VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY
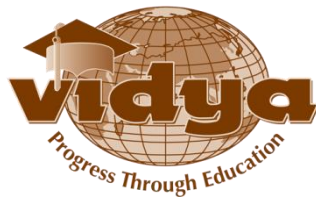# TECHNICAL CAMPUS, KILIMANOOR

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

QUESTION BANK

(2022-26 BATCH S6 ECE)

ACADEMIC YEAR 2024-25 EVEN SEMESTER

LIST OF SUBJECTS

Sl No	Sub Code	Sub Name
1	ECT 302	ELECTROMAGNETICS
2	ECT 304	VLSI CIRCUIT DESIGN
3	ECT 306	INFORMATION THEORY AND CODING
4	ECT 362	INTRODUCTION TO MEMS
5	HUT 310	MANAGEMENT FOR ENGINEERS

ECT 304 VLSI CIRCUIT DESIGN

QUESTION BANK
(S6 ECE 2022-26 BATCH)

Prepared by
Ms. Anjana.N
AP, ECE

MODULE 1

Sl No	Question	Marks	KTU Year
1	What is FPGA? What are the characteristics and applications of FPGA	3	June 2022
2	a) Compare Top down and Bottom up approach in VLSI design b) Explain logical and physical design in VLSI design	6	June 2022 Model Que
3	What is Moore's law in VLSI Design	3	Model Que June 2023
4	a) What are ASICs? Explain the different types of ASICs. b) With a neat flow chart, explain ASIC design flow.	3 8	Jan 2024 June 2023
5	a) Differentiate between full custom and semi-custom ASIC. b) With the help of a flow chart, explain FPGA Design flow	10	June 2022, 23 Jan 2024
6	Describe Gate array based ASIC with neat diagram.	8	Jan 2024
7	Write short notes on SoCs?	3	Jan 2024
8	Compare different ASIC design methodologies.	6	Model Que
9	a) With neat diagram explain the design flow of FPGA b) What is SoC? What are the applications? Draw the internal architecture of SoC	7 7	May 2019 June 2023
10	a) Explain the significance of power considerations in VLSI b) Illustrate the various steps involved in VLSI physical design. Explain how physical design impacts circuit performance, area and power?	4 7	June 2022 Jan 2024

MODULE 2

Sl No	Question	Marks	KTU year
1	Draw the circuit of a MOS inverter with saturated NMOS load	3	June 2022
2	a) Illustrate CMOS inverter DC characteristics with neat diagrams. Explain the different regions b) Plot the Voltage transfer characteristics of a static CMOS inverter and label the details. Derive the equation for the switching threshold.	10	June 2022 June 2023
3	Derive an expression for Switching Threshold of a CMOS inverter	7	Model Que June 2023
4	What is meant by Pass Transistor logic? What are the differences in transmission characteristics of PMOS and NMOS transistors.	7	June 2022, Sep 2020, April 2018 June 2023 Jan 2024
5	Why PMOS transistor can pass only strong ones and NMOS can transfer only strong zeros. What are transmission gates? State the advantages of transmission gates	6 3	Model Que Jan 2024

6	With a neat diagram explain static and transient analysis of CMOS inverter	8	May 2019

7	Realize the given logic function using static CMOS logic and transmission gate logic.
	a) Y=(A(B+C))'
	   i) $Y = \overline{A + B(C + D)}$ using static CMOS
	   ii) 4 to 1 MUX using transmission gate logic
	b)
		7
		
		7
			April 2018
			June 2023
			
			Jan 2024

8	Compare the advantages and disadvantages of static and dynamic circuits	6	Model Que
9	a) What are the different types of power dissipation in a CMOS inverter? What is the expression for total power dissipation? b) Explain the concept of Noise Margin?	10	April 2018 June 2023 Sept 2020
10	Explain the implementation of a 2:1 multiplexer using transmission gate logic	3	June 2023

MODULE 3

Sl No	Question	Marks	KTU Year
1	a) What are the issues associated with NP domino logic b) Discuss the signal degradation issue that occurs while we cascade dynamic logic gates. How can we overcome it in domino logic?	6	June 2022 June 2023
2	Compare DRAM and SRAM cells	3	June 2022 Jan 2024
3	a) Design three transistor and one transistor DRAM cells and explain the working of each types. b) Explain the basic principle of operation of dynamic logic	10 4	June 2022 June 2023 Model Que May 2019
4	a) Design a 4x4 NAND based MOS ROM Cell Array and explain its operation. b) Compare the performance of dynamic and domino logic	10 4	June 2022
5	Differentiate between volatile and non-volatile memories	3	Model Que
6	Draw the circuit diagram and explain the principle of operation of a CMOS based static RAM cell(means 6T). Explain the read and write operations. What are the constraints on the sizes of transistors?	7	April 2018 Sep 2020, May 2019 June 2023
7	a) Compare different ROM structures. b) List the advantages of dynamic logic over static logic c) What is Dynamic CMOS logic ? Compare static and dynamic CMOS logic.Design a 2-input NAND gate in dynamic logic and static CMOS logic.	3 8	Model Que Jan 2024
8	Compare the advantages of three transistor and one transistor DRAM cell.	3	Sep 2020
9	Design a 4×4 bit NOR based ROM array and explain its working To store 1 0 0 0, 0 1 1 0, 0 1 0 0, 0 0 1 0	5	May 2019 June 2023 Jan 2024
10	Draw the circuit of a 3 input NOR gate using Dynamic CMOS logic	3	June 2023

