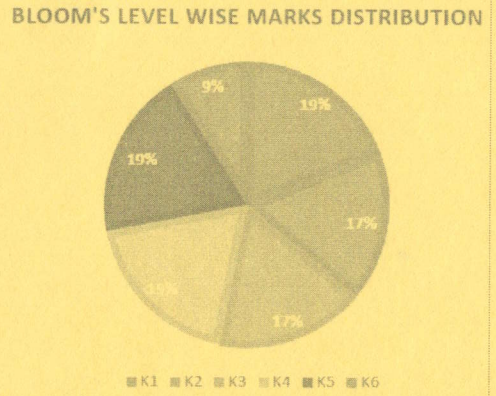
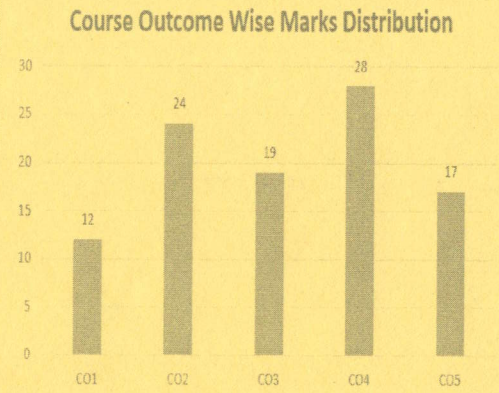
CO- Course Outcomes, **KL**- Knowledge Level, **PO** – Program Outcome

Course Outcomes	CO1	To know the basic of sensor and transducer.
	CO2	To know the different types of sensors used in Electric Vehicle.
	CO3	To understand the working principle of different types of sensors used in Electric Vehicle.
	CO4	Familiarization with the Challenges and Solutions in Implementing sensing technology in Electric Vehicle.
	CO5	To know the role of sensors in battery management system.

GRAPHICAL REPRESENTATION





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ARKA JAIN University Jharkhand — NAAC GRADE A

END SEM EXAMINATION
School of Engineering & IT

Branch	**Electrical Vehicle Technology**	**Program**	**M.Tech.**
Subject Name	**Sensors for Electric Vehicle**	**Semester**	**I**
		Year	**March,2025**

Time: 3 Hour Max. Marks : 70

- Start writing from 2nd page onwards; **don't Write on the 1st Page Backside**
- **Answer all Questions of Section A (Compulsory)**
- **Answer Any Four out of Six of Section B**
- **Answer Any Three out of Five of Section C**
- **Possession of Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will comes under **Unfair Means** and will **Result** in the **Cancellation of the Papers**.

Knowledge Level (KL)	**K1** : Remembering	**K3** : Applying	**K5** : Evaluating
	K2 : Understanding	**K4** : Analysing	**K6** : Creating

Section A (Each question Carry 02 Marks from Q1-i to x) – 20 Marks

Q. N 1	QUESTIONS	Marks	COs	KL	PO
i	Define the sensor.	2	CO4	K2	PO1
ii	How sensor is different from the transducer.	2	CO5	K1	PO1
iii	Enlist any four types of sensor used in Electric vehicle applications.	2	CO1	K1	PO1
iv	State any two applications of Mass air flow sensor used in the Electric vehicle.	2	CO4	K4	PO1
v	Define the smart sensor for Electric vehicle applications	2	CO4	K3	PO2
vi	Illustrate the Variable-Capacitance type MAP Sensor	2	CO2	K5	PO1
vii	Write any two applications of Variable-Inductance type MAP Sensor.	2	CO2	K5	PO2
viii	Write any two examples of Load cell used in Vehicle.	2	CO4	K4	PO2
ix	Write the name of any two types of sensors involved in the current.	2	CO3	K6	PO2
x	Illustrate any two-standard used for the Electric vehicle in India.	2	CO3	K6	PO2

Section B (Answer any FOUR out of SIX) – 20 Marks
(Each question 5 Marks)

