BCE (3)

Reg.No.:								

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 7002

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – April / May 2023
Eighth Semester
Electronics and Communication Engineering
U19ECE42 – SATELLITE COMMUNICATION
(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	What are the conditions required for an orbit to be Geostationary?	2	K2	CO1
2.	Define Sun Transit outage.	2	K1	CO1
3.	A satellite downlink at 12 GHz operates with a transmit power of 6 W and an antenna gain of 48.2dB. Calculate the EIRP in dBW.	2	K3	CO2
4.	What is meant by input back off of a transponder?	2	K2	CO2
5.	List the limitations of FDMA-satellite access.	2	K2	CO3
6.	Distinguish between pre-assigned and demand-assigned TDMA satellite access.	2	K3	CO3
7.	Define earth segment with example.	2	K1	CO4
8.	Define CATV and MATV.	2	K1	CO4
9.	Define the orbital spacing of satellites.	2	K1	CO5
10.	List the major short comings of present day VAST system?	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11. a)	i.	State the Kepler's laws and discuss its importance in satellite communications.	6	K2	CO1
	ii.	Explain satellite launching and the types of launch vehicles.	7	K2	
		(OR)			
b)	i.	Discuss the effect of non-spherical earth atmospheric drag on the satellite orbit.	8	K2	CO1
	ii.	Explain how station keeping helps to keep a geostationary satellite on its correct orbital slot.	5	K2	

12.	a)	i.	Explain the different types of transmission losses in satellite communication with necessary expressions. Write the link power budget equation.	8	K2	CO2
		ii.	For a satellite circuit the individual link carrier-to-noise spectral density ratios are:uplink 100 dB / Hz; Downlink: 87 dB / Hz. Calculate the combined C/No ratio.	5	K3	
			(OR)			
	b)	i.	Discuss the different types of noise and their significance in the design of a satellite link with necessary expression.	8	K2	CO2
		ii.	An antenna has a noise temperature of 35 K and is matched into a receiver which has a noise temperature of 100 K. Calculate the noise power for a band of 36 MHz.	5	K3	
13.	a)	i.	Explain the on-board signal processing for TDMA operation.	6	K2	CO3
		ii.	Explain the acquisition and tracking mechanism for CDMA techniques.	7	K2	
			(OR)			
	b)	i.	Compare pre-assigned FDMA and demand-assigned FDMA.	5	K2	CO3
		ii.	Explain the following with respect to TDMA: Reference burst, preamble and postamble and carrier recovery.	8	K2	
14.	a)	i.	Explain in detail about TVRO systems.	7	K2	CO4
		ii.	Describe how asymmetric channels may be incorporated in internet connections via satellites.	6	K2	
			(OR)			
	b)	i.	Give a brief account of split TCP connections.	5	K2	CO4
		ii.	Describe the mechanisms of enhancing TCP over satellite channels.	8	K2	
15.	a)	i.	Explain the VSAT & polar orbiting satellite in detail.	7	K2	CO5
		ii.	Discuss the satellite mobile services.	6	K2	
			(OR)			
	b)	Write short note on:				
		i.	Bit rate for digital television.	6	K2	CO5
		ii.	MPEG compression standards	7	K2	

PART – C

(1 x 15 = 15Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	Explain with the neat diagram the indoor and outdoor units of DBS home receiver.	7	K2	CO5
		ii.	With a neat sketch, explain Telemetry, Tracking and command subsystem	8	K2	CO2
			(OR)			
	b)	i.	With neat sketch, explain Global Positioning Satellite System.	8	K2	CO5
		ii.	Discuss in detail various units of a transponder.	7	K2	CO2

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Question Paper Code: 7003

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS –April / May 2023
Eighth Semester
Electronics and Communication Engineering
U19ECE16 - WIRELESS SENSOR NETWORKS
(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	What is the significance of Bandwidth-delay product in WSNs.	2	K1	CO1
2.	Define the three-performance metrics of WSNs: (A) Coverage (B) Energy Consumption (C) Worst Case Delay.	2	K1	CO1
3.	Define MAC protocol for WSNs.	2	K1	CO2
4.	State the operation of LEACH protocol.	2	K1	CO2
5.	Define black hole attack in WSNs.	2	K1	CO3
6.	How to overcome the flooding attack in WSNs?	2	K1	CO3
7.	With an example mention the need of time synchronization in WSNs.	2	K1	CO4
8.	Define clustering in WSNs. What are the factors considered for choosing a cluster head in WSNs?	2	K1	CO4
9.	Define Berkeley Motes.	2	K1	CO5
10.	How TOSSIM works as an emulator of actual hardware?	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Explain the various factors considered while designing the transceiver of WSNs.	13	K2	CO1

(OR)

	b)	i.	List and discuss the various hardware components required for WSNs.	7	K2	CO1
		ii.	Discuss various components that affect the energy consumption of sensor nodes?	6	K2	CO1
12.	a)		Explain the operation of Power Aware Multi-Access (PAMAS) contention-based MAC protocol. Explain how this protocol ensures energy efficiency.	13	K2	CO2
			(OR)			
	b)		Explain the challenges and issues in transport layer protocols used in WSNs.	13	K2	CO2
13.	a)	i.	Explain the issues and challenges in security provisioning in WSNs?	9	K2	CO3
		ii.	List any two WSN applications where security is critical.	4	K2	CO3
			(OR)			
	b)		Draw the TCP/IP Protocol stack. List the layer wise attacks in wireless sensor networks	13	K2	CO3
14.	a)		Explain the differences between mobile ad-hoc and sensor networks.	13	K1	CO4
			(OR)			
	b)		Explain topology control and Characteristics requirements in WSNs.	13	K2	CO4
15.	a)		Write short notes on the following: i. TinyOS ii. nesC iii. CONTIKIOS	13	K1	CO5
			(OR)			
	b)		Explain Programming beyond individual nodes and state centric programming.	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Explain how WSN is used for water quality monitoring of an aquaculture farm. Discuss the various hardware components required.	15	K3	CO3
		(OR)			
	b)	Explain how WSN is used for soil health monitoring of an agriculture farm. Discuss the various hardware components required.	15	K3	CO3

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Question Paper Code: 7004

B.E. / B.Tech DEGREE END-SEMESTER EXAMINATIONS – April / May 2023
Eighth Semester
Electronics and Communication Engineering
U19ECE29 - INTRODUCTION TO MEMS
(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	What is the concept of MEMS gyroscope?	2	K1	CO1
2.	Enumerate the significant features of LIGS process.	2	K2	CO1
3.	Mention the types of SMA. List its potential applications.	2	K1	CO2
4.	How does MEMS temperature sensor work?	2	K1	CO2
5.	What are the key elements of MOEMS? Why MOEMS is also called as optical MEMS?	2	K1	CO3
6.	Why highly reflective aluminum micro mirrors are used in DMD?	2	K2	CO3
7.	What is the difference between magneto diodes and magneto transistors?	2	K2	CO4
8.	What are the different types of magnetic field sensor?	2	K1	CO4
9.	Enumerate the significant features, advantages and potential applications of RF MEMS switches.	2	K2	CO5
10.	RF MEMS tunable capacitors and switches are ideal for reconfigurable circuits and systems. Mention the reason for it.	2	K3	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11. a)	i.	Discuss on direct and indirect effect of piezoelectricity. Also explain the concept of cantilever piezoelectric actuator model with neat diagram.	6	K2	CO1
	ii.	What is the concept and significance of Photolithography? How does it differ from conventional lithographic technique. Explain.	7	K2	

(OR)

b)	i.	A thermal bimorph is initially flat where metal 1 is on the top and metal 2 is at the bottom. If its coefficient of thermal expansion (α) is such that $\alpha 1 < \alpha 2$, then in what direction should it bend? Justify.	6	K4	CO1
	ii.	Compare and contrast the MEMS device capabilities within bulk micromachining, surface micromachining and LIGA fabrication technologies.	7	K3	
12. a)	i.	Explain the working of any one thermal actuator with neat diagram. Demonstrate the strategies of lateral thermal actuators.	6	K2	CO2
	ii.	Draw a schematic of thermally activated MEMS relay and explain its working principle.	7	K2	

