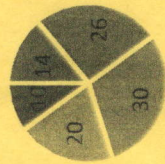


Course Outcomes	CO1	Understand the Fundamentals of Electric Vehicles (EVs)
	CO2	Classify electric vehicles based on the configuration level.
	CO3	Analyse the suspension and transmission systems associated with EVs
	CO4	Analyse the braking system and steering systems of EVs
	CO5	Evaluate the factors affecting the performance of batteries.

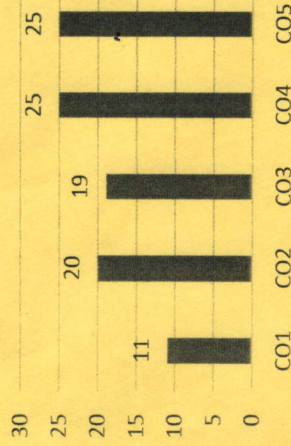
GRAPHICAL REPRESENTATION

Bloom's Level wise Marks Distribution



■ K1 ■ K2 ■ K3 ■ K4 ■ K5

Course Outcome Wise Marks Distribution



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END SEM EXAMINATION
School of Engineering & IT

Program	M. Tech	Branch	Electrical Vehicle Technology
Subject Name	Automotive Engineering For Electric Vehicles	Session	Odd, 2025-26
Semester	1 st	Year	Jan, 2026
Time: 3 Hour Max. Marks : 70	<ul style="list-style-type: none"> 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 Graph Paper / Drawing Sheet/ Log Book/ Ledger (Not Required) 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	QUESTIONS	Marks	COs	KL
1				
i	List any two electric motors used in EVs.	2	CO1	K1
ii	What is battery degradation?	2	CO2	K2
iii	Define four-stroke engine.	2	CO2	K1
iv	What is meant by engine performance?	2	CO2	K2
v	Define air pollution.	2	CO3	K1
vi	What is fuel Cell Electric Vehicle(FCEV)?	2	CO2	K1
vii	Name any two types of springs.	2	CO1	K1
viii	What is air suspension?	2	CO1	K2
ix	What is brake assist system?	2	CO2	K1
x	Define battery thermal management.	2	CO3	K1

12	An electric vehicle consumes 0.18 kWh/km. Calculate the energy required for a trip of 120 km. If battery efficiency is 90%, find actual battery energy needed.	10	CO4	K4
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Section B (Answer any FOUR out of SIX) – 20 Marks (Each question Carry 05 Marks)				
Q. No.	QUESTIONS	Marks	COs	KL
2	Compare electric vehicles and conventional vehicles	5	CO1	K2
3	Explain components of a transmission system.	5	CO2	K2
4	The wheelbase of a car is 2.6m. The CG is located 1.2m from the front axle. Calculate front and rear axle loads for a total vehicle weight of 12 kN.	5	CO3	K4
5	Describe hydraulic braking system.	5	CO2	K2
6	An engine develops a brake power of 40 kW at 3000 rpm. If the torque produced is constant, calculate the torque of the engine.	5	CO4	K4
7	Explain battery thermal management system.	5	CO5	K2
Section C (Answer any THREE out of FIVE) – 30 Marks (Each question Carry 10 Marks)				
Q. No.	QUESTIONS	Marks	COs	KL
8	Describe steering mechanisms and steering gears.	10	CO4	K3
9	Describe construction, thermal management and safety aspects of EV batteries.	10	CO5	K3
10	A lithium-ion battery has an initial capacity of 60 kWh. Capacity fades at 2% per year. (i) Calculate remaining capacity after 5 years (ii) Percentage degradation	10	CO5	K5
11	Explain types of electric vehicles such as BEV, HEV, PHEV and FCEV with advantages.	10	CO3	K3

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.