Q. No.	QUESTIONS	Marks	COs	KL	PO
2	Explain the working principle of Lambda Sensor (Exhaust Gas Oxygen Sensor) used in Vehicle.	5	CO1	K5	PO1
3	Draw and explain the dynamic characteristics of the zero order sensors used in Electric vehicle.	5	CO1	K1	PO1
4	Discuss the basic design of the Throttle Position Sensor used in automobile.	5	CO3	K4	PO2
5	Discuss the working principle of DC/DC sensor used in Electric Vehicle.	5	CO4	K6	PO1
6	Why do we need sensors in Electric Vehicle?	5	CO4	K2	PO1
7	Highlight the common symptoms of battery current sensor in Electric Vehicle and ways to address them.	5	CO5	K3	PO2

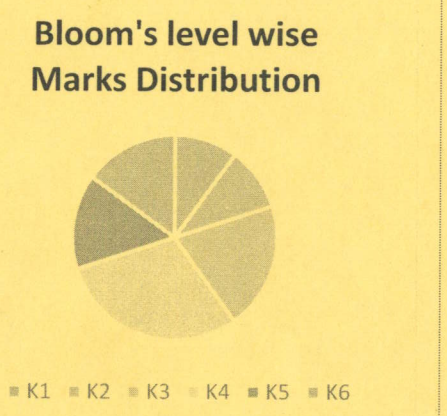
Section C (Answer any THREE out of FIVE) – 30 Marks
(Each question Carry 10 Marks)

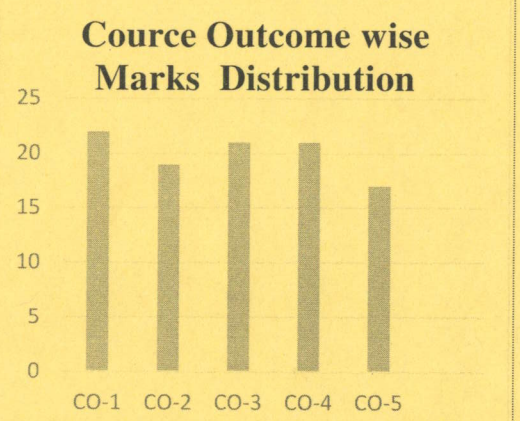
Q. No.	QUESTIONS	Marks	Cos	KL	PO
8	Explain any five static characteristics of the Electric vehicle sensors.	10	CO2	K5	PO1
9	Develop the mathematical model of the first order sensor used in electric vehicle and explain its dynamic behaviour through the graphical presentation.	10	CO2	K2	PO2
10	Discuss the design of Manifold Absolute Pressure (MAP) Sensor and associated signal conditioning circuit used in Vehicle applications.	10	CO3	K1	PO2
11	Discuss the possible sources of EMI I in Electric Vehicle and highlight its suppression techniques for automotive sensors.	10	CO5	K3	PO1
12	Discuss the position and features of the following sensors type used in Electric Vehicle. (i) Motor control position (ii) Motor control angle (iii) Motor control speed (iv) Battery management current sensor (v) Motor current sensor	10	CO4	K4	PO1

CO- Course Outcomes, **KL**- Knowledge Level, **PO** – Program Outcome

Course Outcomes	CO1	Analyse the different types of energy storage systems and their performances to electric vehicle.
	CO2	To understand the electrochemical and energy storage devices.
	CO3	Investigate the depth analysis of fuel cell technology and its integration into electric vehicle.
	CO4	Design and analysis of battery parameters and its performance measures for various types of batteries.
	CO5	Evaluate the battery sizing for real time driving pattern and investigate the battery testing and power management studies.

GRAPHICAL REPRESENTATION





ARKA JAIN University
Jharkhand
NAAC GRADE A ACCREDITED UNIVERSITY

END SEM EXAMINATION
School of Engineering & IT

Branch	Electrical Vehicle Technology	Program	M.Tech
Subject Name	Energy Storage Systems for Electric Vehicle	Semester	I
		Year	March,2025

Time: 3 Hour Max. Marks : 70

- Start writing from 2nd page onwards; **don't Write on the 1st Page Backside**
- **Answer all Questions of Section A (Compulsory)**
- **Answer Any Four out of Six of Section B**
- **Answer Any Three out of Five of Section C**
- **Possession of Mobile Phone** or any kind of **Written Material, Arguments with the Invigilator or Discussion with Co-Student** will comes under **Unfair Means** and will **Result** in the **Cancellation of the Paper(s)**.