(OR)

b)	i.	Explain in detail the different types of SMA with diagrams. Comment on their advantages and real time applications.	6	K2	CO2
	ii.	Write a technical note on data storage cantilever.	7	K2	
13. a)		Discuss in detail the need for actuators and the types of actuators used for active optical MEMS applications with neat diagrams.	13	K2	CO3

(OR)

b)		Explain the working principle of digital micro mirror device (DMD) with neat diagram. How does it used in biomedical instruments? Explain with an example.	13	K2	CO3
14. a)	i.	State and explain the magnetic materials and their properties for MEMS.	6	K2	CO4
	ii.	How does a MEMS magnetometer work? Explain with a diagram.	7	K2	

(OR)

b)	i.	Explain the salient features of 3 axis magnetic field sensor.	6	K2	CO4
	ii.	How to characterize the magento strictive TMR pressure sensors by MOKE? Explain with an example.	7	K3	
15. a)	i.	What is the concept of Opto Electro Wetting (OEW)? Explain. Enumerate the applications of photo electro wetting.	6	K2	CO5
	ii.	Enumerate and explain the differences between MEMS and RF MEMS.	7	K2	

(OR)

b)		Give an account on	13	K2	CO5
	i.	Applications of MEMS switches.			
	ii.	Phase shifters			
	iii.	Dielectro Phoresis (DEP)			

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	i. Explain the working principle of a micro actuator using shape memory alloys with a diagram.	8	K2	CO2
		ii. Discuss the sensors used in an automobile engine and power trains.	7	K2	
		(OR)			
	b)	i. Explain how micro mirror technology is applied in scanning electron micrograph with a diagram.	8	K2	CO3
		ii. Distinguish MOEMS from MEMS	7	K2	

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Question Paper Code: 7001

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – April / May 2023
Eighth Semester
Electronics and Communication Engineering
U19ECE41 – ASIC DESIGN
(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Sketch the ASIC design flow and identify the front-end and back-end components in it.	2	K2	CO1
2.	Realize a 2x1 multiplexer using CMOS logic.	2	K3	CO1
3.	Implement a 8x1 multiplexer using an Actel FPGA.	2	K3	CO2
4.	Draw the schematic of a crystal oscillator used in Xilinx FPGA.	2	K1	CO2
5.	Mention any four synthesizable constructs in Verilog.	2	K1	CO3
6.	What will be the synthesizer output for the following two sets of verilog codes.	2	K3	CO3

i.
```
module reg_test (clk, in1, out1);
input clk, in1;
output out1;
reg reg1, reg2, reg3, out1;
always @ ( posedge clk ) begin
reg1 <= in1;
reg2 <= reg1;
reg3 <= reg2;
out1 <= reg3;
end
endmodule
```

ii.

```
module reg_test (clk, in1, out1);
input clk, in1;
output out1;
reg reg1, reg2, reg3, out1;
always @ ( in1 ) begin
reg1 = in1;
reg2 = reg1;
reg3 = reg2;
out1 = reg3;
end
endmodule.
```

7.	Assume we have five rigid blocks with dimensions as indicated in Table 1. Assume further that all blocks have free orientations. Obtain any two feasible floorplans.	2	K3	CO4

Module	Width	Height
1	1	1
2	1	1
3	2	1
4	1	2
5	1	3

Table 1

8.	List any four commercially available industry standard tools for physical design.	2	K1	CO4
9.	Characterize the parameters required to define local routing problems.	2	K1	CO5
10.	Identify any two reasons for minimizing the number of vias in a layout.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Discuss about the logical effort of a gate and mention its properties. Obtain the logical effort for a 3-input majority gate and calculate its parasitic delay.	13	K2	CO1
		(OR)			
	b)	With suitable diagrams, describe the working principle of various programming technologies used in programmable ASICs.	13	K1	CO1
12.	a)	With a neat sketch explain the architecture of Actel FPGA logic cells and Input-output blocks.	13	K1	CO2
		(OR)			

	b)	Implement a 4-bit ripple carry adder using built-in carry logic and show the logic mapping and interconnections of the design in the architecture.	13	K2	CO2
13.	a)	Develop verilog code for a sequence detector that detects 11011 sequence with 2-bit overlap in mealy model.	13	K3	CO3
		(OR)			
	b)	Design a 4-bit adder that should have a computational complexity of O(1) and implement it by using the gate level model in verilog.	13	K3	CO3
14.	a)	The circuit given in Fig. 1 is to be partitioned into two subcircuits. Apply Kernighan-Lin heuristic to break the circuit into two equal size partitions, so as to minimize the number of interconnections between partitions. Assume that all gates are of the same size.	13	K3	CO4

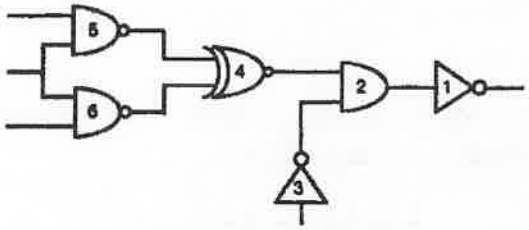

Fig. 1

(OR)

	b)	Compare and contrast the features of constructive and iterative placement algorithms with suitable examples.	13	K2	CO4
15.	a)	Given the following instance of the channel routing problem: Top = [2,1,5,1,2,3,6] Bot = [5,3,6,4,0,2,4] i. Determine the maximal sets and find a lower bound on the channel width. ii. Draw the horizontal constraint graph and vertical constraint graph. iii. Apply the constraint left edge algorithm to route the channel.	13	K3	CO5
		(OR)			
	b)	Clock routing is one of the factors which determines the throughput of any chip. In advanced VLSI systems, clock skew caused by interconnection delay, if not controlled, can lead to significant performance degradation. Elaborate Geometric Matching based Algorithm and Weighted Center Algorithm for clock routing with necessary diagrams.	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Develop a verilog model of a speed warning device. It receives, on two lines, an indication of the speed limit on the highway. There are three possible values: 45, 55, or 65 KMPH. It receives from the automobile, on two other lines, an indication of the speed of the vehicle. There are four possible values: under 45, between 46 and 55, between 56 and 65, and over 65 KMPH. It produces two outputs. The first, f, indicates whether the car is going above the speed limit. The second, g, indicates that the car is driving at a "dangerous speed" – defined as either over 65 KMPH or more than 10 KMPH above the speed limit.	15	K3	CO3
		(OR)			
	b)	For the problem shown in Fig. 2, apply robust channel routing algorithm and obtain an optimal solution.	15	K3	CO5

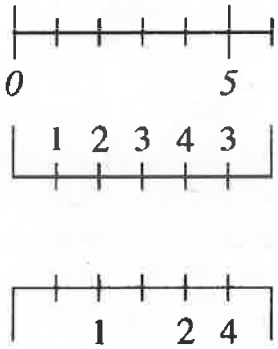

Fig. 2

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Question Paper Code: 7005

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023

Sixth Semester

Electronics and Communication Engineering

U19EC625 – VLSI Design

(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Write the differences between full and semicustom ASIC design?	2	K1	CO1
2.	Let the threshold voltage, V_{gs}, V_{ds}, and β of an nMOSFET are 0.5v, 4v and 2×10^{-4}F/Vs respectively. Find the drain current?	2	K3	CO1
3.	Find the normalized gate delay (with respect to the time constant τ) of the gate G3 as shown in Figure 1?	2	K3	CO2

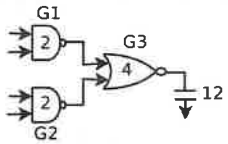

Figure 1

4.	Let the supply voltage, total capacitance, clock frequency, activity factor, subthreshold leakage current, and gate leakage current of the CMOS inverter are 5v, 5×10^{-14}F, 100MHz, 0.5, 6μA, and 4μA respectively. The total power of the design is 122.5μW. Find the junction leakage current of the inverter?	2	K3	CO2
5.	How clock gating is used to reduce the dynamic power.	2	K1	CO3
6.	Draw the CMOS circuit diagram of D Flip-flop.	2	K1	CO3
7.	Let the line u be the output of combinational logic C1. It should be the input of combinational logic C2. Design a DFT circuit only with NOR gates to make the line u to be controllable?	2	K2	CO4