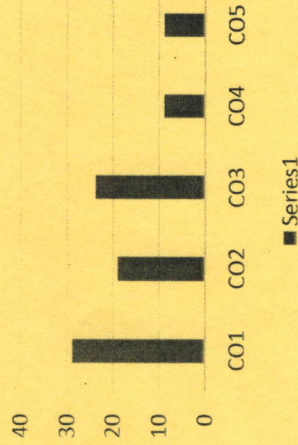
GRAPHICAL REPRESENTATION

Bloom's Level wise Marks distribution



■ Level 1 ■ Level 2 ■ Level 3
■ Level 4 ■ Level 5 ■ Level 6

Course outcome wise Marks distribution



■ Series1



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END SEM EXAMINATION
School of Engineering & IT

Program	M. Tech	Branch	EVT/MS/CSE
Subject Name	Advanced Engineering Mathematics and Experimental methods		
Semester	1 st	Session	Odd, 2025-26
		Year	Jan, 2026
Time: 3 Hour Max. Marks : 70	<ul style="list-style-type: none"> 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	QUESTIONS	Marks	COs	KL
1				
i	Define Interpolation with unequal intervals.	2	CO1	K1
ii	Write down formula for finding approximate root under Newton-Rapson method.	2	CO1	K1
iii	Write down the limits of Rank correlation coefficient.	2	CO2	K1
iv	Define regression coefficients in regression analysis.	2	CO2	K2
v	Compute the probability of getting exactly two heads in tossing three coins simultaneously.	2	CO3	K3
vi	What are the parameters of binomial distribution?	2	CO3	K2
vii	What is meant by one-way classification of Analysis of Variance?	2	CO4	K3
viii	Randomized Block Design is which case of classification of analysis of variance?	2	CO4	K4
ix	Explain the term Balking used in Queuing Theory.	2	CO5	K1
x	What is meant by single channel service in Queuing Theory.	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	Establish the relation $\Delta = E - 1$	5	CO1	K3
3	The coefficient of rank correlation between marks in Statistics and marks in Mathematics obtained by a certain group of students is 0.8. If the sum of the squares of differences in ranks is given to be 33, find the number of students in the group.	5	CO2	K5
4	A coin is tossed 10 times. Find the probability of getting exactly 8 heads.	5	CO3	K5
5	What is random variable? Explain discrete and continuous random variables.	5	CO3	K2
6	Explain Analysis of Variance	5	CO4	K2
7	What do you understand by Queuing Theory and Queuing system?	5	CO5	K2

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

Q. No.	QUESTIONS	Marks	COs	KL
8	Given that $f(0) = 8$, $f(1) = 68$, $f(3) = 123$ and $f(4) = 230$ construct a divided difference table and determine the value of $f(2)$.	10	CO1	K5
9	Describe Newton-Rapson method for solving Algebraic or Transcendental equation.	10	CO1	K3
10	For 10 observations on price (X) and supply (Y) the following data were obtained (in appropriate units), $\sum X = 130$, $\sum Y = 220$, $\sum X^2 = 2288$, $\sum Y^2 = 5506$ and $\sum XY = 3467$. Obtain the line of regression of Y on X and estimate the supply when the price is 16 units.	10	CO2	K5
11	A continuous random variable X follows the probability law: $f(x) = Ax$, $0 \leq x \leq 2$ Determine A and find the probability that a. X lies between 0.5 and 0.8 b. X is less than 1.4	10	CO3	K5
12	Discuss Randomization, Replication and Local Control in Design of Experiment.	10	CO4	K2

Branch	Electrical and Electronics Engineering	Program	M.Tech. (Electric Vehicle)
Subject Name	Sensors for Electric Vehicle	Semester	1 st
		Year	2025-26/Odd

• 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 come under Unfair Means and will Result in the Cancellation of the Papers.