MODULE 4

Sl No	Question	Marks	KTU Year
1	What is the need for array multipliers	3	June 2022
2	Design a 16-bit square-root carry select adder and indicate the worst-case delay	10	June 2022
3	a) Design a 4X4 array multiplier. Show the critical path and also estimate the delay of the multiplier. b) Write the advantages of square-root carry select adder compared to linear carry select adder	10 4	Model Que June 2022 Sept 2020 June 2023
4	Design a full adder with static CMOS logic	7	April 2018 JUNE 2023
5	Compare the worst case delay of Carry-Bypass adder, Linear Carry-Select adder, Square- root carry select adder as number of bits increases	7	April 2018 June 2022 June 2023
6	With block diagram, illustrate the principle of operation of a square root carry select adder. Estimate the delay of an n bit adder	6	May 2019
7	Draw circuit diagram of a full adder with not more than 28 transistors in standard CMOS logic	8	April 2018
8	Explain the working a 16-bit carry-by pass adder and write down the expression for worst-case delay.	8	May 2019 Sept 2020 June 2023
9	Explain the implementation of a 16 bit linear carry select adder with block diagram and compare its delay performance with carry bypass adder	10	Sept 2020 June 2023 Jan 2024

MODULE 5

Sl No	Question	Marks	KTU Year
1	What is meant by lithography? Explain various types of Lithograph	3	June 2022
2	With an example, explain the role of stick diagram and layout diagram in VLSI design	3	June 2022 June 2023
3	a) What are the steps in wafer preparation fabrication b) Explain the necessity of single crystalline silicon in VLSI fabrication. Describe in detail about the production of single crystalline silicon from CZ process c) Explain the Czochralski technique for silicon crystal growth with the help of neat diagram.	4 10 7	May 2019 Sep 2020 June 2022 June 2023 Jan 2024
4	Explain how electronic grade silicon (EGS) is developed	7	May 2019
5	Explain diffusion and ion implantation techniques.	8	Model que June 2023
6	Explain the advantages of SiO2 and With schematic diagram and chemical reactions involved, illustrate wet and dry oxidation processes	10	April 2018 Juen 2023
7	What is photolithography? With diagram illustrate the steps involved in photolithography process.	7	May 2019 June 2023

8	Explain the principle of molecular beam epitaxy, with schematic diagram of an MBE system. What are its advantages and disadvantages?	8	Model que June 2022
9	a) Draw the layout of a CMOS 2 input NAND Gate b) Draw the layout of a CMOS Inverter	6	May 2019 Sep 2020 June 2023
10	What is annealing? Explain various types What are the differences between λ rule and micron rule?	5 3	Sep 2020 May 2024

Subject: ECT 306 Information Theory and Coding(2019 Scheme)

Prepared By,

Ms.DHANYA S

Assistant Professor

Dept of ECE

VAST-TC

Module 1

Sl No	QUESTIONS		Marks
1	Define conditional entropy	KTU May 2024	3
2	Find Huffman code for the source with symbol probabilities {1/2,1/3,1/6}	KTU May 2024	3
3	State Shannon's channel coding theorem. What is its significance in digital Communication system?	KTU May 2024	3
4	State and prove Kraft Inequality.	KTU May 2024	7
5	Show that the entropy is maximum when all the messages are equally like	KTU May 2024	7
6	Explain uniquely decodable and prefix-free property of source code	KTU May 2024	4
7	Consider a source S:{Sr, Sz, Sl} with P = {1/2,1/4,1/4)}. Find self-information of each message and entropy of source S?	KTU May 2023	3
8	Define coding and explain the necessity of coding	KTU May 2023	3
9	Show that H (X, Y) = H(X/y) + H(y).	KTU May 2023	7
10	Given the messages X1, X2, X3,X+Xs and Xo with respective probabilities of 0.4, (7) 0.2, 0.2, 0.1, 0.07 and 0.03. construct a binary code by applying Huffman encoding procedure. Also determine its efficiency and redundancy	KTU May 2023	7
11	Construct an instantaneous binary code for a source producing 5 symbols Sr to 55 with respective probabilities of {1/2, 1/6,116,1/9,l/18}. Also find the code efficiency and redundancy?	KTU May 2023	7

Module 2

1	An analog signal is bandlimited to B Hz, sampled at the Nyquist rate, and the samples are quantized into 4 levels. The quantization levels are assumed independent and occur with probabilities Pl : P4 :3 / 8 and P2 :P3 :l/8.Find the information rate of the source assuming B : l00Hz.	KTU MAY 2024	3
2	List the properties of group. Give an example.	KTU MAY 2024	3
3	Explain Binary Symmetric Channel and derive its channel capacity	KTU MAY 2024	10
4	Also draw the Entropy vs Probability and Channel capacity vs Probability (4) graphs of the Binary Symmetric Channel.	KTU MAY 2024	4
5	State and prove Shannon Hartley theorem	KTU MAY 2024	10
6	Explain BSC with its channel diagram	KTU MAY 2023	3
7	Explain Bandwidth-efficiency relation and Shannon's Limit of a continuous Gaussian channel.	KTU MAY 2023	7
8	A message source produces two independent symbols A and B with probabilities p(A):0.4 and P(B):0.6 and transmitted through a BSC. Calculate the Information transmission rate of the system if the symbols are received in average with 4 in every 100 symbols in error.	KTU MAY 2023	7
9	Calculate the capacity of a Gaussian channel with a bandwidth of lMHz and SA"l ratio of 30dB	KTU MAY 2023	7
10	Explain Binary Erasure Channel and derive its channel capacity	KTU MAY 2023	7