8.	Write the differences between built in self test and scan chain based test?	2	K1	CO4

9.	Find B of a Verilog code as follows:
	wire [3 : 0] A;
	wire B;
	assign A = 40 b1001;
	assign B =~&A;
		2	K2	CO5

10.	The input (in) of the NOT gate in Verilog is given at $time = 30. Let the Verilog code for the NOT gate is as follows: assign #20 out =~ in. The output (out) of the NOT gate is obtained at $time= — ?	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Explain the operation of nMOSFET with neat sketch of the transistor and I-V characteristics.	7	K2	CO1
		ii.	Discuss body effect with necessary diagram	6	K2	CO1
			(OR)			
	b)	i.	Explain the various phases of the back end process in ASIC design.	7	K2	CO1
		ii.	Explain velocity saturation in the short channel nMOSFET.	6	K2	CO2
12.	a)	i.	Find the worst case fall delay of the 4-input CMOS NAND gate using RC delay model.	7	K3	CO2
		ii.	Find the logic efforts of a, b, c, and d of CMOS circuit to perform ((a+b)(c+d))'.	6	K3	CO2
			(OR)			
	b)	i.	Find the worst case rise delay of the 4-input CMOS NAND gate using RC delay model?	7	K3	CO2
		ii.	Find the normalized path delay of the circuit as shown in Figure 2.	6	K3	CO2

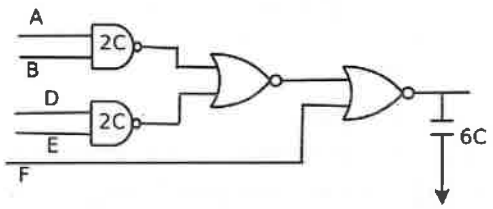

Figure 2

13.	a)	i.	Explain power gating in CMOS circuits with necessary diagram	K2	7	CO3
		ii.	Explain hold time in digital circuits with necessary diagram and how the hold violation can be avoided.	K2	6	CO3
			(OR)			
	b)	i.	Explain dual V_{th} partitioning to reduce the power in CMOS circuits and how voltage domain crossing in the CMOS circuits can be avoided by using a level shifter. Use necessary diagrams.	K2	7	CO3

		ii.	Explain setup time in digital circuits with necessary diagram and how the setup violation can be avoided.	K2	6	CO1
14.	a)	i.	Draw and explain the 5-bit maximal length type 1 and type 2 LFSRs with characteristic polynomial $x^5 + x^2 + 1$.	K2	7	CO4
		ii.	Explain BIST with necessary diagram.	K2	6	CO4
			(OR)			
	b)	i.	Explain the architecture IEEE 1149.1 wrapper used in boundary scan testing.	K2	7	CO4
		ii.	How the test data is travelled between the chips on the PCB using IEEE 1149.1 boundary scan technique? Use necessary diagrams.	K2	6	CO4
15.	a)	i.	Write Verilog code for 3-bit ripple up counter using T Flip-flop.	K3	7	CO5
		ii.	Write Verilog code for 3-to-8 decoder using switch case procedural statements.	K3	6	CO5
			(OR)			
	b)	i.	Write Verilog code for 3-bit ripple down counter using T Flip-flop.	K3	7	CO5
		ii.	Write Verilog code for 8-to-3 priority encoder using switch case procedural statements.	K3	6	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	Design a CMOS circuit for the Boolean expression y=ab+cd+ef. Here, the inputs are a, b, c, d, e, and f. The output of the circuit is y. Write the Verilog code to perform this Boolean operation using gate level modeling.	7	K4	CO5
		ii.	Design 4-bit carry save array multiplier to perform S=AB+F. Here, the 4-bit inputs are A, B, and S. The 8-bit output is S. The constraint is that the design should have only three stages of carry save addition.Write the Verilog code to perform this this operation in structural modelling using three stages of carry save addition.	8	K6	CO5
			(OR)			
	b)	i.	Design CMOS circuit for the Boolean expression y=abc+def. Here, the inputs are a, b, c, d, e, and f. The output of the circuit is y. Write the Verilog code to perform this Boolean operation using gate level modeling.	7	K6	CO5
		ii.	Design 5-bit Wallace tree multiplier to perform $F^i=A^iB^i+F^{i-1}$. Here, the 5-bit inputs at i^{th} clock cycle are A^i and B^i. The 10-bit output at $i^{th}$and $(i-1)^{th}$clock cycles are F^i and F^{i-1} respectively. The constraint is that the design should have only three stages of carry save addition.Write the Verilog code to perform this this operation in structural modelling using three stages of carry save addition.	8	K6	CO5

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Question Paper Code: 7008

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023

Sixth Semester

Electronics and Communication Engineering

U19EC627 – ANTENNA AND WAVE PROPAGATION

(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Find directivity from the radiation pattern.	02	K3	CO1
2.	Write shorts notes on reciprocity principle.	02	K2	CO1
3.	Define retarded vector potential.	02	K1	CO2
4.	Give an illustration for the application of pattern multiplication principle.	02	K2	CO2
5.	What is the meaning of travelling wave antenna?	02	K2	CO3
6.	Write the uses of Spectrum Analyzer.	02	K2	CO3
7.	Write the application of Babinet's principle.	02	K2	CO4
8.	List any two applications of dielectric lens antennas.	02	K2	CO4
9.	When does duct propagation happen?	02	K3	CO5
10.	Suggest any two methods to overcome fading.	02	K2	CO5

PART – B

(5 x 13 = 65 Marks)

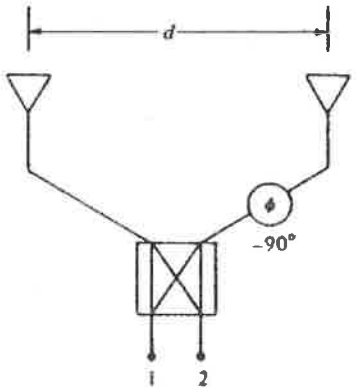
Q.No.		Questions	Marks	KL	CO
11. a)	i.	Outline any four antenna parameters with related diagram and expression.	8	K2	CO1
	ii.	Explain in detail the various types of polarization.	5	K2	CO1

(OR)