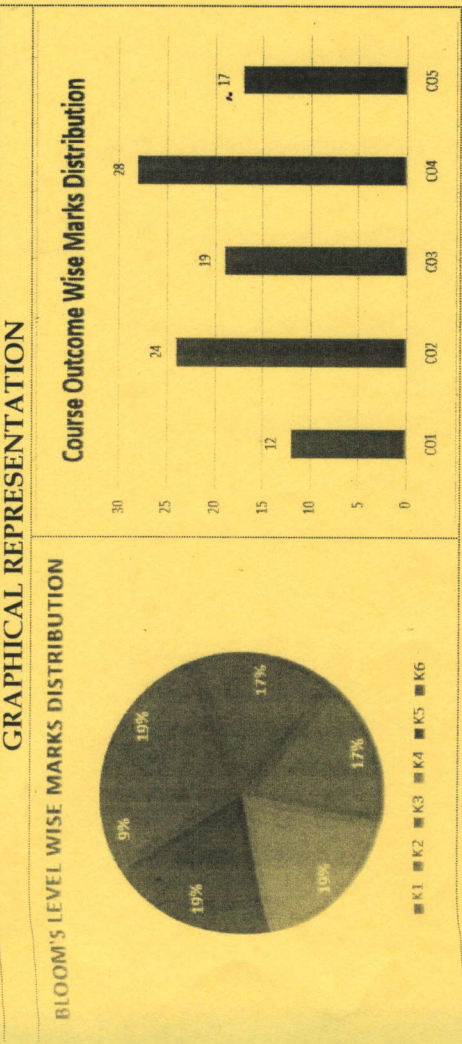
Time: 3 Hour Max. Marks : 70	K1 : Remembering K2 : Understanding	K3 : Applying K4 : Analysing	K5 : Evaluating K6 : Creating
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Knowledge Level (KL)

Q. N 1	QUESTIONS	Marks	COs	KL	PO
i	Define the transducer.	2	CO 4	K2	PO1
ii	Write any two differences between sensor and transducer.	2	CO 5	K1	PO1
iii	Enlist any four types of sensor used in Electric vehicle applications.	2	CO 1	K1	PO1
iv	State any two applications of Mass air flow sensor used in the Electric vehicle.	2	CO 4	K4	PO1
v	Define the smart sensor for Electric vehicle applications.	2	CO 4	K3	PO2
vi	Illustrate the Variable-Inductance type MAP Sensor.	2	CO 2	K5	PO1
vii	Write any two applications of Variable-capacitive type MAP Sensor.	2	CO 2	K5	PO2
viii	Write any two examples of Load cell used in Vehicle.	2	CO 4	K4	PO2
ix	Write the name of any two types of sensors involved in the current measurement.	2	CO 3	K6	PO2

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

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.



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	Explain the working principle of any temperature sensor used in automobile.	5	CO4	K6	PO1
6	How sensors are necessary for Electric Vehicle?	5	CO4	K2	PO1
7	Enlist the common symptoms of battery current sensor in Electric Vehicle.	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	Highlight any five static and dynamic characteristics of the Electric vehicle sensors.	10	CO2	K5	PO1
9	Develop the mathematical model of the zero 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	Enlist and explain the possible sources of EMI in Electric Vehicle and highlight its possible suppression techniques.	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



Illustrate any two standard used for the Electric vehicle in India.

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	Explain the working principle of any temperature sensor used in automobile.	5	CO4	K6	PO1
6	How sensors are necessary for Electric Vehicle?	5	CO4	K2	PO1
7	Enlist the common symptoms of battery current sensor in Electric Vehicle.	5	CO5	K3	PO2

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

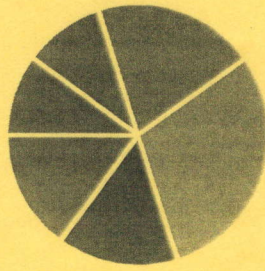
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	ARKA JAIN University Jharkhand		END SEM EXAMINATION School of Engineering & IT	
			Branch	Program
Subject Name	Electrical Vehicle Technology	M.Tech	Semester	1 st
	Energy Storage Systems for Electric Vehicle	Year	2025/ODD	
Time: 3 Hour Max. Marks : 70	<ul style="list-style-type: none"> 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 <u>Mobile Phone</u> or any kind of <u>Written Material, Arguments with the Invigilator or Discussion with Co-Student</u> will come under <u>Unfair Means</u> and will <u>Result</u> in the <u>Cancellation of the Paper(s)</u>. 			
Knowledge Level (KL)	K1 : Remembering	K3 : Applying	K5 : Evaluating	
	K2 : Understanding	K4 : Analysing	K6 : Creating	

