QPcode: 10083229

SE Sem IV R-19 CS Chame Electrical

14 MAY 2025

(3 Hours) **[Total Marks: 80]**

N.B.: 1) Question No. **1** is **Compulsory**.

2) Answer **any THREE** questions from Q.2 to Q.6.

3) Figures to the right indicate full marks.

Q.1 (a) Find (i) k (ii) mean and variance of the following distribution (5)

X	8	12	16	20	24
P(X)	1/12	5/12	k	1/4	1/12

(b) Evaluate $\int_c (x - iy^2)dz$ where c is curve $x = y^2$ from point (0,0) to (1,1). (5)

(c) Find the extremal of $\int_0^{3\pi/2}(y^2 - y'^2)dx$ where y(0)=0 ; y(3π/2)=1 (5)

(d) State and verify the Cauchy Schwarz for the vectors (2, 1, 1,-1) and (1,-2, 1, 1). (5)

Q.2 (a) Evaluate $\int_c \frac{z}{(z^2+3z+2)}dz$, where c is the circle $|z + 1| = 1/2$. (6)

(b) Fit the second degree polynomial for following data (6)

Price(X)	20	16	10	11	16
Demand(Y)	22	41	120	89	56

(c) Transform the basis {(1,0,1) ; (1,1,0);(0,1,1)} into orthogonal basis using Gram-Schmidt process. (8)

Q.3 (a) Check whether the following sets are subspace of R^3 (6)

(i) W=(a ,0,0)/ a belongs toR }

(ii) W={(x ,y, z)/$x^2+y^2+z^2 \leq 1$}

(b) Calculate the rank correlation coefficient 'R' for the following data (6)

x	10	12	18	16	15	40
y	12	18	20	15	50	25

(c) Obtain all possible Laurent's series expansion of $f(z) = \frac{1}{z^2+12z+35}$ about $z = 0$. (8)

Q.4 (a) If X and Y are independent random variable with $E(X) = 6$ and $E(Y) = -6$, $V(X) = 4$, $V(Y) = 9$ then find (6)

i) $E(2X + 3Y - 2)$

ii) $V(3X + 2Y + 2)$

(b) Evaluate $\int_0^{1+i} (x - y + ix^2)\, dz$ along the line from $z = 0$ to $z = 1 + i$. (6)

(c) Find rank, index, signature and nature of the Quadratic form by reducing it into Canonical form by congruent transformation $x^2 + 3y2 + 3z^2 - 2yz$. (8)

Q.5 (a) Three factories A, B, C produce 30%, 50% and 20% of the total production of an item. Out of their production 80%, 50% and 10% are defective respectively. An item is chosen at random and found to be defective. Find the probability that it was produced by the factory A. (6)

(b) A continuous random variable has pdf $f(x) = k(x - x^2), 0 \le x \le 1$. Determine k, mean, and variance. (6)

(c) Using Rayliegh -Ritz method solve boundary value problem (8)

$\int_0^1 (2x^2y - 4y^2 + y'^2)dx$, y(0)=0 , y(1)=0.

Q.6 (a)

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

Calculate the Karl Pearson's coefficient of correlation. (6)

(b) Find the extremals of $\int_a^b (16y^2 - y''^2 + x^2)dx$. (6)

(c) Given: $6y = 5x + 90$, $15x = 8y + 130$ are regression lines and $\sigma_x^2 = 16$ then find (i) mean of X and Y (ii)correlation coefficient (r) $(iii)\sigma_y^2$. (8)

QPcode: 10081120

SE Sem IVth R-19 C scheme Electrical

(3 Hours) Total Marks: 80

15 MAY 2025

N.B: (1) Question No. 1 is compulsory.
(2) Attempt any three from the remaining questions.
(3) Figures to the right indicate full marks.
(4) Each question is of 20 Marks.