	b)	i.	Derive Friis Transmission formula and explain.	8	K2	CO1
		ii.	Explain effective area and effective length of an antenna with suitable examples.	5	K2	CO1
12.	a)		Derive the field expressions of half-wave dipole antenna and deduce the expressions for radiation resistance, maximum effective aperture and directivity.	13	K3	CO2
			(OR)			
	b)		Derive the array factor of N-element linear array and deduce the expressions for maxima, side-lobes, nulls, HP points and first side lobe level.	13	K3	CO2
13.	a)	i.	Discuss about the radiating mechanism of Yagi-Uda antenna.	8	K2	CO3
		ii.	Mention the various methods to measure the gain of antenna and explain.	5	K2	CO3
			(OR)			
	b)	i.	Illustrate Log periodic antenna structure and mention its advantages.	8	K2	CO3
		ii.	Highlight the significance of network analyzer.	5	K2	
14.	a)		Explain how radiation from a rectangular aperture is treated as an array of Huygen's sources.	13	K2	CO4
			(OR)			
	b)		Discuss in detail about parabolic reflector antenna and its feed systems.	13	K2	CO4
15.	a)	i.	Explain the various structures and properties of atmosphere.	8	K2	CO5
		ii.	Find the maximum range of tropospheric transmission for which the height of the transmitting antenna is 100 ft and that of the receiving antenna is 50 ft.	2	K3	CO5
		iii.	A sky-wave is incident on D-layer at an angle of 35°. Find the angle of refraction if the frequency of the transmitted wave is 50 MHz.	3		
			(OR)			
	b)	i.	Explain sky wave propagation.	8	K2	CO5
		ii.	When the maximum electron density of the ionospheric layer corresponds to refractive index of 0.92 at the frequency of 10 MHz, find the range if the frequency is MUF itself. The height of the ray reflection point on the ionospheric layer is 400 Km. Assume flat earth and negligible effect of earth's magnetic field.	5	K3	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16. a)	i.	Two spacecraft are separated by 100000 Km. Each has an antenna with D = 1000 operating at 2.5 GHz. If craft A's receiver requires 20 dB over 1 pW, what transmitter power is required on craft B to achieve this signal level?	7	K4	CO1
	ii.	Consider the two-element array shown in Fig. This array is fed through a 90° phase-lag hybrid junction, and a -90° phase shifter is incorporated in one feed line. The element spacing $d = 3\lambda_o/4$. Find the directions of the beams that are formed by exciting ports 1 and 2. 	8	K4	CO2
		(OR)			
b)	i.	What is the maximum power received at a distance of 0.5 km over a free-space 1 GHz circuit consisting of a transmitting antenna with a 25 dB gain and a receiving antenna with a 20 dB gain? The gain is with respect to a lossless isotropic source. The transmitting antenna input is 150 W.	7	K4	CO1
	ii.	Three horn antennas, A, B, and C are measured in pairs at 12 GHz. The separation of antennas is 8 m. The transmitted power is +3 dBm. The received powers are -31 dBm, 36 dBm, and -28 dBm for antennas pairs AB, AC and BC respectively. Find the gain of the antennas.	8	K4	CO3

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 7006

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023
Sixth Semester
Electronics and Communication Engineering
U19EC626 – COMPUTER NETWORKS
(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 – Evaluating
	K2 – Understanding	K4 – Analyzing	K6 – Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define circuit switching and packet switching.	2	K1	CO1
2.	State various types of transmission medias in computer networks.	2	K1	CO1
3.	What are the responsibilities of Data Link Layer?	2	K2	CO2
4.	The message 11001001 is to be transmitted using the CRC polynomial (X^3+1) to protect it from errors. Find out the message that should be transmitted.	2	K3	CO2
5.	What is the difference between IPv4 and IPv6?	2	K2	CO3
6.	What is a routing table in the context of the network layer?	2	K1	CO3
7.	What is flow control in the transport layer?	2	K1	CO4
8.	What is congestion control in the transport layer?	2	K2	CO4
9.	What are the common protocols used in the presentation layer?	2	K1	CO5
10.	What is a Firewall? List any two advantages of using Firewall.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Define OSI Model. Explain in detail its functions, protocols, and services of each layer.	13	K2	CO1
		(OR)			
	b)	Define computer networks. Discuss various types of network topologies in computer network. Also discuss various advantages and disadvantages of each topology.	13	K2	CO1

12.	a)	i.	A network has a data transmission bandwidth of 20×10^6 bits per second. It uses CSMA/CD in the MAC layer. The maximum signal propagation time from one node to another node is 40 microseconds. What is the minimum size of the frame (in bytes) in the network?	5	K3	CO2
		ii.	A 7-bit hamming code is received as 1011011. Assume even parity and state whether the received code is correct or wrong, if wrong locate the bit in error.	8	K3	CO2
			(OR)			
	b)		Explain the following error control mechanisms in brief			
		i.	Stop & Wait ARQ	6	K2	CO2
		ii.	Sliding Window ARQ	7		
13.	a)		Define routing. Explain the distance vector routing and link state routing in detail.	13	K2	CO3
			(OR)			
	b)	i.	Define IP addressing.	2	K2	CO3
		ii.	Explain classful addressing and classless addressing in detail.	11		
14.	a)		Explain the following.			
		i.	TCP connection establishment phase	6	K2	CO4
		ii.	TCP data transmission phase in detail	7	K2	CO4
			(OR)			
	b)		Explain User Datagram Protocol (UDP) protocol in detail.	13	K2	CO4
15.	a)		Explain			
		i.	File transfer protocol	6	K2	CO5
		ii.	Simple mail transfer protocol working in detail.	7		
			(OR)			
	b)		Explain socket programming with TCP in detail?	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	What is the role of flow control in the Data Link Layer and how is it implemented?	5	K2	
		ii.	Describe the process of framing and its importance in the Data Link Layer.	5	K2	CO2
		iii.	What is the difference between error detection and error correction in the Data Link Layer?	5	K2	
			(OR)			
	b)	i.	Explain the process of collision detection in CSMA/CD and how it handles collisions.	5	K2	
		ii.	Explain how the Request-to-Send/Clear-to-Send (RTS/CTS) mechanism is used in CSMA/CA to avoid collisions.	5	K2	CO2
		iii.	Compare and contrast the advantages and disadvantages of CSMA/CD and CSMA/CA in terms of network performance, efficiency and reliability.	5	K2	

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
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Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 8010

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023
Sixth Semester
Electronics and Communication Engineering
U19EEOE3 – ENERGY AUDITING
(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

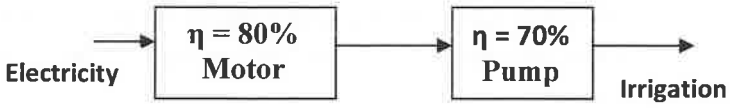
Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Name any five designated consumers notified under the Energy Conservation Act.	2	K1	CO1
2.	List the energy audit instruments for electrical and non-electrical parameter measurements.	2	K1	CO3
3.	In view of energy efficiency, suggest the rating in kW / HP, if a single phase induction motor is drawing 7.5 A at 230 V with the operating power factor 0.90.	2	K5	CO4
4.	Compare a conventional induction motor with energy efficient motor.	2	K2	CO4
5.	Write the advantages and disadvantages of an incandescent, fluorescent and CFL lamps for domestic applications.	2	K3	CO4
6.	Specify the use of diffusers in LED lamps.	2	K4	CO4
7.	Examine the reason for the COP of VAR system below VCR system.	2	K3	CO4
8.	Summarise the advantages of a central air conditioning system	2	K2	CO4
9.	Enumerate the classification of furnaces.	2	K1	CO4
10.	Find the cascade efficiency of a system following process.	2	K5	CO2



PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	i. Define the energy audit as per the energy conservation Act 2001 and recall the salient features of the energy conservation act–2003.	7	K1	CO2
		ii. Give a typical energy audit reporting format.	6	K1	CO3
		(OR)			
	b)	Distinguish between 'preliminary energy audit' and 'detailed energy audit'. Illustrate the steps involved in detailed energy audit.	13	K2	CO3
12.	a)	i. Describe various techniques for determining motor loading and identify the motor loading range for maximum efficiency.	7	K2	CO4
		ii. Illustrate the concept of conservation of energy using variable frequency drives in induction motors.	6	K2	CO4
		(OR)			
	b)	i. Write the importance of motor star rating and labelling provided by BEE	3	K2	CO2
		ii. Elaborately discuss the motor efficiency including losses.	10	K3	CO2
13.	a)	During energy audit, it is recommended to replace 100 numbers of fused 60 W pure resistive incandesant light bulbs (ILB) by same number of 12 W CFL instead of new ILB. Calculate the following for 4000 working hours per year. i. The annual reduction in electricity cost if Rs. 4.00 per kWh is the energy cost and Rs. 250 per kVA per month as fixed demand charge ii. The simple payback period if the ILB costs Rs. 10 and CFL costs Rs. 100.	13	K5	CO4
		(OR)			
	b)	Explain all the possible lighting energy conservation measures.	13	K3	CO4
14.	a)	i. Summaries the electrical energy conservation measures for an air conditioning system.	7	K2	CO4
		ii. Explain the necessity of insulation in a HVAC system and discuss its advantages.	6	K2	CO4
		(OR)			
	b)	i. The COP of a vapour compression refrigeration system is 3.0. If the compressor motor draws power of 15 kW at 90% motor efficiency, find out the tonnage of the refrigeration system.	7	K5	CO4
		ii. Describe the working of a basic vapour compression refrigeration system with a schematic diagram.	6	K2	CO4