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

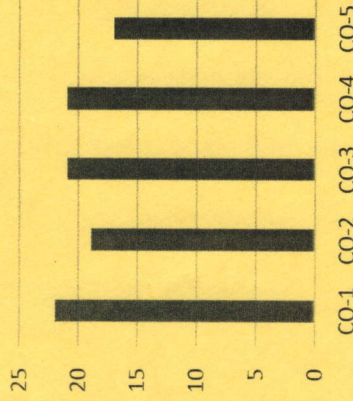
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Bloom's level wise Marks Distribution



■ K1 ■ K2 ■ K3 ■ K4 ■ K5 ■ K6

Course Outcome wise Marks Distribution



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

Q. N 1	QUESTIONS	Marks	COs	KL
i	What is a flywheel-based energy storage system?	2	CO1	K1
ii	What are the key components of a supercapacitor?	2	CO4	K2
iii	Name two advantages of solid oxide fuel cells (SOFC).	2	CO3	K1
iv	What are the different types of batteries used in EVs?	2	CO3	K2
v	Define primary and secondary batteries.	2	CO5	K1
vi	What is State of Charge (SoC) in a battery?	2	CO4	K2
vii	Write down the chemical properties of salt-based batteries?	2	CO4	K1
viii	What is thermal runaway in a battery system?	2	CO2	K2
ix	List different battery charging methods used in EVs.	2	CO3	K1
x	What is an inductive charger?	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	Apply the constant current (CC) and constant voltage (CV) method to charge a Li-ion battery.	05	CO2	K6
5	Analyze the advantages and disadvantages of different energy storage systems used in EVs.	05	CO1	K4
6	Explain the control system for managing charge-discharge cycles 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)

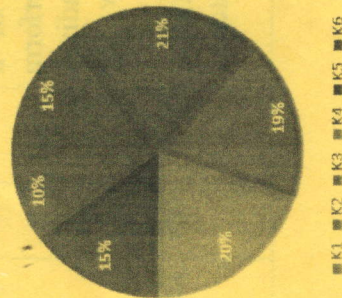
Q. No.	QUESTIONS	Marks	COs	KL
8	Develop an energy storage system for EVs that minimizes environmental impact.	10	CO1	K6
9	Develop a new safety protocol for handling and integrating fuel cells in EVs.	10	CO2	K4
10	Demonstrate how voltage measurement helps in battery health monitoring.	10	CO3	K4
11	Evaluate the effect of temperature on battery efficiency and life cycle.	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

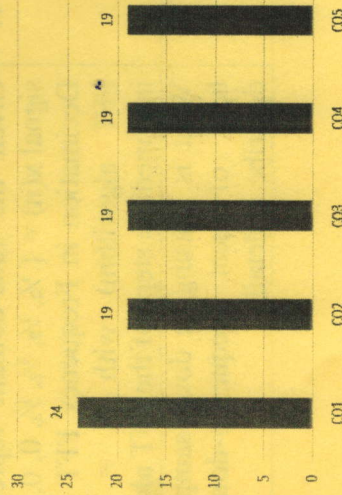
CO1	Know the analysis of discrete time signals.
CO2	Design digital FIR and IIR filters.
CO3	Analyze and design different multirate systems.
CO4	Differentiate between different transformations to analyze non-stationary signals
CO5	Analyze wavelet transforms and apply it for signal decomposition.