Q. 1 **Answer any four questions.** **20M**

a. List out the conditions for successful parallel operation of two single phase transformers. 5M

b. Explain the necessity of starter in case of a three phase induction motor? 5M

c. State and explain the advantages and disadvantages of autotransformer 5M

d. Describe connection and phasor diagram of yy0 and yd11 transformer. 5M

e. Why single-phase induction motor is not self-starting. 5M

Q. 2 **Answer following questions.** **20M**

a. A 3-phase Induction Motor 50 Hz, 4 pole, having a rating of 18.65 kW has friction and windage losses of 2.5% of the output. The full load slip is 4%. Find for full load (i) the rotor Cu. Loss (ii) the rotor input (iii) the shaft torque (iv) the gross electromagnetic torque. 10M

b. Discuss various speed controlling methods for 3 phase induction motor. Explain any one in detail. 10M

Q. 3 **Answer following questions.** **20M**

a. Discuss the torque-speed characteristics for all operating regions of a three phase induction motor. 10M

b. Explain working of shaded pole single phase induction motor with the help of phasor diagram, and Also explain the operating characteristics. 10M

Q. 4 **Answer following questions.** **20M**

a. Describe the phenomenon of double field revolving theory in single phase induction motor. 10M

b. Describe harmonics and Suppression of harmonics in three phase transformer. 10M

Q. 5 **Answer following questions.** **20M**

a. Write a short note on Oscillating neutral phenomenon. 10M

b. Explain O.C. and S.C. test of a single phase transformer with equivalent circuit. 10M

Q. 6 **Answer following questions.** **20M**

a. A 100 *KVA*, 2200/440 V transformer has $R_1 = 0.3\ \Omega$, $X_1 = 1.1\Omega$, $R_2 = 0.01\Omega$, $X_2 = 0.035\Omega$. Calculate (i) the equivalent impedance of transformer referred to the primary and (ii) total copper losses. 10M

b. Discuss excitation Phenomenon in transformers. 10M

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QP code : 10085663

SE sem - IV Electrical R-19 C scheme

Duration: 3 Hours **Marks: 80**

Note:
1. Question No. 1 is compulsory.
2. Attempt any three questions out of the remaining five questions.
3. Assume suitable data wherever necessary.
4. Figures to the right indicate full marks.

1		Answer any FOUR questions	[20]
	a	Convert 25.45 decimal number to equivalent binary, hexadecimal, octal numbers.	[5]
	b	Using the truth table, prove that $AB + \bar{A}B + \bar{A}\bar{B} = \bar{A} + B$	[5]
	c	Given the logic $Y = (A + BC)(B + \bar{C}A)$, reduce it using Boolean theorem and realize using NAND gates.	
	d	Differentiate between combinational circuit and sequential circuit with the help of suitable examples for each.	[5]
	e	Discuss various specifications of Digital to analog converter.	[5]
	e	List the difference between random access memory and read only memory.	[5]
2	a	Explain BCD code, excess 3 code and gray code. Tabulate these three code for 4 bits binary number. Explain the concept of negative numbers in binary number system	[10]
	b	What are different logic families? Explain RTL logic based OR gate with the help of suitable diagram.	[10]
3	a	Realize the logical f(A, B,C,D)=Σm(0,1,4,5,7,9,11,12,14) +d(2,8,13) using NAND gate after minimizing by K-map	[10]
	b	Realize the logic circuit for half adder, full adder, half subtractor and full subtractor using K map.	[10]
4	a	Explain the mode and state of counter. Design and explain the working of mode 10 asynchronous upcounter.	[10]
	b	Design a 3 bits synchronous counter and explain the working with the help of suitable diagrams.	[10]
5	a	Design and explain a 4 bits parallel in serial out shift register with the help of suitable diagrams.	[10]
	b	Explain the application of ROM as programmable logic device	[10]
6	a	Explain the output of a 4 bits R-2R type DAC if the digital input is 1010. Use suitable diagrams wherever applicable.	[10]
	b	Explain working of dual slope ADC with the help of suitable diagrams. Explain its advantages	[10]

SE sem IV Electrical R-19 C scheme

[Max Marks: 80]

Duration: 3hrs

Note: 1) Question No. 1 is compulsory
2) Attempt any three questions out of remaining five
3) All Questions carry equal marks
4) Assume suitable data if required and state it clearly