Knowledge Level (KL)	**K1** : Remembering	**K3** : Applying	**K5** : Evaluating
	K2 : Understanding	**K4** : Analysing	**K6** : Creating

Section A (Each question Carry 02 Marks from Q1-i to x – 20 Marks)

Q. N 1	QUESTIONS	Marks	COs	KL
i	Define energy storage in electric vehicles (EVs).	2	CO1	K1
ii	What are the key components of a supercapacitor?	2	CO4	K2
iii	List the different types of fuel cells based on operating temperature.	2	CO3	K1
iv	Define a fuel cell and its primary function in electric vehicles.	2	CO3	K2
v	What is State of Charge (SoC) in a battery?	2	CO5	K1
vi	Explain the concept of battery cell equalization.	2	CO4	K2
vii	What is the function of a battery management system (BMS)?	2	CO4	K1
viii	Write down the chemical properties of salt-based batteries?	2	CO2	K2
ix	What is an inductive charger?	2	CO3	K1
x	Define battery sizing in energy storage applications.	2	CO2	K2

Section B (Answer any FOUR out of SIX) – 20 Marks
(Each question Carry 05 Marks)

Q. No.	QUESTIONS	Marks	COs	KL
2	Describe the significance of hybrid energy storage systems in EV applications.	05	CO1	K3
3	Demonstrate how can battery modeling help optimize battery performance in EVs?	05	CO4	K3
4	Create a battery selection guideline for different types of EV applications.	05	CO2	K6
5	Analyze the advantages and disadvantages of different energy storage systems used in EVs.	05	CO1	K4
6	Evaluate different battery management strategies and their efficiency in EVs.	05	CO5	K5
7	Compare the battery sizing requirements for different EV types.	05	CO3	K4

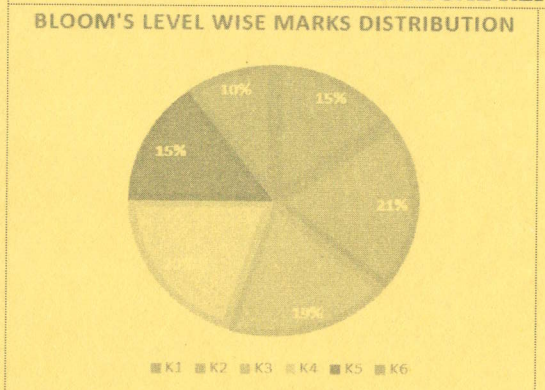
Section C (Answer any THREE out of FIVE) – 30 Marks
(Each question Carry 10 Marks)

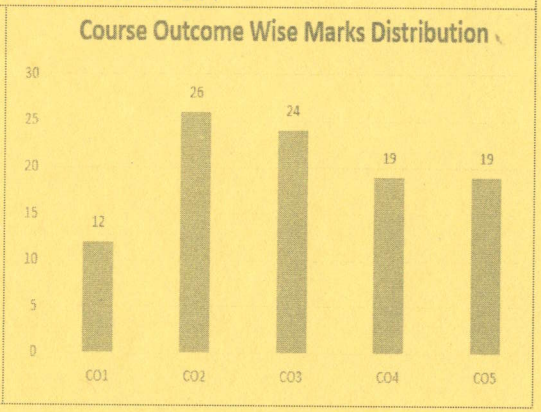
Q. No.	QUESTIONS	Marks	COs	KL
8	Develop an energy storage system for EVs that minimizes environmental impact.	10	CO1	K6
9	Analyze the differences between low, medium, and high-temperature fuel cells.	10	CO2	K4
10	Compare primary and secondary batteries in terms of recyclability and energy density.	10	CO3	K4
11	Demonstrate how voltage measurement helps in battery health monitoring.	10	CO5	K3
12	Evaluate the effectiveness of hybrid charging methods in extending battery life.	10	CO4	K5

CO- Course Outcomes, **KL**- Knowledge Level, **PO** – Program Outcome

Course Outcomes	CO1	Know the analysis of discrete time signals.
	CO2	Design digital FIR and IIR filters.
	CO3	Analyze and design different multirate systems.
	CO4	Differentiate between different transformations to analyze non-stationary signals
	CO5	Analyze wavelet transforms and apply it for signal decomposition.