15	a)	i.	Explain the type of boilers and explain the energy conservation opportunities in boilers.	7	K2	CO4
		ii.	Define simple payback period. Calculate simple payback period for a boiler that cost Rs.75.00 lakhs to purchase and Rs.5 lakhs per year on an average to operate and maintain and is expected to annually save Rs.30 lakhs.	6	K5	CO4
			(OR)			
	b)	i.	Examine the areas of energy loss in a furnace and the scope for energy saving to increase the furnace thermal efficiency.	7	K4	CO4
		ii.	Summarise the factors affecting the performance of furnaces and calculate the heat efficiency of fuel fired furnace.	6	K2	CO4

PART – C

(1 x 15 = 15Marks)

Q.No.			Questions	Marks	KL	CO
16	a)	i.	Explain the advantages of using ceramic fibre in furnaces and the advantages of using fluidized bed boilers	10	K2	CO4
		ii.	Illustrate the importance of Kigali Amendment for using low global warming potential refrigerant.	5	K4	CO4
			(OR)			
	b)		A domestic power circuit has 20 lamps of 50 W each. The power demand is as follows. From 00.00 hrs – 5.00 hrs -- 100 W From 05.00 hrs – 18.00 hrs -- NIL From 18.00 hrs – 19.00 hrs -- 750 W From 19.00 hrs – 21.00 hrs -- 900 W From 21.00 hrs – 24.00 hrs -- 150 W	15	K5	CO4
		i.	Calculate average load, maximum load, load factor, bi monthly (60 days) energy consumption units and energy cost @ the rate of Rs 5.00 per unit.			
		ii.	If the lamps are replaced by 20 W energy efficient lamps calculate the total energy saving units / month			

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[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 5011

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023

Sixth Semester

Electronics and Communication Engineering

U19CSOE8 – PYTHON PROGRAMMING

(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	What is the significance of Python as a programming Language?	2	K2	CO1
2.	What is a tuple in Python? Write a Python program to create a tuple with different data types.	2	K3	CO1
3.	Define a string literal in Python.	2	K1	CO2
4.	Define regular expression in Python. Show use of a match function.	2	K3	CO2
5.	What is a function prototypes? Show with the help of an example.	2	K2	CO3
6.	Define anonymous function.	2	K1	CO3
7.	What is the significance of files in Python?	2	K2	CO4
8.	What is the purpose of tracer() method of turtle?	2	K2	CO4
9.	Which widget is used as a container to house other widgets and add borders?	2	K2	CO3
10.	Write the advantages of operator overloading.	2	K1	CO3

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Explain the Identifiers, Keywords, Statements, Expressions, and Variables in Python programming language. Support your answer with suitable examples.	7	K2	CO1
		ii.	Explain the basic data types available in Python with examples.	6	K3	
			(OR)			
	b)	i.	Discuss the relation between tuples and lists, tuples and dictionaries in detail.	8	K2	CO1
		ii.	List numeric types available in Python. Illustrate with examples in each case.	5	K3	
12.	a)	i.	Explain the different string formats available in Python with examples.	6	K2	CO2
		ii.	Write Python Program to count the number of characters in a string using dictionaries. Display the keys and their values in alphabetical Order.	7	K3	
			(OR)			
	b)	i.	Explain the concept of String formatting with the help of a suitable example.	6	K2	CO2
		ii.	Explain the python string encode with the help of examples.	7	K3	
13.	a)	i.	Write a Python program using functions to find the value of ${}^{n}P_{r}$ and ${}^{n}C_{r}$ without using inbuilt factorial() function.	7	K3	CO3
		ii.	Define Python class. Write a program to show the use of a class.	6	K4	
			(OR)			
	b)	i.	Write Pythonic code to create a function called most frequent that takes a string and prints the letters in decreasing order of frequency.	7	K3	CO3
		ii.	What are Iterators? Show their use by an example.	6	K4	
14.	a)	i.	Describe the different access modes of the files with an example.	7	K3	CO4
		ii.	Write Python Program to Find the Longest Word in a File. Get the File Name from User.	6	K6	
			(OR)			
	b)	i.	Discuss the following methods associated with the file object: read() readline() readlines() tell() seek() write()	6	K3	CO4

		ii.	Write about Errors and Exception Handling in Python programming?	7	K4	
15.	a)	i.	What are different types of inheritance supported by Python? Explain.	6	K3	CO4
		ii.	Explain the methods that are used to synchronize threads. Support your answer with examples in each case.	7	K4	
			(OR)			
	b)	i.	Write a Python program that creates two demon threads and two non-daemon threads. Main thread should wait for all other threads to finish.	6	K3	CO4
		ii.	What type of parameter passing is used in Python? Justify your answer with sample programs	7	K4	

PART – C

(1 x 15 = 15Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	Given the Coordinates (x, y) of a center of a Circle and its radius, write Python program to determine whether the Point lies inside the Circle, on the Circle or outside the Circle.	7	K6	CO5
		ii.	Write Pythonic code to create a function named move_rectangle() that takes an object of Rectangle class and two numbers named d_x and d_y. It should change the location of the Rectangle by adding d_x to the x coordinate of corner and adding d_y to the y coordinate of corner.	8		
			(OR)			
	b)	i.	Write a Python program that creates a GUI with a textbox, Ok button and Quit button. On clicking Ok, the text entered in textbox is to be printed in Python shell; on clicking Quit, the program should terminate.	8	K6	CO5
		ii.	Write a Python turtle program to draw a blue square of size 200 and the draw a green circle which touches the square on all sides from inside.	7		

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Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 7016

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023
Fourth Semester
Electronics and Communication Engineering
U19EC414 – MEASUREMENTS AND INSTRUMENTATION
(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Differentiate between accuracy and precision.	2	K2	CO1
2.	Define gross and random error.	2	K1	CO1
3.	What is the Hall effect?	2	K1	CO2
4.	Differentiate between transducers and sensors.	2	K2	CO2
5.	What is duty cycle with reference to a square wave?	2	K2	CO3
6.	Differentiate between phase and frequency of a signal.	2	K2	CO3
7.	What is PMMC mechanism?	2	K1	CO4
8.	What is the difference between RMS and average value of voltage?	2	K2	CO4
9.	What is resolution? Why it is important in measurement?	2	K1	CO5
10.	Differentiate between analog and digital data.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Explain the working of Anderson bridge with a neat diagram. Which components can we measure using it?	13	K1	CO1
		(OR)			
	b)	Explain in detail the types of errors and sources of errors in measurement techniques.	13	K4	CO1
12.	a)	Explain the working of Linear Variable Differential Transformer (LVDT) with a neat diagram. Why we use it?	13	K1	CO2
		(OR)			
	b)	Explain the working principle of optoelectronic transducers? Is LED an optoelectronic transducers? Support your answer with justification.	13	K3	CO2
13.	a)	Draw the block diagram of general purpose oscilloscope and explain the blocks in details.	13	K4	CO3
		(OR)			
	b)	Explain the working principle of sine wave generator. How can we generate different frequency using it?	13	K1	CO3
14.	a)	How Q meters works? What are the applications of Q-meter? How can we construct a Q meters?	13	K2	CO4
		(OR)			
	b)	What is a dual trace oscilloscope? Cleary differentiate between the working of dual beam and dual trace oscilloscopes.	13	K2	CO4
15.	a)	Draw the block diagram of data acquisition systems (DAS or DAQ) and explain the function of each block.	13	K2	CO5
		(OR)			
	b)	Explain the working principle of digital Voltmeters. How can we convert voltmeters into ammeter?	13	K1	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	What is meant by static and dynamic characteristics of instruments? Explain their importance in detail with example.	15	K1	CO1
		(OR)			
	b)	Explain IEEE 488 standard with neat diagram and Bus Configuration. Also, explain GPIB interface functions.	15	K4	CO5

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 2003

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023

Fourth Semester

Electronics and Communication Engineering

U19MA407 – PROBABILITY AND RANDOM PROCESSES

(Regulation2019)