Q1 Attempt any FOUR [20]
a. Explain significance of free-wheeling diode. [5]
b. Compare power BJT, MOSFET and IGBT [5]
c. Explain need of Heat Sink in PE circuits [5]
d. Define Latching and Holding current. [5]
e. Give applications of DC to DC converter. [5]
f. Explain any one forced commutation circuit

Q2. a) Defined different performance parameters of single-phase bridge inverter. [10]
b) Draw and explain PWM techniques for the control of output voltage of Inverters. [10]

Q3. a) Draw and explain 3-phase full bridge converter and draw following wavwforms for $\alpha=30^{\circ}$ 1. supply voltage, 2. firing pulses, 3. Load voltage for resistive load. [10]
b) What is a safe operating area of a semiconductor switch? How is the conduction and switching loss calculated? [10]

Q4. a) Draw and explain single phase full Dual converter. [10]
b) Explain different protection techniques of SCR in detail. [10]

Q5. a) Draw and explain Buck regulator with waveforms and derive the relation for output voltage. [10]
b) Draw and explain 3 phase inverter in 120^{0} mode of operation [10]

Q6. Write short notes on **(any two)** [20]

a) Two-transistor's analogy of SCR
b) Gate triggering circuits of SCR
c) Bootstrap driver circuit

QP code: 1008285

SE sem IV Electrical R-19 C scheme

(3 Hours) Total Marks: 80

N.B: (1) Question No. 1 is compulsory.
(2) Attempt any three from the remaining questions.
(3) Figures to the right indicate full marks.
(4) Each question is of 20 Marks

Q.1 Attempt any 4 questions

A Explain the general block diagram of electric vehicle. 5
B Elaborate on the concept of G2V. 5
C Explain the performance parameter of the motors used in Electric vehicle. 5
D List the importance of ultracapacitors in EV/ HEV. 5
E What is hybridness? List the classification of hybridness in HEV. 5

Q.2

A Elaborate on the architecture of parallel hybrid electric drive train. List down the advantages, disadvantages and applications 10
B Compare and Differentiate between the battery electric vehicle (BEV), Hybrid Electric Vehicle (HEV) and plug in hybrid Electric Vehicle (PHEV), with neat, labelled block diagrams. 10

Q.3

A Explain the power characteristics of motor and ICE used in EV/HEV 10
B State and define the key battery parameters (i) Battery capacity (ii) C rate (iii) SoC (iv) DoD (v) Specific Energy (vi) Energy Density 10

Q.4

A Classify the different EV battery charging methods. Explain in brief. 10
B Derive the Peukert's education. Give its importance. Calculate the capacity of lead Acid Battery if the charging time is 5 hrs with a current of 10 amps. The peukert condtant is 1.3. 10

Q.5

A Describe in detail all modes of operation for series-parallel hybrid vehicle. 10
B Classify the different types of AC motors used in EV/HEVs. Explain each in brief. 10

Q.6

A Classify Energy Management Strategies. Explain Rule based energy management strategies. 10
B Explain why hybridization of energy sources is important for EV/HEV. 10

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SE - IV - Elect - R - 19 QP: - 10095-295

Duration: 3hrs **Max Marks: 80**

Note:
1. **Q. No. 1 is compulsory**
2. **Attempt any 3 from rest**
3. **Make suitable assumptions wherever required**
4. **Draw neat and clear diagrams**
5. **Write in legible handwriting**
6. **Figure to the right indicate full marks**

1. Answer any 4 questions 20

a. Convert the binary no. 11011.011 in to equivalent decimal, octal and hexadecimal number

b. Illustrate the difference between number system and code.

c. Convert the T to SR flip flop

d. Explain 3bits digital register circuit in brief.

e. State the characteristics of the memories and classify the same

f. Explain Quantization

2. a. Explain BCD code, excess 3 code and grey code. Tabulate these three code for 4 bits binary number. Explain the concept of negative numbers in binary number system 10

b. Explain in detail TTL logic family with example with its advantages and disadvantages 10

3. a. Realize the logical $f(A, B, C, D)=\Sigma m(0,1,3,4,5,7,9,11,12,13,14) + d(2,8,10)$ using NAND gate after minimizing by K-map 10

b. Realize the logic circuit for BCD to excess 3 code converter 10

4. a. Explain the difference between sequential circuit and combinatinal circuit. Design a logic circuit for three input half adder and full adder. 10

b. What is a multiplexer? Explain the construction of basic 8x1 Multiplexter circuit using gates 10

