = ±15V. Determine the Bandwidth of the amplifier (UGB = 10^6 for 741 op-amp). **(04 Marks)**

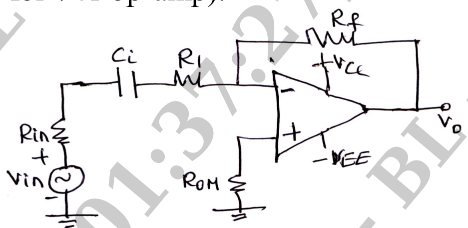

Fig.Q.2(c)

Module-2

3 a. Derive the gain equation for first order low pass butterworth filter. **(08 Marks)**

b. Design a second order high pass filter at a cut-off of 1kHz. **(06 Marks)**

c. Design a wide band pass filter with lower cut-off frequency f_L = 200Hz, higher cut-off frequency f_H = 1kHz, pass band gain = 4. Assume capacitor values of high pass and low pass sections as 0.05 μf and 0.01 μf respectively. Also calculate Q factor. Draw the circuit and mark the design values. **(06 Marks)**

OR

4 a. Explain the working and design of op-amp voltage follower regulator. **(06 Marks)**

b. Design an adjustable voltage to produce an output of 12V with a maximum load current of 50mA, using a 741 op-amp use a 1N756 zener diode with V_Z = 8.2V, I_Z = 20mA and $Z_Z = 8\Omega$. Analyze the circuit designed to find line regulation, load regulation and ripple rejection. **(10 Marks)**

c. Sketch the circuit of vlg regulator using LM317 voltage regulator. Explain the circuit operation. **(04 Marks)**

Module-3

5 a. Design an RC phase shift oscillator for an output frequency of 5kHz. Use LM741 with ±15V supply. **(06 Marks)**

b. A triangular/rectangular signal generator is to be designed to have a 5V peak-to-peak triangular output, a frequency ranging from 200Hz to 2kHz and a duty cycle adjustable from 20% to 80%. Bipolar op-amps with a supply of ±15V are to be used. Determine suitable component value and draw circuit diagram. **(08 Marks)**

c. Explain the working of voltage to current converter with grounded load. **(06 Marks)**

OR

6 a. Explain the working of an inverting voltage comparator circuit. Draw the input, output voltage waveforms when v_{ref} is positive and negative. **(06 Marks)**

b. Using a 741 op-amp with a supply of ±12V, design an inverting Schmitt trigger circuit to have trigger points of ±2V. **(06 Marks)**

c. Draw the circuits to show how diodes may be used to select different trigger points of an inverting Schmitt trigger circuit. Explain its operation and draw relevant input and output waveforms. **(08 Marks)**

Module-4

7 a. Discuss the advantages of a precision rectifier over an ordinary diode circuit and show how voltage gain can be achieved with a precision saturating rectifier. Explain circuit operation. **(06 Marks)**

b. Design a non-saturating precision halfwave rectifier to produce 2V peak output from a sine wave input with a peak value of 0.5V and frequency of 1MHz. Use a bipolar op-amp with a supply voltage of ±15V. **(06 Marks)**

c. Show how half-wave precision rectifier can be combined with a summing circuit to produce a full wave precision rectifier. Draw the voltage waveforms throughout the circuit and write equation to show that full-wave rectification is performed. **(08 Marks)**

OR

8 a. With a neat circuit diagram, explain 3-bit R-2R DAC. **(08 Marks)**

b. Explain the working of linear ramp ADC. **(06 Marks)**

c. With a neat block diagram, explain the operation of successive approximation analog to digital converter. **(06 Marks)**

Module-5

9 a. With a neat diagram, explain internal architecture of 555 timer. **(06 Marks)**

b. Explain the operating principle of phase locked loop. **(06 Marks)**

c. Explain monostable multivibrator circuit realized using IC 555 timer. Draw the circuit waveforms. **(08 Marks)**

OR

10 a. Design a circuit using 555 timer to be used as frequency divider. **(08 Marks)**

b. Define the following terms related to PLL (Phase Locked Loop).
i) Lock range ii) Capture range iii) Pull in time iv) Tracking range. **(04 Marks)**

c. A PLL system with 105 kHz input has VCO with 100 kHz free running frequency and sensitivity of 3.3 kHz/V. Phase detector has sensitivity 0.68 V/rad and amplifier gain of 5. Calculate : i) Loop again ii) Phase difference iii) Static error voltage iv) Tracking range. **(08 Marks)**

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CBCS SCHEME

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BEE401

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Electric Motors

Time: 3 hrs. Max. Marks: 100

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

		Module – 1	M	L	C
Q.1	a.	Derive an expression for the torque of a DC motor.	08	L1	CO1
	b.	Explain the concept of back emf and its significance.	06	L1	CO1
	c.	A 4 pole, 250 V, DC series motor has a wave connected armature with 200 conductors. The flux per pole is 25 mWb when motor is drawing 60 A from the supply. Armature resistance is 0.15 Ω while series field winding resistance is 0.2 Ω. Calculate the speed under this condition.	06	L2	CO1
		OR			
Q.2	a.	Draw and explain the characteristics of DC shunt and series motor.	08	L1	CO1
	b.	Explain the different methods of controlling speed of a DC shunt motor.	06	L1	CO1
	c.	Derive the condition for maximum efficiency of a DC machine.	06	L2	CO1
		Module – 2			
Q.3	a.	Explain with suitable sketches the construction of squirrel cage and slip ring induction rotor. State the merits and demerits of each type.	08	L1	CO2
	b.	A 3 phase, 400 V, 50 Hz, 4 pole induction motor has star connected stator winding. The rotor resistance and reactance are 0.1 Ω and 1 Ω respectively. The full load speed is 1440 rpm. Find the torque developed on full load by the motor. Assume stator to rotor ratio as 2 : 1.	08	L2	CO2
	c.	Derive Torque equation for 3ϕ induction motor.	04	L2	CO2
		OR			
Q.4	a.	Discuss the complete torque-slip characteristics of a 3ϕ induction motor including motoring, generating and braking regions.	08	L1	CO2
	b.	A 3-phase induction motor having 6-poles. Stator winding is star connected runs on 240 V, 50 Hz supply. The rotor resistance and stand still reactance are 0.12 Ω and 0.85 Ω per phase. The ratio of stator to rotor turns is 1.8 and full load slip is 4%. Find the developed torque at full load, maximum torque and the speed at maximum torque.	08	L2	CO2
	c.	How to change the direction of rotating magnetic field?	04	L1	CO2

		Module – 3			
Q.5	**a.**	Describe the constructional features of a double cage and deep bar rotors of 3ϕ induction motors and explain its operation.	**10**	**L1**	**CO3**
	b.	Starting from the fundamentals develop the equivalence circuit of a polyphase induction motor and explain how mechanical power developed is taken care of in the equivalence circuit.	**10**	**L1**	**CO3**
		OR			
Q.6	**a.**	Explain the phenomenon of logging and crawling in a 3ϕ induction motor.	**10**	**L1**	**CO3**
	b.	Discuss the procedure for no load test and blocked rotor test on a 3ϕ induction motor. How are the parameters of equivalent circuit determined from test results?	**10**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the Direct on line starter of 3ϕ induction motor with a suitable circuit diagram.	**10**	**L1**	**CO4**
	b.	Enumerate the speed control methods of 3ϕ induction motor and explain supply frequency control method.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	With schematic connection diagram and phasor diagram, explain the construction, working and application of a capacitor start induction motor.	**10**	**L1**	**CO4**
	b.	Explain double field revolving theory as applied to a single phase induction motor.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Explain briefly about the construction and working principle of a synchronous motor.	**10**	**L2**	**CO5**
	b.	Write a note on V-curves and inverted V-curves of a synchronous motor.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Explain the working, characteristics and applications of Universal motor.	**10**	**L2**	**CO5**
	b.	Explain the principle of operation of linear induction motor.	**10**	**L2**	**CO5**

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BEE402

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

Time: 3 hrs. Max. Marks: 100

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

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

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

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BEE403

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

Microcontrollers

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.	What are the differences between microcontroller and microprocessor?	05	L1	CO1
	b.	Draw the programming model of 8051 microcontroller and explain the following: (i) Program counter and data pointer (ii) Accumulator A, Register B and CPU Registers (iii) Stack and stack-pointer	10	L2	CO1
	c.	Draw the status of PSW register. What is the status of AC and CY flags after adding 52H with 74H.	05	L2	CO1
		OR			
Q.2	a.	Define addressing mode. Explain the following types of addressing modes with examples: (i) Immediate addressing mode (ii) Register addressing mode (iii) Register indirect addressing mode (iv) Indexed addressing mode	10	L1	CO1
	b.	Calculate the memory capacity for following cases: (i) 512 bytes of RAM (ii) 8 KB RAM	05	L2	CO1
	c.	Explain the functions of following pins: (i) External Access Input ($\overline{EA}$) (ii) Program Store Enable ($\overline{PSEN}$)	05	L1	CO1
		Module – 2			
Q.3	a.	Define assembler directive. Use assembler directive to place constants 0FFH, 07H, 82H, 31D and character string 'VTU' in program memory starting from 0080H. Explain the content of each location.	05	L3	CO2
	b.	Explain port 0 as input port and output port. What is the dual role of port 0?	05	L1	CO2
	c.	Explain the working of DAA instruction. Write a program to add the following 6, BCD numbers from the location 90H onwards. Save the carry in register R5 and sum in register R4. Data : 10, 20, 30, 40, 50, 60.	10	L3	CO2
		OR			
Q.4	a.	Explain the working of SUBB instruction, when Borrow = 0 and Borrow = 1. Write a program to subtract 2 numbers using 2's complement arithmetic.	10	L3	CO2
	b.	Check the following instructions to be valid or invalid. Justify with reasons: i) MOV P2, #0FFH ii) MOV R3, R4 iii) SETB PCON·7 iv) MOV A, @R2 v) PUSH R7	05	L3	CO2
	c.	Explain the working of RLCA and RLA instructions with examples.	05	L1	CO2
		Module – 3			
Q.5	a.	State the advantages of programming 8051 in 'C'.	05	L1	CO3
	b.	Explain the differences between sbit, bit and str declarations in 8051 'C' program.	05	L2	CO3
	c.	Write 8051 C program to: (i) Convert packed BCD to ACSII and display bytes on port P0 and P1 (ii) Convert ASCII digits to packed BCD and display it on port P2.	10	L3	CO3

		OR			
Q.6	**a.**	Explain the characteristics and operations of mode-1 timer in 8051. Also explain the steps to program in mode-1. How do you calculate initial count for given delay.	**10**	**L2**	**CO3**
	b.	Write a program to generate square wave of frequency 1 kHz on bit 3 of port 1. Consider timer-0 in mode-2. Show initial count and TMOD calculations in detail. Assume XTAL = 22 MHz.	**10**	**L4**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the bit status of SCON register.	**05**	**L2**	**CO4**
	b.	Write a program to transfer the message 'GOOD' serially at 9600 baud rate, 8-bit data, one start and one stop bit. Show TH1, TMOD and SCON calculations in detail. Assume XTAL = 11.0592 MHz.	**10**	**L4**	**CO4**
	c.	Explain the steps to program 8051 to receive the data serially.	**05**	**L2**	**CO4**
		OR			
Q.8	**a.**	Compare interrupts method with polling method.	**05**	**L2**	**CO4**
	b.	Write a program to real data from port-0 and sends it to port P2 continuously, creating a square wave of 200 μs on P2.5. Use timer-0, XTAL = 11.0592 MHz, in mode-2. Show TMOD, THO and IE calculations. Use timer-0 interrupt. Explain the working of program.	**10**	**L4**	**CO4**
	c.	Assume that after RESET, the interrupt priority register IP is set by MOV IP, # 00001100 B. Discuss the default sequence and sequence of interrupts that are serviced.	**05**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Calculate the address range of: (i) 40 × 2 LCD (ii) 16 × 2 LCD	**05**	**L2**	**CO5**
	b.	Draw the interfacing circuit of DAC 0808 with 8051 microcontroller. Write a program to generate sinewave. Assume 30° interval between each steps. Show the look-up table calculations	**10**	**L4**	**CO5**
	c.	Draw the control word format of 8255A programmable peripheral IC. What is the control word if all the ports are output ports?	**05**	**L2**	**CO5**
		OR			
Q.10	**a.**	Explain the construction and working of stepper motor. Define step angle and steps per revolution.	**10**	**L2**	**CO5**
	b.	Write a program to rotate stepper motor 68° clock wise. Assume step angle = 2°. Use 4 step sequence.	**05**	**L3**	**CO5**
	c.	What is an optoisolator? Draw the interfacing circuit of optoisolater with 8051 microcontroller.	**05**	**L1**	**CO5**

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BEE405B

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
OPAMPS and LIC

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.	Draw the block diagram of an op-amp and write the functions of each block.	10	L2	CO1
	b.	Sketch the 3-input inverting summing amplifier circuit, explain the operation of the circuit and derive an expression for the output voltage. Also explain how to convert it to an adder and averaging amplifier.	10	L2	CO1
		OR			
Q.2	a.	List the ideal characteristics of an op-amp (any 5).	05	L2	CO1
	b.	Mention the advantages of using negative feedback in op-amps (any 5).	05	L2	CO1
	c.	What is an instrumentation amplifier? Obtain an expression for output voltage interms of change in resistance ΔR using transducer bridge.	10	L2	CO1
		Module – 2			
Q.3	a.	With a neat circuit diagram, explain First Order low pass Butterworth filter and obtain its frequency response.	08	L2	CO2
	b.	With a neat circuit diagram, explain the working of voltage follower Regulator.	06	L2	CO2
	c.	Design a First Order High Pass filter for $f_L = 5$ kHz and $A_f = 4$. Also draw the circuit and write the component values.	06	L3	CO2
		OR			
Q.4	a.	Design a Narrow Band pass filter for the following specifications. Centre frequency = 1.5 kHz, Q = 7, gain at f_c is 15. Also draw the circuit diagram.	08	L3	CO2
	b.	Draw the circuit of a adjustable voltage regulator and explain its operation.	06	L3	CO2
	c.	Define the following terms: (i) Line regulation (ii) Load regulation and (iii) Ripple rejection ratio	06	L2	CO2
		Module – 3			
Q.5	a.	With a neat block diagram, circuit diagram and waveform, explain triangular wave generator.	08	L2	CO3
	b.	With a neat circuit diagram and waveform, explain the working of non-inverting Zero Cross over Detector (ZCD).	06	L2	CO3
	c.	With a neat circuit diagram, explain current to voltage converter.	06	L2	CO3
		OR			
Q.6	a.	With a neat circuit diagram, explain the working of R-C phase shift oscillator using op-amp.	06	L2	CO3
	b.	With a neat circuit diagram and waveform, explain the operation of inverting Schmitt trigger.	06	L2	CO3

	c.	With a neat diagram and necessary derivation for load current, explain voltage to current converter with grounded load.	**08**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	With a neat circuit diagram and waveform, explain the working of precision full wave rectifier.	**10**	**L2**	**CO4**
	b.	With a neat circuit diagram, explain the working of successive approximation type ADC.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	Draw the circuit and explain the working of integrated circuit 8-bit DAC.	**10**	**L2**	**CO4**
	b.	With a neat circuit diagram and waveform, explain sample and hold circuit.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	With a neat block diagram, explain phase locked loop in detail.	**10**	**L2**	**CO5**
	b.	Draw the pin diagram of IC 555 Timer and mention its pin functions.	**06**	**L2**	**CO5**
	c.	Design a monostable multivibrator using IC 555 Timer to obtain a pulse width of 10 msec.	**04**	**L2**	**CO5**
		OR			
Q.10	**a.**	With a neat diagram, explain the internal architecture of IC 555 timer.	**08**	**L2**	**CO5**
	b.	Define the following terms related to PLL: (i) Lock range (ii) Capture range (iii) Pull in time (iv) Tracking range	**08**	**L2**	**CO5**
	c.	Mention the applications of PLLIC (any 4).	**04**	**L2**	**CO5**

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18EE52

Fifth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Microcontrollers

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Draw the programming model of 8051 microcontroller and explain the following blocks:
(i) Program counter (ii) Stack pointer.
(iii) Accumulator (iv) Register B. **(08 Marks)**

b. Explain the bits of program status word (PSW) register. **(06 Marks)**

c. What is the status of carry flag, auxiliary carry flag and parity flag after adding :
(i) 96 H and 99 H (ii) 64 H and 46 H **(06 Marks)**

OR

2 a. Explain the role of EA pin and P0 and P2 ports in providing addresses. **(06 Marks)**

b. Explain the following addressing modes :
(i) Immediate addressing mode.
(ii) Register indirect addressing mode. **(06 Marks)**

c. What is memory address decoding? Explain the different methods. Design interfacing of $4K \times 8$ RAM using logic gates address decoder. Assume that address range is 8000 H to 8FFFH. **(08 Marks)**

Module-2

3 a. Explain the working of following instructions :
(i) JZ (ii) LJMP (iii) SJMP **(06 Marks)**

b. Write a program to perform the following :
(i) Keep monitoring pin P1.2 until it becomes high.
(ii) When P1.2 becomes high, read in the data from port P_2.
(iii) Send a high to low pulse on P1.3 to indicate that data has been received. **(06 Marks)**

c. Explain the working of DAA instruction. 6 BCD numbers are stored in RAM locations starting at 80 H. Write a program to find sum of all numbers and result showed be in BCD. Assume that data is 10, 20, 30, 40, 50 and 60. Save the sum in register R5 and carry in register R6. Draw the flow chart also. **(08 Marks)**

OR

4 a. Explain the working of following instructions :
(i) MUL AB
(ii) DIV AB. **(06 Marks)**

b. Write a program to count number of 1's and 0's in a 8-bit number. Let the data be 67 H save the data in register R1, number of 1's in regiser R2 and number of 0's in register R3. Draw the flow chart also. **(08 Marks)**

c. Let the accumulator A has packed BCD data. Write a program to convert packed BCD to two ASCII numbers and place them in registers R2 and R6. Assume data in accumulator A = 49H. **(06 Marks)**

Module-3

5 a. Compare 8051 'C' programming with assembly language programming. **(05 Marks)**

b. Write 8051 'C' program to toggle only bit P2.6 continuously. **(05 Marks)**

c. Write an 8051 'C' program to get bit P1.2 and send it to polt P2.3 after inverting it. **(05 Marks)**

d. Write a 'C' program to send out the value 33H serially one bit at a time through the port P1.5. The MSB should go out first. **(05 Marks)**

OR

6 a. Explain the bit status of TMOD and TCON special function registers. **(10 Marks)**

b. Write 8051 assembly language program to generate square wave of ON time 3 ms and OFF time of 10 ms on all pins of port 1. Assume crystal frequency of 11.0592 MHz. Show THO and TLO calculation for ON and OFF time. Use times 0 in mode – 1. **(10 Marks)**

Module-4

7 a. State the programming steps to transfer the data serially in 8051 microcontroller. What is the importance of TI flag? **(07 Marks)**

b. Write 8051 'C" program to transfer the message "VTU" serially at 9600 baud, 8 – bit data, 1 start and 1 stop bit. Do it continuously. **(07 Marks)**

c. If the crystal frequency is 22 MHz, what is the baud rate if

i) TH1 = –3

ii) TH1 = –12

With SMOD = 0 and SMOD = 1. **(06 Marks)**

OR

8 a. Compare interrupts vs polling. **(05 Marks)**

b. Explain the bit status of IP register. **(05 Marks)**

c. Write a program to generate two square waves, one of 5 KHz frequency at pin P1.3 and another of frequency of 25 KHz at P2.3. Assume XTAL = 22 MHz. Use timer-0 and timer-1 in mode – 2. Show TMOD, THO and TH1 and IE calculations. **(10 Marks)**

