Hall Ticket Number :										

R-20

Code: 20A443T

II B.Tech. II Semester Regular & Supplementary Examinations July 2023

Electromagnetic Theory

(Electronics and Communication Engineering)

Max. Marks: 70 Time: 3 Hours

****

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. In Part-A, each question carries **Two marks.**
3. Answer **ALL** the questions in **Part-A** and **Part-B**

PART-A

(Compulsory question)

		CO	BL
1.	**Answer ALL the following short answer questions** (5 X 2 = 10M)		
a)	A point is located at P (-2, 4, -1). Express it in cylindrical coordinate system.	CO1	L1
b)	State Gauss's law.	CO2	L1
c)	Illustrate the expressions for Continuity equation and Relaxation time.	CO3	L4
d)	Compare magnetic scalar and vector potentials.	CO4	L5
e)	Discuss pointing vector.	CO5	L2

PART-B

Answer *five* questions by choosing one question from each unit (5 x 12 = 60 Marks)

		Marks	CO	BL
	UNIT–I			
2. a)	Evaluate the divergence and curl of the following vectors. i) $\mathbf{A} = 5z^2 \cos\emptyset\, \boldsymbol{a}_\rho + z\sin^2\emptyset\, \boldsymbol{a}_z$ at (5, π/2, 1) ii) $\mathbf{B} = r\boldsymbol{a}_r + r\cos 2\theta\, \boldsymbol{a}_\emptyset$ at (1, π/2, π/6)	8M	CO1	L5
b)	Find the gradient of the given scalars. i) $V = 4xz^2 + 3yz$. ii) $W = r^2 \cos\theta \cos\emptyset$.	4M	CO1	L3
	OR			
3. a)	Express $\mathbf{A} = xy^2z\,\mathbf{a}_x + x^2yz\,\mathbf{a}_y + xyz^2\,\mathbf{a}_z$ in cylindrical co-ordinates.	6M	CO1	L1
b)	Express the points P(2, 5π/6, 3), Q(2, 5π/6, π/2) in the rectangular co-ordinate system	6M	CO1	L1
	UNIT–II			
4. a)	State and explain Coulomb's law.	6M	CO2	L2
b)	Derive the expression for the energy stored in electrostatic fields.	6M	CO2	L6
	OR			
5. a)	Two-point charges -4μC and 5μC are located at (2, -1, 3) and (0, 4, -2) respectively. Find the potential at (1, 0, 1) assuming zero potential at infinity.	6M	CO2	L3

	b)	Explain any one of the applications of Gauss's law?	6M	CO2	L2

UNIT–III

6.	a)	The current density **J** = $\frac{100}{\rho^2}\boldsymbol{\alpha}_\rho$ A/m^2. Find the total current passing through surface defined by $\rho = 2, 0 < z < 1, 0 < \emptyset < 2\pi$.	6M	CO3	L3
	b)	Derive the expression for continuity of current equation.	6M	CO3	L6

OR

7.	a)	Determine the capacitance for unit length of coaxial conductor with outer radius 2.25cm and inner radius 0.75cm, if the dielectric with ε_r = 2.7.	6M	CO3	L6
	b)	Discuss isotropic, homogeneous materials? Also discuss dielectric constant?	6M	CO3	L2

UNIT–IV

8.	a)	Develop the relationship between magnetic vector potential and magnetic flux density?	6M	CO4	L6
	b)	Outline the Maxwell's equations in differential and integral forms with necessary statements for static EM fields.	6M	CO4	L4

OR

9.		Elaborate the forces due to magnetic fields?	12M	CO4	L2

UNIT–V

10.	a)	When a uniform plane wave is incident normally on an interface between two media, derive the expression for transmission coefficient.	6M	CO5	L6
	b)	Determine the phase velocity of propagation, attenuation constant, phase constant and intrinsic impedance for a forward travelling wave in a large block of copper at 1MHz (σ = 5.8 x 10^7, $\varepsilon_r = \mu_r$ = 1).	6M	CO5	L3

OR

11.		Derive an expression for characteristic impedance of a transmission line.	12M	CO5	L6

*** End ***

Hall Ticket Number :										

R-20

Code: 20A441T

II B.Tech. II Semester Regular & Supplementary Examinations July 2023

Linear IC Applications

(Electronics and Communication Engineering)

Max. Marks: 70 Time: 3 Hours

****

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. In Part-A, each question carries **Two marks.**
3. Answer **ALL** the questions in **Part-A** and **Part-B**

PART-A

(Compulsory question)