Module 3

1	List the properties of group. Give an example.	KTU MAY 2024	3
2	Explain Repetition code with general example.	KTU MAY 2024	3
3	Explain with examples how error detection and correction is possible with Block codes	KTU MAY 2024	7
4	Draw and explain the general decoding circuit of a (n,k) Linear Block cod	KTU MAY 2024	7
5	Explain single parity check bit coding for error detect	KTU MAY 2024	7
6	Distinguish between block codes and convolutional code	KTU MAY 2023	3
7	Explain how generator matrix is obtained for a linear block cod	KTU MAY 2023	3
8	Construct the encoding circuit of a systematic (6,3) LBC with the parity matrix [101.| given by P: l0 1 1l l-r 1 ol Also find all possible code vectors	KTU MAY 2023	7
9	Explain the error detection and correction capabilities of linear block cod	KTU MAY 2023	7
10	Explain the procedure to prepare the standard array of LBC. Also construct the understand array of (4,2) LBC whose parity matrix is given by, $P = [1\ 1\ ,\ 1\ 0]$	KTU MAY 2023	7

Module 4

1	What are the features of Hamming Code	KTU MAY 2024	3
2	List the features of Reed Solomon code.	KTU MAY 2024	3
3	Draw the general encoding circuit for a (n,k) Systematic Cyclic code and explain its operation	KTU MAY 2024	10
4	The generator polynomial of a (7,4) Cyclic code is G(p): I +p+p3. Find the code vector corresponding to the message vector l0l0 in Non Systematic form.	KTU MAY 2024	4
5	Draw the encoder circuit fora(7,4) Cyclic code with G(p): I +p+p3and (10) obtain the code word in systematic form for the message sequence I I10	KTU MAY 2024	10
6	Explain the features of BCH code	KTU MAY 2024	4
7	List any three properties of cyclic code	KTU MAY 2023	3
8	Find the generator and parity check matrices of (7,4) cyclic code where xn+l: x7+l : (l+x+x3) (l+x+x2+x 4)	KTU MAY 2023	7
9	For a (7,4) cyclic code, the received vector Z(x) is lll0l01 and the generator polynomial is g(x):l*xfx3. Draw the syndrome calculation circuit and explain the procedure with the register contents. Also correct the single error in the received vector	KTU MAY 2023	14
10	List any three properties of cyclic code	KTU MAY 2023	3

Module-5

1	What is Tanner graph representation of LDPC codes	KTU MAY 2024	3
2	What is trellis diagram.	KTU MAY 2024	3
3	With the help of figures, explain Viterbi algorithm for decoding of Convolutional code with example.	KTU MAY 2024	14
4	Explain LDPC code & with general example	KTU MAY 2024	7
5	Draw a (32,1) Convolutional encoder with generator sequences g1(l) = (1) g1(2) - (0 l), g1o): (1 l) and &(r) = (0 l), g2Q) =(1 0), g3(Q) :(l 0).	KTU MAY 2024	7
6	Consider a(3,1,2) convolutional code with gttx(1 1 0), g(2)t(l 0 l) and g(3) i) Draw the encoder block diagram. ii) Find the generator matrix. iii) Find the code vector corresponding to the information sequence (1 I I 0 l) using time domain and transfer domain approach.	KTU MAY 2023	14
7	Explain Viterbi algorithm for decoding of convolutional code with example with the help of figure.	KTU MAY 2023	14
8	For a (2,1,2) convolutional encoder with impulse response g(l)=[l l] and g(2):1 0 l], find the output sequence for the message D =l 0 0 r l by time domain approach.	KTU MAY 2023	3
9	Explain trellis diagram	KTU MAY 2023	3

ECT362INTRODUCTIONTOMEMS

Faculty-Ms LEKSHMY S

ECT362 INTRODUCTION TO MEMS

<table>
<tr><td colspan="5">MODULEI</td></tr>
<tr><td>SlNo:</td><td>Questions</td><td>Mark s</td><td colspan="2">KTU,Year</td></tr>
<tr><td rowspan="3">1</td><td>Explain the basic blockdiagram of Microsensors &Actuators with neat sketches.</td><td>10</td><td colspan="2">KTUJUN 2022</td></tr>
<tr><td>Explain Lorentz force .Explain the operating principle of magnetic actuators with relevant figures.</td><td>10</td><td colspan="2">KTUMAY2019</td></tr>
<tr><td>Explain the working principle of Piezoelectric Sensors and Actuators with one example.</td><td>6</td><td colspan="2">KTUJUN 2022</td></tr>
<tr><td rowspan="4">2</td><td>Explain the working principle of micro inertia sensor</td><td>3</td><td colspan="2">KTUJUN 2022</td></tr>
<tr><td>Write short notes on the multidisciplinary nature Of microsystem design and manufacturing</td><td>3
3
6</td><td colspan="2">KTU MAY 2024
KTU MAY 2024</td></tr>
<tr><td>List the different application areas of MEMS.</td><td></td><td colspan="2">KTUJUN 2022</td></tr>
<tr><td>Describe the operating principle of Linear Micromotors with neat diagrams</td><td></td><td colspan="2"></td></tr>
<tr><td rowspan="4">3</td><td>Compare between Electrostatic sensing and Piezoelectric sensing in microsystems. Illustrate the sensing principle in each of these schemes with figures</td><td>10</td><td colspan="2">KTUDEC2021</td></tr>
<tr><td>Explain the principle of operation   of MEMS-based electrostatic sensors and actuators</td><td></td><td colspan="2">KTUJUN2022</td></tr>
<tr><td>Explain the basis of shape memory effect exhibited by Nitinol with graphs/figures</td><td></td><td colspan="2">KTUDEC2021</td></tr>
<tr><td>With necessary block diagram explain principle of micro actuators.</td><td></td><td colspan="2"></td></tr>
<tr><td rowspan="4">4</td><td>Explain the pull-in effect of parallel plate actuators. Derive the expression for pull-in voltage</td><td></td><td colspan="2">KTUDEC2021
KTUDEC2020</td></tr>
<tr><td>Describe the basic building blocks of MEMS with neat diagrams.</td><td></td><td colspan="2">KTUDEC2019
KTUJUN 2023