Module-5

9 a. Explain the interfacing circuit of LCD with 8051 μc. Write assembly program for sending commands and data to LCD with a time delay. **(10 Marks)**

b. Explain the internal architecture of serial ADC MAX1112. Draw the MAX1112 control byte also. **(10 Marks)**

OR

10 a. Write a program to rotate stepper motor 64° in clockwise direction. The motor has a step angle of 2°. Show the calculations. **(05 Marks)**

b. Draw the interfacing circuit of DC motor with opto isolator. A switch SW is connected to pin 3.2 which is INTO pin. Write a program :

(i) Normally motor runs with 33% duty cycle

(ii) When INTO is activated, the motor runs with 100% duty cycle for a short duration. **(10 Marks)**

c. Explain the role of electromechanical relays in microcontroller. **(05 Marks)**

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18EE53

Fifth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Power Electronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the types of power electronic converter system and specify the form of input and output waveforms. **(10 Marks)**

b. With a neat block diagram, explain the peripheral effects of power electronics equipments. **(06 Marks)**

c. List the following power semiconductor devices with symbol and control characteristics :

i) GTO
ii) MOSFET
iii) LASCR
iv) SITH. **(04 Marks)**

OR

2 a. With neat circuit diagram and output waveforms. Explain uncontrolled single phase full wave rectifier using RC load using DC source. **(08 Marks)**

b. Describe reverse recovery characteristics of diode. **(06 Marks)**

c. With circuit diagram explain the working of single phase full wave rectifier using R load and analyze the output waveforms. **(06 Marks)**

Module-2

3 a. Explain a switching characteristics of power mosfet using relevant waveforms. **(06 Marks)**

b. Sketch the structure of n-channel type enhancement mosfet and explain its working. **(08 Marks)**

c. The BJT is specified to have a range of 8 to 40. The load resistance is $R_C = 11\Omega$. The DC supply voltage is $V_{CC} = 200$ V and input voltage to the base drive circuit is $V_B = 10$ V. If $V_{CE}(sat) = 1.0$ V and $V_{BE}(sat) = 1.5$ V.
Find :
i) The value of RB that results in saturation with a over drive factor of 5.
ii) The forced B_f
iii) The power loss P_r in transistor. **(06 Marks)**

OR

4 a. Name and explain various switching limits in case of power BJT's with a neat circuit diagram, explain antisaturaiton control of BJT and analyze output equations. **(07 Marks)**

b. What is the necessity of isolating gate and base drive circuits? Discuss the methods employed to isolate gate drive circuits. **(08 Marks)**

c. The collector clamping circuit in Fig.Q4(c) has V_{cc} = 100 V, R_C = 1.5Ω, V_{d1} = 2.1 V, V_{d2} = 0.9V, V_{BE} = 0.7V, V_B = 15Vv and R_B = 2.5Ω and β = 16.
Calculate :
i) Collector current without clamping
ii) The collector emitter clamping voltage Vc
iii) Collector current with clamping. **(05 Marks)**

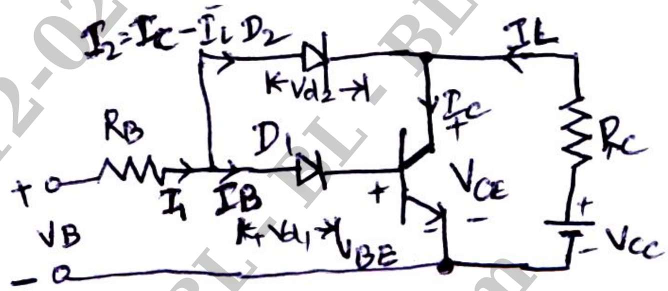

Fig.Q4(c)

Module-3

5 a. Derive an expression for anode current of thyristor using 2 transistor analogy with diagram. **(06 Marks)**

b. Mention the different turn on methods and explain methods employed to switch ON SCR. **(08 Marks)**

c. A thyristor has the forward break over voltage of 175 V when gate pulse of 2mA is made to flow. Find the delay angle and conduction angle if a sine wave for 350 V peak is applied. **(06 Marks)**

OR

6 a. What is the need for protection of thyristors? Explain how thyristors are protected against high di/dt and high dv/dt. **(08 Marks)**

b. With neat circuit diagram and waveforms, explain RC half wave triggering circuit. **(06 Marks)**

c. A UJT is used to trigger the thyristor whose minimum gate triggering voltage is 6.2 V, the ujT ratings are :
η = 0.66, I_p = 3 mA, I_v = 0.5 mA, $R_{B1} + R_{B2}$ = 5 KΩ, leakage current = 3.2 mA, V_P = 14 V and V_V = 1 V. Oscillator frequency is 2 KHz and capacitor C = 0.04 µf. Design the complete circuit. **(06 Marks)**

Module-4

7 a. With neat circuit diagram explain the operation of 1 ϕ dual converter. **(10 Marks)**

b. A single phase fully controlled rectifier is fed from 230 V – 50 Hz supply the load is highly inductive, find the average load voltage and current if load resistance is 10Ω and firing angle is 45°. **(05 Marks)**

c. With neat circuit diagram explain single phase half wave circuit with RL load. **(05 Marks)**

OR

8 a. What is an AC voltage controller? With help of circuit diagram, explain the principle of ON-OFF/Integral control and analyze the output equations. **(10 Marks)**

b. A single phase full wave AC voltage controller has an R_L load. The input is 230 V, 50 Hz and load is R = 2 Ω and X_L = 2 Ω, $d_1 = d_2 = \pi/2$.
Calculate the following :
i) Angle until which thyristor conducts
ii) Conduction angle of thyristor
iii) RMS voltage of output. Derive the formula. **(10 Marks)**

Module-5

9 a. With the help of circuit diagram, discuss the operation of a step down DC chopper with RL load. Derive an expression for the load current of step down chopper in discontinuous mode. **(10 Marks)**

b. A chopper is feeding an RL load as shown below Fig.Q9(b). The chopper frequency is 1 KHz and duty cycle K = 0.5.
Calculate :
i) The minimum instantaneous load current
ii) The instantaneous value of load current
iii) The average value of load current
iv) The RMS load current
v) The RMS chopper i/p current.

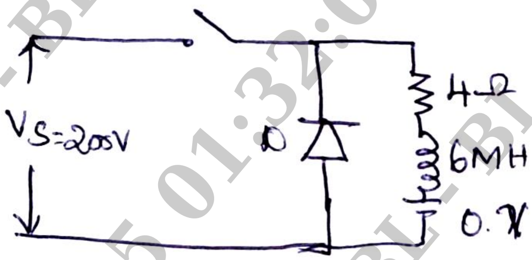

Fig.Q9(b) **(10 Marks)**

OR

10 a. Explain the working of single phase bridge inverter with necessary waveforms. **(10 Marks)**

b. Explain any two modulation techniques used for voltage control of a single phase inverter. **(10 Marks)**

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18EE54

Fifth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Signals and Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Signal and System. Explain with the help of suitable examples. **(05 Marks)**

b. Determine the periodicity of following continuous time signal.
$X(t) = 4\cos(3\pi t + \pi/4) + 2\cos 4\pi t$. **(05 Marks)**

c. Sketch the even and odd party of the following signals : **(10 Marks)**

i)

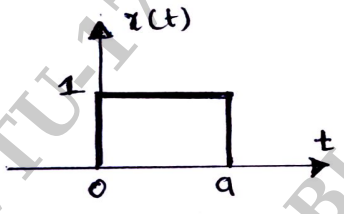

Fig. Q1(c) (i)

ii)

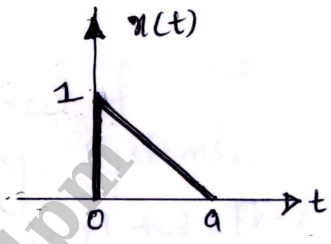

Fig. Q1(c) (ii)

OR

2 a. Explain the operation on signals for both dependent and independent variable. **(05 Marks)**

b. Determine whether following signal is energy or power signal, $x(n) = (\pi/4)^n U[n]$. **(05 Marks)**

c. State whether the following systems are linear , causal , time variant and dynamic.

i) $y(n) = x(n) + \dfrac{1}{x(n-1)}$ ii) $y(n) = x(n-1)$. **(10 Marks)**

Module-2

3 a. Consider an input x[n] and unit impulse response h[n] given by
$x[n] = \alpha^n u[n]$; $0 < \alpha < 1$.
$h[n] = u[n]$.
Evaluate and plot the o/p signal y[n]. **(10 Marks)**

b. Consider a continuous – time LTI system with unit impulse response ,
$h(t) = u(t)$ and input $x(t) = e^{-at} u(t)$; $a > 0$.
Determine the output y(t) of system. **(10 Marks)**

OR

4 a. Determine the total response of system given by

$$\frac{d^2y(t)}{dt^2} + 3.\frac{dy(t)}{dt} + 2y(t) = 2x(t) \quad \text{with } y(0) = -1 , \quad \left.\frac{dy(t)}{dt}\right|_{t=0} = 1 \ \& \ x(t) = \cos t\, u(t).$$

(10 Marks)

b. Sketch direct form I and direct form II implementations for following systems.

i) $y[n] + \frac{1}{2} y[n-1] - y[n-3] = 3x[n-1] + 2x[n-2]$.

ii) $\frac{dy(t)}{dt} + 5y(t) = 3x(t)$. **(10 Marks)**

Module-3

5 a. Prove the following properties of continuous time Fourier transform.
i) Linearity ii) Time shift iii) Frequency shift. **(10 Marks)**

b. Determine the Fourier transform of signals :
i) $x(t) = e^{-at} u(t)$; $a > 0$ ii) $x(t) = e^{-a|t|}$, $a > 0$.
Draw its magnitude spectrum. **(10 Marks)**

OR

6 a. Determine the Fourier transform of the following signals using time differentiation property. **(10 Marks)**

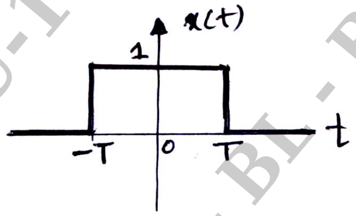

Fig. Q6(a) (i)

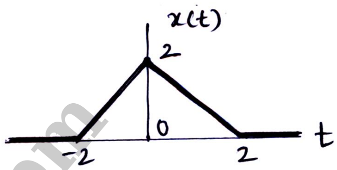

Fig. Q6(a) (ii)

b. Determine the Fourier transform of the following signals using appropriate properties :

i) $x(t) = \frac{2}{t^2 + 1}$ ii) $x(t) = \frac{d}{dt}[t\ e^{-2t} \sin(t)\ u(t)]$. **(10 Marks)**

Module-4

7 a. Prove the following properties of discrete time Fourier transform :
i) Scaling ii) Summation iii) Convolution. **(10 Marks)**

b. Determine the discrete time Fourier transform of following signals :
i) $x(n) = \alpha^n u(n)$; $|\alpha| < 1$ ii) $x(n) = \delta(n)$.
Draw its Magnitude spectrum of both signals. **(10 Marks)**

OR

8 a. Using appropriate properties, determine the DTFT of following signals :

i) $x(n) = (1/2)^n\ u(n-2)$ ii) $x(n) = \sin\left(\frac{\pi}{4}n\right)\left(\frac{1}{4}\right)^n\ u(n-1)$. **(10 Marks)**

b. Determine the frequency response and the impulse response of the system having the output y(n) for the input x(n) as given below

$x(n) = (1/2)^n\ u(n)$; $y(n) = \frac{1}{4}(1/2)^n u(n) + \left(\frac{1}{4}\right)^n\ u(n)$. **(10 Marks)**

Module-5

9 a. Determine the Z transform of following signals :
i) $x(n) = \alpha^n u(n)$ ii) $x(n) = -\alpha^n u(-n-1)$. Find its ROC for both signals. **(10 Marks)**

b. Prove the following properties of Z – transform :
i) Initial value theorem ii) Final value theorem. **(10 Marks)**

OR

10 a. Determine the inverse Z transform of the following using partial fraction expansion method.

$$X(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - \frac{3}{2}z^{-1} + \frac{1}{2}z^{-2}}$$, with ROC ; $|z| > 1$. **(10 Marks)**

b. Solve the following difference equation using unilateral Z transform :

$y(n) - \frac{3}{2}\, y(n-1) + \frac{1}{2}\, y(n-2) = x(n)$ for $n \geq 0$ with initial condition $y(-1) = 4$, $y(-2) = 10$ and $x(n) = \left(\frac{1}{4}\right)^n u(n)$. **(10 Marks)**

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CBCS SCHEME

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18EE55

Fifth Semester B.E. Degree Examination, June/July 2024
Electrical Machine Design

Time: 3 hrs. Max. Marks: 100

Note:* 1. *Answer any FIVE full questions, choosing ONE full question from each module.
2. Design data handbook is allowed if necessary.

Module-1

1 a. Discuss the design factors to be considered for electrical machine. **(06 Marks)**
b. Explain briefly on limitations imposed during Electrical Machine Design. **(08 Marks)**
c. Write a note on modern trends in machine design and manufacturing techniques. **(06 Marks)**

OR

2 a. Mention any five desirable properties of insulating and conducting materials used in electrical machines. **(10 Marks)**
b. Discuss the classification of insulating material based on heat resisting properties mentioning with any two examples of each type. **(10 Marks)**

Module-2

3 a. Define specific magnetic loading and specific electric loading for a DC machine. **(04 Marks)**
b. Derive the output equation of DC Machine. **(06 Marks)**
c. A 5 KW, 250V, 4 pole, 1500 rpm, wave winding connected, DC shunt generator is designed to have a square pole face. The loadings are average flux density in the gap = 0.42 wb/mt^2 and ampere conductor per meter = 15000. The ratio of pole arc to pole pitch is 0.66 and efficiency is 87%. Find the main dimensions of the machine. Verify:
(i) Peripheral speed of armature is within the limit of 30 m/sec
(ii) Voltage between adjacent commutator segments is within 20 V. **(10 Marks)**

OR

4 a. Discuss the factors to be considered for selection of number of poles, in detail. **(10 Marks)**
b. Design a 4 pole, 10 KW, 220 V, 1000 rpm DC shunt motor with respect to the following:
(i) Output coefficient
(ii) The diameter and length of armature
(iii) Number of armature conductors
(iv) Number of slots
Assume, specific magnetic loading = 0.45 wb/mt^2, specific electric loading = 17500 ac/m; efficiency = 91%; pole arc/pole pitch = 0.68; 10% voltage drop in armature winding. **(10 Marks)**

Module-3

5 a. Starting from the basic emf equation derivation, obtain an expression for emf per turn in terms of output of the transformer. Write a note on factor 'K'. **(08 Marks)**
b. Determine the main dimensions of the core, the number of turns and the cross section of the conductors for a 5 kVA, 11000/400 V, 50 Hz, single phase core type distribution transformer. The net conductor area in the window is 0.6 times the net cross section of iron in the core. Assume a square cross-section for the core, flux density of 1 wb/mt^2, a current density of 1.4 A/mm^2 and a window space factor 0.2. The height of window is 3 times its width. **(12 Marks)**

OR

6 a. Derive an expression for leakage reactance of core type transformer. List the assumptions made. **(10 Marks)**

b. A 1000 KVA, 6600/440 V, 3-phase core type transformer has the following design details:
(i) Distance between centre's of adjacent limbs = 0.47 m
(ii) Outer dia of HV winding = 0.44 m
(iii) Height of frame = 1.24 m
(iv) Core loss = 3.7 KW
(v) I^2R loss = 10.5 KW

Design a suitable tank for transformer and number of cooling tubes. The average temperature rise is to be limited to 35°C. The diameter of tubes is 50 mm and the average height of tubes is 1.4 m. Allow clearance along width as 14 cm, breadth as 18 cm and height as 60 cm. Assume specific heat dissipation due to radiation and convection is 6 and 6.5 W/mt^2/°C respectively. Convection is improved by 35% due to provision of tubes. **(10 Marks)**

Module-4

7 a. With usual notations derive output equation for a three phase induction motor. **(06 Marks)**

b. Write the advantages and disadvantages of choosing higher value of specific loadings. **(06 Marks)**

c. Find the main dimensions of a 15 KW, 3-ϕ, 400 V, 50 Hz, 2810 rpm, squirrel cage induction motor having an efficiency of 0.88 and full load p.f. of 0.9. Take the rotor peripheral speed as 20 m/sec at synchronous speed. Assume specific magnetic loading as 0.5 wb/mt^2 and specific electric loading as 25000 ac/m. **(08 Marks)**

OR

8 a. Discuss the factors to be considered while deciding the length of air gap and number of stator slots. **(10 Marks)**

b. A 15 KW, 440 V, 4-pole, 50 Hz, 3-ϕ IM is built with a stator bore 0.25 m and a core length of 0.16. The specific electric loading is 23000 ac/m. Using the data of this machine, determine the core dimensions, number of stator slots and number of stator conductors for a 11 KW, 460 V, 6 poles, 50 Hz motor. Assume a full load efficiency of 84% and p.f. of 0.82 for each machine. The winding factor is 0.955. Slots per pole per phase = 3. **(10 Marks)**

Module-5

9 a. Define SCR and list advantages and disadvantages of choosing low value of SCR. **(10 Marks)**

b. Determine the main dimensions for a 1000 KVA 50 Hz, 3-ϕ, 375 rpm alternator. The average air gap flux density is 0.55 wb/mt^2 and ac/m are 28000. Use rectangular poles and assume a suitable value for ratio of core length to pole pitch as 2 and maximum peripheral speed permissible is 50 m/sec. The runaway speed is 1.8 times the synchronous speed. $K_W = 0.995$. **(10 Marks)**

OR

10 a. Discuss the factors which influence the selection of armature slots of synchronous machine. **(10 Marks)**

b. Determine a suitable number of slots and conductors per slot for the stator winding of a 3-ϕ, 3300 V, 50 Hz, 300 rpm alternator. The diameter is 2.3 m and the axial length of core is 0.35 m. The maximum flux density in the air gap should be approximately 0.9 wb/mt^2. Assume sinusoidal flux distribution. Use single layer winding and star connection for stator. **(10 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | 18EE56

Fifth Semester B.E. Degree Examination, Dec.2024/Jan.2025
High Voltage Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the Townsend's current growth equation along with current growth in the pressure of secondary processes. **(10 Marks)**

b. Classify the breakdown mechanism in liquids and explain any one mechanism. **(10 Marks)**

OR

2 a. Explain Intrinsic breakdown and thermal breakdown in detail. **(10 Marks)**

b. In an experiment in a certain gas it was found that the steady state current is 5.5×10^{-8} A at 8 KV at a distance of 0.4 cm between the plane electrodes. Keeping the field constant and reducing the distance to 0.1 cm results in a current of 5.5×10^{-9}A. Calculate Townsends's primary ionization coefficient α. If the breakdown occurred when the gap distance was increased to 0.9 cm, what is the value of γ? **(10 Marks)**

Module-2

3 a. Describe, with a neat sketch the working of Van de Graaff generator. What are the factors that limit the maximum voltage obtained? **(10 Marks)**

b. Explain one method of controlled tripping of impulse generator. Why is controlled tripping necessary? **(10 Marks)**

OR

4 a. Why is a Cockcroft – Walton circuit preferred for voltage multiplier circuits? Explain its working with a schematic diagram. **(10 Marks)**

b. Give the Marx circuit arrangement for multistage impulse generators. How is the basic arrangement modified to accodomate the wave time control resistances? **(10 Marks)**

Module-3

5 a. Describe the generating voltmeter used for measuring high dc voltage. Also mention advantages and Limitations. **(10 Marks)**

b. What is Rogowski coil? Explain with a neat diagram its principle of operation for measurement of high impulse currents. **(10 Marks)**

OR

6 a. Draw Chubb – Fortescue circuit for measurement of peak value of ac voltages. Discuss its advantages over other methods. **(10 Marks)**

b. Explain how a sphere gap can be used to measures the peak value of voltages. What are the parameter and factors that influence such voltage measurement? **(10 Marks)**