GRAPHICAL REPRESENTATION





ARKA JAIN University Jharkhand — NAAC GRADE A

END SEM EXAMINATION
School of Engineering & IT

Branch	Electrical Vehicle Technology	Program	M.Tech
Subject Name	Advanced Digital Signal Processing	Semester	I
		Year	March,2025

Time: 3 Hour
Max. Marks : 70

- Start writing from 2nd page onwards; **don't Write on the 1st Page Backside**
- **Answer all Questions of Section A (Compulsory)**
- **Answer Any Four out of Six of Section B**
- **Answer Any Three out of Five of Section C**
- **Possession of Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will comes under **Unfair Means** and will **Result** in the **Cancellation of the Papers**.

Knowledge Level (KL)	**K1** : Remembering	**K3** : Applying	**K5** : Evaluating
	K2 : Understanding	**K4** : Analysing	**K6** : Creating

Section A (Each question Carry 02 Marks from Q1-i to x) – 20 Marks

Q. N 1	QUESTIONS	Marks	COs	KL	PO
i	Mention the advantages of using discrete wavelet transform (DWT) for MRA.	2	CO4	K1	PO1
ii	What is the computational complexity of direct computation of DFT in terms of addition and multiplication?	2	CO3	K1	PO1
iii	How many complex multiplications are involved in radix-2 DIT-FFT algorithms?	2	CO1	K1	PO1
iv	Give the expression for Fourier transform and inverse Fourier transform.	2	CO2	K2	PO1
v	Explain with an expression the term twiddle factor.	2	CO2	K3	PO2
vi	What is the effect of multiplication of signal in time?	2	CO3	K2	PO1
vii	What is the main advantage of wavelet transform over short-time Fourier transform (STFT)?	2	CO5	K1	PO2
viii	Why FFT is preferred over DFT?	2	CO2	K3	PO2
ix	What is the difference between DFT and Fourier transform?	2	CO1	K1	PO2
x	Define DFT and IDFT in terms of twiddle factor.	2	CO5	K2	PO2

Section B (Answer any FOUR out of SIX) – 20 Marks
(Each question 5 Marks)

Q. No.	QUESTIONS	Marks	Cos	KL	PO
2	Explain the following standard signals with mathematical expression and graphical representation: a) Unit impulse function b) Sinc Function c) Rectangular Function d) Sinusoidal Function	5	CO1	K1	PO1
3	Compute DFT of the sequence x(n)=cos(n∏/2) using DIT FFT.	5	CO4	K4	PO1
4	Compute the Z-transform and determine the ROC for the sequence $x(n) = -a^n u(-n-1)$, where "a" is a constant, a<1 and u[n] is the unit step function.	5	CO4	K4	PO2
5	Find the convolution of the signal x(n) = (3, 1, 2, 4) where impulse response of the signal is h(n) = (1, 3, 2, 1) using any method.	5	CO3	K3	PO1
6	Explain the concepts of upsampling and downsampling in digital signal processing.	5	CO5	K5	PO1
7	Compute the 8 point circular convolution for following sequences, $x_1(n)$ = { 1, 1, 1, 1, 0, 0, 0, 0} $x_2(n)$ = sin (3∏n/8) where ≤ n ≤ 7	5	CO3	K2	PO2

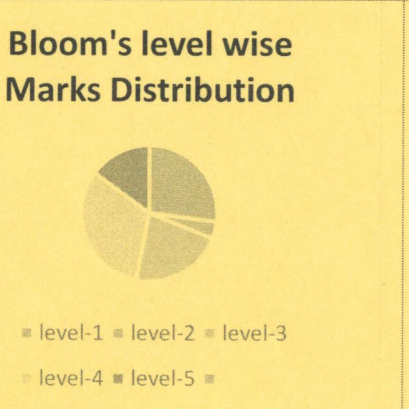
Section C (Answer any THREE out of FIVE) – 30 Marks
(Each question Carry 10 Marks)