GRAPHICAL REPRESENTATION

BLOOM'S LEVEL WISE MARKS DISTRIBUTION



Course Outcome Wise Marks Distribution



END SEM EXAMINATION
School of Engineering & IT

Branch	Electrical and Electronics Engineering	Program	M.Tech
Subject Name	Advanced Digital Signal Processing	Semester	1 st
		Year	2025-26 (ODD)
Time: 3 Hour Max. Marks : 70	<ul style="list-style-type: none"> 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 <u>Mobile Phones</u> or any kind of <u>Written Material, Arguments with the Invigilator or Discussing with Co-Student</u> will comes under <u>Unfair Means</u> and will <u>Result in the Cancellation of the Papers.</u> 		
Knowledge Level (KL)	K1 : Remembering	K3 : Applying	K5 : Evaluating
	K2 : Understanding	K4 : Analysing	K6 : Creating

Section A (Each question Carry 02 Marks from O1-i to O1-xx) – 20 Marks

Q. N1	QUESTIONS	Marks	Cos	KL	PO
i	What is the role of interpolation filter in multirate systems?	2	CO3	K1	PO1
ii	Compare the computational complexities of DIT-FFT algorithm and direct computation of DFT for N=1024.	2	CO3	K1	PO1
iii	How many complex additions are involved in radix-2 DIT-FFT algorithms?	2	CO1	K1	PO1
iv	Why does up-sampling create spectral images but not aliasing?	2	CO1	K2	PO1
v	Explain with an expression the term twiddle factor.	2	CO2	K3	PO2
vi	List the components obtained after applying MRA to a signal.	2	CO4	K2	PO1

Q.No.	QUESTIONS	Marks	Cos	KL	PO
vii	Name two commonly used wavelets in DWT.	2	CO5	K1	PO2
viii	In context to FFT, what is radix-2?	2	CO5	K3	PO2
ix	A signal sampled at 8 kHz is down-sampled by a factor of 4. (a) What is the new sampling frequency? (b) What is the maximum allowable signal frequency to avoid aliasing?	2	CO4	K1	PO2
x	If all poles lie inside the unit circle, what can be said about system stability?	2	CO1	K2	PO2
Section B (Answer any FOUR out of SIX) – 20 Marks (Each question 5 Marks)					
Q.No.	QUESTIONS	Marks	Cos	KL	PO
2	Compute DFT of the sequence $x(n) = \cos(\pi n/4)$ using DIT FFT.	5	CO1	K1	PO1
3	Compute the Z-transform and determine the ROC for the sequence $x(n) = a^n u(n-1)$ $a < 1$	5	CO4	K4	PO1
4	Compute the 4-point DIT FFT of the signal $x(n) = \{1, 3, 2, 5\}$	5	CO1	K4	PO2
5	Draw frequency-domain representation showing aliasing due to down-sampling.	5	CO3	K3	PO1
6	Compare and contrast the continuous wavelet transform (CWT) and discrete wavelet transform (DWT). Provide examples of applications where each method is used.	5	CO5	K5	PO1
7	Determine the circular convolution of following sequences and compare the results with linear convolution. $x_1(n) = \{1, 1, 1, 1, -1, -1, -1, -1\}$ $x_2(n) = \{0, 1, 2, 3, 4, 3, 2, 1\}$	5	CO2	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	Given $x(n) = \{1, 2, 3, 4, 3, 2, 1\}$, find $X(k)$ using DIT FFT algorithm.	10	CO2	K5	PO1
9	Find the Fourier transform of a rectangle.	10	CO1	K6	PO2
10	Discuss the properties of DFT giving mathematical expression.	10	CO5	K3	PO2
11	Given the time-domain representation of a signal $x(n) = \{1/2, 1/2, 1/2, 0, 0, 0, 0\}$, perform Decimation in Frequency FFT (using Radix-2 FFT algorithm) with $N = 8$. Show the intermediate steps of the FFT algorithm.	10	CO3	K4	PO1
12	What is aliasing in down-sampling? With the help of neat frequency-domain sketches, describe in detail.	10	CO4	K2	PO1