Module-4

7 a. Explain theories of charge formation in clouds. **(10 Marks)**

b. Explain mechanism of lightning stroke in detail. Derive the mathematical model for lightning. **(10 Marks)**

OR

8 a. Narrate the characteristics of switching surges. Explain switching over voltages in EHV and UHV systems. **(10 Marks)**

b. Explain in detail the principles of Insulation coordination on high voltage and extra high voltage power systems. **(10 Marks)**

Module-5

9 a. Explain the high voltage Schering bridge for the tan δ and capacitance measurement of insulators or bushings. **(10 Marks)**

b. Explain the testing of transform in detail. **(10 Marks)**

OR

10 a. Explain partial discharge detection using straight detector method. **(10 Marks)**

b. Explain the testing of Insulators and Bushing in detail. **(10 Marks)**

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CBCS SCHEME

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

Time: 3 hrs. Max. Marks: 100

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

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-1

1 a. Draw the single line diagram of a typical power supply schemes indicating the standard voltages and explain. **(06 Marks)**

b. With usual notations, derive an expression for the sag of a transmission line when the supports are at equal levels. **(06 Marks)**

c. An overhead transmission line at a river crossing is supported from two towers at heights of 40m and 90m above water level , the horizontal distance between the towers being 400m. If the maximum allowable tension is 2000 kg. Find the clearance between the conductor and water at a point midway between the towers. Weight of conductor is 1kg/m. **(08 Marks)**

OR

2 a. Write the methods of improving the string efficiency and explain any two methods. **(07 Marks)**

b. An insulator string consists of three units, each having a safe working voltage of 15KV. The ratio of self capacitance to shunt capacitance of each unit is 8 : 1. Find the maximum safe working voltage of the string. Also find the string efficiency. **(06 Marks)**

c. Write short notes on the following :
i) Vibration of conductors ii) Stock bridge type vibration damper. **(07 Marks)**

Module-2

3 a. Derive an expression for the inductance of a single phase two wire line. **(06 Marks)**

b. Find the inductance per phase per km of double circuit three phase line shown in Fig. Q3(b). The line is completely transposed. Use GMD method. The radius of the conductor is 9mm. **(08 Marks)**

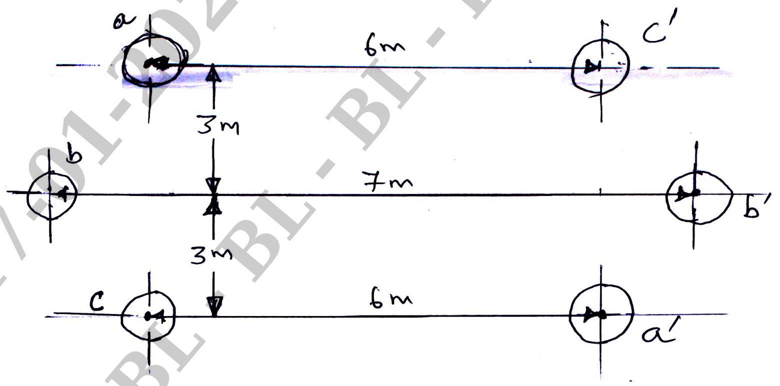

Fig. Q3(b)

c. A 3 – phase, 50Hz, 66KV overhead line conductors are placed in a horizontal plane as shown in Fig. Q3(c). The conductor diameter is 1.25cm. If the line length is 100km. Calculate i) Capacitance per phase
ii) Charging current per phase, assuming complete transposition of the line. **(06 Marks)**

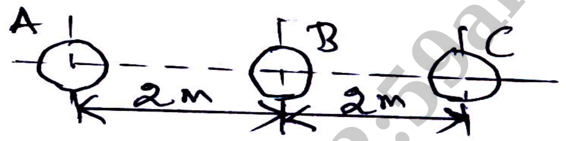

Fig. Q3(c)

OR

4 a. Derive expression for the capacitance per phase of a 3 – phase line with
i) Equilateral spacing ii) Unsymmetrical spacing (single circuit) transposed. **(12 Marks)**

b. Two conductors of a single phase line, each of 1cm diameter are arranged in a vertical plane with one conductor mounted 1m above the other. A second identical line is mounted at the same height as the first and spaced horizontally 0.25m apart from it. The upper and the two lower conductors are connected in parallel. Determine the inductance per km of the resulting double circuit line. **(08 Marks)**

Module-3

5 a. Show how regulation and transmission efficiency are determined for medium transmission line using nominal 'T' method with suitable vector diagram. **(07 Marks)**

b. A 3 phase, 50 Hz, 150km line has a resistance, inductive reactance and capacitive shunt admittance of 0.1Ω , 0.5Ω and 3×10^{-6} S per km per phase. If the line delivers 50 MW at 110 kN and 0.8 p.f lagging, determine the sending end voltage and current. Assume a nominal π circuit for the line. **(09 Marks)**

c. Write a note on Ferranti effect. **(04 Marks)**

OR

6 a. Write a note on classification of transmission lines. **(04 Marks)**

b. Derive an expression for A, B, C, D constants of a long transmission line by rigorous method of analysis. **(08 Marks)**

c. An overhead 3 phase transmission line delivers 5000 KW at 22 KV at 0.8 p.f lagging. The resistance and reactance of each conductor is 4Ω and 6Ω respectively. Determine
i) Sending end voltage ii) Percentage regulation iii) Transmission efficiency. **(08 Marks)**

Module-4

7 a. Explain the phenomenon of corona in an Overhead Transmission line. **(06 Marks)**

b. Explain the following terms with reference to corona :
i) Critical disruptive voltage ii) Visual critical voltage. **(06 Marks)**

c. A single core lead sheathed cable has a conductor diameter of 3cm, the diameter of the cable being 9cm. The cable is graded by using two dielectrics of relative permittivity 5 and 4 respectively with corresponding safe working stresses of 30 KV/cm and 20 KV/cm. Calculate the radial thickness of each insulation and the safe working voltage of the cable. **(08 Marks)**

OR

8 a. Derive the expression for capacitance of a single core cable. **(06 Marks)**

b. Define Grading of cables. Explain capacitance grading. **(08 Marks)**

c. The insulation resistance of a single core cable is 495 MΩ per km. If the core diameter is 2.5cm and resistivity of insulation is 4.5×10^{14} Ω – cm, find the insulation thickness. **(06 Marks)**

Module-5

9 a. Explain Radial and Parallel feeders. **(06 Marks)**

b. With the help of neat sketch, explain Bath tub curve. **(06 Marks)**

c. A single phase distributor 2 kilometers long supplies a load of 120A at 0.8 p.f lagging at its far end and load of 80A at 0.9 p.f lagging at its mid point. Both power factors are referred to the voltage at the far end. The resistance and reactance per km (go and return) are 0.05Ω and 0.1Ω respectively. If the voltage at the far end is maintained at 230V, calculate

i) Voltage at the sending end.

ii) Phase angle between voltages at the two ends. **(08 Marks)**

OR

10 a. Write a note on Power quality. **(06 Marks)**

b. Define : i) Reliability ii) Availability iii) Adequacy iv) Security. **(08 Marks)**

c. Write a note on limitation of distribution system. **(06 Marks)**

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CBCS SCHEME

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21EE52

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Control Systems

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Semilog graph sheet required.

Module-1

1 a. Define control system. Distinguish the types of control system with example. **(08 Marks)**

b. For the mechanical system shown in Fig.Q1(b). Write the differential equations describing its behavior. Write the analogous electrical equations based on force-voltage analogy, and force–current analogy, and draw the corresponding networks. Also draw the mechanical network and obtain the transfer function : $\frac{Y_1(s)}{F(s)}$.

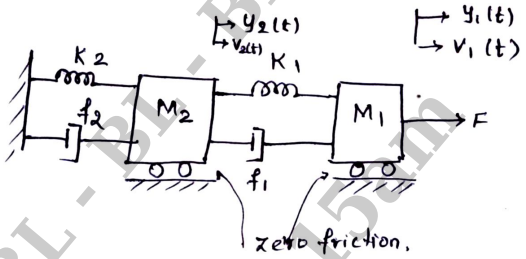

Fig.Q1(b) **(12 Marks)**

OR

2 a. Obtain the governing equation for the given electrical network and derive its transfer function shown in Fig.Q2(b).

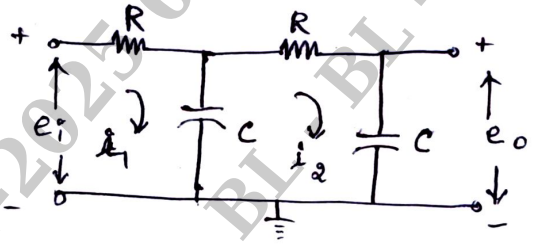

Fig.Q2(b) **(10 Marks)**

b. Discuss about : i) Synchros ii) Gear trains. **(10 Marks)**

Module-2

3 a. Give the list of block diagram reduction rules. **(08 Marks)**

b. Obtain the transfer function of the feedback control system shown in Fig.Q3(b) by block diagram reduction technique.

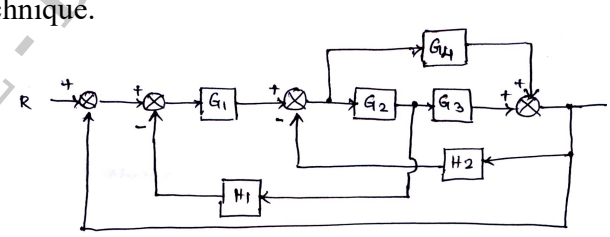

Fig.Q3(b) **(12 Marks)**

OR

4 a. Explain the construction of signal flow graph with its properties. **(08 Marks)**

b. Obtain the transfer function of the control system represented by the block diagram shown in Fig.Q4(b) by signal flow graph method.

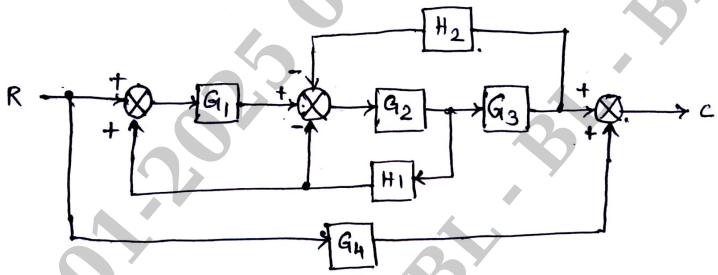

Fig.Q4(b) **(12 Marks)**

Module-3

5 a. A unity feedback system is characterized by an openl-loop transfer function :

$G(s) = \frac{k}{s(s+10)}$. Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K, determine the setting time, peak overshoot and time to peak overshoot for a unit-step input. **(10 Marks)**

b. The characteristic equation of a feedback control system is given by :

$s^4 + 20s^3 + 15x^2 + 2s + K = 0$

i) Determine the range of K for the system to be stable

ii) Can the system be marginally stable? If so, find the required value of K and the frequency of sustained oscillations. **(10 Marks)**

OR

6 a. The open-loop transfer function of a servo system with unity feedback is

$G(s) = \frac{10}{s(0.1s+1)}$

Evaluate the static error coefficients (K_p, K_V, K_a) for the system obtain the steady-state error of the system when subjected to an input given by the polynomial $r(t) = a_0 + a_1 t + \frac{a_2}{2} t^2$. Also evaluate the dynamic error using dynamic error coefficients. **(12 Marks)**

b. Using the Routh criterion, cheek whether the system represented by the following characteristic equation is stable or not. Comment on the location of the roots. Determine the frequency of sustained oscillations if any, $s^4 + 2s^3 + 6s^2 + 8s + 8 = 0$. **(08 Marks)**

Module-4

7 a. Give the list of rules for the construction of the root locus. **(08 Marks)**

b. Sketch the root locus of the open-loop transfer function given below :

$G(s)H(s) = \frac{K}{s(s+2)(S^2+2s+5)}$. **(12 Marks)**

OR

8 a. A unit-step response test conducted on a second-order system yielded peak overshoot $M_p = 0.12$, and peak time $t_p = 0.2s$. Obtain the corresponding frequency response indices (M_r, W_r, W_b) for the system. **(08 Marks)**

b. Sketch the bode plot for the following transfer function and determine the system gain K for the gain cross over frequency $w_g = 10$ rad/s.

$$G(s)H(s) = \frac{Ks^2}{(1+0.25s)(1+0.025s)}.$$ **(12 Marks)**

Module-5

9 a. Define principle of argument. Discuss in detail about Nyquist stability criterion. **(10 Marks)**

b. Design a lead compensator for a unity feedback system with an open-loop transfer function :

$$G_f(s) = \frac{k}{s(s+1)}$$

For the specifications of $K_v = 10s^{-1}$ and $\varphi_m = 35^o$. **(10 Marks)**

OR

10 a. Draw the Nyquist plot and assess the stability of the closed loop system whose open loop transfer function is :

$$G(s)H(s) = \frac{(s+4)}{(s+1)(s-1)}.$$ **(10 Marks)**

b. Consider a unity feedback system with open loop transfer function :

$$G(s) = \frac{5}{s(s+0.5)(s+1)}$$

Design a PD controller so that the phase margin of the system is 30° at a frequency of 1.2 rad/sec. **(10 Marks)**

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CBCS SCHEME

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21EE53

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Power System Analysis – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define per unit quantity and mention the advantages of p.v. system. **(06 Marks)**

b. Show that the per unit impedance of two winding transformer will remain same referred to primary as well as secondary. **(08 Marks)**

c. Draw the impedance diagram for:
(i) Two winding transformer
(ii) Transmission line
(iii) Three winding transformer **(06 Marks)**

OR

2 a. Draw the impedance and reactance diagram for a typical power system. Mention the assumptions made. **(10 Marks)**

b. Obtain the per unit impedance (reactance) diagram of the power system shown in Fig.Q2(b).

Fig.Q2(b)

The reactance data of the elements are:
G1 : 30 MVA, 10.5 KV, $X'' = 1.6\ \Omega$
G2 : 15 MVA, 6.6 KV, $X'' = 1.2\ \Omega$
G3 : 25 MVA, 6.6 KV, $X'' = 0.56\ \Omega$
T1 : 15 MVA, 33/11 KV, $X = 15.2\ \Omega$ per phase on H.T. side
T2 : 15 MVA, 33/6.2 KV, $X = 16\ \Omega$ per phase on H.T. side
Transmission line 20.5 ohms/phase
Load A : 40 MW, 11 KV, 0.9 p.f. (lag)
Load B : 40 MW, 6.6 KV, 0.85 p.f. (lag) **(10 Marks)**

Module-2

3 a. Describe the method of get doubling effect in a transmission line. **(10 Marks)**

b. A synchronous generator and motor are rated 30 MVA, 13.2 KV. Bothe have subtransient reactance of 10%. The line connecting them has a reactance of 10% on the base of machine rating. The motor is drawing 15 MW at 0.8 p.f.(lead). The terminal voltage of motor is 12.8 KV. When a symmetrical fault occurs at motor terminals, find subtransient current in generator and motor. **(10 Marks)**

OR

4 a. With the help of waveform at the time of 3 phase symmetrical fault on synchronous generator, explain steady state, transient and subtransient reactances. **(10 Marks)**

b. Two generators are connected in parallel to the LV side of a 3-phase Δ-Y transformer. The ratings of the machines are:

G1: 50 MVA, 13.8 KV, $X''_d = 25\%$

G2: 25 MVA, 13.8 KV, $X''_d = 25\%$

Transformer T : 75 MVA, 13.8 Δ - 69 Y KV, X = 10%

Before the fault occurs, the voltage on the HV side of the transformer is 66 KV. Find the subtransient current in each generator when a 3-phase fault occurs on the high voltage side of the transformer. **(10 Marks)**

Module-3

5 a. Draw the circuit of fully transposed transmission line carrying unbalanced currents. Write KVL equations and hence draw sequence diagram. **(09 Marks)**

b. Solve: (i) $1 + \alpha + \alpha^2$ (ii) $\alpha - \alpha^2$ (iii) $\alpha^2 - \alpha^3$ **(03 Marks)**

c. Draw the zero sequence network for different combination of 3-phase transformer bank. **(08 Marks)**

OR

6 a. Prove that balanced set of 3-phase voltages will have only positive sequence components of voltages. **(10 Marks)**

b. A delta connected balanced resistive load is connected across an unbalanced 3-phase supply as shown in Fig.Q6(b). With currents in lines A and B specified, find the symmetrical components of line currents.

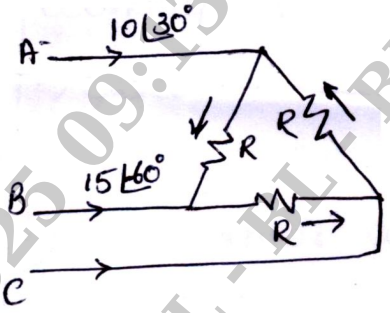

Fig.Q6(b) **(10 Marks)**

Module-4

7 a. Derive an expression for fault current if single line to ground fault occurs through fault impedance Z_f in power system. Show the connection of sequence networks to represent the fault. **(10 Marks)**

b. Draw the sequence networks for the system shown in Fig.Q7(b). Determine the fault current if line-line fault occurs at f.

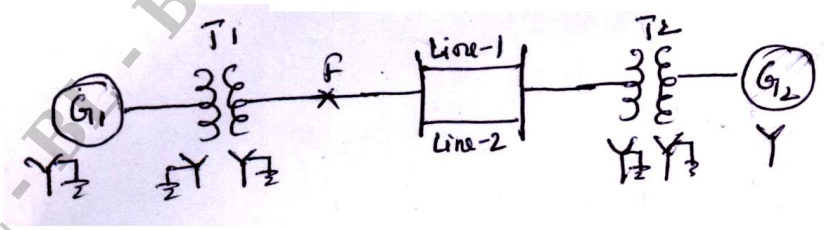

Fig.Q7(b)

Both generators are generating 1.0 pu. The pu reactances referred to same base as given:

Component	X_0	X_1	X_2
G1	0.05	0.3	0.2
G2	0.03	0.25	0.15
Line 1	0.7	0.3	0.3
Line 2	0.7	0.3	0.3
T1	0.12	0.12	0.12
T2	0.10	0.10	0.10

(10 Marks)

OR

8 a. Write a detailed note on open-conductor faults. **(10 Marks)**

b. Derive an expression for fault current if LLG fault occurs through a fault impedance Z_f in power system. Show the connection of sequence network to represent fault. **(10 Marks)**

Module-5

9 a. Derive the power angle equation of a salient pole synchronous machine connected to an infinite bus. Draw the power angle curve. **(12 Marks)**

b. Explain Equal Area Criterion to achieve stability of power system. **(08 Marks)**

OR

10 a. Derive swing equation governing the rotor dynamics of synchronous machine. **(10 Marks)**

b. A turbo generator, 6 pole, 50 Hz, of capacity 80 MW working at 0.8 p.f. has an inertia of 10 MJ/MVA.

(i) Calculate the energy stored in the rotor at synchronous speed.

(ii) Find rotor acceleration if the mechanical input is suddenly raised to 75 MW for an electrical load of 60 MW. **(10 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | | **21EE54**

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Power Electronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Mention and explain the different types of power electronic converter systems. Draw their input output characteristics. **(08 Marks)**

b. With circuit diagram and waveforms explain single phase full wave rectifier with RL load. **(08 Marks)**

c. List the applications of power electronics. **(04 Marks)**

OR

2 a. With the help of diagram, explain the reverse recovery characteristics of a power diode. **(06 Marks)**

b. Discuss the peripheral effects of static power converter system. **(06 Marks)**

c. List the major types of power electronic devices with their symbols. In each case, draw their output characteristics. **(08 Marks)**

Module-2

3 a. Discuss the needs and methods for providing isolation of gate/base circuits from power circuit with necessary circuit diagrams. **(08 Marks)**

b. With neat circuit diagram and switching times explain study state and switching characteristics of power MOSFET. **(08 Marks)**

c. What is di/dt and dv/dt protection for transistor? **(04 Marks)**

OR

4 a. A transistor switch of Fig.Q4(a) has β in the range of 10 to 50. Calculate :

i) The value of R_B that results in saturation with an overdrive factor of 6

ii) The forced β_f

iii) The power loss in the transistor.