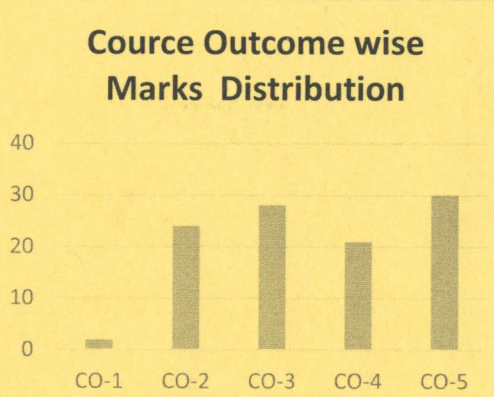
Q. No.	QUESTIONS	Marks	Cos	KL	PO
8	Obtain the Fourier series transformation of the function e^{-at} .u(t) where u(t) is a unit step function.	10	CO5	K5	PO1
9	Given a sequence x(n) = {1, 1, 1, 1, 0, 0, 0, 0}, perform Decimation in Time FFT (using Radix-2 FFT algorithm) with N = 8. Show the butterfly diagram for each stage of computation.	10	CO2	K6	PO2
10	Give the expression for DFT and discuss its properties.	10	CO4	K2	PO2
11	Find the DFT of the sample data sequence x(n)= {1, 1, 2, 2, 3, 3} and compute the corresponding amplitude and phase spectrum.	10	CO2	K3	PO1
12	Describe the process of multiresolution analysis (MRA) in wavelet transform. How does MRA help in decomposing signals into different frequency bands, and what are its practical applications?	10	CO3	K4	PO1

CO- Course Outcomes, **KL**- Knowledge Level, **PO** – Program Outcome

Course Outcomes	CO1	Analyze the basic principles of switch mode power converters
	CO2	Analyze the operating principles and models of different types of power electronic converters AC-AC, AC-DC, DC-AC and DC-DC converter systems
	CO3	Analyze and design switch mode power electronic converters for various applications
	CO4	Apply microprocessor power supplies, renewable energy systems, and motor drives
	CO5	Analyze pulse width modulated inverters used for variable speed drives.

GRAPHICAL REPRESENTATION





ARKA JAIN University Jharkhand — NAAC GRADE A — ACCREDITED UNIVERSITY

END SEM EXAMINATION
School of Engineering & IT

Branch	Electrical Vehicle Technology	Program	M.Tech
Subject Name	Power Electronics Drives	Semester	I
		Year	March,2025

Time: 3 Hour
Max. Marks : 50

- Start writing from 2nd page onwards; **don't Write on the 1st Page Backside**
- **Answer all Questions of Section A (Compulsory)**
- **Answer Any Four out of Six of Section B**
- **Answer Any Three out of Five of Section C**
- **Graf Paper / Drawing Sheet/ Log Book/ Ledger (please Mention if any)**
- **Possession of Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will comes under **Unfair Means** and will **Result** in the **Cancellation of the Papers**.

Knowledge Level (KL)			
	K1 : Remembering	**K3** : Applying	**K5** : Evaluating
	K2 : Understanding	**K4** : Analysing	**K6** : Creating

Section A (Each question Carry 02 Marks from Q1-i to x) – 20 Marks

Q. N 1	QUESTIONS	Marks	COs	KL	PO
i	What are the advantages of phase-controlled rectifiers over uncontrolled rectifiers?	2	CO2	K2	PO3
ii	What is the difference between a half-controlled and a fully controlled rectifier?	2	CO3	K1	PO1
iii	How does a bridge rectifier improve performance compared to a center-tapped rectifier?	2	CO5	K1	PO3
iv	How does a single-phase half-wave rectifier work?	2	CO3	K1	PO3
v	How does the power factor of a three-phase rectifier compare to that of a single-phase rectifier?	2	CO3	K2	PO2
vi	Why 120 degree conduction mode is superior to 180 conduction mode?	2	CO4	K1	PO3
vii	List some applications of dc chopper?	2	CO1	K1	PO2
viii	What is the principle of operation of a step-down (buck) chopper?	2	CO2	K4	PO1
ix	How does SPWM control the output voltage of an inverter?	2	CO3	K3	PO3
x	How does modulation index influence the output of SPWM?	2	CO4	K1	PO2