			CO	BL
1.	**Answer ALL the following short answer questions**	(5 X 2 = 10M)		
a)	What are the advantages of integrated circuits over discrete circuits?		CO1	L4
b)	Derive the voltage gain of inverting op-amp.		CO2	L3
c)	Discuss about virtual ground concept in op-amp.		CO3	L4
d)	Draw the pin diagram of 555 timer IC and name the pins.		CO4	L6
e)	Define the accuracy and resolution of the DACs.		CO5	L1

PART-B

Answer *five* questions by choosing one question from each unit (5 x 12 = 60 Marks)

			Marks	CO	BL
		UNIT–I			
2.	a)	List out the different types of integrated circuits and their package types.	6M	CO1	L6
	b)	An op-amp has a slew rate of 2V/μs. What is the maximum frequency of an output sinusoid of peak value 5V at which the distortion sets in due to the slew rate limitation?	6M	CO1	L3
		OR			
3.	a)	Draw the generalized block diagram for the operational amplifier. Explain each block in detail.	6M	CO1	L2
	b)	Explain the following terms of op-amp. (i) CMRR (ii) PSRR (iii) Output offset voltage	6M	CO1	L4
		UNIT–II			
4.	a)	Explain open loop and closed loop operations of an op-amp.	6M	CO2	L1
	b)	Describe the working of op-amp differentiator circuit. Derive the expression for output voltage.	6M	CO2	L5
		OR			

5.	a)	What is the output voltage of integrator when input voltage of 5V with 5ms is applied?	6M	CO2	L5
	b)	With a neat diagram explain about the voltage to current converter in details.	6M	CO2	L2

UNIT–III

6.	a)	Explain the operation of an astable multivibrator using op-amp and discuss about duty cycle of it.	6M	CO3	L5
	b)	Draw the circuit of triangular wave generator and explain its working.	6M	CO3	L2

OR

7.	a)	Explain the operation of Schmitt trigger (using op-amp).Generally for what purpose it is preferred?	6M	CO3	L3
	b)	Explain the principle of operation of a precision full wave rectifier with waveforms.	6M	CO3	L4

UNIT–IV

8.	a)	Explain the functions of each of the pins in 555 timer IC.	6M	CO4	L1
	b)	Explain the operation of Monostable multivibrator using 555 timer. Derive the expression for quasi stable state time period of the multivibrator.	6M	CO4	L5

OR

9.	a)	Draw the block diagram for PLL and explain in detail.	6M	CO4	L2
	b)	Explain the application of PLL as a frequency multiplier with a neat diagram.	6M	CO4	L6

UNIT–V

10.	a)	In detail explain the operation of binary weighted DAC and mention its limitations.	6M	CO5	L4
	b)	Why is an inverted R-2R ladder network DAC better than R-2R ladder network DAC?	6M	CO5	L4

OR

11.	a)	Which is the fastest ADC? Explain the operation and discuss its merits.	6M	CO5	L3
	b)	Explain in detail with a neat circuit diagram the operation of 3-bit parallel ADC.	6M	CO5	L4

*** End ***

Hall Ticket Number :										

R-20

Code: 20AC42T

II B.Tech. II Semester Regular & Supplementary Examinations July 2023

Numerical Methods and Random Variables

(Common to EEE and ECE)

Max. Marks: 70 Time: 3 Hours

****

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. In Part-A, each question carries **Two marks.**
3. Answer **ALL** the questions in **Part-A** and **Part-B**

PART-A

(Compulsory question)

1. **Answer ALL the following short answer questions** (5 X 2 = 10M) CO BL

a) Find the missing value in the following table using forward difference operator.

x	0	1	2	3	4
y	1	3	9	-	81

CO1 L1

b) Consider the differential equation $\frac{dy}{dx} = f(x,y), y(x_0) = y_0$. Explain Euler's method for finding the approximate solution *y(x).* CO2 L1

c) Find the mean and median of the data set. 15, 13, 9, 9, 7, 1, 11, 10, 13, 1, 13. CO3 L2

d) Write a short note on Discrete Probability distribution function. CO4 L1

e) Find the mean of the Poisson distribution. CO5 L2

PART-B

Answer *five* questions by choosing one question from each unit (5 x 12 = 60 Marks)

Marks CO BL

UNIT–I

2. a) Apply Regula Falsi method to find the real root of the equation $3x - \cos x - 1 = 0$. 6M CO1 L3

b) Apply Newton's Forward interpolation formula to find number of students who obtained marks between 40 and 45 from the following data.