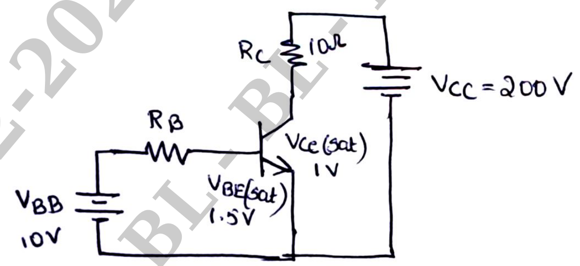

Fig.Q4(a) **(08 Marks)**

b. With the help of a circuit diagram, how the base current peaking is obtained during turn-on of power transistors? **(06 Marks)**

c. Draw and explain switching characteristics of power IGBT. **(06 Marks)**

Module-3

5 a. Using 2 transistor model, explain how a small gate current can turn-on the SCR when blocking forward voltage. **(08 Marks)**

b. Define holding current and latching current of a thyristor. **(06 Marks)**

c. With a neat circuit, explain the R-firing circuit of thyristor with necessary waveform. **(06 Marks)**

OR

6 a. The values of protection elements of a protection circuit for a thyristor, used as a switch connecting a load to a supply are, R_S = 15Ω, C_s = 0.1 μF and L_S = 150 μH. If the supply voltage is 300 V AC and load resistance is 10 Ω. Calculate the maximum permissible $\frac{dv}{dt}$ and $\frac{di}{dt}$ valves. **(08 Marks)**

b. Explain thyristor characteristics and modes of operation with a suitable diagram. **(08 Marks)**

c. What is the necessity of series and parallel connection of thyristors. **(04 Marks)**

Module-4

7 a. Describe the operation of single phase semi-converter feeding resistive load. obtain expression for the average DC o/p. **(10 Marks)**

b. With the circuit diagram and waveforms explain the operation of a 3-phase dual converter. **(10 Marks)**

OR

8 a. With the help of neat circuit diagram and waveforms explain the operation of a bidirectional controller with R – load. Derive equation for V_0(rms). **(10 Marks)**

b. A single phase half wave AC voltage controller shown in the Fig.Q8(b) feeds power to a resistive load of 6Ω from 230V, 50 Hz source. The firing angle of SCR is $\alpha = \frac{\pi}{2}$.

Calculate :
i) RMS value of o/p voltage
ii) Input power factor
iii) Average input current.

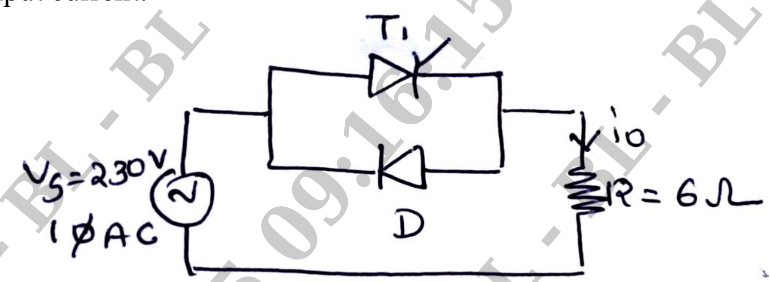

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. A step up chopper has input voltage of 220 V and output voltage of 660 volts. If the non-conducting time of thyristor chopper is 100 μ sec, compute the pulse width of output voltage. In case pulse width is halved for constant frequency operation, find new output voltage. **(08 Marks)**

b. With the help of circuit and waveforms, explain the operation of step up chopper. **(06 Marks)**

c. How choppers are classified? Write quadrant of operation. **(06 Marks)**

OR

10 a. What are inverters? Explain the operation of single phase full bridge inverter for R – L load. **(10 Marks)**

b. Explain the voltage control of single phase inverter using :
i) Multiple pulse width modulation
ii) Sinusoidal pulse width modulation. **(10 Marks)**

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CBCS SCHEME

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BEE501

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Engineering Management and Entrepreneurship

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 briefly the Management Functions.	10	L2	CO1
	b.	Discuss in detail roles of Manager.	10	L1	CO1
		OR			
Q.2	a.	What are limitations of planning? Give any five differences between strategies planning and tactical planning.	10	L1	CO1
	b.	Explain the process of decision making.	10	L2	CO1
		Module – 2			
Q.3	a.	What is an organization? Explain the characteristics, process of an organization.	10	L1	CO2
	b.	Differentiate between recruitment and selection. Describe the steps involved in the selection process.	10	L1	CO2
		OR			
Q.4	a.	What is meant by departmentalization? List and explain different bases for departmentalization.	10	L1	CO2
	b.	Define committees. List and explain different types of committees.	10	L1	CO2
		Module – 3			
Q.5	a.	Define leadership and explain important characteristic of leadership.	10	L1	CO3
	b.	Explain different techniques of coordination.	10	L2	CO3
		OR			
Q.6	a.	What is social audit? What are its benefits and limitation?	10	L1	CO3
	b.	Discuss the social responsibilities of business towards different groups.	10	L1	CO3
		Module – 4			
Q.7	a.	Explain the evolution of the concept of entrepreneurship.	10	L2	CO4
	b.	List and explain different types of Entrepreneurs.	10	L1	CO4
		OR			
Q.8	a.	Discus the concept of entrepreneurial mobility, focusing on its types.	10	L1	CO4
	b.	What are the emerging business opportunities in India, how does demographic trends contribute to their growth.	10	L1	CO4
		Module – 5			
Q.9	a.	Explain purpose and contents of business plan.	10	L2	CO5
	b.	Define SSI. Enumerate various objectives of SSI.	10	L1	CO5
		OR			
Q.10	a.	Write a note on Single Window DIC agency.	10	L1	CO5
	b.	List and explain all the services provided by SIDBI.	10	L1	CO5

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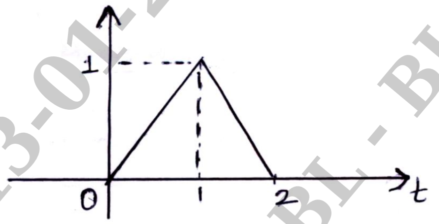
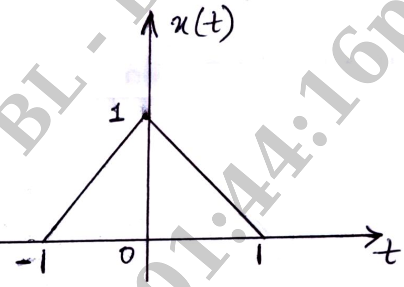
CBCS SCHEME

USN | | | | | | | | | | | **BEE502**

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Signals and DSP

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 classification of signals with examples.	**06**	**L2**	**CO1**
	b.	Determine and sketch the even and odd parts of the signal shown in Fig.Q1(b).  Fig.Q1(b)	**06**	**L3**	**CO1**
	c.	For the continuous time single x(t) shown in Fig.Q1(c), sketch the signal: (i) $y_1(t) = x(3t+2)$ (ii) $y_2(t) = x(3t) + x(3t+2)$  Fig.Q1(c)	**08**	**L3**	**CO1**
		OR			
Q.2	**a.**	Check whether the following signals are periodic or not. If periodic, solve the fundamental period: (i) $x_1(n) = (-1)^n$ (ii) $x_2(n) = \cos\left(\frac{\pi}{3}n\right) + \cos\left(\frac{\pi}{4}n\right)$	**06**	**L3**	**CO1**
	b.	Determine the following signal y(n) = 2x(n) + 3 is linear, time variant, causal, memory and invertible.	**06**	**L3**	**CO1**
	c.	Evaluate the continuous time convolution integral given as $y(t) = e^{-at}u(t) * u(t)$.	**08**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	State and prove the following properties of DFT: (i) Linearity (ii) Circular time shift (iii) Symmetry of real valued sequences	**08**	**L2**	**CO2**
	b.	For the sequences $x_1(n) = \cos\left(\frac{2\pi n}{N}\right)$, $x_2(n) = \sin\left(\frac{2\pi n}{N}\right)$, $0 \le n \le N-1$, solve for N-point circular convolution $x_1(n) \circledast_N x_2(n)$.	**06**	**L3**	**CO2**

	c.	Determine the 4-point DFT of the sequence, x(n) = (1, −1, 1, −1). Also, using time shift property, find the DFT of the sequence, $y(n) = x((n-2))_4$.	06	L3	CO2
		OR			
Q.4	a.	Define DFT and IDFT and compute 4-point DFT of a single x(n) = (1, 2, 1, 0) using DFT matrix.	08	L3	CO2
	b.	The 5-point DFT of a complex sequence x(n) is given as X(K) = (j, 1 + j, 1 + j2, 2 + j2, 4 + j) Compute Y(K), if y(n) = x*(n).	06	L3	CO2
	c.	Using DFT, IDFT method, compute circular convolution of the sequences $x_1(n) = (1, 1, 1)$ and $x_2(n) = (1, -2, 2)$.	06	L3	CO2
		Module – 3			
Q.5	a.	Compute 8 point DFT of the sequence x(n) = (1, 2, 3, 4, 4, 3, 2, 1) using radix-2 DIT-FFT algorithm.	12	L3	CO3
	b.	Determine the 4-point real sequence x(n), if its 4-point DFT samples are X(0) = 6, X(1) = −2 + j2, X(2) = −2. Use DIF-FFT algorithm.	08	L3	CO3
		OR			
Q.6	a.	Given the sequence $x_1(n)$ and $x_2(n)$ below, compute the circular convolution $x_1(n) \circledast_N x_2(n)$ for N = 4. Use DIT-FFT algorithm.	10	L3	CO3
	b.	Solve for the 4-point circular convolution of x(n) and h(n) using radix-2 DIF-FFT algorithm. Given X(n) = (1, 1, 1, 1), h(n) = (1, 0, 1, 0).	10	L3	CO3
		Module – 4			
Q.7	a.	Design a Butterworth analog highpass filter that will meet the following specifications: (i) Maximum passband attenuation = 2 dB (ii) Passband edge frequency = 200 rad/sec (iii) Minimum stopband attenuation = 20 dB (iv) Stopband edge frequency = 100 rad/sec	10	L3	CO4
	b.	Obtain the direct form I and direct form II of the following transfer function: $H(z) = \dfrac{8z^3 - 4z^2 + 11z + 2}{\left(z - \frac{1}{4}\right)\left(z^2 - z + \frac{1}{2}\right)}$	10	L3	CO4
		OR			
Q.8	a.	Design a Chebyshev I filter to meet the following specifications: (i) Passband ripple : ≤ 2 dB (ii) Passband edge : 1 rad/sec (iii) Stopband attenuation : ≥20 dB (iv) Stopband edge : 1.3 rad/sec	10	L3	CO4
	b.	The system function of an analog filter is given by $H(s) = \dfrac{s+0.1}{(s+0.1)^2 + 9}$. Obtain the system function of IIR digital filter by using impulse invariant method.	10	L3	CO4

Module – 5					
Q.9	**a.**	A filter is to be designed with the following desired frequency response: $$H_d(\omega)=\begin{cases}0 & -\frac{\pi}{4}<\omega<\frac{\pi}{4}\\ e^{-j2\omega} & \frac{\pi}{4}<\lvert\omega\rvert<\pi\end{cases}$$ Compute the frequency response of the FIR filter designed using a rectangular window defined below: $$\omega_R(n)=\begin{cases}1 & 0\le n\le 4\\ 0 & \text{otherwise}\end{cases}$$	**10**	**L3**	**CO5**
	b.	Determine the filter coefficients h(n) obtained by sampling $H_d(\omega)$ given by, $$H_d(\omega)=\begin{cases}e^{-j3\omega} & 0<\omega<\frac{\pi}{2}\\ 0 & \frac{\pi}{2}<\lvert\omega\rvert<\pi\end{cases}$$ Also, obtain the frequency response, $H(\omega)$. Take N = 7.	**10**	**L3**	**CO5**
OR					
Q.10	**a.**	The desired frequency response of a lowpass filter is given by $$H_d(e^{j\omega})=H_d(\omega)=\begin{cases}e^{-j3\omega} & \lvert\omega\rvert<\frac{3\pi}{4}\\ 0 & \frac{3\pi}{4}<\lvert\omega\rvert<\pi\end{cases}$$ Determine the frequency response of the FIR filter if Hamming window is used with N = 7.	**10**	**L3**	**CO5**
	b.	The frequency response of an FIR filter is given by $$H(\omega)=e^{-j3\omega}(1+1.8\cos 3\omega+1.2\cos 2\omega+0.5\cos\omega)$$ Determine the coefficients of the impulse response h(n) of the FIR filter.	**10**	**L3**	**CO5**

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CBCS SCHEME

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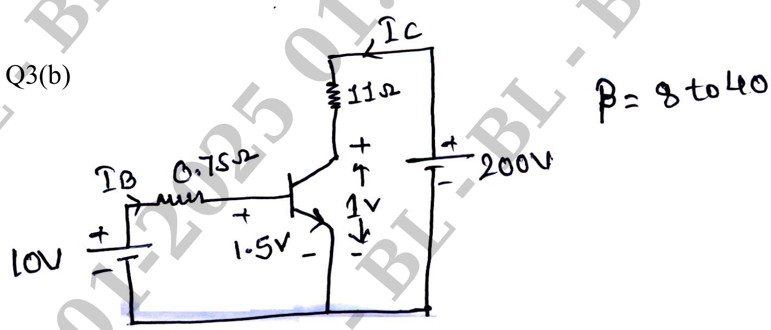
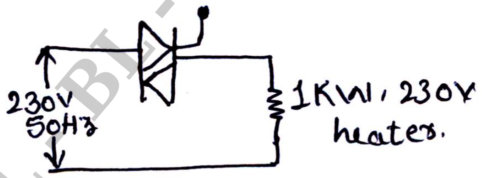
BEE503

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Power 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
Q.1	a.	Explain control characteristics of power devices with neat circuit and wave form.	8	L1	CO1
	b.	With neat diagram, explain different types of power electronic converters.	8	L1	CO1
	c.	The forward voltage drop of power diode is $V_D = 1.2V$ at $I_D = 300A$, $n = 2$ and $V_T = 25.7mV$, find the reverse saturation current I_S.	4	L3	CO1
		OR			
Q.2	a.	Explain Full wave Rectifier with central tapped transformer with R load. Derive the expression for $V_{o(rms)}$, $V_{o(av)}$, RF, FF, TUF.	10	L2	CO1
	b.	With neat waveform and equation, explain Reverse Recovery characteristics.	10	L2	CO1
		Module – 2			
Q.3	a.	Explain Steady State characteristics and switching characteristics of BJT with neat circuit and waveforms.	10	L2	CO2
	b.	For the transistor switch of Fig. Q3(b), calculate forced beta, β_f of transistor, ODF and power loss P_T of transistor. Fig. Q3(b) 	10	L3	CO2
		OR			
Q.4	a.	Explain different methods of providing gate and base drive isolation.	10	L1	CO2
	b.	The collector clamping of Antisaturation control has $V_{CC} = 100V$, $R_C = 1.5\Omega$, $Vd_1 = 2.1V$, $Vd_2 = 0.9V$, $V_{BE} = 0.7V$, $V_B = 15V$ and $R_B = 2.5\Omega$ and B = 16. Calculate i) The Collector current without clamping ii) The Collector – Emitter clamping voltage and iii) The Collector current with clamping.	10	L3	CO2

Module – 3					
Q.5	**a.**	Derive an expression for the anode current of thyristor with the help of two transistor analogy.	**10**	**L2**	**CO3**
	b.	The latching current for SCR inserted in between adc voltage source of 200V and load is 100 mA. Calculate the minimum width gate pulse current required to turn on SCR in case load consist of i) L = 0.2H ii) R = 20Ω in series with L = 0.2H.	**10**	**L3**	**CO3**
OR					
Q.6	**a.**	With the help of neat diagram and waveform , explain RC firing circuit used with half controlled rectifier.	**10**	**L2**	**CO3**
	b.	Design the UJT triggering circuit for SCR. Given V_{BB} = 20V , η = 0.6 , I_P = 10μA, V_V = 2V , I_V = 10mA. The frequency of oscillation is 100Hz. The triggering pulse width should be 50μS.	**10**	**L3**	**CO3**
Module – 4					
Q.7	**a.**	With neat diagram and waveform explain single phase dual converter.	**10**	**L2**	**CO4**
	b.	A single phase half wave converter is operated from a 120V , 50Hz supply and the load resistance of 10Ω. If average output is 25% of the maximum possible average output voltage calculate : i) Delay angle ii) The rms and average output current iii) The rms and average thyristor current. iv) The Input power factor.	**10**	**L3**	**C)4**
OR					
Q.8	**a.**	With neat circuit and waveform, explain the operation of single phase bidirectional AC voltage controller with resistive load. Obtain the equation for output voltage.	**10**	**L2**	**CO4**
	b.	The single phase full wave AC voltage controller operates on single phase supply voltage of 230V rms at 50Hz. If the triac is triggered at a delay angle of 45º, during each half cycle of Input supply. Calculate i) RMS value of output voltage. ii) RMS value of current through heater. iii) Average value of triac current and RMS. iv) Input power factor.  Fig. Q8(b)	**10**	**L3**	**CO4**
Module – 5					
Q.9	**a.**	Explain the principle of operation of a step – up chopper with suitable circuit diagram and waveform. Derive the expression for average output voltage.	**10**	**L1**	**CO5**

	b.	A step up input chopper is 200 V. The output required is 600 V. If the conducting time of thyristor is 200 μs, compute i) Chopping frequency ii) If pulse width is halved for constant frequency of operation, find the new output voltage.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	With circuit diagram, explain the operation of 1 ϕ full bridge inverter with R load.	**10**	**L1**	**CO5**
	b.	The single phase full bridge inverter has a resistive load of 24Ω and DC input voltage of 48 V. Determine i) rms output voltage at fundamental frequency. ii) The output supply. iii) The peak and average currents of each transistor.	**10**	**L3**	**CO5**

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CBCS SCHEME

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BEE515B

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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.