Section B (Answer any FOUR out of SIX) – 20 Marks
(Each question 5 Marks)

Q. No.	QUESTIONS	Marks	COs	KL	PO
2	A single-phase full-bridge inverter controls the power in a resistive load. The nominal value of input dc voltage is Vs = 220 V and a uniform pulse-width modulation with five pulses per half cycle is used. For the required control, the width of each pulse is 30°. (a) Determine the rms voltage of the load. (b) If the dc supply increases by 10%, determine the pulse width to maintain the same load power. If the maximum possible pulse width is 35°, determine the minimum allowable limit of the dc input source.	5	CO2	K1	PO2
3	The single-phase dual converter is operated from a 120-V, 60-Hz supply and the load resistance is R = 10 Ω. The circulating inductance is Lr = 40 mH; delay angles are α1 = 60° and α2 = 120°. Calculate the peak circulating current and the peak current of converter 1	5	CO5	K4	PO4
4	Explain the 180 conduction mode of inverter	5	CO3	K3	PO4
5	Explain the working principle of class D chopper.	5	CO2	K5	PO2
6	Explain the operation of half wave controlled rectifier with R-load.	5	CO5	K4	PO5
7	Explain operation principle of single phase full wave inverter with R load	5	CO3	K3	PO4

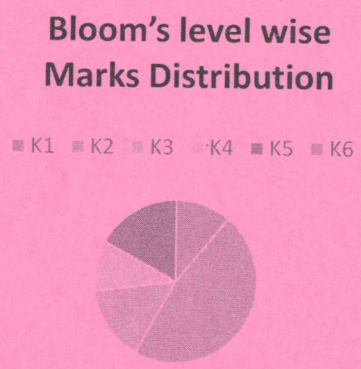
Section C (Answer any THREE out of FOUR) – 30 Marks
(Each question Carry 10 Marks)

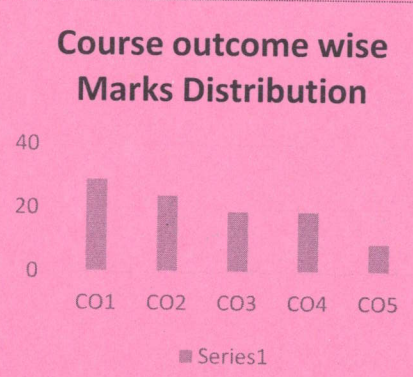
Q. No.	QUESTIONS	Marks	COs	KL	PO
8	Explain the operation of three phase fully controlled rectifier with R load and also derive the average and RMS load voltage.	10	CO3	K4	PO4
9	The bridge inverter has an RLC load with R = 10 Ω, L = 31.5 mH, and C = 112 μF. The inverter frequency is f0 = 60 Hz and dc input voltage is Vs = 220 V. (a) Express the instan- taneous load current in Fourier series. Calculate (b) the rms load current at the fundamental frequency Io1, (c) the THD of the load current, (d) the power absorbed by the load P0 and the fundamental power P01, (e) the average current of dc supply Is, and (f) the rms and peak current of each transistor.	10	CO2	K3	PO2
10	Explain operation principle three phase Full wave controlled rectifier?	10	CO5	K1	PO2
11	Explain the operation of 120 degree conduction mode of three phase inverter?	10	CO4	K4	PO4
12	A three-phase full converter is operated from a three-phase 230-V, 60-Hz supply. The load is highly inductive and the average load current is Ia = 150 A with negligible ripple content. If the delay angle is α = π/3, determine the ratings of thyristors	10	CO5	K3	PO5

CO- Course Outcomes, **KL**- Knowledge Level, **PO** – Program Outcome

Course Outcomes	CO1	The students will be able to apply interpolation methods and find approximate solution of algebraic and transcendental equations.
	CO2	The students will be able to compute several statistical measures and analyze any given bivariate data.
	CO3	The students will be able to deal with the treatment of random variables and their probability distributions.
	CO4	The students will be able to apply Statistical techniques of the Analysis of Variance and the Designs of Experiments.
	CO5	The students will be able to have idea of Queuing system and Queuing Models.