Marks	30-40	40-50	50-60	60-70	70-80
Number of students	31	42	51	35	31

6M CO1 L4

OR

3. a) Apply Newton-Raphson's method to find the real root of the equation $xe^x = 2$ by taking suitable initial approximation. 6M CO1 L3

b) Apply Lagrange's interpolation formula to find f(x) from the data. Hence, find f(3.5).

x	0	2	3
f(x)	0	8	27

6M CO1 L4

UNIT–II

4. Apply Runge-Kutta method of order 4 to find the approximate value of y for x = 0.2, in step of *h=0.1* if $\frac{dy}{dx} = x + y^2, y = 1 \text{ when } x = 0.$ 12M CO2 L4

OR

5. a) From the following table, find the values of $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at x = 2.02.

x	1.96	1.98	2	2.02	2.04
f(x)	0.78	0.77	0.76	0.75	0.74

6M CO2 L4

b) A river is 60 feet wide. The depth d (in feet) of the river at a distance x from one bank is given by the following table.

Distance (x)	0	10	20	30	40	50	60
Depth (d)	0	3	7	10	12	8	4

Find approximately the area of the cross-section of the river $\int_0^{60} y\,dx$ using Simpson's 1/3rd rule. 6M CO2 L4

UNIT–III

6. a) Calculate Mean, Median from the following grouped data:

Class	2-4	4-6	6-8	8-10
Frequency(*f*)	3	4	2	1

6M CO3 L5

b) Find the coefficient of correlation between industrial production and export using following data.

Production(in crore tones)	55	56	58	59	60	60
Exports (in crore tones)	35	38	38	39	44	43

6M CO3 L5

OR

7. The following marks have been obtained by ten students in Physics (x) and Mathematics (y). Compute the rank correlation coefficient.

x	68	64	75	50	64	80	75	40	55	64
y	62	58	68	45	81	60	68	48	50	70

12M CO3 L5

UNIT–IV

8. An urn I contains 3 white and 4 red balls and an urn II contains 5 white and 6 red balls. One ball is drawn at random from one of the urns and is found to be white. Find the probability that it was drawn from urn I. 12M CO4 L3

OR

9. Define Continuous Probability distribution function. The frequency function of a continuous random variable is given by $f(x) = Cx(2-x)$ for $0 \le x \le 2$. Find the value of C, mean and variance of x. 12M CO4 L3

UNIT–V

10. Four coins were tossed 200 times. The number of tosses showing 0, 1, 2, 3 and 4 heads was found as under.

No. of Heads (x)	0	1	2	3	4
No. of Tosses (f)	15	35	90	40	20

Fit a Binomial distribution to above observed results and compare the theoretical frequencies with actual ones. 12M CO5 L6

OR

11. Let X be a continuous random variable, « is the mean and ± is the standard deviation of the normal distribution. In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution. 12M CO5 L6

*** End ***

Hall Ticket Number :										

R-20

Code: 20A444T

II B.Tech. II Semester Regular & Supplementary Examinations July 2023

Advanced Digital Design Concepts

(Electronics and Communication Engineering)

Max. Marks: 70 Time: 3 Hours

****

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. In Part-A, each question carries **Two marks.**
3. Answer **ALL** the questions in **Part-A** and **Part-B**

PART-A

(Compulsory question)

			CO	BL
1.	**Answer ALL the following short answer questions**	(5 X 2 = 10M)		
a)	What is the main advantage of CMOS logic compared to bipolar logic?		1	L1
b)	How are data types used in HDL?		2	L3
c)	Differentiate between concurrent and sequential signal assignment statements		3	L2
d)	Give an example of a three-state device and explain its function.		4	L3
e)	Differentiate between synchronous and asynchronous sequential circuits.		5	L2

PART-B

Answer *five* questions by choosing one question from each unit (5 x 12 = 60 Marks)

			Marks	CO	BL
		UNIT–I			
2.	a)	Design a CMOS transistor circuit for 2-input NAND gate and explain its operation	6M	1	L6
	b)	Describe the steady-state electrical behavior of CMOS logic circuits. Explain why CMOS circuits consume negligible power when in the steady state	6M	1	L2
		OR			
3.	a)	Design a CMOS logic circuit that can operate as NOR gate. Include the schematic diagram, truth table, and explain its operation.	6M	1	L6
	b)	Develop a comprehensive comparison of various logic families, including CMOS, Bipolar, TTL, and ECL.	6M	1	L4
		UNIT–II			
4.	a)	Describe the design flow for designing a digital system using HDL. Explain each sage in the design flow.	6M	2	L2
	b)	Create a structural design using HDL for a 4-bit adder circuit.	6M	2	L6
		OR			
5.	a)	Evaluate the advantages and disadvantages of using HDL for digital circuit design. Discuss any limitations or challenges faced in the design process.	6M	2	L5
	b)	Evaluate the role of functions and procedures in HDL.	6M	2	L5

UNIT–III

6.		Design a behavioral model of a simple digital system using HDL. Include entity declaration, architecture body, process statements, variable and signal assignment statements, wait statements, if statements, case statements, null statements, loop statements, and assertion statements.	12M	3	L6