KTUSEP2020</td></tr>
<tr><td>Explain different types of micro accelerometer with diagrams</td><td></td><td colspan="2" rowspan="2">KTUJUN 2023</td></tr>
<tr><td>Explain the operating principle   of the   cantilever beam accelerometer with a neat sketch.</td><td></td></tr>
</table>

		Describe the working principle of micro accelerometer with neat	10	KTUJUN 2023
		Explain the working principle of micro grippers and micro pumps	8	KTUSEP2020
5		Explain the operating principle of thermal bimorphs with figures. State any two applications of thermal sensors	7	KTUSEP2020
		Explain the operating principle of thermal bimorphs with neat sketches		KTUDEC2018
		Derive the equation for pull-in voltage. Also, explain the advantages and limitations of electrostatic actuation methods .	8	KTUJUN 2023
		Explain the operating principle of two types of micro motors with suitable schematics	8	KTUDEC 2019 KTUDEC2019 KTUDEC2018
6		State a commercial product that uses MEMS technology. Explain with figures its operating principle of product	5	KTUMAY2019
		Give one application of MEMS in automobiles. Illustrate its working with neat sketches. List three applications of MEMS systems.	5	KTUDEC2018
		Explain the working of shape memory alloys.	3	KTUJUN 2023
7		With necessary diagrams explain the working of linear micro motors and rotary micro motors.	8 6	KTUJUN 2023
		Draw and explain the working of a microvalve With necessary diagrams explain the working of linear micro motors and rotary micro motors.	8 6	KTU JAN 2024 KTU JAN 2024
		Explain the constitutive relations between electrical displacement and stress of piezoelectric sensors. Explain the working principle of micro-grippers and micro pumps Explain the principle of operation of MEMS based on electrostatic sensors and actuators. schematic diagrams. Give two application	8 6	KTU JAN 2024 KTU JAN 2024
8		With necessary diagram explain shape memory alloy.	4	KTU MAY 2024

		Explain the operation of linear micromotor and rotary micromotor with neat diagrams.	10	KTU MAY 2024
		Explain the operating principle of piezoelectric sensors and actuators with relevant sketches.	8	KTU MAY 2024
		Explain the operating principle of thermal bimorphs with neat sketches.	7	

MODULEII

1	1. Define normal stress and strain, how it is different from shear Stress and strain	3	KTUJUN 2022
		3	KTUJUN 2022
	2. Explain the different boundary conditions and the types of beams with figures	5	KTUDEC2021
	3. Identify the relation between tensile stress and strain interms of compliance matrix	6	KTUJUN 2022
	4. Discriminate how plates and diaphragm scan be used for the design of MEMS with examples	8	KTUJUN 2022
2	Determine the moment of inertia for a beam under longitudinal strain and also find Flexural formula.	8 7	KTUJUN 2022 KTUDEC2020 KTUSEP2020 KTUDEC2019
	Derive flexural formula for a beam with rectangular cross-section under pure bending .Also find the equation for maximum longitudinal strain.	7	KTUMAY2023
	State the reasons for intrinsic stress in thin film materials under room temperature and zero loading conditions	6 10	KTUDEC2021 KTUDEC2018
	With reference to the general stress-strain relations ,state the principle stress components and derive the stiffness matrix of Silicon <100>	10	KTUDEC2021
	Explain sketches the general stress-strain relationship with neat diagram	7	KTUSEP2020
	In terms of the compliance matrix ,Identify the relation between tensile stress and strain	7	KTUJUN2023
3	With reference to pure bending of the longitude in a lbeam, Derive the expression for the magnitude of applied bending moment.	5	KTUMAY2019
	Explain the purpose of micro cantilevers in MEMS systems. What is the relevance of spring constant (k) of the mechanical structure in the microsystem?	10	KTUMAY2019
	Explain the constitutive relations between electrical displacement and stress of piezoelectric sensors.	5	KTUDEC2018
4	Define the term stress ,strain ,and modulus of elasticity.	3	KTUMAY2023
	Define normal stress and strain.		KTU JAN 2024
	What is yield strength? What is its significance?		