			M	L	C
		Module – 1			
Q.1	**a.**	Give the different classification of Energy sources.	**10**	**L1**	**CO1**
	b.	Explain the impact of Renewable energy generation on the environment.	**10**	**L2**	**CO1**
		OR			
Q.2	**a.**	State the advantages and disadvantages of conventional energy sources.	**10**	**L1**	**CO1**
	b.	Give the importance of non-conventional energy sources.	**10**	**L2**	**CO1**
		Module – 2			
Q.3	**a.**	With a neat graph, explain the solar PV characteristics. Also discuss the various parameters involved.	**10**	**L3**	**CO2**
	b.	With a neat circuit diagram, explain 12 pulse rectifier circuits in detail. Also give the waveforms.	**10**	**L3**	**CO2**
		OR			
Q.4	**a.**	Explain the operation of solar PV systems in both Grid connected and islanded mode	**10**	**L3**	**CO2**
	b.	Explain the following control techniques used in solar PV systems i) Perturb and observe method ii) Incremental conductance method.	**10**	**L4**	**CO2**
		Module – 3			
Q.5	**a.**	With a neat diagram, explain standalone mode of operation of wind energy systems.	**10**	**L4**	**CO3**
	b.	With a neat Graph, explain the wind turbine characteristics.	**10**	**L4**	**CO3**
		OR			
Q.6	**a.**	Explain AC/DC/AC power converter employed in wind energy systems.	**10**	**L4**	**CO3**
	b.	With a neat diagram, explain wind energy conversion system.	**10**	**L4**	**CO**
		Module – 4			
Q.7	**a.**	Discuss the qualitative analysis of the following renewable energy sources. i) Biomass Energy ii) Ocean energy.	**10**	**L3**	**CO3**
	b.	What is a fuel cell? Explain the VI characteristics of a fuel cell with a neat graph, showing various types polarization regions.	**10**	**L4**	**CO4**

		OR			
Q.8	**a.**	Writ short notes on Hydrogen Energy.	**10**	**L4**	**CO4**
	b.	With a neat sketch, explain the operation of Alkaline fuel cell.	**10**	**L4**	**CO4**
		Module – 5			
Q.9	**a.**	With a neat architecture, explain the operation of microgrid. Also state its advantages and disadvantages.	**10**	**L3**	**CO5**
	b.	Explain the Grid forming control of AC microgrid systems with a neat Block diagram.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	Write short notes on Hierarchical control of microgrid system.	**10**	**L3**	**CO5**
	b.	Explain voltage based drop control method employed in Micro-grid system with neat Graphs.	**10**	**L3**	**CO5**

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CBCS SCHEME

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18EE61

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Control Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Distinguish between open loop and closed loop control system with examples. **(06 Marks)**

b. Find the transfer function of the electrical network shown in Fig.Q1(b) in phase load form:

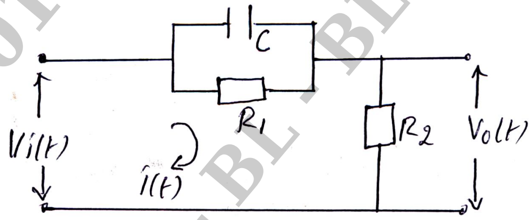

Fig.Q1(b) **(06 Marks)**

c. For the mechanism system shown in Fig.Q1(c):
(i) Draw the mechanical network
(ii) Write the differential equations
(iii) Draw electrical network by force voltage analogy.

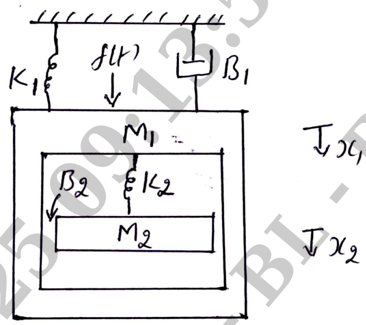

Fig.Q1(c) **(08 Marks)**

OR

2 a. Define servo motor. Compare AC servomotor and DC servo motor. **(04 Marks)**

b. For the mechanical system shown in Fig.Q2(b), obtain the equation of motion for masses M_1 and M_2 and find $\frac{X_2(s)}{F(s)}$.

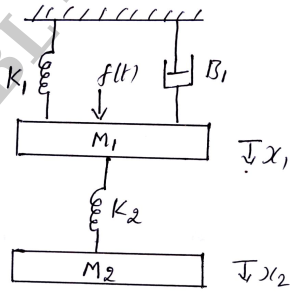

Fig.Q2(b) **(08 Marks)**

c. For the rotational system shown in Fig.Q2(c), draw electrical network based on torque current analogy.

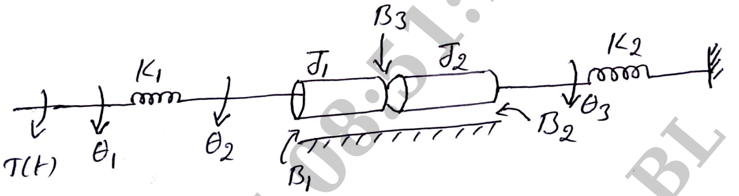

Fig.Q2(c) **(08 Marks)**

Module-2

3 a. Define the following terms in connection with signal flow graph:
(i) Node
(ii) Forward path gain
(iii) Feedback loop
(iv) Non touching loops **(04 Marks)**

b. For the block diagram shown in Fig.Q3(b), determine the transfer function $\frac{C(s)}{R(s)}$ using block diagram reduction technique.

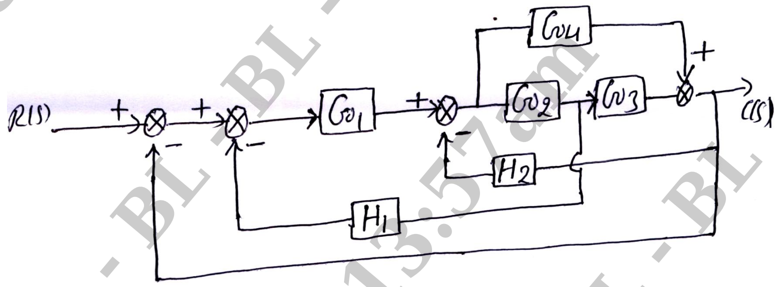

Fig.Q3(b) **(08 Marks)**

c. For the signal flow graph shown in Fig.Q3(c), determine the transfer function $\frac{C(s)}{R(s)}$ using Mason's gain formula.

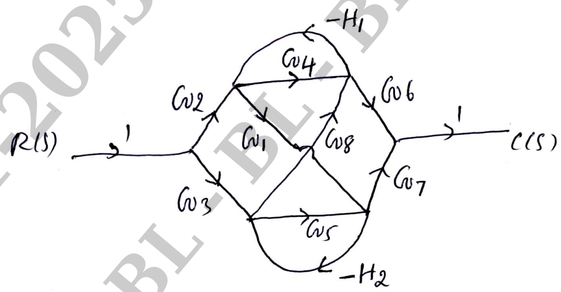

Fig.Q3(c) **(08 Marks)**

OR

4 a. A system is represented by following set of equations, find $\frac{X(s)}{U(s)}$ using signal flow graph technique:

$$X(t) = x_1(t) + \beta_3 u(t)$$

$$\dot{X}_1(t) = -a_1 x_1(t) + x_2(t) + \beta_2 u(t)$$

$$\dot{X}_2(t) = -a_2 x_1(t) + \beta_1 u(t)$$ **(08 Marks)**

b. Draw the corresponding signal flow graph of given block diagram shown in Fig.Q4(b) and find $\frac{C(s)}{R(s)}$.

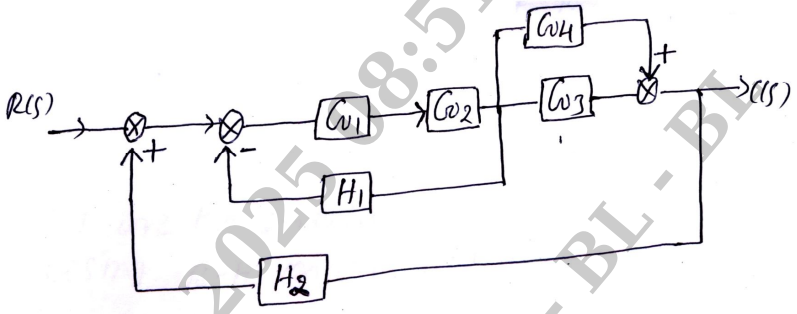

Fig.Q4(b) **(08 Marks)**

c. Explain Mason's gain formula indicating each term. **(04 Marks)**

Module-3

5 a. Define the following for an under damped second order system:
(i) Rise time (ii) Peak overshoot (iii) Settling time **(06 Marks)**

b. Derive an expression for under damped response of a second order feedback control system for unit step input. **(08 Marks)**

c. The characteristic equation of the system is given by $s^4 + 22s^3 + 10s^2 + 2s + K = 0$. Using RH criterion, find the range of K for which the system is stable. **(06 Marks)**

OR

6 a. What are the difficulties encountered while assessing R-H criteria and how do you eliminate these difficulties? Explain with examples. **(06 Marks)**

b. Derive an expression for rise time and peak time for a second order system excited by a step input. **(08 Marks)**

c. Evaluate the static error constants for unity feedback system with $G(s) = \frac{10}{s(1+0.1s)}$. Obtain the steady state error when the input is $r(t) = a_0 + a_1 t + \frac{a_2 t^2}{2}$. **(06 Marks)**

Module-4

7 a. Write notes on: (i) Break away point (ii) Asymptotes **(04 Marks)**

b. Show that part of root locus of a system with $G(s)H(s) = \frac{K(s+3)}{s(s+2)}$ is a circle having centre $(-3, 0)$ and radius at $\sqrt{3}$. **(08 Marks)**

c. Sketch the root locus plot for the open loop transfer function $G(s)H(s) = \frac{K}{s(s+2)(s+3)}$. **(08 Marks)**

OR

8 a. Explain the angle and magnitude condition of root locus. **(06 Marks)**

b. Sketch the bodes magnitude and phase diagram for

$$G(s)H(s) = \frac{5}{s(1+0.5s)(1+0.05s)}$$ **(08 Marks)**

c. Find the open loop transfer function of a system whose approximate plot is as shown in Fig.Q8(c).

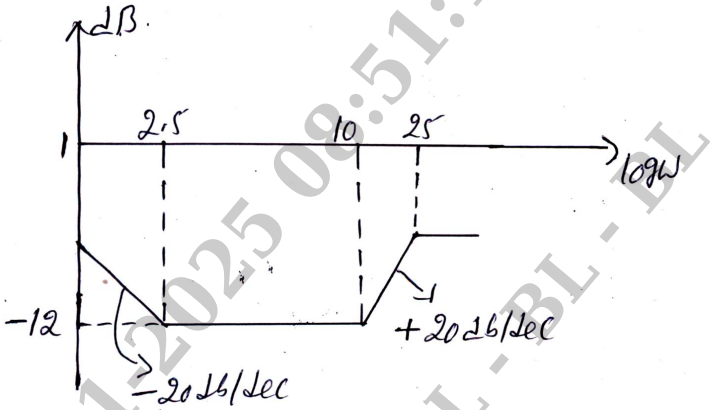

Fig.Q8(c) **(06 Marks)**

Module-5

9 a. Discuss the advantages of Nyquist plot. **(06 Marks)**

b. What is controller? Explain the effect of PI and PD controller on second order system. **(08 Marks)**

c. What are the limitations of single phase lead control? **(06 Marks)**

OR

10 a. A feedback control system has loop function $GH(s) = \frac{5}{s(s+1)}$. Sketch the Nyquist plot and comment on the stability of a system. **(08 Marks)**

b. Explain Nyquist stability criteria. **(05 Marks)**

c. Explain the principle of argument in Nyquist stability criteria. **(07 Marks)**

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CBCS SCHEME

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18EE62

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Power System Analysis – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define in unit Quantity. Enumerate the advantages of per unit representation. **(05 Marks)**

b. Show that per – unit impedance of transformer referred to primary or secondary remains same. **(05 Marks)**

c. Draw the per unit reactance diagram for the power system shown in Fig Q1(c), selecting the generator rating as the base. Also find the generator terminal voltage.

Fig Q1(c)

The rating of the various components are
G = 13.8 KV, 25 MVA, X″ = j0.15 PU ;
T_1 = 13.2/69 KV, 25 MVA, X = j0.11 PU ;
T_2 = 69/13.2 KV, 25 MVA, X = j0.11 PU ;
M_1 = 13 KV, 15 MVA, X″ = j0.15 PU
M_2 = 13 KV, 10 MVA, X″ = j0.15 PU
Determine the generator terminal voltage, when both the motors operate at 12 KV, 75% full load and unity power factor. **(10 Marks)**

OR

2 a. Draw single Line diagram of lower system indicating the various components of it, Obtain the impedance diagram and reactance diagram. Explain each component and the assumption made to draw the reactance diagram. **(10 Marks)**

b. The Schematic diagram of a radial transmission system is shown in Fig Q2(b). The ratings and reactance of the various components are shown there in. A load of 60 MW at 0.9 pf lagging is tapped from 66 kV substations which is to be maintained at 60 kV. Calculate the terminal voltages of the machine. Represent the transmission line and transformer by series reactance only.

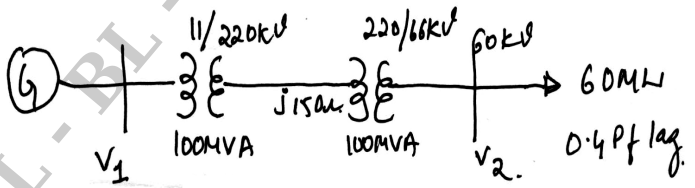

Fig Q2(b) **(10 Marks)**

Module-2

3 a. With the help of waveform at the time of three phase symmetrical fault, On synchronous generator define steady state, transient and sub transient reactances. **(10 Marks)**

b. For the radial network shown in Fig Q3(b) a 3 phase fault occurs at point F. Determine the fault current, choose the generator ratings as base values.

Generator G_1 : 10 MVA, 11 KV, $X'' = 15\%$
Generator G_2 : 10 MVA, 11 KV, $X'' = 12.5\%$
Transformer T_1 : 10 MVA, 11/33 KV, $X = 10\%$
Transformer T_2 : 5 MVA, 33/6.6 KV, $X = 8\%$
Over head line impedance $Z = 0.27 + j0.36$
Feeder impedance $Z = (0.135 + j0.08)\Omega/km$

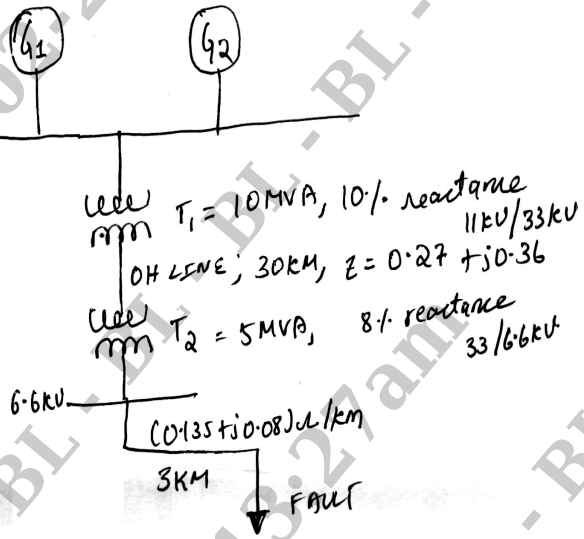

Fig Q3(b) **(10 Marks)**

OR

4 a. What is Doubling effect in a transmission line? Substantiate with equations. **(08 Marks)**

b. A synchronous generator and motor are rated 30 MVA, 13.2 KV, both have sub transient reactance of 20%. The line connecting them has a reactance of 20%, on the base of machine rating. The motor is drawing 20 MW at 0.8 pf (lead). The terminal voltage of motor is 12.8 KV. When a symmetrical fault occurs at motor terminals find sub transient current in generator, motor and at the point of fault? **(12 Marks)**

Module-3

5 a. Draw the zero sequence impedance networks of a transformer for the following connections.

i) Y - Y ii) Δ - Δ iii) Δ - Y

(06 Marks)

b. Draw the negative, positive and zero sequence networks shown in Fig Q5(b)

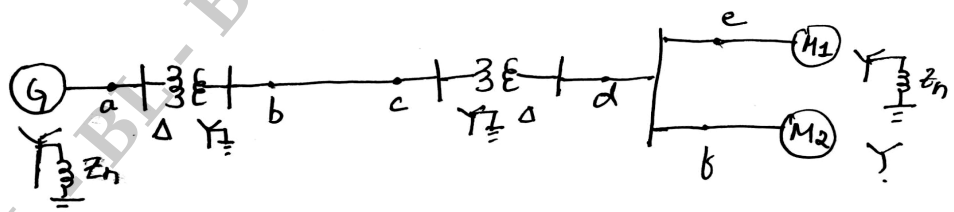

Fig Q5(b)

G = 300 MVA, 20 KV, $X_d'' = 15\%, X_o = 5\%$, $Z_n = 0.4\ \Omega$
M_1 = 200 MVA, 13.2 KV, $X_d'' = 20\%$, $X_0 = 5\%$, $Z_n = 0.5\Omega$
M_2 = 100 MVA, 13.2 KV, $X_d'' = 20\%$, $X_0 = 5\%$
T_1 = 300 MVA, 230 KV/20 KV, X = 10%
T_2 = Three single phase transformers rated 100MVA, 132 KV/13.2 KV, X = 10%.
Transmission line: 10 KM, reactance 0.5 Ω/Km. $Z_0 = 3z_1$.
Choose generator rating as base values in generator circuit. **(14 Marks)**

OR

6 a. Explain the concept of phase shift in star – delta transformer bank. **(06 Marks)**

b. Prove that
i) $(1 + \alpha + \alpha^2) = 0$ ii) $[\alpha - \alpha^2] = j\sqrt{3}$ iii) $[\alpha^2 - \alpha] = -j\sqrt{3}$ **(06 Marks)**

c. A 3 phase star connected load shown in Fig Q6(c) is connected to a 3 phase supply having a line voltage of 440 volts. Calculate the sequence current in line 'a'.

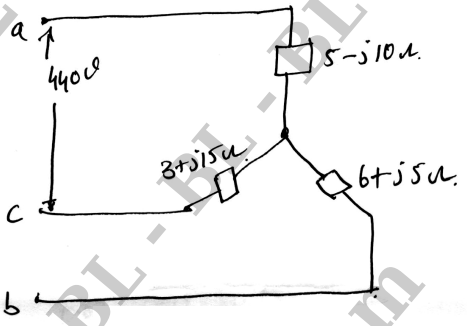

Fig Q6(c) **(08 Marks)**

Module-4

7 a. An unloaded fully excited three phase alternator is subjected to an LG fault at its terminals. Find the fault current. Using symmetrical components by showing the interconnection of all sequence networks. **(10 Marks)**

b. A 3-phase generator with line to line voltage of 400V is subjected to an LLG fault if $Z_1 = j2\Omega$, $Z_2 = j0.5\Omega$, and $Z_0 = j0.25\Omega$. Determine the fault current. **(10 Marks)**

OR

8 a. Derive the expression for fault current in Line – Line – Ground [LLG] fault occurs through fault impedance Z_f in power system. show the connection of sequence networks to represent the fault. **(10 Marks)**

b. Draw the sequence networks for the system shown in Fig Q8(b). Determine the fault current if a line to line occur at 'F'. The PU reactance all referred to the same base are as follows :

Component	X_0	X_1	X_2
G_1	0.05	0.30	0.20
G_2	0.03	0.25	0.15
Line – 1	0.70	0.30	0.30
Line – 2	0.70	0.30	0.30
T_1	0.12	0.12	0.12
T_2	0.10	0.10	0.10

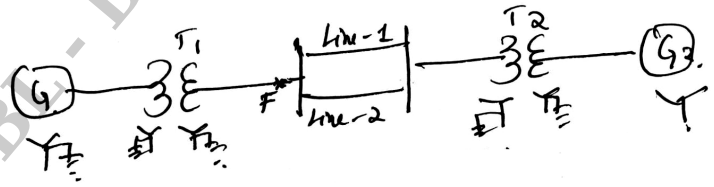

Fig Q8(b) **(10 Marks)**

Module-5

9 a. Derive Power angle equation of a salient pole synchronous machine. **(10 Marks)**

b. Explain "Equal area criteria" concept when a power system is subjected to sudden loss of one of the "Parallel lines". **(10 Marks)**

OR

10 a. Derive an expression for the swing equation. **(10 Marks)**

b. An Alternator operating at 50Hz delivers 1 PU of power to an infinite bus through a transmission line. A fault occurs, reducing. The maximum power transferred at 0.5 PU, whereas before the fault it was 2 PU, and after the fault is cleared it is 1.5 PU. Calculate the criteria clearing angle. **(10 Marks)**

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CBCS SCHEME

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18EE63

Sixth Semester B.E. Degree Examination, June/July 2024
Digital Signal Processing

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Calculate 8-point DFT of $x(n) = \cos\left(\frac{n\pi}{4}\right)$. Draw magnitude and phase of x(k). **(10 Marks)**

b. Derive the DFT properties for Periodicity and linearity property. **(10 Marks)**

OR

2 a. Compute circular convolution of discrete sequence $x_1(n) = \{1, 3, 5, 3\}$ $x_2(n) = \{2, 3, 1, 1\}$ by i) Circular method ii) Matrix method. **(10 Marks)**

b. Find the output y(n) of a filter whose impulse response is h(n) = {1, 1, 1} and the input signal to the filter is x(n) = {3, –1, 0, 1, 3, 2, 0, 1, 2, 1}. Using overlap save method. **(10 Marks)**

Module-2

3 a. Develop an 8-point DIF-FFT algorithm starting from DFT. State clearly all the step. Explain how it reduces the number of computation. **(10 Marks)**

b. Find DFT of x(n) = {1, 1, 1, 1, 0, 0, 0, 0} using DIT – FFT algorithm show all the intermediate result in signal flow graph. **(10 Marks)**

OR

4 a. The DFT x(k) of sequence is given as x(k) = {0, 2, + 2j, –j4, 2 –j2, 0, 2 + 2j, j4, 2 –j2} using using IDIF – FFT. Determine x(n). **(10 Marks)**

b. Develop an 8-point IDIT-FFT algorithm starting from DFT. Draw the complete signal flow graph to find x(n). **(10 Marks)**

Module-3

5 a. Design an analog Butterfly filter has a gain – 2dB and 20r/s and attenuation in excess of 10dB beyond 30r/s. **(10 Marks)**

b. Determine the transfer function if Chebyshev filter for the following specification :
   i) Maximum passband repple is 1dB
   ii) Stop and band attenuation is 40dB for $\Omega \geq 4$r/s. **(10 Marks)**

OR

6 a. For the constraints $0.8 \leq |H(e^{jw})| \leq |$ for $0 \leq w \leq 0.2\pi$, $|H(e^{jw})| \leq 0.2$ for $0.6\pi \leq w \leq \pi$. Design a Butterworth digital filter using bilinear transformation. Assume T = 1 Second. **(10 Marks)**

b. Using Impulse invariant technique find the transfer function of digital filter H(z) for analog Transform function

$$H(s) = \frac{b}{(s+a)^2 + b^2}.$$ **(10 Marks)**

Module-4

7 a. Design a Chebyshev filter with T = 1 second using Bilinear transformation for the following specification.

i) $0.8 \le |H(e^{jw})| \le 1$ for $0 \le w \le 0.2\pi$

ii) $|H(e^{jw})| \le 0.1$ for $0.5\pi \le w \le \pi$ **(10 Marks)**

b. Realise the system for direct Form – I and direct form – II.

$$H(z) = \frac{0.7 - 0.25z^{-1} - z^{-2}}{1 + 0.1z^{-1} - 0.72z^{-2}}.$$ **(10 Marks)**

OR

8 a. Obtain the parallel form and cascade form for given system.

