

## II B.Tech I Semester Regular Examinations, December-2024

**R23**

Sub Code: R23EC2101

**PROBABILITY THEORY & STOCHASTIC PROCESS**

Time: 3 hours

(ECE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No	Questions	KL	CO	M
1	a State the axioms of probability.	3	1	2M
	b Mention two properties of the Gaussian distribution.	2	1	2M
	c Define skewness and its significance.	2	2	2M
	d What is a monotonic transformation of a continuous random variable?	2	2	2M
	e State two properties of the joint distribution function.	3	3	2M
	f Define joint central moments.	2	3	2M
	g Differentiate between wide-sense stationarity (WSS) and strict-sense stationarity (SSS).	3	4	2M
	h Define the Poisson random process.	2	4	2M
	i State two properties of the power spectrum.	3	5	2M
	j Define the autocorrelation function in terms of the power spectrum.	2	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No	Questions	KL	CO	M	
2	Unit-I				
	a	i) Derive the total probability theorem with a practical illustration.	3	1	5M
		ii) Write and explain the properties of the Rayleigh distribution.	2	1	5M
	OR				
	b	i) Discuss the exponential distribution, its properties, and applications.	2	1	5M
		ii) The lifetime of a device follows an exponential distribution with a mean of 10 years. Find the probability that the device lasts: a. Between 3 and 8 years. b. At least 5 years	3	1	5M
3	Unit-II				
	a	i) State and prove Chebyshev's inequality.	3	2	5M
		ii) Let X be a continuous random variable with PDF $f_X(x)=2x, 0 \leq x \leq 10$ . Find: a. $E[X]$ b. $Var(X)$ .	3	2	5M
	OR				
	b	i) Discuss the properties and applications of the characteristic function of a random variable.	2	2	5M
ii) Derive the moments of a random variable X that follows an exponential distribution with rate $\lambda$ .		3	2	5M	

Unit-III					
4	a	i) Discuss the properties of jointly Gaussian random variables in the two-variable case.	2	3	5M
		ii) Describe the steps involved in the linear transformation of Gaussian random variables.	2	3	5M
	OR				
	b	i) Derive the relationship between marginal distribution and joint distribution.	3	3	5M
ii) For two random variables X and Y, the joint PDF is $f_{X,Y}(x, y)=6xy$ for $0 \leq x, y \leq 1$ . Find: a. $F_X(x)$ b. $f_X(x)$ .		3	3	5M	
Unit-IV					
5	a	i) Discuss the conditions for a process to be wide-sense stationary (WSS).	2	4	5M
		ii) A random process has an autocorrelation function $R_X(\tau)=5e^{- \tau }$ . Find $R_X(0)$ .	3	4	5M
	OR				
	b	i) Derive the properties of the autocorrelation function.	3	4	5M
ii) Compare nth-order stationarity and strict-sense stationarity.		2	4	5M	
Unit-V					
6	a	i) Derive the relationship between the power spectrum and the autocorrelation function using the Wiener-Khinchin theorem.	3	5	5M
		ii) Describe the properties of the cross-power density spectrum with examples.	2	5	5M
	OR				
	b	i) Explain the relationship between the cross-correlation function and the cross-power spectrum in the frequency domain.	2	5	5M
ii) For a process with $R_X(\tau)=\cos(2\pi f_0\tau)$ , derive the corresponding power spectral density.		3	5	5M	

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

## II B.Tech I Semester Regular Examinations, December-2024

Sub Code: R23CC2102

### UNIVERSAL HUMAN VALUES

Time: 3 hours.