	List any three strategies form intimizing undesirable intrinsic bending.		3	KTUJUN2023
	Define normal stress, strain and modulus of elasticity.		3	KTU MAY2024
	List any three mechanical structures used in MEMS. Explain any one structure by emphasizing its application.		3 3	KTU MAY 2024
	List any 3 commonly used mechanical structures in MEMS. Explain the operation of any one of the mechanical structures Mentioning its application.		7	KTUJUN2023
6	State the reasons for intrinsic stress in thin film materials under room temperature. Describe anyone method for stress compensation.		4	KTUMAY2023
	Derive flexural formula for a beam with rectangular cross-section under pure bending. Also find the equation for maximum longitudinal strain.		10	KTUMAY2024
	Describe the different boundary conditions of beams that are encountered in MEMS systems.		4	KTUMAY2024
	In terms of the compliance matrix, identify the relation between tensile stress and strain.		8	KTUMAY2024
	What is intrinsic stress? How intrinsic stress is developed in a MEMS structure? Explain anyone strategy used for minimizing undesirable intrinsic bending.		7	KTUMAY2024
7	Explain with neat sketches the type of mechanical beams and boundary conditions associated with supports.		8	KTU JAN 2024
	Determine the moment of inertia for a beam under longitudinal strain and also find the flexural formula.		7	KTU JAN 2024
	Explain the general stress -strain relationship with neat sketches.		8	KTU JAN 2024
	State the reasons of intrinsic stress in thin film materials under room temperature and zero loading conditions.		6	KTU JAN 2024

MODULEIII

1	DefineTrimmerforcescalingvector		3	KTUJUN 2022
	Explain Trimmer Force Scaling Vector. Use scaling laws to estimate the changes in acceleration, time to actuate a MEMS component if its weight is reduced by a factor of 10.		8	KTUMAY2023
	State three relevant properties of Silicon for use in Microsystem		3	KTUJUN 2022
	Derive the expressions for Electromagnetic potential energy reference to scaling of electromagnetic forces OR With reference to scaling of electrostatic forces, derive			KTUJUN 2022

	theexpressions for Electrostatic potential energyand force.	8	
		8	KTUDEC2020 KTUSEP2020 KTUMAY2019
2	Explain the Langmuir-Blodgett process with relevant figures.	6 1	KTUJUN 2022 KTUDEC2018
	What are the advantages of LB films?	0 3	KTUMAY2024
	Obtain the relationship with linear dimension l under scaling for the following electrical parameters a) Electrical resistance R b) Resistive power loss P	3	KTUMAY2024
	Give one application each of PDMS and PMMA in MEMS fabrication.		
	By deriving the power loss to energy ratio in a the microsystem justify the following statement. "10 times reduction in the size of a power supply system would lead to 100timesgreaterpowerlossdue to increase of resistivity"	10	KTUDEC 2021
3	Derive the equations for scaling of heat transfer in convection for fluids in micrometer and sub-micrometer regime.	10	KTUDEC2021
	By giving the significance of the S/V ratio explain scaling in geometry for designing a microsystem.	5	KTUDEC2021
	Explain the scaling in heat conducting and heat convection methods	7	KTUDEC2020
	Explain various laws in miniaturization	7	KTUSEP2020
4	Compare the p roperties of silicon,SiO2andSiC State three relevant properties of Silicon Carbide and Silicon Nitride for use in Microsystems	7	KTUSEP2020
		8	KTUMAY2023
5	Derive equations for acceleration a, time t and power density P/V based on the Trimmer Force Scaling Vector? What information does the force scaling vector provide to the MEMS designer?	10	KTUSEP2020 KTUDEC2018
6	Explain scaling in fluid mechanics .What are the advantages of piezoelectric pumping?	7	KTUDEC2019
	State the constraints in pumping fluids in micro channels. What pumping scheme is usually used in micro fluidics, give One example.	7	KTUMAY2019
7	Derive equations for acceleration a, time t, and power density P/V based on the Trimmer force scaling vector.	7	KTUMAY2024
	State three relevant properties of Silicon Carbide and Silicon Nitride	8	KTUMAY2024

	for use in microsystems.			
	With reference to scaling, derive the expressions for electrostatic forces and electromagnetic forces. Prove that electromagnetic actuation is least preferred over electrostatic actuation for scaling . What are the reasons for using Si most widely as a MEMS material?	10	KTUMAY2024	
8	Why electrostatic actuation is preferred over electromagnetic actuation in micro motors?	3	KTU JAN 2024	
	State three relevant properties of Silicon Carbide for use in Microsystems.	3	KTU JAN 2024	
	Derive equations for acceleration a, time t and power density P/V based on the Trimmer Force Scaling Vector?	6	KTU JAN 2024	
	Explain the Langmuir- Blodgett process with relevant figures. What are the advantages of LB films?	8 8	KTU JAN 2024 KTU JAN 2024	
	With reference to scaling of electromagnetic forces, derive the expressions for electromagnetic potential energy and force Write a note on the uses of PDMS, PMMA and SU-8	8	KTU JAN 2024	

MODULEIV

1	Explain the features of Isotropic etching. Why isotropic etching is hardly used for micro manufacturing?	5	KTUDEC2021	
	Explain chemical vapour deposition process with figures	10	KTUDEC2021 KTUSEP2020	
	Explain with figures the Micro stereo lithography process. What are its advantages over micromachining techniques?	10	KTUDEC2021	
	Explain with figures the fabrication of a diaphragm based pressure sensor using bulk micromachining	10	KTUDEC2021	
2	Explain Deep reactive ion etching process with neat sketches	5 10	KTUDEC2021	