$y(n) = 0.75\,y(n-1) - 0.125y(n-2) + 6\,x(n) + 7x(n-1) + x(n-2)$ **(10 Marks)**

b. Design a maximally flat digital LPF to meet following specification.

$0.8 \le |H(e^{jw})| \le 1$ for $0 \le w \le \pi/4$

$|H(e^{jw})| \le 0.18$ for $0.75\pi \le w \le \pi$

Using impulse invariant transformation. Assume T = 1 Sec. **(10 Marks)**

Module-5

9 a. For a given FIR filter $y(n) = x(n) + 2/5\,x(n-1) + 3/4x(n-2) +$. Draw direct form – I and Lattice structure. **(10 Marks)**

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

$$H_d(w) = \begin{cases} e^{-jwz} & \text{for } |w| \le w_c \\ 0 & \text{otherwise} \end{cases}$$

The length of the filter should be 7 and $w_c = 1$ radius/sample use rectangular window. **(10 Marks)**

OR

10 a. Determine the filter coefficient $h_d(n)$ for the desired frequency response of a low pass filter given by

$$H_d(e^{jw}) = \begin{cases} e^{-j2w} & \text{for } -\frac{\pi}{4} \le w \le \frac{\pi}{4} \\ 0 & \text{for } \frac{\pi}{4} \le |w| \le \pi \end{cases}$$

If we define the new filter coefficient by $h(n) = h_d(n) \cdot w(n)$ where

$$w(n) = \begin{cases} 1 & \text{for } 0 \le n \le 4 \\ 0 & \text{for otherwise} \end{cases}$$

Determine h(n) and also the necessary response $|H(e^{jw})|$ and compare with $|H_d(e^{jw})|$ determine $H(e^{jw})|$ Determine $H(e^{jw})$ using Hamming window. **(10 Marks)**

b. Determine form structures of casecade first order section also as a cascade 1st and 2nd order section form FIR lattice filter for $H(z) = |(1 + 0.6z^{-1})^5$. **(10 Marks)**

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CBCS SCHEME

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18EE653

Sixth Semester B.E. Degree Examination, June/July 2024
Renewable Energy Resources

Time: 3 hrs. Max. Marks: 100

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

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-1

1 a. With the help of diagram, define :
i) Hour Angle ii) Latitude Angle
iii) Surface Azimuth Angle iv) Declination Angle. **(08 Marks)**

b. Calculate Zenith Angle of the Sun at Lucknow (26.75ºN) at 9:30am on February 16.2016. **(04 Marks)**

c. What are the factors affecting Energy Resources development. **(08 Marks)**

OR

2 a. Discuss the causes of Energy Scarcity. **(06 Marks)**

b. Write a note on Solar Thermal Energy Storage. **(06 Marks)**

c. Find the Solar Altitude Angle at 2hr after Local Solar noon on 1 June 2016 for a City, which is located at (26.75 ºN) Latitude also find the Sunrise and Sunset hour's. **(08 Marks)**

Module-2

3 a. With a neat sketch, discuss the Operation of Solar flat plate Air and Liquid collector. **(08 Marks)**

b. What are the advantages of Solar pond? With a neat diagram, explain Solar Pond. **(08 Marks)**

c. Discuss the material aspects of Solar collectors. **(04 Marks)**

OR

4 a. With the help of neat diagram, explain Brayton Cycle Solar Electric generation. **(08 Marks)**

b. Explain the principle of Solar photovoltaic power generation. List the application and 3 important function of Solar cell. **(08 Marks)**

c. Discuss the working of Solar cookers. **(04 Marks)**

Module-3

5 a. Explain different Hydrogen production technology. List applications, advantages and disadvantages of Hydrogen Energy. **(08 Marks)**

b. With a neat diagram, explain Vertical Wind mill and list advantages and disadvantages. **(08 Marks)**

c. Explain the problems associated with Hydrogen Energy. **(04 Marks)**

OR

6 a. With a neat diagram, explain Single Flash geothermal steam electric power plant. List its advantages and disadvantages. **(08 Marks)**

b. With a neat schematic representation, explain Waste refuse Energy Management. **(06 Marks)**

c. Difference between Pyrolysis and Incineration. **(06 Marks)**

Module-4

7	a.	With a neat sketch, explain Updraft and Down draft gasifers.	**(08 Marks)**
	b.	Define Biomass gasification. Explain the gasification process involved in Biomass.	**(08 Marks)**
	c.	Explain the different process of Anaerobic digestion.	**(04 Marks)**

OR

8	a.	Explain with sketch, Two Basin system of Tidal power harnessing.	**(08 Marks)**
	b.	Describe the construction and working of floating dome – type biogas plant. List its advantages and disadvantages.	**(08 Marks)**
	c.	List the advantages and disadvantages of Tidal Energy.	**(04 Marks)**

Module-5

9	a.	Explain the various devices for Harnessing Wave Energy.	**(08 Marks)**
	b.	Explain Oscillating water column device for wave Harnessing.	**(08 Marks)**
	c.	Discuss the application of OTEC in addition to produce Electricity.	**(04 Marks)**

OR

10	a.	Explain the selection of working fluid for OTEC.	**(08 Marks)**
	b.	Explain Open cycle and Closed cycle OTEC techniques.	**(08 Marks)**
	c.	List the advantages and disadvantages of Wave power.	**(04 Marks)**

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21EE61

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Management and Entrepreneurship

Time: 3 hrs. Max. Marks: 100

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

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-1

1 a. Define manufacturing. Explain nature and characteristics of management. **(10 Marks)**
b. Explain importance of planning. **(06 Marks)**
c. Name the different types of plans. Compare them. **(04 Marks)**

OR

2 a. Explain the functions of management. **(10 Marks)**
b. Explain the steps in planning process. **(10 Marks)**

Module-2

3 a. Define organization. Explain line and staff organization with structure. **(08 Marks)**
b. Explain Maslow's hierarchy of needs theory with a neat sketch. **(06 Marks)**
c. Name the different types of sources of recruitment. Explain any three external sources of recruitment. **(06 Marks)**

OR

4 a. Explain the process of "Selection" in recruitment. **(06 Marks)**
b. What are the different leadership styles? Mention any three limitations of participative style of leadership style. **(04 Marks)**
c. Explain types and techniques of co-ordination. **(10 Marks)**

Module-3

5 a. Discuss the meaning of social responsibility. Explain social responsibility towards different groups of society. **(10 Marks)**
b. Explain the importance of entrepreneurship. **(06 Marks)**
c. Explain any four benefits of social audits. **(04 Marks)**

OR

6 a. Explain :
i) Business Ethics
ii) Benefits of corporate governance. **(10 Marks)**
b. Classify entrepreneurs. Explain classification of Entrepreneur according to technology. **(06 Marks)**
c. Compare Entrepreneur and Intrapreneurs. **(04 Marks)**

Module-4

7 a. Define Small scale industries (SSI), explain the role of SSI for development of economy. **(10 Marks)**
b. Explain sickness in small scale industries sector. **(06 Marks)**
c. Discuss about National Small Industries Corporation (NSIC). **(04 Marks)**

OR

8	a.	Explain characteristics of small scale industries.	**(06 Marks)**
	b.	Name the state level institutions which supports. Entrepreneurship. Discuss about District Industries Centre (DIC).	**(08 Marks)**
	c.	Discuss the problems faced by SSI in India.	**(06 Marks)**

Module-5

9	a.	Define project. Explain project life cycle.	**(10 Marks)**
	b.	Define PERT. Explain the five step process of PERT analysis.	**(10 Marks)**

OR

10	a.	Explain the stage of formulation of project report.	**(10 Marks)**
	b.	Classify Networking Techniques.	**(06 Marks)**
	c.	Discuss Four limitations of CPM and PERT technique.	**(04 Marks)**

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21EE62

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Power System Analysis – 2

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain with an example of the following :
i) Oriented graph ii) Basic cutsets iii) Basic loops. **(06 Marks)**

b. With usual notations prove that $Y_{BUS} = A^T[Y]A$ using singular transformation method. **(06 Marks)**

c. For the power system shown in Fig.Q1(c) select ground as reference and a tree for which link elements are 1–2, 1–4, 2–3, 3–4. Obtain basic cutset and basic loop incidence matrices. Verify the relation $C_b = B_\ell^T$.

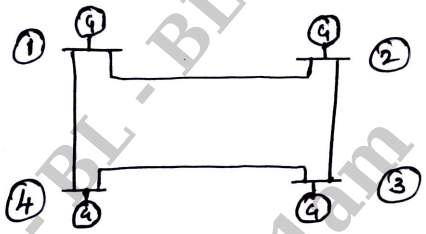

Fig.Q1(c) **(08 Marks)**

OR

2 a. What is primitive network? Give the representation of a typical component and arrive at their performance equation in impedance and admittance form. **(07 Marks)**

b. For a power system shown in Fig.Q2(b) below, obtain Y_{BUS} using singular transformation method by considering Bus(4) as reference bus.

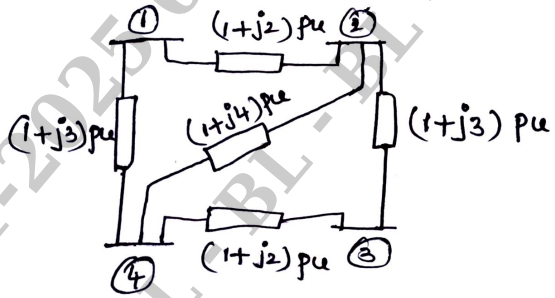

Fig.Q2(b) **(08 Marks)**

c. For the sample network shown in Fig.Q2(c). Obtain bus admittance matrix by using inspection method [Y_{BUS}].

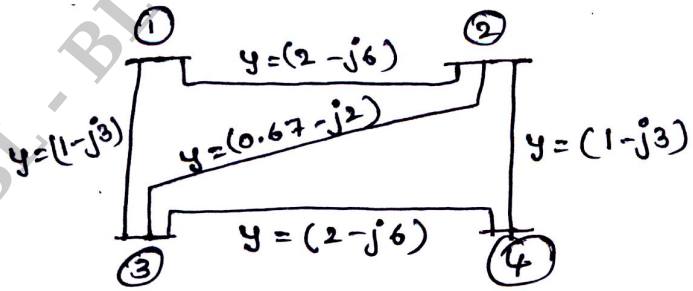

Fig.Q2(c) **(05 Marks)**

Module-2

3 a. Derive the expressions for power flow-equations used in load flow analysis. **(08 Marks)**

b. What are different types of buses, considered during load fowl analysis? Explain briefly. **(06 Marks)**

c. Why load flow analysis in power system in necessary? Explain. **(06 Marks)**

OR

4 a. Explain the load flow solution procedure of Gauss-Siedel method for a power system having PQ and PV buses with 'Q' limits. **(10 Marks)**

b. For the sample power system shown in Fig.Q4(b), all buses except slack bus are PQ buses. Calculate the voltages at end of 1st iteration using Gauss-Seidel load flow [GSLF] method.

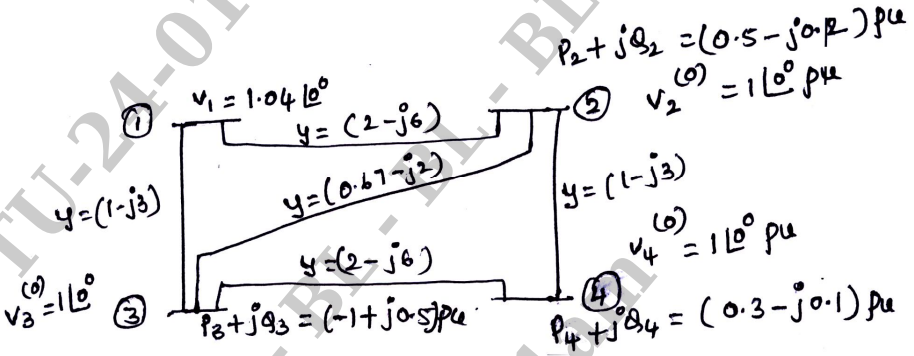

Fig.Q4(b) **(10 Marks)**

Module-3

5 a. Compare NR and method for load flow analysis. **(06 Marks)**

b. Derive the expressions of diagonal elements of Jacobian matrices in NR method of load flow analysis. **(08 Marks)**

c. Starting from all the assumptions deduce the Fast Decoupled Load Flow (FDLF] method. **(06 Marks)**

OR

6 a. Explain with flow chart and equation how the load flow analysis is carried out using Newton – Raphson Load Flow [NRLF] method. **(10 Marks)**

b. For a 3-bus system, the elements of Y_{BUS} are as follows :

$Y_{11} = y_{22} = Y_{33} = 24.23\angle -75.95$ pu ; $Y_{12} = Y_{13} = Y_{21} = Y_{23} = Y_{31} = Y_{32} = 12.13\angle 104{\cdot}04$ Pu.

The bus voltages are V_1 = (1.04 + j0)pu (Slack), V_2 = (1 + j0)pu (PQ Bus), V_3 = (1.04 + j0)pu (PV bus). Determine the elements of sub matrix J_1 and J_4 of Jacobian matrix in NR load flow method. **(10 Marks)**

Module-4

7 a. Derive the expression for economic dispatch with transmission losses neglected. **(06 Marks)**

b. Write a brief note on the performance curves of a thermal power station for economic load dispatch studies. **(06 Marks)**

c. A power plant consisting of two units.
$C_1 = 0.05\ p_1^2 + 20P_1 + 800$ Rs/hr
$C_2 = 0.06P_2^2 + 20P_2 + 900$ Rs/hr
Find the total yearly saving in fuel cost in rupees. For optimal scheduling of a load of 150Mw as compared to equal distribution of same load between them. **(08 Marks)**

OR

8 a. What are the transmission line loss co-efficients? Derive an expression for transmission loss as a function of plant generation for a two plant system. **(10 Marks)**

b. Explain how dynamic programming is applied to obtain unit commitment. **(10 Marks)**

Module-5

9 a. Obtain the generalized algorithm expression for bus impedance matrix elements when a link is added to the partial network. Also discuss the special cases. **(10 Marks)**

b. Explain clearly the point-by-point method of solving swing equation. Mention the assumptions made. **(10 Marks)**

OR

10 a. Obtain Z_{BUS} by building algorithm for the system shown in Fig.Q10(a). all value are in pu. (impedance).