(COMMON TO ALL BRANCHES)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

#### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Describe the value education.	2	1	2M
	b	Differentiate between happiness and prosperity.	2	1	2M
	c	Define the concept of harmony in the human being.	1	2	2M
	d	Interpret the harmony in the self.	2	2	2M
	e	Describe the harmony in the family.	2	3	2M
	f	Differentiate between 'trust' and 'respect'.	2	3	2M
	g	List the four orders of nature.	2	4	2M
	h	Interpret the interconnectedness in nature	2	4	2M
	i	Define the term definitiveness of ethical human conduct.	1	5	2M
	j	Describe the natural acceptance.	2	5	2M

#### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) Explain the role of education in achieving holistic development.	2	1	5M
		ii) Outline the method to fulfill basic human aspirations.	2	1	5M
	OR				
	b	i) List the basic components of holistic development.	2	1	5M
		ii) Explain the current scenario concerning happiness and prosperity in society.	2	1	5M
3	Unit-II				
	a	i) Explain the co-existence of the self and the body.	2	2	5M
		ii) How do the needs of the self differ from the needs of the body?	2	2	5M
	OR				
	b	i) Briefly explain the role of health in ensuring harmony in the human being.	2	2	5M
		ii) Discuss the key components of a programme for self-regulation?	2	2	5M
4	Unit-III				
	a	i) Explain the significance of 'trust' as a foundational value in relationships.	2	3	5M
		ii) Explain why harmony in the family is considered the basic unit of human interaction.	2	3	5M

OR				
b	i) Explain the importance of harmony in society for the well-being of individuals.	2	3	5M
	ii) Mention two examples of other feelings that contribute to harmonious relationships.	2	3	5M
Unit-IV				
a	i) Explain the concept of self-regulation in the four orders of nature.	2	4	5M
	ii) Explain the relationship between interconnectedness and coexistence.	2	4	5M
OR				
b	i) Explain the significance of coexistence in realizing existence	2	4	5M
	ii) How does nature achieve self-regulation without external intervention?	2	4	5M
Unit-V				
a	i) Explain the significance of humanistic education in shaping individual behavior.	2	5	5M
	ii) Discuss the main features of value-based management models.	2	5	5M
OR				
b	i) Outline any one strategy for transitioning toward a value-based profession.	1	5	5M
	ii) How does a humanistic constitution contribute to a universal human order?	2	5	5M

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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## II B.Tech I Semester Regular Examinations, December-2024

R23

Sub Code: R23EC2103

SIGNALS & SYSTEMS

Time: 3 hours

(ECE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Give one example each for energy signal and power signal.	3	1	2M
	b	State Sampling theorem.	2	1	2M
	c	Write the Dirichlet conditions.	3	2	2M
	d	Define and give example of orthogonal functions.	2	2	2M
	e	State and write the convolution property of the Fourier transform.	2	3	2M
	f	Define Hilbert transform with formula.	2	3	2M
	g	Define time reversal property of Z-transform.	2	4	2M
	h	Define time shifting property of Laplace transform.	2	4	2M
	i	Give an example of Linear time variant system.	3	5	2M
	j	Define system bandwidth.	2	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M	
2	Unit-I					
	a	i) Define and Give an example of each for periodic, aperiodic, even and odd signals.	3	1	5M	
		ii) Explain Sinc, Signum, and exponential functions with equations and figures.	4	1	5M	
	OR					
	b	i) Explain any one technique for the reconstruction of signals from its samples.	4	1	5M	
ii) Explain effect of under sampling with example.		3	1	5M		
3	Unit-II					
	a	i) Define and prove scaling and frequency shifting properties of Fourier series.	3	2	5M	
		ii) Derive the condition for orthogonality between two signals $x_1(t)$ and $x_2(t)$	4	2	5M	
	OR					
	b	i) Calculate Fourier series of $x(t) = 4 \sin 200\pi t + 5 \cos 300\pi t$	4	2	5M	
ii) Explain conversion of exponential Fourier series from Trigonometric Fourier series.		4	2	5M		
4	Unit-III					
	a	i) Calculate Fourier transform of $x(t) = 4t$ for $0 < t < 2$ and 0 otherwise.	3	3	5M	
		ii) State and prove linearity and time shifting property of Fourier transform.	4	3	5M	