OR

7.	a)	Evaluate the functionality and usage of the if statement and the case statement in behavioral design.	6M	3	L5
	b)	Analyze the role and significance of the delay models, namely the inertial delay model and the transport delay model, in behavioral design.	6M	3	L4

UNIT–IV

8.	a)	Design a 4X1 Multiplexer using VHDL	6M	4	L6
	b)	Design BCD to Exess-3 code converter using VHDL	6M	4	L6

OR

9.	a)	Design a full subtractor using VHDL.	6M	4	L6
	b)	Design 3:8 Decoder using VHDL	6M	4	L6

UNIT–V

10.	a)	Design JK-Flip Flop using SR-Flip Flop	8M	5	L6
	b)	Explain how VHDL is used to model and describe the behavior of counters in digital circuits.	4M	5	L2

OR

11.		Analyze the potential impediments to synchronous design.	12M	5	L4

*** End ***

Hall Ticket Number :										

R-20

Code: 20A442T

II B.Tech. II Semester Regular & Supplementary Examinations July 2023

Communication Systems

(Electronics and Communication Engineering)

Max. Marks: 70 Time: 3 Hours

****

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. In Part-A, each question carries **Two marks.**
3. Answer **ALL** the questions in **Part-A** and **Part-B**

PART-A

(Compulsory question)

		CO	BL
1.	**Answer ALL the following short answer questions** (5 X 2 = 10M)		
a)	Define modulation index of AM.	CO1	L1
b)	What is frequency deviation?	CO2	L2
c)	Define Nyquist rate.	CO3	L1
d)	Compare uniform and non-uniform quantization.	CO4	L4
e)	Write the expression for probability of error in BPSK system.	CO5	L3

PART-B

Answer *five* questions by choosing one question from each unit (5 x 12 = 60 Marks)

		Marks	CO	BL
	UNIT–I			
2. a)	With a neat schematic diagram, explain basic communication system.	6M	CO1	L2
b)	What is the principle involved in Amplitude Modulation? Derive the expression for AM wave and draw its spectrum.	6M	CO1	L2
	OR			
3. a)	Sketch the circuit diagram of balanced modulator and explain how DSB-SC waveform is generated.	6M	CO1	L3
b)	A modulating signal 20 sin (2 $\times 10^3$t) is used to modulate a carrier signal of 40 sin (2 $\times 10^4$t). Determine the modulation index, bandwidth of the modulated wave, frequency of side band components and their amplitudes.	6M	CO1	L5
	UNIT–II			
4. a)	Explain the indirect method of generation of FM signal using relevant diagrams.	6M	CO2	L2
b)	Construct a balanced frequency discriminator to demodulate a FM signal and explain.	6M	CO2	L6
	OR			

5.	a)	Compare AM and FM.	6M	CO2	L2
	b)	The frequency deviation in an FM broadcast system is 75KHz. If the modulating signal is a single-tone sinusoidal of 8KHz, determine the bandwidth of FM signal. What will be the bandwidth when modulating signal amplitude is doubled?	6M	CO2	L5

UNIT–III

6.	a)	Illustrate PAM, PWM and PPM waveforms with reference to same clock pulse with necessary diagrams.	6M	CO3	L3
	b)	Explain the generation of PWM signals.	6M	CO3	L2

OR

7.	a)	With the aid of block diagram, briefly explain Time division multiplexing.	6M	CO3	L2
	b)	Analyze how Aliasing affects signal transmission and how it is eliminated.	6M	CO3	L4

UNIT–IV

8.	a)	Draw the block diagram of a PCM system and explain each block in detail.	6M	CO4	L2
	b)	Compare Delta modulation and PCM techniques in terms of bandwidth and signal to noise ratio.	6M	CO4	L4

OR

9.	a)	Illustrate the working of adaptive delta modulation system with a neat block diagram.	6M	CO4	L2
	b)	A PCM system uses a uniform quantizer followed by a 7 bit encoder. The system bit rate is 50Mbits/sec. Calculate sampling frequency and transmission bandwidth.	6M	CO4	L5

UNIT–V

10.	a)	Describe the generation and detection of Amplitude shift Keying signal.	6M	CO5	L2
	b)	Draw and explain the operation of transmitter and receiver of a coherent FSK.	6M	CO5	L2

OR

11.	a)	Compare ASK, FSK and PSK with respect to bandwidth requirements, power requirements, immunity to channel impairments and equipment complexity.	6M	CO5	L4
	b)	Determine the DPSK transmitter output b(t) for bit stream d(t) = 001010011010. Derive the expression for bandwidth requirement of DPSK signal.	6M	CO5	L6

*** End ***