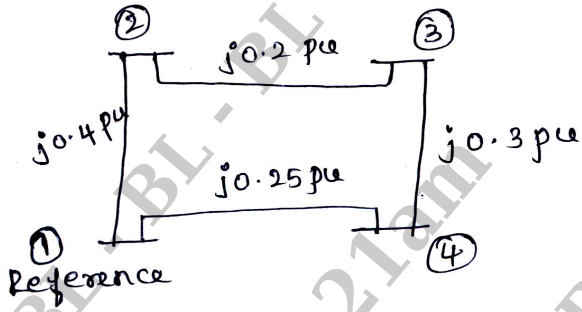

Fig.Q10(a) **(10 Marks)**

b. Discuss the methodology of using Runge-Kutta technique for transient stability studies of a power system. **(10 Marks)**

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CBCS SCHEME

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21EE63

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Signals and Digital Signal Processing

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. For the following discrete time systems, determine whether the system is : i) Linear ii) Time invariant iii) Memory less iv) Causal v) Stable.
I) $y(n) = x(1-n)$ II) $y(n) = \log_{10}^{(|x(n)|)}$ **(06 Marks)**

b. Sketch the even and odd component of the continuous time signal x(t) shown in Fig.Q.1(b) **(06 Marks)**

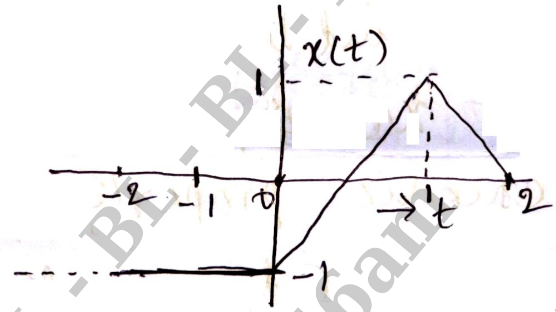

Fig.Q.1(b)

c. Consider an LTI system with unit impulse response $h(t) = u(-t + 2)$. If the input applied to the system is $x(t) = u(t + 2) - u(t - 1)$ find the output y(t) of the system. **(08 Marks)**

OR

2 a. Consider an LTI system with input $x(n) = 2^n u(-n)$ and impulse response $h(n) = u(n)$. Compute the output of the system y(n) and also plot it. **(10 Marks)**

b. Check whether the following discrete time signals are energy or power signals:
i) $x(n) = \begin{cases} 3(-1)^n; & n \ge 0 \\ 0; & n < 0 \end{cases}$ ii) $x(n)=A\delta(n)$ **(06 Marks)**

c. Find the step response for the LTI system represented by $h(t) = e^{-|t|}$. **(04 Marks)**

Module-2

3 a. Let x(n) be a finite length sequence with $X(K) = \{10, \ -2+j2, \ -2, \ -2-j2\}$. Using the properties of DFT find the DFT^s of the following sequences i) $x_1(n) = x((n + 2))_4$ ii) $x_2(n) = x(4 - n)$. **(08 Marks)**

b. Prove the periodic property of DFT. **(02 Marks)**

c. Using overlap save method, compute y(n) of a FIR filter with impulse response $h(n) = \{3, 2, 1\}$ and input $x(n) = \{2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1\}$ **(10 Marks)**

OR

4 a. Using frequency domain approach, compute the energy of the 4 point sequence $x(n) = \sin\left(\frac{2\pi}{N}n\right),\ 0 \le n \le 3$ **(08 Marks)**

b. State and prove the following properties of DFT i) Time reversal ii) Circular convolution iii) Multiplication. **(12 Marks)**

Module-3

5 a. Develop an 8-point decimation in frequency FFT algorithm. Draw the complete signal flow graph. **(10 Marks)**

b. Find 4 point circular convolution of x(n) and h(n) using radix-2 DIF-FFT algorithm. x(n) = {1, 1, 1, 1}, h(n) = {1, 0, 1, 0}. **(10 Marks)**

OR

6 a. First five points of 8-point DFT of a real valued sequence is given by x(k) = {0, 2 + j2, -j4, 2 – j2, 0}; Determine the remaining points. Hence find the sequence x(n) using DIF-FFT algorithm. **(10 Marks)**

b. Why FFT is needed? Explain the classification of FFT algorithms. **(05 Marks)**

c. List any two similarities and differences between DIT and DIF algorithms. **(05 Marks)**

Module-4

7 a. Design a chebyshev analog filter with ripple of 0.5dB in the passband $|\Omega| \le 1$ and at Ω = 3, amplitude is down by 3dB. **(10 Marks)**

b. Obtain H(z) using impulse invariance method for following analog filter.

$$H_a(s) = \frac{1}{(s+0.5)(s^2+0.5s+2)}$$ **(10 Marks)**

OR

8 a. Explain the frequency transformation in analog filters. **(06 Marks)**

b. List the advantages and disadvantages of digital filter. **(04 Marks)**

c. Design a unit band width 3dB digital Butterworth filter of first order by using bilinear transformation. **(10 Marks)**

Module-5

9 a. Obtain the direct form – I, direct form – II, cascade and parallel form realization for the following system y(n) = 0.75y (n – 1) – 0.125y (n – 2) + 6x(n) + 7x (n – 1) + x (n – 2). **(14 Marks)**

b. List the advantages and disadvantages of FIR filters. **(06 Marks)**

OR

10 a. Design the symmetric FIR lowpass filter whose desired frequency response is given as

$$H2(w) = \begin{cases} e^{-jwt} & \text{for } |w| \le w_c \\ 0; & \text{other wise} \end{cases}$$

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

b. Realize the following system function in i) Direct form ii) Cascade form

$$H(z) = 1 + \frac{3}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}$$ **(10 Marks)**

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CBCS SCHEME

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Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Sensors and Transducers

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Describe the classification of transducer. **(06 Marks)**
b. With a neat diagram, explain strain measurement using resistive strain gauge. **(08 Marks)**
c. Discuss the advantages and disadvantages of transducer. **(06 Marks)**

OR

2 a. Define transducer and explain transducers actuating mechanisms. **(06 Marks)**
b. With a neat diagram, explain the working of capacitive transducer. **(08 Marks)**
c. Describe Hall effect transducers, with a neat diagram. **(06 Marks)**

Module-2

3 a. Define load cell and explain the working of load cell used to measure strain. **(07 Marks)**
b. Explain rotary form of variable differential transformer for measurement of rotation. **(07 Marks)**
c. Discuss the selection of sensors. **(06 Marks)**

OR

4 a. Explain the working of fiber optic transducer. **(08 Marks)**
b. Discuss the application of proximity sensor. **(05 Marks)**
c. Describe the operation of digital transducer with neat diagram. **(07 Marks)**

Module-3

5 a. Explain the functions of signal conditioning equipment in detail. **(10 Marks)**
b. Compare and contrast mechanical amplifiers, fluid amplifiers and electronic amplifiers, provide examples where each type might be used. **(10 Marks)**

OR

6 a. Explain the process of data conversion in a data acquisition system. **(08 Marks)**
b. Discuss the importance of Analog to Digital Conversion (ADC) in measurement systems. **(07 Marks)**
c. Discuss the objectives of a typical data acquisition systems. **(05 Marks)**

Module-4

7 a. Define telemetry. Explain the general telemetring system. **(10 Marks)**
b. Discuss the advantages and disadvantages of landline telemetry system. **(10 Marks)**

OR

8 a. Explain the operation of pressure measurement of non-electrical quantities using Bridgman gauge. **(10 Marks)**

b. Explain the data transmission system. **(10 Marks)**

Module-5

9 a. Explain the working of temperature measurement on non-electrical quantities. Any two types in brief. **(10 Marks)**

b. Explain the measurement of electromagnetic flow meters on non electrical quantities. **(10 Marks)**

OR

10 a. Explain the measurement of liquid level on non electrical quantities using capacitive and ultrasonic methods. **(10 Marks)**

b. Explain the measurement of shaft power using eddy current dynamometer. **(10 Marks)**

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CBCS SCHEME

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21EE652

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Renewable Energy Resources

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain briefly the factors affecting energy resources development. **(10 Marks)**
b. Explain briefly the solution of energy scarcity. **(06 Marks)**
c. List the difference between renewable and non-renewable energy sources. **(04 Marks)**

OR

2 a. Explain the following :
i) Zenith angle (θ_z)
ii) Hour Angle (ω)
iii) Angle of declination (δ)
iv) Solar altitude anlage (α)
v) Solar Azimuth angle(γ). **(10 Marks)**
b. Explain briefly with figure layer of the Sun. **(10 Marks)**

Module-2

3 a. Explain briefly with figure of flat plate collectors. **(10 Marks)**
b. Explain briefly working of Brayton Heat Engine. **(10 Marks)**

OR

4 a. Explain briefly solar pond with a neat diagram. **(10 Marks)**
b. Explain briefly Direct Radiation Cooker. **(10 Marks)**

Module-3

5 a. Explain benefits, advantages and disadvantages problems associated with Hydrogen energy. **(10 Marks)**
b. With neat diagram explain wind will and list the advantages and disadvantages. **(10 Marks)**

OR

6 a. With a neat sketch explain geothermal based electric power generation and list the problems associated to it. **(10 Marks)**
b. Explain waste recovery management scheme, list the advantages and disadvantages of waste recycling. **(10 Marks)**

Module-4

7 a. Explain briefly the Biomass gasification and list the applications of biomass gasifer. **(10 Marks)**

b. Explain the construction details and working of KVIC digester. **(10 Marks)**

OR

8 a. Explain with a neat sketch the construction of biogas production. **(10 Marks)**

b. Explain the process of Anaerobic digestion. **(06 Marks)**

c. Explain the problems faced in exploiting Tidal energy. **(04 Marks)**

Module-5

9 a. Explain briefly with a neat sketch the closed cycle OTEC plant. **(10 Marks)**

b. Explain the devices for harnessing wave energy. List the advantages and disadvantages of wave power. **(10 Marks)**

OR

10 a. Explain briefly the principle of floating power plant of OTEC plant. **(10 Marks)**

b. Explain application of OTEC in addition to produce electricity, list advantages and disadvantages of OTEC. **(10 Marks)**

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18EE741

Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025
Industrial Drives and Application

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain clearly different components of load torque with its characteristics. **(06 Marks)**

b. Explain the speed torque conventions and multi-quadrant operation on a motor. **(08 Marks)**

c. What are the advantages of electrical drives? **(06 Marks)**

OR

2 a. Obtain expression for equivalent moment of inertia and load torque of a motor drive with rotational motion loads. **(06 Marks)**

b. With a neat diagram explain closed-loop torque control closed-loop speed control. **(08 Marks)**

c. A drives has the following parameters :
$J = 10$ Kg-m^2, $T = 100\text{-}0.1N$, N-m, passive load torque $T_\ell = 0.05N$, 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 characteristics is changed to $T = -100\text{-}0.1N$, N-m. Calculate the time of reversed. **(06 Marks)**

Module-2

3 a. Explain the operation of single-phase fully controlled rectifier control of DC separately excited motor with continuous conduction. **(08 Marks)**

b. Explain Field current reversal in multi-quadrant operation and dc separately excited motor. **(06 Marks)**

c. A 200V, 875 rpm, 150 A separately excited dc motor has an armature resistance of 0.06Ω. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220V, 50Hz. Assuming continuous conduction. Calculate :
i) Firing angle for rated motor torque and 750 rpm
ii) Motor speed for $\alpha = 160°$ and rated torque **(06 Marks)**

OR

4 a. Expl ain the rectifier control of dc series motor and draw its speed torque curves. **(08 Marks)**

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

c. A 220V, 1500 rpm, 50 A superlatively excited motor with armature resistor of 0.5Ω is fed from a 3 phase fully controlled rectifier. Available ac source has a line voltage of 440 V, 50 Hz. Determine the value of firing angle when
i) Motor is running at 1200 rpm and rated torque
ii) Motor is running at -800 rpm and twice the rated torque. **(06 Marks)**

Module-3

5 a. Explain the behaviour of Induction motor when fed from a Non-sinusoidal voltage supply. **(06 Marks)**

b. Obtain the analysis and performance of a three-phase induction motors. **(08 Marks)**

c. Explain the operation of three-phase induction motor with unbalanced rotor impedance and draw speed-torque curves. **(06 Marks)**

OR

6 a. With a neat diagram, explain source-delta and Auto transformer method of starting of three phase induction motor. **(08 Marks)**

b. What are the methods employed for braking of an induction motor? Explain in brief Regenerative braking. **(06 Marks)**

c. Explain ac dynamic braking of three phase induction motor with two lead connections. **(06 Marks)**

Module-4

7 a. Explain with relevant diagrams the voltage source inverter control of three phase induction motor. **(08 Marks)**

b. Explain the three-phase Induction motor fed from a variable frequency control from a current source. **(06 Marks)**

c. With a neat diagram, explain cycloconverter control of three phase induction motor. **(06 Marks)**

OR

8 a. With a neat diagram, explain variable frequency control of multiple synchronous motors. **(06 Marks)**

b. Explain the closed-loop speed control and converter rating for VSI and cyclo-converter Induction motor drives. **(08 Marks)**

c. What are the modes of variable frequency control in synchronous motor and briefly explain. **(06 Marks)**

Module-5

9 a. Explain self controlled synchronous motor drive employing load commutated thristor inverter. **(08 Marks)**

b. Draw Torque Vs stepping rate characteristics and explain in stepper motor drives. **(06 Marks)**

c. Explain single-stack variable reluctance type stepper motor. **(06 Marks)**

OR

10 a. With the help of equivalent circuits and phasor diagrams, explain sinusoidal PMAC motor drives. **(08 Marks)**

b. What are the advantages and disadvantages of stepper motors? **(06 Marks)**

c. What are drive requirements for cranes and hoists? **(06 Marks)**

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18EE742

Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025
Utilization of Electrical Power

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is electrical heating? Mention advantages and disadvantages of electrical heating. **(06 Marks)**

b. Derive and explain the design procedure for circular and rectangular strip heating element. **(08 Marks)**

c. A 15 KW, 220 V, single phase resistance oven employs nickel-chrome wire for heating elements. If the wire temperature is not to exceed 1000°C and the temperature of the charge is to be 600°C. Calculate the diameter and length of the wire. Assume radiating efficiency to be 0.6 and emissivity as 0.9. For nickel chrome resistivity is 1.016×10^{-6} Ω-m. **(06 Marks)**

OR

2 a. State and explain Faraday's law of electrolysis. **(06 Marks)**

b. With a neat sketch, explain the construction and working principle of vertical core type furnace. **(08 Marks)**

c. Define welding process. Discuss about Laser Welding with a neat sketch. **(06 Marks)**

Module-2

3 a. State and explain laws of illumination. **(06 Marks)**

b. What are polar curves? Explain about Rousseau's construction? **(06 Marks)**

c. Two similar lamps having uniform intensity of 500 cp in all directions below the horizontal are mounted at a height of 4 meters. What must be the maximum spacing between the lamps so that illumination on the ground midway between the lamps shall be atleast one half the illumination directly under the lamps. **(08 Marks)**

OR

4 a. Define the following:
(i) Luminous flux
(ii) Luminous intensity
(iii) Illumination
(iv) Mean spherical candle power **(08 Marks)**

b. Discuss about requirements of good lighting. **(06 Marks)**

c. What is photometry? Explain about the principle of photometry. **(06 Marks)**

Module-3

5 a. Using a trapezoidal speed time curve, derive an expression for its maximum speed. **(07 Marks)**

b. An electric train is to have acceleration and braking retardation of 0.8 km/h/s and 3.2 km/h/s respectively. If the ratio of maximum to average speed is 1.3 and time for stops 26 seconds, find schedule speed for a run of 1.5 km. Assume simplified trapezoidal speed-time curve. **(07 Marks)**

c. Discuss the factors affecting specific energy consumption. **(06 Marks)**

OR

6 a. Explain with the help of suitable circuit diagrams (i) Shunt transition (ii) Bridge transition as applied to a pair of d.c. traction motors. **(06 Marks)**

b. Define the following terms:
(i) Dead weight
(ii) Accelerating weight
(iii) Adhesive weight
(iv) Coefficient of adhesion **(08 Marks)**

c. With a neat diagram, explain the construction and working of a single phase series motor. **(06 Marks)**

Module-4

7 a. Explain how plugging, rheostatic braking and regenerative braking are employed with dc motor. **(07 Marks)**

b. A train weighing 500 tonnes is going down a gradient of 20 in 1,000. It is desired to maintain train speed at 40 kmph by regenerative braking. Calculate the power fed into the line tractive resistance is 40 N/tonne and allow rotational inertia of 10% and efficiency of conversion of 75%. **(07 Marks)**

c. Write short notes on mechanical braking arrangements used in electric traction. **(06 Marks)**

OR

8 a. Write short notes on:
(i) Trolley buses
(ii) Pantograph collector
(iii) Trolley wires **(10 Marks)**

b. With a neat sketch, explain the function of a negative Booster in tramway system. **(10 Marks)**

Module-5

9 a. With a relevant block diagram, discuss the working principle of hybrid electric vehicle. **(10 Marks)**

b. Discuss the electric energy consumption in an electric vehicle. **(10 Marks)**

OR

10 a. Explain the configuration of electric vehicle with neat diagram. **(10 Marks)**

b. Write notes on:
(i) Series hybrid drive train
(ii) Parallel hybrid drive train **(10 Marks)**

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18EE752

Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025

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. Explain the laws of motion and vehicle kinetics associated with vehicle dynamics. **(10 Marks)**
b. Explain force velocity characteristics and maximum gradability. **(10 Marks)**

OR

2 a. Explain the concept of constant F_{TR} and level road. **(10 Marks)**
b. Explain propulsion system design of EV. **(10 Marks)**

Module-2

3 a. With neat block diagram, explain the illustration of general EV configuration. **(10 Marks)**
b. Explain tractive effort in normal driving. **(10 Marks)**

OR

4 a. With neat block diagram explain series hybrid electric drive train configuration. **(10 Marks)**
b. With neat block diagram explain parallel hybrid electric drive train configuration. **(10 Marks)**

Module-3

5 a. With neat diagrams explain working of lead acid battery and nickel cadmium battery. **(10 Marks)**
b. With neat diagrams, explain working of Li-ion battery and Li-polymer battery. **(10 Marks)**

OR

6 a. With neat diagram explain the basic operation of fuel cell. **(10 Marks)**
b. With neat diagram, explain the operation of Alkaline fuel cell. **(10 Marks)**

Module-4

7 a. With neat diagram, explain the operation of chopper control of DC motors. **(10 Marks)**
b. Explain permanent magnet Brushless DC motor drive train. **(10 Marks)**

OR

8 a. Explain switched reluctance motor drive system. **(10 Marks)**
b. With neat diagram, explain torque control of the BLDC motor. **(10 Marks)**

Module-5

9 a. Explain different operation patterns of series hybrid electric drive train. **(10 Marks)**
b. With necessary diagrams explain thermostat control strategy of series hybrid drive train. **(10 Marks)**

OR

10 a. Explain Max-SOC of PPS control strategy of parallel hybrid drive train. **(10 Marks)**
b. Write a note on energy storage design. **(10 Marks)**

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18EE754

Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025
Electrical Energy Conservation and Auditing

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain briefly the energy sector reforms in India. **(06 Marks)**
b. Define the following terms with examples for each:
i) Commercial and non commercial energy
ii) Primary and secondary energy. **(06 Marks)**
c. What are the issues addressed by the energy conservation Act, 2001? **(08 Marks)**

OR

2 a. Discuss the present energy scenario in India. **(06 Marks)**
b. Explain the energy conservation techniques used to reduce energy costs. **(06 Marks)**
c. Discuss the various components of energy strategies for the future. **(08 Marks)**

Module-2

3 a. Explain various types of automatic power factor controllers. **(07 Marks)**
b. With maximum demand controllers, explain the realization of savings on energy bill. **(07 Marks)**
c. Write the advantages of soft starters over conventional starters. **(06 Marks)**

OR

4 a. Briefly explain the types of variable speed drives. **(07 Marks)**
b. Explain the reduction of losses by using energy efficient motors. **(06 Marks)**
c. Explain the types of energy efficient lighting controls. **(07 Marks)**

Module-3

5 a. Briefly explain the key instruments used for the energy audit. **(10 Marks)**
b. Explain in detail the contents of the typical energy audit report. **(10 Marks)**

OR

6 a. What is energy Audit? Explain the need for energy audit. **(10 Marks)**
b. Give the ten steps methodology for detailed energy audit and explain. **(10 Marks)**

Module-4

7 a. Define transmission congestion. Explain the importance of congestion management in the deregulated environment. **(10 Marks)**
b. Explain briefly the following power sector reforms:
i) Framework of Indian power sector.
ii) Availability Based Tariff (ABT). **(10 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.