Time : Three Hours | Maximum : 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No	Questions	Marks	KL	CO
1	A continuous random variable x that can assume any value between $x = 2$ and $x = 5$ has a density function given by $f(x) = k(1 + x)$. Find $P(X < 4)$.	2	K1	CO1
2	The mean and variance of the binomial distribution are 8 and 6. Find P $(X \geq 2)$	2	K2	CO1
3	A privately owned business operates both a drive-in facility and a walk-in facility. On a randomly selected day, let X and Y , respectively, be the proportions of the time that the drive-in and the walk-in facilities are in use, and suppose that the joint density function of these random variables is$f(x, y) = k(2x + 3y); 0 \leq x \leq 1, 0 \leq y \leq 1$. Find the value of k.	2	K3	CO2
4	An electrical firm manufactures light bulbs that have a length of life that is approximately normally distributed, with mean equal to 800 hours and a standard deviation of 40 hours. What is the probability that a random sample of 16 bulbs will have an average life of less than 775 hours?	2	K2	CO2
5	What is the difference between random variable and random process?	2	K1	CO3
6	Is the autocorrelation of a random process the same as the correlation coefficient of the process? Why?	2	K1	CO3
7	Check whether the function is valid autocorrelation function?	2	K2	CO4
8	Write the Wiener- Khinchin relation.	2	K1	CO4

9	When will you say a linear system is time invariant?	2	K1	CO5
10	What is a band limited white noise? Write the power spectral density of the band-limited white noise.	2	K1	CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.			Questions	Marks	KL	CO
11	a)	i.	Find the Moment generating function of the random variable X whose probability function $P(X=x)=\begin{cases} x & ,0<x<1 \\ 2-x & ,1<x<2 \end{cases}$	8	K4	CO1
		ii.	State and Prove Memory less property of geometric distribution.	8	K3	
			(OR)			
	b)	i.	The time (in hours) required to repair a machine is exponentially distributed with parameter. What is the probability that the repair time exceeds 2h? 1. What is the probability that the required time exceeds 2 hours 2. What is the conditional probability that a repair takes at least 10h given that its duration exceeds 9h?	8	K1	CO1
		ii.	Suppose the time it takes a student to finish a quiz is uniformly distributed between 6 and 15 minutes, inclusive. Find probability that a randomly selected student needs at least eight minutes to complete the quiz. Then find the probability that a different student needs at least eight minutes to finish the quiz given that she has already taken more than seven minutes.	8	K2	
12	a)		Determine the value of C that makes the function $f(x,y)=C(x+y)$ a joint probability mass function over the nine points with x =1, 2, 3 and y =1, 2, 3. Determine the following i. $P(X=1,Y<4)$ ii. $P(Y=2)$ iii. $E(X), E(Y), V(X)$, and $V(Y)$ iv. Marginal probability distribution of the random variable X. v. Conditional probability distribution of Y given that X = 1. vi. Conditional probability distribution of X given that Y = 2. vii. Are X and Y independent? viii. Covariance and correlation.	16	K3	CO2
			(OR)			

b)	i.	A random sample of size 100 is taken from a population whose mean is 60 and variance is 400. Using central limit theorem, with what probability can we assert that the mean of sample will not differ from $\mu = 60$ by more than 4?	8	K3	CO2
	ii.	Calculate the lines of regression from the following date	8	K3	CO2

X	1	2	3	4	5	6	7
Y	9	8	10	12	11	13	14

13	a)	i.	Show that the random process $X(t) = Acos(\omega_0 t + \theta)$ is wide-sense stationary, if A and ω_0 are constants and θ is uniformly distributed random variable in $(0,2\pi)$.	8	K2	CO3
		ii.	If $\{X(t)\}$ is a wide sense stationary process with auto correlation $R(\tau) = Ae^{-\alpha\|\tau\|}$, determine the second order moment of the random variable $X(8) - X(5)$.	8	K2	
			(OR)			
	b)	i.	If customers arrive at a counter in accordance with a Poisson process with a mean rate of 2 per minute, find the probability that the interval between two consecutive arrivals is (i) more than 1 minute (ii) between 1 and 2 minutes and (iii) 4 minute or less.	8	K3	CO3
		ii.	Suppose that $X(t)$ is a Gaussian process with $\mu_X = 2$, $R_{XX}(\tau) = 5e^{-0.2\|\tau\|}$, Find the probability that $X(4) \leq 1$.	8	K3	
14	a)	i.	If the wide sense stationary process $\{X(t)\}$ is given by $X(t) = 10\cos(100t + \theta)$, where θ is uniformly distributed over $(-\pi, \pi)$, prove that $\{X(t)\}$ is correlation ergodic.	8	K3	CO4
		ii.	The auto correlation function of the random telegraph signal process is given by $R(\tau) = a^2 e^{-2\gamma\|\tau\|}$. Determine the power spectrum of the random telegraph signal.	8	K3	
			(OR)			
	b)	i.	$\{X(t)\}$ is the input voltage to a circuit and $\{Y(t)\}$ is the output voltage. $\{X(t)\}$ is a stationary random process with $\mu_X = 0$ and $R_{XX}(\tau) = e^{-\alpha\|\tau\|}$. Find μ_Y, $S_{YY}(\omega)$ and $R_{YY}(\tau)$, if the power transfer function is $H(\omega) = \frac{R}{R+iL\omega}$.	8	K2	CO4
		ii.	The cross-correlation function of two processes $\{X(t)\}$ and $\{Y(t)\}$ is given by $R_{XY}(t, t+\tau) = \frac{AB}{2}\{\sin(\omega_0\tau) + \cos[\omega_0(2t+\tau)]\}$, where A, B and ω_0 are constants. Find the cross spectrum $S_{XY}(\omega)$.	8	K3	

15	a)	i.	Let $Y(t)$ be the input of an Linear time invariant system with impulse response h(t), when $X(t)$ is applied as input. Find $R_{XY}(t_1, t_2)$ and $R_{YY}(t_1, t_2)$.	8	K2	CO5
		ii.	An LTI system has an impulse response $h(t) = e^{-\beta t}u(t)$. Find the output auto correlation function $R_{YY}(\tau)$ corresponding to an output $X(t)$.	8	K2	
			(OR)			
	b)	i.	Suppose that $X(t)$ is the input to an LTI system impulse response $h_1(t)$ and that $Y(t)$ is the input to another LTI system with impulse response$h_2(t)$. It is assumed that $X(t)$ and $Y(t)$ are jointly wide sense stationary. Let $V(t)$ and $Z(t)$ denote the random process at the respective system outputs. Find the cross-correlation of $X(t)$ and $Y(t)$.	8	K2	CO5
		ii.	If $\{N(t)\}$ is a band limited white noise such that $S_{NN}(\omega)=\begin{cases}\frac{N_0}{2}, & \lvert\omega\rvert < W_B \\ 0, & elsewhere\end{cases}$, find the auto correlation function.	8	K2	

Reg.No.:								

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 7007

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023

Fourth Semester

Electronics and Communication Engineering

U19EC413 / U19EC420 – LINEAR INTEGRATED CIRCUITS

(Regulation 2019)

(Common to Biomedical Engineering)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Draw the internal schematic block diagram of an opamp.	2	K1	CO1
2.	If the base currents for the emitter coupled transistors of a differential amplifier are 18 μA and 22 μA, determine, i. input bias current ii. input offset current for an opamp	2	K3	CO1
3.	What do you understand by precision rectifiers? How do they differ from conventional rectifiers?	2	K2	CO2
4.	What are the advantages of active filter over passive filter?	2	K1	CO2
5.	What are the applications of voltage controlled oscillator?	2	K1	CO3
6.	Using block diagram explain how frequency multiplier can be achieved using PLL?	2	K4	CO3
7.	A 12-bit DAC has a step size of 8 mv. Determine the full-scale output voltage and percentage resolution. Also find the output voltage for the input of 010101101101?	2	K4	CO4
8.	For a particular 8-bit ADC, the conversion time is 9μs. Find the maximum frequency of an input sine wave that can be digitized.	2	K4	CO4
9.	State the advantages of IC regulator.	2	K1	CO1
10.	What do you mean by video amplifier?	2	K1	CO1

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	A circuit using IC 741 opamp has single break frequency of 5 Hz. The feedback transfer function is 1. Draw rough sketch of its	13	K4	CO1

frequency response. Obtain the approximate value of phase margin. Comment on the stability of the circuit. The dc gain of the circuit is 2×10^5 .