		OR			
b	i) Derive Fourier transform from Fourier series.		3	5M	
	ii) Calculate Fourier transform of $x(t) = 5 \sin 100\pi t + 3 \cos 400\pi t$	4	3	5M	
		Unit-IV			
5	a	i) A signal has $X(s) = \frac{s-3}{(s-2)(s-4)}$ derive all possible x(t) for above one.	5	4 5M	
		ii) Calculate Z transform of $x(n) = u(n-1)$ . U is a step function.	4	4 5M	
			OR		
b		i) calculate the Laplace transform of $x(t) = u(-t-1)$ . U is a step function.	4	4 5M	
		ii) A signal has $X(Z) = \frac{Z-1}{(Z-4)(Z-5)}$ derive all possible x(n) for above one.	5	4 5M	
			Unit-V		
6	a	i) Define and give examples of causal, non causal, stable and unstable systems.	3	5 5M	
		ii) Define ideal low pass and band pass filter characteristics.	3	5 5M	
			OR		
	b		i) Explain impulse response and transfer function of a LTI system.	3	5 5M
		ii) Define and give examples of static, dynamic, linear and non-linear systems.	3	5 5M	

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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## II B.Tech I Semester Regular Examinations, December-2024

Sub Code: R23EC2104

**ELECTRONIC DEVICES & CIRCUITS**

Time: 3 hours

(ECE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Define Insulator, Semiconductor, and Conductor.	K1	1	2M
	b	Draw an energy band diagram of a PN diode.	K3	1	2M
	c	Compare the bridge rectifier with the half-wave rectifier.	K4	2	2M
	d	Write different applications of Varactor Diode.	K3	2	2M
	e	Why is the emitter region of a transistor more heavily doped than the base region?	K4	3	2M
	f	Why the width of the Collector region of a transistor is larger than the base and emitter region?	K3	3	2M
	g	Define the load line with its significance.	K2	4	2M
	h	Write down the various bias compensation techniques.	K1	4	2M
	i	Compare JFET and MOSFET.	K2	5	2M
	j	What is the inversion layer?	K1	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) How are the width of the space charge region and the barrier height affected when a PN junction is forward-biased and reverse-biased?	K4	1	5M
		ii) Derive diode current equation?	K3	1	5M
	OR				
	b	i) Sketch the ideal energy band diagram of a metal-semiconductor junction in which $\phi_m < \phi_s$ . Explain how it will work as an ohmic contact.	K4	1	5M
		ii) Analyze the Transition capacitance and diffusion Capacitance of the PN diode.	K3	1	5M
3	Unit-II				
	a	i) With circuit and necessary waveforms explain the operation of the Bridge Rectifier.	K4	2	5M
		ii) How a Zener diode works as a voltage regulator.	K3	2	5M
	OR				
	b	i) With the necessary diagram, explain the operation of the Full wave rectifier and derive the expression for the ripple factor.	K3	2	5M
ii) Write a short note on LED.		K4	2	5M	

4	Unit-III				
	a	i) Draw the circuit diagram of a common-emitter transistor amplifier and explain its operation.	K4	3	5M
		ii) Explain the conditions of the cut-off, saturation, and active modes in a transistor.	K3	3	5M
	OR				
b	i) Explain the input and output characteristics of common collector configuration.	K4	3	5M	
	ii) Derive the relation between $\alpha$ and $\beta$ of a transistor.	K3	3	5M	
5	Unit-IV				
	a	i) What are the different types of biasing methods? Explain with proper diagrams.	K4	4	5M
		ii) Determine $R_B$ and $R_C$ for a fixed-bias configuration, if $V_{CC} = 12V$ , $\beta = 100$ , $I_{CQ} = 2.0$ mA with $V_{CEQ} = 5$ V.	K3	4	5M
	OR				
b	i) Draw the transistor biasing circuit using fixed bias arrangement and explain its principle with suitable analysis.	K4	4	5M	
	ii) Prove that the bias current $I_{CQ}$ in a voltage divider configuration of the Bipolar Junction Transistor is independent of the change in current gain ( $\beta$ ) of the transistor.	K3	4	5M	
6	Unit-V				
	a	i) Draw a neat sketch to illustrate the structure of a P-channel Depletion MOSFET. Explain its operation.	K4	5	5M
		ii) Explain the construction and working of N-channel JFET.	K3	5	5M
	OR				
b	i) Describe how an inversion layer of charges can be formed in an MOS with the n-type substrate.	K3	5	5M	
	ii) Write a short note on UJT.	K4	5	5M	