			10	KTUDEC2020
	Explain with figure the Deep Reactive Ion Etching(DRIE) and Plasma etching processes.			
	Explain the fabrication of a Micro gear using LIGA process with neat sketches.		10	KTUDEC2020
	Explain steps off abrication of a Square tube using LIGA process		10	KTUSEP2020
3	Explain the oxide growth process in Silicon with relevant figures.		8	KTUDEC2020 KTUMAY2019
	Explain with figures the steps in surface micromachining. Discuss the various fabrication challenges associated with surface micromachining		10	KTUSEP2020
4	Explain two processes used for doping silicon substrate and also specify two n and p type dopants		7	KTUSEP2020
	Explain surface micro machining process for fabricating a mechanical structure with neat sketches.		10	KTUDEC2019
	Explain the steps involved in photolithography with neat sketches.		7	KTUDEC2019
	Explain the steps involved in photolithography. State the chemicals used in each of the stages along with the operating conditions.		10	KTUMAY2019
	A silicon substrate is doped with boron ions at 100 KeV. Assume the maximum concentration after the doping is 30 x 10^{18}/cm3. Find (a) the dose, Q, (b) the dopant concentration at the depth 0.15 μm and (c) the depth at which the dopant concentration is at 0.1% of the maximum value. (Given: Rp = 307nm=307x10^{-7}cm and ΔRp=69x10^{-7}cm at 100KeV energy level).		10	KTUDEC2018
6	Describe the role of sacrificial layers in surface micromachining with figures. Give examples of two sacrificial materials used in micro system fabrication.		5	KTUDEC2018
	Compare wet and dry oxidation.		3	KTUJUN 2023
	a) With neat sketches. explain diffusion and ion implantation involved in micro system fabrication. (b)With neat sketches, explain any two problems associated With surface micro mach		8 6	KTUJUN 2023

7	Describe chemical etching and plasma etching	8	KTUJAN 2024
	Explain surface micro machining process for fabricating a mechanical structure with neat sketches.	6	KTUJAN 2024
	Explain the steps involved in photolithography.	8	KTUJAN 2024
	Explain the criteria for choice of surface or bulk micromachining techniques in the design of micro systems	6	KTUJAN 2024
	Discuss the criteria for selecting materials for the masks used in etching	3	KTUJAN 2024
	State two advantages of LIGA process over other micro machining techniques	3	KTUJAN 2024
8	Describe chemical etching and plasma etching	8	KTU MAY 2024
	Describe steps of fabrication of a square tube using LIGA process.	6	KTU MAY 2024
	With neat sketches and equations, explain chemical vapor deposition involved microsystem fabrication.	8	KTU MAY 2024
	With neat diagrams explain how a cantilever beam is fabricated using surface micromachining.	6	KTU MAY 2024
	Differentiate dry oxidation and wet oxidation method.	3	KTU MAY 2024
	Explain stiction with an example.	3	KTU MAY 2024

		MODULEV		
1		With necessary diagrams, explain the anodic bonding process	10	KTUDEC2021
		Write a briefnote on I.RFMEMS II NEMS	10	KTUDEC2021
		Explain with figures any three surface bonding techniques.	10	KTUDEC2021
		State the objectives and explain the levels of micro system packaging.	10	KTUDEC2021 KTU SEP 2020 KTUMAY2019
2		What is meant by Bio MEMS .Discuss the challenges involved in BioMEMS. List two applications of BioMEMS	10	KTUDEC2020 KTUMAY2019
		Explain the different stages in the Assembly of micro systems.	10	KTUDEC2020
		Explain with figures two application which use NEMS technology	10	KTUSEP2020 KTUMAY2019
		Explain with figures two RFMEMS applications	10	KTUSEP2020 KTUDEC2019 KTUMAY2023
3		Explain the following bonding techniques with figuresa) Silicon-on-Insulator b) Wire bonding	10	KTUSEP2020 KTUDEC2018
		Explain Anodic bonding and Silicon Fusion Bonding.	10	KTUDEC2019 KTUMAY2019
		State the challenges involved in designing packages for micro systems.	5	KTUDEC2018
		Explain any one application of MOEMS with figures.	5	KTUDEC2018
4		a) With neat sketches, explain sealing in micro pressure sensors, microvalves, and micropumps. b))Explain the various applications of RF MEMS.	10 3	KTUJUN 2023
5		a) Describe different levels of microsystem packaging. b) Describe SOI process and wire bonding.	8 6	KTUMAY2023
6		Describe any one sealing method used in assembly of micro systems.	3	KTUMAY2023
7		Describe any one sealing method used in assembly of microsystems.	3	KTUMAY2024
		Mention the general considerations to be taken in the microsystem packaging design	3	KTUMAY2024
		Explain the following process techniques with figures a) Silicon-on-Insulator b) Wire bonding	8	KTUMAY2024

		Explain the various applications of RF MEMS.		
		Explain the following bonding techniques a) Anodic bonding b) Silicon fusion bonding	8	KTUMAY2024
		Write short notes on a) Bio-MEMS b) NEMS	6	KTUMAY2024
8		State the various levels of micro system packaging	3	KTU JAN2024
		Explain any one application of MOEMS with figures	3	KTU JAN2024
		Explain with figures two RF MEMS applications	8	KTU JAN2024
		Explain Anodic bonding and Silicon Fusion Bonding	6	KTU JAN2024
		Explain the challenges involved in BioMEMS. List three applications of BioMEMS	8	KTU JAN2024
		Explain the challenges involved in designing packages for microsystems	6	KTU JAN2024

HUT 310: MANAGEMENT FOR ENGINEERS
MODULE 1

Sl No	Question		Marks
1	"Management is a combination of arts, science and profession. Explain fully.	Model Qn May 2024	3
2	Explain System approach to management with block diagram? Describe roles of a manager	Model Qn, Dec 2021 Dec 2023 June 2024 May 2024	10 4
3	What are the different levels of management? What is the importance of delegation in management	Dec 2021	3
4	Explain Task and Responsibilities of a professional Manager.	Dec 2021	8
5	Discuss any three skills of management	June 2022 Dec 2023 June 2024	3
6	Explain contingency Approach in Management	June 2023	3
7	Explain in detail about 14 principles of Henry Fayol's Administrative Management	June 2023	14
8	"Effectiveness and efficiency balance is a main feature of management". Summarize. "Management is a composite and continuous process". Express your views.	Dec 2023	6
9	Discuss the aspects in which the neoclassical theory improved the classical theory.	Dec 2023	3
10	Explain how the managerial functions interrelates with each other	Dec 2023	8
11	Specify the characteristics of management	June 2024	10