(OR)

	b)	What is the effect of negative feedback in non-inverting amplifiers? And calculate the closed-loop voltage gain, the input resistance, the output resistance, the bandwidth, and the total output offset voltage for the same.	13	K4	CO1
12.	a)	Explain and draw the output waveforms of the ideal integrator circuit when the input is			
		i. sine wave	4	K4	CO2
		ii. step Input	4		
		iii. square wave	5		
		(OR)			
	b)	Draw and explain the commonly used three opamp instrumentation amplifier circuit. Derive expression for its gain.	13	K3	CO2
13.	a)	Derive the four-quadrant variable transconductance multiplier circuit. Derive the expression for its output voltage.	13	K3	CO3
		(OR)			
	b)	Explain the operation of PLL with the help of block diagram, draw and explain the transfer characteristics of PLL.	13	K1	CO3
14.	a)	Explain the working of successive approximation A/D converter technique with the help of block diagram.	13	K2	CO4
		(OR)			
	b)	Explain the operation of a 4-bit R-2R type DAC and derive the expression for the output voltage.	13	K2	CO4
15.	a)	Draw the circuit diagram of an astable multivibrator to generate the output signal with frequency of 1KHz and the duty cycle of 75%.	13	K6	CO5
		(OR)			
	b)	Draw and explain the following protection circuits.			
		i. Short circuit protection	6.5	K2	CO5
		ii. Fold back current limiting	6.5		

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Explain any one isolation amplifier IC with the help of block diagram.	15	K1	CO5
		(OR)			
	b)	i. How are the power amplifiers classified on the basis of their operating conditions?	7	K1	CO5
		ii. Explain the internal circuit diagram of LM 380 audio amplifier and list down its features.	8		

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Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 7011

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023
Fourth Semester
Electronics and Communication Engineering
U19EC411 - DIGITAL SIGNAL PROCESSING
(Regulation 2019)
(Common to Biomedical Engineering – Fifth semester)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	List any four properties of DFT.	2	K1	CO1
2.	Calculate the DFT for the sequence $x(n) = (1/4)^n$ for N=16.	2	K3	CO1
3.	What is the general form of IIR filter?	2	K2	CO2
4.	Write the magnitude function of Chebyshev low pass filter?	2	K2	CO2
5.	How the constant group delay and phase delay is achieved in linear phase FIR filters?	2	K2	CO3
6.	Justify the usage of Hamming and Hanning window in FIR filter design as against Rectangular window.	2	K3	CO3
7.	What are the quantization error due to finite word length registers in digital filters?	2	K2	CO4
8.	Mention is the effect of coefficient quantization?	2	K2	CO4
9.	Define decimation and interpolation.	2	K1	CO5
10.	Classify DSPs and highlight the factors that influence selection of DSPs.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Describe the process of frequency domain sampling and reconstruction of discrete signal.	8	K1	CO1
		ii.	Find the 4-point DFT of the sequence x(n)={1,2,0,1} using matrix method.	5	K3	
			(OR)			
	b)	i.	Compute the 4-point DFT of the given sequence x(n)={0,1,2,3} and verify the result with IDFT method using formula method.	9	K3	CO1
		ii.	Compute the N-point DFT of the sequence $x(n)=a^n$; $0<n<N-1$	4		
12.	a)		Using bilinear transformation ,design a digital Butterworth LPF with following specifications, α_p=3db, α_s=10db, f_p=350Hz, f_s=1000Hz & Sampling frequency = 5000Hz.	13	K3	CO2
			(OR)			
	b)	i.	Draw the Direct form-I and Direct form-II structure for the system given by, $H(z)= z^{-1}-3z^{-2}/(10-z^{-1})(1+0.5z^{-1}+0.5z^{-2})$	8	K2	CO2
		ii.	Draw the flow chart for IIR filter design using Bilinear transformation and explain.	5		
13.	a)	i.	Determine the direct form realization of the following system function: $H(z)=1+2z^{-1}-3z^{-2}+5z^{-4}-4z^{-3}$	7	K3	CO3
		ii.	Mention the advantages and disadvantages of FIR filters.	6		
			(OR)			
	b)		Design a linear phase FIR low pass filter with a cut off frequency 0.5π rad/sec with N=11 using frequency sampling technique.	13	K3	CO3
14.	a)		Derive the expressions for quantization noise power and mention their effects in digital filters.	13	K3	CO4
			(OR)			
	b)	i.	The output of A/D converter is applied to digital filter with the system function H(z)=0.5z/z-0.5. Find the output noise power from the digital filter when the input signal is quantized to have 8 bits.	8	K4	CO4
		ii.	Describe the quantization errors that occur in rounding and truncation in two's complement representation.	5	K2	

15.	a)	Explain the various addressing modes of a DSP processor with suitable examples	13	K2	CO5
		(OR)			
	b)	Sketch the architecture of TMS320C5 X DSP processor and explain the internal blocks of it.	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Consider a FIR filter with impulse response h(n)={3,2,1,1} compute the output for the input x(n)={1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1}. Use overlap save method assuming the length of the block is 9.	15	K3	CO2
		(OR)			
	b)	Compute the DFT of the following sequence x(n) = [1,−1, −1, −1, 1,1,1, −1] using the decimation in time FFT algorithm.	15	K3	CO1

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Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 7016

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023

Fourth Semester

Electronics and Communication Engineering

U19EC414 – MEASUREMENTS AND INSTRUMENTATION

(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Differentiate between accuracy and precision.	2	K2	CO1
2.	Define gross and random error.	2	K1	CO1
3.	What is the Hall effect?	2	K1	CO2
4.	Differentiate between transducers and sensors.	2	K2	CO2
5.	What is duty cycle with reference to a square wave?	2	K2	CO3
6.	Differentiate between phase and frequency of a signal.	2	K2	CO3
7.	What is PMMC mechanism?	2	K1	CO4
8.	What is the difference between RMS and average value of voltage?	2	K2	CO4
9.	What is resolution? Why it is important in measurement?	2	K1	CO5
10.	Differentiate between analog and digital data.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Explain the working of Anderson bridge with a neat diagram. Which components can we measure using it?	13	K1	CO1
		(OR)			
	b)	Explain in detail the types of errors and sources of errors in measurement techniques.	13	K4	CO1
12.	a)	Explain the working of Linear Variable Differential Transformer (LVDT) with a neat diagram. Why we use it?	13	K1	CO2
		(OR)			
	b)	Explain the working principle of optoelectronic transducers? Is LED an optoelectronic transducers? Support your answer with justification.	13	K3	CO2
13.	a)	Draw the block diagram of general purpose oscilloscope and explain the blocks in details.	13	K4	CO3
		(OR)			
	b)	Explain the working principle of sine wave generator. How can we generate different frequency using it?	13	K1	CO3
14.	a)	How Q meters works? What are the applications of Q-meter? How can we construct a Q meters?	13	K2	CO4
		(OR)			
	b)	What is a dual trace oscilloscope? Cleary differentiate between the working of dual beam and dual trace oscilloscopes.	13	K2	CO4
15.	a)	Draw the block diagram of data acquisition systems (DAS or DAQ) and explain the function of each block.	13	K2	CO5
		(OR)			
	b)	Explain the working principle of digital Voltmeters. How can we convert voltmeters into ammeter?	13	K1	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	What is meant by static and dynamic characteristics of instruments? Explain their importance in detail with example.	15	K1	CO1
		(OR)			
	b)	Explain IEEE 488 standard with neat diagram and Bus Configuration. Also, explain GPIB interface functions.	15	K4	CO5