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks



## II B.Tech I Semester Regular Examinations, December-2024

Sub Code: R23EC2105

SWITCHING THEORY & LOGIC DESIGN

Time: 3 hours

(ECE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Explain the ones and twos complement representation of a binary number.	2	1	2M
	b	Convert $(2468)_{10}$ to $( )_{16}$	1	1	2M
	c	Write the advantages and disadvantages of k-map.	2	2	2M
	d	State duality theorem.	3	2	2M
	e	Define half subtractor and full subtractor.	4	3	2M
	f	List out the applications of multiplexers.	5	3	2M
	g	Explain the operation of a SR flip-flop?	2	4	2M
	h	Draw the circuit diagram of a shift register and list its types	1	4	2M
	i	What is a PLD? What is the principal advantage of a PLD?	3	5	2M
	j	Draw the basic architecture of a PAL?	1	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) Convert the following to Decimal and then to octal (a) $(125F)_{16}$ (b) $(10111111)_2$ (c) $(392)_{10}$	2	1	10M
	OR				
	b	i) What is the Hamming code? How is the Hamming code word tested and corrected?	3	1	10M
3	Unit-II				
	a	i) State and prove the laws of Boolean algebra	1	2	5M
		ii) Simplify the following expression using necessary minimization technique. $F = \sum m(0,1,2,8,9,15,17,21,24,25,27,31)$ .	2	2	5M
	OR				
	b	i) Reduce the following expression to the simplest possible SOP forms. $F = \sum m(6,8,13,18,19,25,27,29,31) + d(2,3,11,15,17,24,28)$	5	2	5M
ii) Reduce using mapping the following expression and implement the real minimal expression in Universal logic. $F = \sum m(0, 2, 4, 6, 7, 8, 10, 12, 13, 15)$		2	2	5M	
4	Unit-III				
	a	i) What is an excess-3 adder circuit and draw its logic diagram? ii) Write a short note on i) Half adder. ii) Full adder.	4	3	5M
			4	3	5M

	OR				
	b	i) What is decoder? Construct 3*8 decoder using logic gates and truth tables	3	3	5M
		ii) Discuss the functional principle of 4-bit ripple carry adder. What is its major disadvantage?	3	3	5M
5	Unit-IV				
	a	i) Draw the circuit diagram of a positive edge triggered JK flip flop and explain its operation with the help of a truth table?	4	4	5M
		ii) Explain synchronous and ripple counters. Compare their merits and demerits.	1	4	5M
	OR				
	b	i) Draw the block diagram of universal shift register and explain its operation	3	4	5M
		ii) Draw and explain the logic diagram of Moore model	2	4	5M
6	Unit-V				
	a	i) Show how the PLA circuit can be programmed to implement the binary to gray conversion.	2	5	5M
		ii) Discuss how PROM, PLA and PAL technologies differ from each other	1	5	5M
	OR				
	b	i) Implement $f(A,B,C,D)=\Sigma(0,1,3,5,6,8,9,11,12,13)$ using PROM and explain its procedure.	4	5	5M
		ii) Implement $f(A,B,C,D)=\Sigma(0,1,4,5,6,9,10,12,13,15)$ using PLA and explain its procedure.	1	5	5M

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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