MODULE 2

1	What are planning premises, explain the classification of planning premises. Explain the process of communication.	Model Qn June 2024 May 2024	10
2	a)Explain 3 motivational theories b) Describe Managerial grid	Model Qn, June 2023	9 5
3	Explain the vision, mission, goals, strategy, programmes, policy, objective and procedures of an organisation with suitable examples.	Dec 2021 Model Qn Dec 2023	8
4	Differentiate between strategic and tactical decisions.	Dec 2021	6
5	a) Illustrate the different types of organisation structures. b) Explain the factors governing the selection of organisation structures.	Dec 2021 June 2023 June 2024 May 2024	8 6
6	Differentiate positive and negative motivation	June 2022	3
7	What is transactional leadership Explain about dimensions of leadership	June 2022 June 2023	8

8	Explain the concept of span of control in an organisation. What are the factors governing the selection of span of management. Differentiate narrow and wide spans of management.	June 2022 Dec 2022 Dec 2023 June 2024	12
9	Enumerate the advantages of functional organisation. List the features of management process	Dec 2023	6
10	Define the terms Authority, Responsibility and Accountability. Also, list the sources of authority.	Dec 2023	8

MODULE 3

1	Explain decision making and types List out and explain the models of decision making.	Model Qn Paper June 2024 May 2024	3
2	Describe the economic man model	Model Qn Paper	3
3	a) Modern forest management uses controlled fires to reduce fire hazards and to simulate new forest growth.Management has the option to postpone or plan a burning.In a specific forest tract,if burning is postponed a general administrative cost of Rs, 300 is incurred .I a controlled burning is planned,there is a 50% chance that good weather will prevail and burning will cost Rs.3200.The results of burning may be either successful with probability 0.6 or marginal with probability 0.4.Successful excitation will result in an estimated benefit of Rs.6000 and marginal execution will provide 3000/- in benefits. i) Develop a decision tree for the problem. ii)Analyse the decision tree and determine the optimal course of action. b) Student tuition at ABC university is $100 per semester credit hour. The education dept. supplements the university revenue by matching student tuition,$ per $.Average class size for a typical 3 credit course is 50 students.Labour cost is $ 4000 per class,material cost is $ 20 per student and overhead cost is $25000?- per class. a) Determine the total factor productivity b) Instructors deliver lectures 14 hr per week and the semester lasts for 15 weeks. What is the labour productivity?	Model Qn Paper May 2024	14
4	a)The producer of an apple crates company produces 270 crates per 100 logs with his current equipment. He currently purchases 100 logs per day, and each log required 3 labour hours to process. He believes that he can hire a professional buyer who can buy a better quality log at the same cost. If this is the case, he increases his production to 290 crates per 100 logs. His labour hours will increase by 8 hours per day. What will be the impact on productivity (measured in crates per labour-hour) if the buyer is hired? What is the growth in productivity in this case? b) Explain decision making under uncertainty.	Dec 2022	10 4

5	a)A cell phone manufacturer has invented a 3D phone. The company wants to take decision whether to manufacture the phone, take royalty from another manufacturer, or sell rights of the invention and take a lump sum amount of ₹50,000. The profits associated and probability of these alternatives is given in the table below. Represent the problem as a decision tree and suggest a decision to maximise profits.	Dec 2022	7

Demand	Manufacture the phone		Take royalty	
	Probability	Profit (₹)	Probability	Profit (₹)
High	0.25	200,000	0.25	60,000
Medium	0.4	50,000	0.4	40,000
Low	0.35	-10,000	0.35	20,000

b) Explain the different models of decision-making behaviour

4

6	How can we improve the productivity of an organisation? What is the difference between production and productivity?	Dec 2022 June 2023 June 2024 May 2024	3
7	List out the steps in rational decision-making. Illustrate the difference between programmed and non programmed decisions by highlighting suitable examples	Dec 2022 Dec 2023 May 2024	3
8	Discuss decision making under risk Describe types of risks with example.	June 2022 June 2024	3
9	A food products company is planning the introduction of a revolutionary new product with new packing to replace the existing product at much higher price (S1) or a moderate change in the composition of the existing product with a new packaging at a small increase in price(S2) or a small change in the composition of the existing except the word, 'New' with a negligible increase in the price (S3). The three possible states of nature of events are (i) high increase in sales (N1) (ii) no change in sales (N2) (iii) decrease in sales (N3). The marketing department of the company worked out the payoffs in terms of yearly new profits for each of the strategies on these events. This is represented in the following table. Which strategy should the executive concernmed choose on the basis of (a) Maximin Criterion (b) Maximax Criterion	Dec 2023 June 2024	10

(c)Minimax regret Criterion

(d)Laplace criterion

	Pay offs		
	States of nature		
Strategies	N1	N2	N3
S1	700	300	150
S2	500	450	0
S3	300	300	300

10	Explain in detail different productivity measurement indices.	Dec 2023	14

MODULE 4

1	Explain the concept of crashing and dummy activity	Model Qn Dec 2022	3
2	a)Differentiate qualitative and quantitative methods in forecasting b) Differentiate between CPM and PERT	Model Qn June 2024	3
3	a) A project consists of 7 activities and the three time estimates are as follows:	Dec 2022 Dec 2023	10

Activities	Duration in weeks		
	t_o	t_m	t_P
A	2	6	10
B	4	6	12
C	2	3	4
D	2	4	6
E	3	6	9
F	6	10	14
G	1	3	5

The sequence of activities is as follows: Activities A and B start at the beginning of the project.   When A is completed C and D start. Ecan start when B and D are finished.