5. a. Explain the working of universal shift register with the help of suitable diagram. 10

b. Explain mode 10 synchronous counter with the help of suitable diagrams. 10

6. Write short note on any two 20

a. Weighted register Digital to analog converter

b. Dual slop method of ADC

c. ROM as programmable logic device

d. Sample and Hold circuit

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SE - IV - Elect - R-19

QP : 10093179

[Max Marks: 80]

Duration: 3hrs

Note: 1) Question No. 1 is compulsory
2) Attempt any three questions out of remaining five
3) All Questions carry equal marks
4) Assume suitable data if required and state it clearly

		Marks
Q1	**Solve any four from the following**	**5**
a	Explain working of SCR with two-transistor analogy.	**5**
b	Explain different performance parameters of inverter.	**5**
c	Explain in brief applications of MOSFET, IGBT and SCR	**5**
d.	Compare VSI and CSI.	**5**
e	Explain any one forced commutation circuit	
Q2		
a	Explain working and characteristics of power MOSFET. Also state gate driving requirements.	**10**
b	Explain working of a buck-boost converter. Draw waveforms and derive equation to calculate output voltage	**10**
Q3		**10**
a	Explain single-phase full bridge inverter driving R-L load.	**10**
b	Explain need and working of Dual converter in circulating current mode.	
Q4		**10**
a	Explain three phase inverter in 180° mode of conduction.	**10**
b	Draw and explain dynamic characteristics of SCR.	
Q5		
a	Draw waveforms and explain three phase full converter with R load also write the output voltage equation.	**10**
b	Explain Pulse Triggering of SCR.	**10**
Q6	**Write short notes on any two.**	**20**
a	Write a short note on 'Protection of SCR'.	
b	Compare SiC and GaN devices	
c	Explain Space Vector Modulation	

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SE-IV-Elect-R-19

GP:-10098225

Time : 3 Hours **Marks: 80**

Note :

- **Question No.1 is compulsory.**
- Solve **ANY THREE** questions from the **remaining** questions.
- Figure to the right indicates full marks.

			Marks
Q. 1		Solve **ANY FOUR** questions from following. (Each question carries 5 marks)	**20**
	a)	Explain the basic movements in vehicle driving.	
	b)	Explain the AC and DC characteristics of motors used in EV/HEV.	
	c)	Give the importance of flywheels used in EV/ HEV	
	d)	Explain Rule based energy management strategy.	
	e)	Give the drawbacks of the batteries used in EV/HEV	
Q. 2	**a)**	Explain the series-parallel architecture with neat diagram. Also explain the power flow stages at each stage.	**10**
	b)	Explain why hybridization of energy sources is important for EV/HEV.	**10**
Q.3	**a)**	Explain the power characteristics of ICE and motors used in EV/HEV ?	**10**
	b)	Explain the working of ulteracapacitors with neat diagram. Compare it with other energy sources used in EV/HEV	**10**
Q4.	**a)**	(i)Derive the expression of power output for the series motor ?	**05**
		(ii) Define SOC, DOD, Specific energy of battery. Calculate peukart capacity of lead acid battery discharge time of 20 hours having current carrying capacity 5A (k = 1.5)	**05**
	b)	Explain with neat diagram V2G concept? Also mention the advantages and disadvantages.	**10**
Q5.	**a)**	Classify the DC and AC chargers used in EV and HEV as per the standard rating. Draw a neat diagram and give applications of the vehicles.	**10**
	b)	Explain the working of SRM motor used in EV/HEV.	**10**
Q6.	**a)**	Explain the fuel efficiency of anyone drive train in EV/HEV.	**10**
	b)	Explain working of converters. Draw and explain two quadrant DC-DC choppers.	**10**

SE - Sem - IV - R - 19 - Electrical

Paper / Subject Code: 40621 / Engineering Mathematics - IV

Time: 3 hrs.