GRAPHICAL REPRESENTATION





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JGI ARKA JAIN University Jharkhand — NAAC GRADE A ACCREDITED UNIVERSITY			**END SEM EXAMINATION** **School of Engineering & IT**
Branch	**ME / CSE / EVT**	**Program**	**M. Tech**
Subject Name	**Advanced Engineering Mathematics and Experimental Methods**	**Semester**	**I**
		Year	**March,2025**
Time: 3 Hour Max. Marks : 70	• Start writing from 2nd page onwards; don't Write on the 1st Page Backside • **Answer all Questions of Section A (Compulsory)** • **Answer Any Four out of Six of Section B** • **Answer Any Three out of Five of Section C** • **Possession of Mobile Phone** or any kind of **Written Material, Arguments with the Invigilator or Discussion with Co-Student** will comes under **Unfair Means** and will **Result** in the **Cancellation of the Paper(s)**.		
Knowledge Level (KL)	**K1** : Remembering	**K3** : Applying	**K5** : Evaluating
	K2 : Understanding	**K4** : Analysing	**K6** : Creating

Section A (Each question Carry 02 Marks from Q1- i to x – 20 Marks)

Q. N 1	QUESTIONS	Marks	COs	KL
i	What do you mean by interpolation?	2	CO1	K1
ii	Write down formula used for finding roots under Regula Falsi mehtod.	2	CO1	K1
iii	What is the effect of change of origin and change of scale on correlation coefficient?	2	CO2	K2
iv	Write down the equations of two regression lines.	2	CO2	K2
v	What do you mean by probability function of a random variable?	2	CO3	K1
vi	The mean of a binomial variate with parameters n and p are 4 and 2 respectively. Evaluate p	2	CO3	K5
vii	What is meant by two-way classification of Analysis of Variance?	2	CO4	K2
viii	Write down any two advantages of R.B.D. over C.R.D.	2	CO4	K2
ix	Explain reneging.	2	CO5	K2
x	Explain FCFS.	2	CO5	K2

Section B (Answer any FOUR out of SIX) – 20 Marks
(Each question Carry 05 Marks)

Q. No.	QUESTIONS	Marks	COs	KL
2	The following data is given, prepare difference table: Arguments: 4, 7, 10, 13, 16 Entries: 5, 12, 20, 30, 45	05	CO1	K3
3	What is correlation? How it is measured? Mention the limits of correlation coefficient.	05	CO2	K2
4	Find rank correlation coefficient for the following data: Rank in honesty: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 Rank in intellegency: 3, 4, 1, 8, 2, 6, 5, 7, 10, 9	05	CO2	K5
5	Define binomial random variable. What are its parameters? Also write expressions for its mean and variance.	05	CO3	K1
6	Explain the Lay-out of a Randomized Block Design.	05	CO4	K2
7	Explain any one Queuing Model.	05	CO5	K2

Section C (Answer any THREE out of FIVE) – 30 Marks
(Each question Carry 10 Marks)

Q. No.	QUESTIONS	Marks	COs	KL
8	Estimate f(8) by applying suitable interpolation formula for the data given below: x: 6, 7, 9, 11 f(x): 12, 25, 40, 54	10	CO1	K5
9	Apply Bisection method to find the approximate root of the equation $x^2 + x - 3 = 0$ up to 4th approximation.	10	CO1	K3
10	Find the regression line of Y on X for the following bivariate data: X: 8, 10, 11, 13, 15, 16, 18, 20, 22, 23 Y: 10, 11, 10, 12, 14, 16, 17, 18, 18, 20	10	CO2	K4
11	Define Random variable. Distinguish between discrete and continuous random variable. Also explain probability function of a random variable.	10	CO3	K2
12	Write an essay on Analysis of Variance.	10	CO4	K2