Reg.No.:								

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]

Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 7015

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023

Fourth Semester

Electronics and Communication Engineering

U19EC410 - ELECTRONIC CIRCUITS - II

(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	The voltage gain without negative feedback is 40dB. What is the new voltage gain if 3% negative feedback is introduced?	2	K4	CO1
2.	Distinguish series and shunt feedback.	2	K2	CO1
3.	What are factors which affect the frequency stability of an oscillator?	2	K2	CO2
4.	State Barkhausen criteria.	2	K1	CO2
5.	What is the use of transformer in tuned amplifer circuits?	2	K4	CO3
6.	Define Q factor of the capacitor.	2	K1	CO3
7.	Differentiate between clippers and clampers circuits	2	K2	CO4
8.	Draw a Schmitt trigger circuit and obtain its output for a Sinusoidal input.	2	K3	CO4
9.	What is pulse transformer?	2	K4	CO5
10.	Highlight the advantages of UJT relaxation oscillator.	2	K4	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Draw the equivalent circuit of current series feedback amplifier and derive R_{if}, R_{of}, A_v, A_{vf}.	13	K3	CO1

(OR)

	b)	Explain with neat diagram, two stage voltage series feedback amplifier and determine A_v and A_{vf}.	13	K3	CO1
12.	a)	Draw Wein Bridge oscillator using BJT and derive the condition for oscillation.	13	K4	CO2
		(OR)			
	b)	Design Hartely oscillator using FET with necessary equations and mention its advantages.	13	K4	CO2
13.	a)	Explain single tuned amplifier and derive the gain and resonant frequency.	13	K3	CO3
		(OR)			
	b)	i. Explain the stability of tuned amplifiers using Neutralization technique.	9	K3	CO3
		ii. Design a stagger tuned amplifier and explain its working principle.	4		
14.	a)	Explain with a neat diagram the operation of Bitable multivibrator and draw the output waveform.	13	K2	CO4
		(OR)			
	b)	With the help of a neat circuit diagram explain the working principle of emitter coupled Astable multivibrator.	13	K2	CO4
15.	a)	Highlight the working principle of voltage sweep generator and current time base circuit.	13	K2	CO5
		(OR)			
	b)	Discuss in detail the working principle of UJT Sawtooth generator and free running blocking oscillator.	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	An amplifier has voltage gain with feedback of 100. If the gain without feedback changes by 20% and the gain with feedback should not vary more than 2%, determine the values of open loop gain, feedback ratio and loop gain of the amplifier.	15	K3	CO1
		(OR)			
	b)	In a colpitts oscillator, the value of the inductors and the value of capacitors in the LC circuit are 40mH, 100 pF and 500 pF respectively. i) Determine the frequency of oscillations. ii) If the output voltage is 10V, find the feedback voltage. iii) Find the minimum gains if the frequency is changed by changing L alone. iv) Determine the value of C_1 for a gain of 10. Also, calculate the new frequency	15	K3	CO2

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Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 7016

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023
Fourth Semester
Electronics and Communication Engineering
U19EC414 – MEASUREMENTS AND INSTRUMENTATION
(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Differentiate between accuracy and precision.	2	K2	CO1
2.	Define gross and random error.	2	K1	CO1
3.	What is the Hall effect?	2	K1	CO2
4.	Differentiate between transducers and sensors.	2	K2	CO2
5.	What is duty cycle with reference to a square wave?	2	K2	CO3
6.	Differentiate between phase and frequency of a signal.	2	K2	CO3
7.	What is PMMC mechanism?	2	K1	CO4
8.	What is the difference between RMS and average value of voltage?	2	K2	CO4
9.	What is resolution? Why it is important in measurement?	2	K1	CO5
10.	Differentiate between analog and digital data.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Explain the working of Anderson bridge with a neat diagram. Which components can we measure using it?	13	K1	CO1
		(OR)			
	b)	Explain in detail the types of errors and sources of errors in measurement techniques.	13	K4	CO1
12.	a)	Explain the working of Linear Variable Differential Transformer (LVDT) with a neat diagram. Why we use it?	13	K1	CO2
		(OR)			
	b)	Explain the working principle of optoelectronic transducers? Is LED an optoelectronic transducers? Support your answer with justification.	13	K3	CO2
13.	a)	Draw the block diagram of general purpose oscilloscope and explain the blocks in details.	13	K4	CO3
		(OR)			
	b)	Explain the working principle of sine wave generator. How can we generate different frequency using it?	13	K1	CO3
14.	a)	How Q meters works? What are the applications of Q-meter? How can we construct a Q meters?	13	K2	CO4
		(OR)			
	b)	What is a dual trace oscilloscope? Cleary differentiate between the working of dual beam and dual trace oscilloscopes.	13	K2	CO4
15.	a)	Draw the block diagram of data acquisition systems (DAS or DAQ) and explain the function of each block.	13	K2	CO5
		(OR)			
	b)	Explain the working principle of digital Voltmeters. How can we convert voltmeters into ammeter?	13	K1	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	What is meant by static and dynamic characteristics of instruments? Explain their importance in detail with example.	15	K1	CO1
		(OR)			
	b)	Explain IEEE 488 standard with neat diagram and Bus Configuration. Also, explain GPIB interface functions.	15	K4	CO5

Reg.No.:								

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]

Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 7013

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023

Fourth Semester

Electronics and Communication Engineering

U19EC412 – ELECTROMAGNETIC FIELDS

(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Transform vector $2xya_x-x^2a_y$ into cylindrical co-ordinates.	2	K4	CO1
2.	Define Divergence theorem.	2	K1	CO1
3.	Compare electric field Intensity with electric flux density.	2	K2	CO2
4.	Define electric potential.	2	K1	CO2
5.	What do you understand from current continuity equation?	2	K2	CO3
6.	Compare convection and conduction currents.	2	K2	CO3
7.	State Ampere's circuit law.	2	K1	CO4
8.	What is the significance of magnetic vector potential?	2	K3	CO4
9.	Define retarded potential.	2	K1	CO5
10.	How do you identify the direction of propagation of electromagnetic waves?	2	K3	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Write stoke's theorem.	4	K4	CO1
		ii.	State the physical interpretation of Gradient, Divergence and Curl.	9	K2	CO1
			(OR)			
	b)	i.	How a point in a rectangular coordinate system can be converted to cylindrical coordinate system?	4	K4	CO1
		ii.	Explain line, surface and volume integrals.	9	K2	CO1

12.	a)	Derive electric field intensity due to any one type of charge distributions.	13	K3	CO2
		(OR)			
	b)	Define Gauss's law and explain with any-2 applications.	3+5+5	K3	CO2
13.	a)	Explain the properties of materials for electric fields.	13	K2	CO3
		(OR)			
	b)	State any-4 applications of Poisson's and Laplace's equations and explain any-1.	4+9	K2	CO3
14.	a)	Explain Maxwell's equation in differential and integral form.	13	K3	CO4
		(OR)			
	b)	Define Biot-savart's law and explain with any-2 applications.	3+5+5	K3	CO4
15.	a)	Explain electromagnetic wave propagation in lossy dielectrics.	13	K2	CO5
		(OR)			
	b)	Explain the reflection of a plane wave at normal incidence.	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	The electric field and the magnetic field in free space are given by	5+10	K4	CO4

$$\mathbf{E} = \frac{50}{\rho}\cos(10^6 t + \beta z)\mathbf{a}_\phi \text{ V/m}$$

$$\mathbf{H} = \frac{H_o}{\rho}\cos(10^6 t + \beta z)\mathbf{a}_\rho \text{ A/m}$$

Express these in phasor form and determine the constants H_0 and β such that the fields satisfy Maxwell's equations.

(OR)

b) An electric field in free space is given by

$$\mathbf{E} = 50\cos(10^8 t + \beta x)\mathbf{a}_y \text{ V/m}$$

i.	Calculate b and the time it takes to travel a distance of $\lambda/2$.	6	K4	CO5
ii.	Sketch the wave at $t = 0$, $T/4$, and $T/2$.	9		