Max. Marks: 80

QP: 10094551

N.B. : 1. Q1 is compulsory
2. Attempt any three questions from Q2 to Q6.
3. Figures to the right indicate full marks.

Q1. (a) Find the extremals of $\int_{x_1}^{x_2} \frac{(y')^2}{x^3}\,dx$. 5

(b) Verify Cauchy-Schwartz inequality for the vectors u = (2, 3, 1) and v = (3, 0, 4). 5

(c) Evaluate $\int_C \frac{3z-5}{z^2-4}\,dz$ where C is the circle $|z-2| = 1$. 5

(d) Calculate the coefficient of correlation from the following data. 5

X :	3	5	4	6	2
Y :	3	4	5	2	6

Q2. (a) Construct an orthonormal basis of R^3 using Gram-Schmidt process to S = { (3, 0, 4), (-1, 0, 7), (2, 9, 11) }. 6

(b) Fit a Poisson distribution to the following data. 6

No. of deaths :	0	1	2	3	4
Frequencies :	123	59	14	3	1

(c) Using the Rayleigh-Ritz method, solve the boundary value problem 8

$$\int_0^1 2xy - y^2 - (y')^2\,dx,\ y(0) = 0,\ y(1) = 0.$$

Q3. (a) Using residue theorem evaluate $\int_C \frac{z+3}{z^2+2}\,dz$ where C is the circle $|z| = 2$. 6

(b) Find the extremals of 6

$$\int_0^1 yy' + (y'')^2\,dx,\quad y(0) = 0,\ y'(0) = 1,\ y(1) = 2,\ y'(1) = 4.$$

(c) Find the singular value decomposition of $\begin{bmatrix} 4 & 4 \\ -3 & 3 \end{bmatrix}$. 8

Q4. (a) Check whether following are subspaces of the space R^3. 6
(i) W = {(a, b, c) / a = 1, c = 1}
(ii) W = {(a, 0, 0) / a ∈ R}

40622

Qcode. 10094763

SE Sem IV R-19 C scheme Electrical

(Time: 3 Hours) (Total Marks: 80)

N.B: (1) Question No. 1 is compulsory.
(2) Attempt any three from the remaining questions.
(3) Figures to the right indicate full marks.
(4) Each question is of 20 Marks.

Q. 1	**Answer following questions.**	**20M**
a.	Explain the working principle of transformer.	5M
b.	State the advantages and disadvantages of autotransformer.	5M
c.	Explain power stages of 3 Phase I. M.	5M
d.	Explain need of starter for 3 Phase induction motor.	5M
Q. 2	**Answer following questions.**	**20M**
a.	Develop equivalent circuit of single-phase transformer from no load and short circuit test.	10M
b.	Draw and explain open delta connection of transformer in detail.	10M
Q. 3	**Answer following questions.**	**20M**
a.	Draw and explain oscillating neutral phenomenon of three phase transformer in detail.	10M
b.	Draw and explain Torque-speed characteristics of 3 phase induction motor in braking, motoring and generating regions.	10M
Q. 4	**Answer following questions.**	**20M**
a.	A 3-phase star connected 400V, 50 Hz, 4 pole induction motor has the following constants in ohms per phase referred to stator. **r_1 = 0.15, x_1 = 0.45, r_2 = 0.12, x_2 = 0.45, X_m = 28.5** Fixed losses = 400watts, slip of 0.04 Calculate 1) Stator current 2) Output torque 3) Efficiency	10M
b.	Explain different speed controlling methods for 3 phase induction motor.	10M
Q. 5	**Answer following questions.**	**20M**
a.	Draw and explain Scott connection of transformer in detail.	10M
b.	Explain about copper saving in autotransformer.	10M
Q. 6	**Answer following questions.**	**20M**
a.	Explain the construction and working of split phase induction motor.	10M
b.	The following data relates to tests on 110 volt, 150 watts, 50 Hz, 6pole, single phase induction motor. No load test: 110 volts, 63 Watts, 2.7 amps. Blocked rotor test: 55 volts, 212 watts, 5.8 amp. The stator winding resistance is 2.5 ohms and during blocked rotor test, the starting winding is open. Determine the equivalent circuit parameters. Also find the core, friction and windage losses.	10M

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