OR

8	a.	What are the distinguishing features of electricity as a commodity?	**(10 Marks)**
	b.	What are Ancillary services? Explain the types of Ancillary services.	**(10 Marks)**

Module-5

9	a.	Explain the tariff options for demand side management.	**(10 Marks)**
	b.	Explain various steps followed in DSM planning and implementation.	**(10 Marks)**

OR

10	a.	Explain the energy saving measures in New Buildings.	**(10 Marks)**
	b.	Explain the methodology of water audit.	**(10 Marks)**

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CBCS SCHEME

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21EE71

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
High Voltage and Power System Protection

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Mention the desired properties of gaseous dielectric for high voltage application. **(04 Marks)**

b. Derive an expression for the current in air gap $I = I_o Exp(\alpha d)$ considering Townsends first ionization coefficient. **(08 Marks)**

c. Explain the following mechanism in liquid dielectric:
(i) Suspended particle mechanism
(ii) Thermal mechanism **(08 Marks)**

OR

2 a. What is Paschen's law? Discuss to measure minimum voltage for breakdown under a given $P \times d$ conditions. **(10 Marks)**

b. Explain the following mechanism in solid dielectric:
(i) Electronic Breakdown
(ii) Avalanche or Streamer Breakdown **(10 Marks)**

Module-2

3 a. With a neat sketch, explain the working of Cockcroft Walton Voltage Multiplier with waveforms. **(10 Marks)**

b. With a neat sketch, explain:
(i) Series Resistance Microammeter
(ii) Resistance Potential divider
for measurement of high dc voltage. **(10 Marks)**

OR

4 a. Explain in detail the components of Multistage impulse generator. **(10 Marks)**

b. Explain discharge detection using straight detectors. **(10 Marks)**

Module-3

5 a. With a neat diagram, explain zones of protection in a power system. **(08 Marks)**

b. List the types of faults and its effects. **(04 Marks)**

c. With a neat diagram, explain the construction and working of:
(i) Plunger or solenoid type relay
(ii) Reed Relay **(08 Marks)**

OR

6 a. Explain in detail about Primary and Backup protection. **(08 Marks)**

b. With a neat sketch, explain the working of Induction Cup relay. **(08 Marks)**

c. Write short notes on protection of parallel feeder. **(04 Marks)**

Module-4

7	a.	With a neat sketch, explain the Operating Principle of impedance relay and its characteristics.	**(08 Marks)**
	b.	Explain Balanced Voltage Scheme with a neat diagram.	**(08 Marks)**
	c.	Explain in brief protection of transformer against overheating.	**(04 Marks)**

OR

8	a.	List the various type of differential relay and explain any one of them.	**(10 Marks)**
	b.	Write a short note on stator overheating protection.	**(10 Marks)**

Module-5

9	a.	Explain with a neat sketch Air-break Circuit Breaker.	**(10 Marks)**
	b.	Explain the causes of over voltages.	**(10 Marks)**

OR

10	a.	Explain in detail about direct testing and indirect testing of circuit breaker.	**(10 Marks)**
	b.	With a neat diagram, explain the construction and working of klydonograph.	**(10 Marks)**

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21EE72

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Power System Operation and Control

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List out the operating states of power system. Explain it briefly with a neat block diagram. **(08 Marks)**

b. List out the seven key concepts proposed by North American Electric Reliability Corporation (NERC). Explain any two in brief. **(07 Marks)**

c. List out the four major components of Energy Centres. Explain any two in brief. **(05 Marks)**

OR

2 a. What are Intelligent Electronic Devices (IED's)? Explain IED functional block diagram in detail. **(08 Marks)**

b. List out the objectives of power system control. Discuss the measures taken to achieve them. **(07 Marks)**

c. Draw the following standard SCADA configurations:
(i) Single Master Station and Single Remote Terminal Unit (RTU)
(ii) Single Master Station and Multiple RTU's
(iii) Multiple RTU's, multi-drop circuit, multiple masters
(iv) Multiple master stations, multiple single ported RTU's
(v) Single Master Station, multiple sub-master stations **(05 Marks)**

Module-2

3 a. Draw a neat schematic diagram of load frequency and excitation voltage regulation of a turbo generator. Explain its operation in detail. **(08 Marks)**

b. With a derivation of transfer function of an isolated power system equipped with PI controller (proportional + Integral), prove that steady state frequency error results zero for a step change in the load. **(12 Marks)**

OR

4 a. Draw a neat schematic diagram of turbine speed governing system. Explain all the components of it in detail. **(08 Marks)**

b. Derive mathematical model of the following components only:
(i) Turbine model (ii) Generator + Load model **(12 Marks)**

Module-3

5 a. With a neat schematic diagram of alternator voltage regulator scheme, explain Automatic Voltage Control (AVR) with necessary mathematical equations and transfer functions. **(10 Marks)**

b. Write a short note on load frequency control with generation rate constraints (GRC's). **(05 Marks)**

c. A 100 MVA synchronous generator operates on full load at a frequency of 50 Hz. The load is suddenly reduced to 50 MW. Due to time lag in governor system, the steam valve begins to close after 0.4 sec. Determine the change in frequency that occurs in this time. Take H = 5 KWs/KVA. **(05 Marks)**

OR

6 a. Derive the mathematical model of Tie line. And draw complete block diagram of two area system with primary loop only. **(10 Marks)**

b. Write a short note speed governor dead band and its effects on Automatic Generation Control (AGC). **(05 Marks)**

c. Two generators rated 200 MW and 400 MW are operating in parallel. The droop characteristics of their governors are 4% and 5% respectively from no load to full load. Assuming that the generators are operating at 50 Hz at no load, how would a load of 600 MW be shared between them? What will be the system frequency at this load? Assume free governor operation. **(05 Marks)**

Module-4

7 a. What is voltage collapse? Explain the phenomenon of voltage collapse using PV and QV diagrams. **(10 Marks)**

b. Three supply points A, B and C are connected to a common bus bar M. Supply point A is maintained at a nominal 275 KV and is connected to M through 275/132 KV transformer (0.1 pu reactance) and a 132 KV line of reactance 50 Ω. Supply point C is nominally at 275 KV and is connected to M by a 275/132 KV transformer (0.1 pu reactance) and a 132 KV line of 50 Ω reactance. Point 'B' is at 132 KV and is connected to M via 132 KV line of 50 Ω reactance. If at particular system load, the line voltage of M falls below its nominal value by 5 KV, calculate the magnitude of the reactive volt-ampere injection required at M to re-establish the original voltage.
Note: Take base $(KV)_B$ as 275 KV and PU values are expressed on a 500 MVA base. Ignore resistance throughout. **(10 Marks)**

OR

8 a. Discuss the following methods of injection of reactive power with necessary figures.
(i) Shunt capacitors and reactors (ii) Series capacitors
(iii) Synchronous compensators **(10 Marks)**

b. In the radial transmission system shown in Fig.Q8(b) all pu values are referred to the voltage bases shown and 100 MVA. Determine the power factor at which the generator must operate.

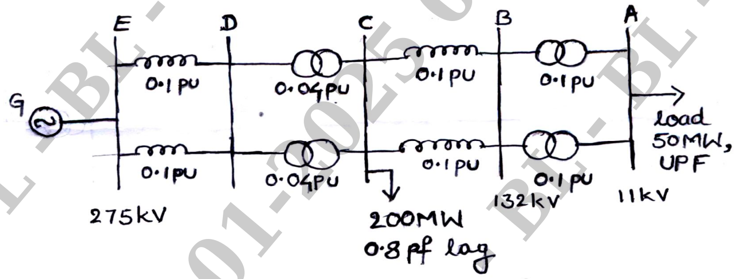

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. List out the factors affecting power system security. Explain Security Constrained Optimal Power Flow (SCOPF) with the help of an example. **(10 Marks)**

b. With a neat flow chart of contingency analysis using sensitivity factors, explain:
(i) Generation shift factors
(ii) Line outage distribution factors **(10 Marks)**

OR

10 a. With a neat flow chart, discuss the process involved in AC power flow security analysis with contingency case selection. **(10 Marks)**

b. Explain linear least square estimation with suitable equations. **(10 Marks)**

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21EE734

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Electric Vehicle Technologies

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define a series hybrid electric vehicle and explain it configuration with neat diagram in corporating various nodes of operation. **(10 Marks)**

b. Draw and explain various possible EV configurations based on the variations in electric propulsion characteristics and energy sources. **(10 Marks)**

OR

2 a. Explain the configuration of modern electric vehicle drive train with a neat functional diagram. **(10 Marks)**

b. With neat diagram explain hybrid electric vehicles working principle in detail. **(10 Marks)**

Module-2

3 a. List out and explain in detail various requirements of energy storage devices used in EV application. **(10 Marks)**

b. Define and explain the following battery parameters
i) Specific energy
ii) Energy stored
iii) Charge capacity
iv) Battery capacity
v) Depth of charge **(10 Marks)**

OR

4 a. Explain the following Fuel cells :
i) PEMFC ii) DMFC iii) SOFC iv) PAFC **(12 Marks)**

b. Explain the principle of operation of a double layer ultra capacitor with a neat diagram. **(08 Marks)**

Module-3

5 a. Explain the operation of following DC drives with a neat circuit diagram and steady state wave form.
i) Step down chopper drive
ii) Step up chopper drive **(10 Marks)**

b. Explain the separation of half bridge converter used in switched reluctances motor drives with the help of a circuit diagram. **(10 Marks)**

OR

6 a. Explain the following control schemes of a BLDC motor drives with a relevant block diagram.
i) Torque control scheme
ii) Speed control scheme **(10 Marks)**

b. Explain field orientation control of induction motor for varying its torque speed characteristics with relevant curves. **(10 Marks)**

Module-4

7 a. With neat block diagram of control scheme of the parallel hybrid drive train, explain its control strategies. **(10 Marks)**

b. Explain several operating patterns of drive train. **(10 Marks)**

OR

8 a. With neat block diagram, explain the configuration of the parallel torque coupling hybrid drive train. **(10 Marks)**

b. Explain design of drive train parameters with necessary equation and curves. **(10 Marks)**

Module-5

9 a. List out and explain in detail various charging methods of battery used in Ev and HEv. **(10 Marks)**

b. Explain high frequency transformer based two stage insulated charger topology for batteries used in Ev and HEv with neat circuit diagram. **(10 Marks)**

OR

10 a. Explain the following tranformerless charger topology for battery with a neat circuit diagram.
i) Simple buck topology
ii) Neutral – point clamped topology **(10 Marks)**

b. Explain in detail about the design of z-circuit capacitor and inductor with relevant equations. **(10 Marks)**

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21EE744

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Industrial Drives and Applications

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Describe the modes of operation of an electrical drive. **(10 Marks)**

b. A drive has the following parameters:
$J = 10$ kg-m^2, $T = 100 - 0.1$ N, N-m, passive load torque $T_l = 0.05$ N N-m, where N is speed in rpm. Initially the drive is operating in steady state. Now it is to be reversed. For this motor characteristics is changed to $T = -100 - 0.1N$ N-m. Calculate the time of reversal. **(06 Marks)**

c. What are the factors affecting the choice of an electric drive? **(04 Marks)**

OR

2 a. Explain the speed torque conventions and multi-quadrant operation of motor driving hoist load. **(07 Marks)**

b. What is the necessity of mounting flywheel on motor shaft in non-reversible drives? Obtain the equations to calculate moment of inertia of flywheel. **(07 Marks)**

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

Module-2

3 a. A 200 V, 875 rpm, 150 A separately excited DC motor has an armature resistance of 0.06 Ω. It is fed from a single phase fully controlled rectifier with an AC source voltage of 220 V, 50 Hz. Assuming continuous conduction. Calculate:
(i) Firing angle for rated motor torque and 750 rpm
(ii) Firing angle for rated motor torque and –500 rpm
(iii) Motor speed for $\alpha = 160°$ and rated torque **(06 Marks)**

b. Explain the operation of Chopper control of separately excited DC motor. **(10 Marks)**

c. Discuss the operation of controlled rectifier fed DC drives. **(04 Marks)**

OR

4 a. A 230 V, 960 rpm and 200 A separately excited DC motor has an armature resistance of 0.02Ω. The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. Assuming continuous conduction:
(i) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm.
(ii) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm.
(iii) If maximum duty ratio of chopper is limited to 0.95 and maximum permissible motor current is twice the rated. Calculate maximum permissible motor speed, obtainable without field weakening and power fed to source.
(iv) If motor field is also controlled in (iii) above, calculate field current as a fraction of its rated value for speed of 1200 rpm. **(10 Marks)**

b. Describe the operation of single phase fully controlled rectifier control of separately excited DC motor. **(10 Marks)**

Module-3

5 a. Explain the analysis of induction motor fed from non-sinusoidal voltage supply. **(10 Marks)**

b. A 2.8 KW, 400 V, 50 Hz, 4-pole, 1370 rpm, delta connected squirrel cage induction motor has following parameters referred to stator: $R_S = 2\ \Omega$, $R'_r = 5\Omega$, $X_S = X'_r = 5\Omega$, $X_m = 80\ \Omega$. Motor speed is controlled by stator voltage control. When driving a fan load it runs at rated speed at rated voltage. Calculate:

(i) Motor terminal voltage, current and torque at 1200 rpm.

(ii) Motor speed, current and torque for terminal voltage of 300 V. **(10 Marks)**

OR

6 a. Describe the operation of three phase induction motor operating with unbalanced source voltages and single phasing. **(08 Marks)**

b. Explain any two methods of starting an induction motor. **(06 Marks)**

c. A 400 V, star connected, 3-ϕ, 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 of motor, determine:

(i) Maximum overhauling torque it can hold and range of speed for safe operation.

(ii) Speed at which it will hold on overhauling load with a torque of 100 N-m.

(iii) Maximum overhauling torque the motor can hold as a ratio of maximum overhauling torque without capacitor if a capacitive reactance of 2Ω is inserted in each phase of stator. **(06 Marks)**

Module-4

7 a. Describe the current regulated voltage source inverter control. **(08 Marks)**

b. Explain the closed loop speed control and converter rating for Voltage Source Inverter (VSI) and cyclo-converter induction motor drives. **(06 Marks)**

c. Write short notes on any one method of speed control of single phase induction motor. **(06 Marks)**

OR

8 a. Describe the operation of synchronous motor from fixed frequency supply, using the method of starting. **(08 Marks)**

b. A 6 MW, 3-phase, 11 KV, Y-connected, 6-pole, 50 Hz, 0.9 p.f. (leading) synchronous motor has $X_S = 9\ \Omega$ and $R_S = 0$. Rated field current is 50 A. Machine is controlled by variable frequency control at constant (V/f) ratio up to base speed and at constant V above base speed. Determine torque and field current for rated armature current, 750 rpm and 0.8 leading power factor. **(06 Marks)**

c. Discuss the modes of variable frequency control of synchronous motor drives. **(06 Marks)**

Module-5

9 a. Describe the operation of self controlled synchronous motor drive employing load commutated thyristor inverter. **(10 Marks)**

b. Explain the operation of brushless DC motor drives for servo applications with suitable waveforms. **(10 Marks)**

OR

10 a. Explain any one type of variable reluctance stepper motor. **(08 Marks)**

b. Discuss the operation of textile mill drives. **(08 Marks)**

c. Mention the important features of stepper motor. **(04 Marks)**

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21EE752

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Electric Vehicles

Time: 3 hrs. Max. Marks: 100

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

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-1

1 a. With an example graph of roadway on the fixed co-ordinate system, explain the following terms used in roadway fundamentals :
i) Roadway position vector
ii) Tangential road way length
iii) Roadway percent grade. **(10 Marks)**

b. A straight roadway has a profile in x_F - y_F plane given by, $f(x_F) = 3.9\sqrt{x_F}$ for $0 \le x_F \le 2$ miles, where x_F and y_F are given in feet.
i) Plot the roadway
ii) Find $\beta(x_f)$ calculate the percent grade at $x_f = 1$ mile
iii) Calculate tangential length. **(10 Marks)**

OR

2 a. Discuss in brief the dynamics of vehicle motion with relevant dynamic modeling equations and block diagram. **(07 Marks)**

b. Discuss in brief the concept of maximum gradability. **(05 Marks)**

c. An electric vehicle has the following parameter values : m = 800 kg, $C_D = 0.2$, $A_F = 2.2\ m^2$, $C_0 = 0.008$, $C_1 = 1.6 \times 10 - 6\ s^2/m^2$. The density of air p = 1.8 kg/m^3 and acceleration due to gravity g = 9.81 m/s^2. The vehicle is on level road. It accelerates from 0 to 65 mph in 10 seconds, such that its velocity profile is given by,
$V(t) = 0.29055\ t^2$ for $0 \le t \le 10$seconds
Calculate :
i) $F_{TR}(t)$ for $0 \le t \le 10$seconds
ii) $P_{TR}(t)$ for $0 \le t \le 10$seconds
iii) Energy loss due to non –conservative forces
iv) Δe_{TR}. **(08 Marks)**

Module-2

3 a. With a neat diagram, discuss about the conceptual illustration of general EV configuration and list out the variety of possible EV configurations with relevant diagrams due to variation in propulsion design and energy source. **(10 Marks)**

b. Discuss with relevant graphs,
i) Traction motor characteristics
ii) Tractive effect and transmission requirement. **(10 Marks)**

OR

4 a. List out the different architecture of hybrid electric drive trains, also draw the diagram to show conceptual illustrate of hybrid electric derive train. **(04 Marks)**

b. With a neat diagram, explain the series hybrid electric drive train. **(06 Marks)**

c. With a neat diagram, discuss the general configuration of parallel hybrid electric drive train and also draw the diagrams showing the two shaft configurations. **(10 Marks)**

Module-3

5 a. List out any ten battery parameters and briefly discuss about any two of them. **(10 Marks)**

b. With a neat diagram of cell charge and discharge operation of lead-acid battery, discuss in brief the operating principle with relevant chemical reaction equations. **(10 Marks)**

OR

6 a. With a neat diagram, discuss the working principle of Lithium – ion (Li – ion) battery along with chemical reactions and two advantages. **(10 Marks)**

b. List out the any four types of fuel cell and mention the electrolyte used in each of them. **(04 Marks)**

c. Find the curve fitting constants 'n' and 'λ' for Peukert's equation for the two measurements available form a constant current discharge experiment of a battery.

i) $(t_1, I_1) = (10, 18)$

ii) $(t_2, I_2) = (1, 110)$. **(06 Marks)**

Module-4

7 a. Discuss the two quadrant operation of chopper with respect to the following control schemes of DC motor in electric vehicles.

i) Single chopper with a reverse switch

ii) Class –C two quadrant chopper **(10 Marks)**

b. Discuss in brief the following topologies used for SRM drive in electric vehicles :

i) Classic converter

ii) R – dump inverter

iii) C – dump inverter. **(10 Marks)**

OR

8 a. Discuss the following control schemes used for BLDC motor drive in electric vehicles.

i) Torque control scheme

ii) Speed control scheme. **(10 Marks)**

b. Discuss the constant v/f control as applicable to induction motor drive for EVs. **(05 Marks)**

c. With a neat diagram (block diagram) explain the power electronic control scheme for constant V/f control. **(05 Marks)**

Module-5

9 a. Discuss the various operating patterns of series hybrid electric derive train for its optimal operation and draw a typical series hybrid electric drive train configuration. **(10 Marks)**

b. For the vehicles with different mission requirements, discuss the various control strategies employed in a series hybrid electric drive train. **(10 Marks)**

OR

10 a. Discuss in detail the parallel torque coupling hybrid drive train with a neat diagram. **(08 Marks)**

b. Discuss in brief the following strategies employed in parallel hybrid electric drive train :

i) Max SOC – of – PPS control strategy

ii) Engine on –off control strategy

iii) Constrained engine on –off control strategy. **(12 Marks)**

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21EE755

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Energy Conservation and Audit

Time: 3 hrs. Max. Marks: 100

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

Module-1

1	a.	Explain in detail about primary and secondary energy sources with examples.	**(10 Marks)**
	b.	Write a short note on long term energy scenario for India.	**(10 Marks)**

OR

2	a.	Explain the salient features of Energy Conservation Act 2001.	**(10 Marks)**
	b.	Explain the energy conservation and its importance.	**(10 Marks)**

Module-2

3	a.	Explain the following: (i) Soft starters (ii) Maximum demand controllers	**(10 Marks)**
	b.	Explain energy efficient lighting system and its measures.	**(10 Marks)**

OR

4	a.	Explain briefly about automatic power factor controller.	**(10 Marks)**
	b.	Explain flow control strategies and energy conservation in pumps.	**(10 Marks)**

Module-3

5	a.	Explain ten step methodologies for detailed Energy Audit.	**(10 Marks)**
	b.	Explain the different types of measuring equipments used in energy audit.	**(10 Marks)**

OR

6	a.	Define energy audit and its importance. Mention the advantages of the same.	**(10 Marks)**
	b.	Explain energy use profile and audits required for constructing the energy use profile.	**(10 Marks)**

Module-4

7	a.	Explain the different types of distinguish features of electricity as a commodity.	**(10 Marks)**
	b.	Explain four pillars of market design.	**(10 Marks)**

OR

8	a.	Distinguish between Existing Tariff and Availability Based Tariff (ABT).	**(08 Marks)**
	b.	Explain the India Power Sector Model with a neat diagram.	**(12 Marks)**

Module-5

9	a.	Explain Water Audit and its methodology.	**(10 Marks)**
	b.	Explain the evolution of DSM concept and its scope.	**(10 Marks)**

OR

10	a.	Explain energy saving tips applicable to new and existing buildings.	**(10 Marks)**
	b.	Explain the tariff options for DSM.	**(10 Marks)**

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