F can start when B, C and D are completed and is the final activity. G can start when F is finished and is the final activity. i. What is the expected time of the duration of the project? ii. Identify the critical path of the project. iii. Calculate the probability that the project will be completed in 23 weeks.

b) Write notes on Fulkerson's rule of numbering events.

| June 2024 | 4 |

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4 a)The following table shows the precedence requirements, normal and crash times, and normal and crash costs for a project. The indirect costs are ₹ 70/day.

Activity	Required Time (days)		Cost (₹)	
	Normal	Crash	Normal	Crash
1-2	8	6	100	200
1-3	4	2	150	350
2-4	2	1	50	90
2-5	10	5	100	400
3-4	5	1	100	200
4-5	3	1	80	100

   i. Draw the network. ii. Determine the critical path. iii.
   Determine the optimal duration and the associated cost after
   crashing.

b) Differentiate between activity and event in a project network.

| Dec 2022 | 10 |

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5 What are the rules for constructing a project network

| June 2022 | 3 |

6	What is an event in a project network? Using sketches, explain merge and burst events What are the different networking components Explain the rules for network analysis in project management	June 2022 Dec 2023 May 2024	3
7	Using beta distribution, explain the three time estimates associated with the PERT.	June 2022	4
8	Following details are available regarding a project: | Activity	Predecessor activity	Duration(weeks)
---	---	---
A	-	3
B	A	5
C	A	7
D	B	10
E	C	5
F	D,E	4	 a) Draw network diagram b) Calculate EST,EFT,LST,LFT and slack of the project network c) Find critical path and project duration	June 2022 June 2024	10
9	Consider the project network with data given in the following table. 	Activity	Predecessor(s)	Time		
---	---	---	---	---
		Optimistic	Most likely	Pessimist
A	-	4	6	8
B	A	5	7	15
C	A	4	8	12
D	B	15	20	25
E	B	10	18	26
F	C	8	9	16
G	E	4	8	12
H	D,F	1	2	3
I	G,H	6	7	8 | a) Construct an arrow diagram for the above data. Determine critical path and expected project completion time. b) Determine the probability that the project would be completed in 55 days	June 2022 Dec 2023 May 2024	10
10	Explain Activity-on-Arc(AOA) and Activity-on-Node(AON) in detail with suitable graphical representation.	Dec 2023	8

MODULE 5

1	"Human Resource Management policies and principles contribute to effectiveness, continuity and stability of the organization". Discuss List out the basic activities of human resource development	Dec 2022 May 2024	10
2	a)What are intellectual property rights? Explain the business importance of patents. Explain the different forms of Intellectual Property Rights. b)"Corporate social responsibility is about giving back to society." In view of the statement, explain the concept of CSR and current CSR practices of firms in India.	Dec 2022 June 2024 May 2024 June 2024	7 7
3	Explain the various interrelationships between the following functional areas. (i) Production and Marketing (ii) Production and Finance (iii) Production and Personnel.	Dec 2022	7
4	Explain the process of market segmentation. How is the marketing mix related to market segmentation? Discuss the four P's of marketing mix	Dec 2022 Dec 2023	10
5	Operations management is the process of planning, organizing and controlling the activities of a production function". Explain.	Dec 2022 June 2023	12
6	Distinguish between the following. (i) Assets and Liabilities (ii) Production concept and Marketing concept (iii) Needs and Wants (iv) Design functions and Operational control functions	Dec 2022	4
7	Explain the entrepreneurial process. Illustrate any three types of entrepreneurships. Explain the different characteristics of a successful entrepreneur. Compare entrepreneur and manager	Dec 2022, June 2022 June 2023 Dec 2023 May 2024	14
8	a)Describe the significance of a business plan in a company. b) Elaborate different market segmentation strategies c)Explain the purpose of budgets?What is the financial budget? Describe any three types	June 2022 June 2024 Dec 2023	6 8 7

		June 2024	
9	Differentiate between recruitment and selection Define marketing and marketing mix.	Dec 2022 Dec 2023	3 3
10	"Financial Management is managing the finances through scientific decision making". Defend stating the different financial management functions.	Dec 2023	10

ECT302
ELECTROMAGNETICS

Faculty-
Dr. Jayarenjini N

	MODULE 1		
Sl. No.	Questions	Marks	KTU/YEAR
1	Define divergence and state divergence theorem.	3	June 2024
2	Write all equations for transforming a vector field from cylindrical to rectangular coordinates.	3	June 2023 Dec 2024
3	Given $\vec{D} = 2xy\,\vec{a_x} + x^2\,\vec{a_y}$ c/m² in Cartesian co-ordinates. Verify Gauss diverg theorem for volume enclosed by $0 \le x \le 1, 0 \le y \le 2$ and $0 \le z \le 3$.	8	June 2023
	Determine D at (4, 0, -3) if there is a point charge -5 π mc at (4, 0, 0) and a line charge 3 π mc along y axis.	3	June 2022
	Point charges 5 nC and -2 nC are located at (2, 0, 4) and (-3, 0,5), respectively. Determine the force on a 1nC point charge located at (1,-3,7). Find the electric field E at (1, - 3, 7).	7	Dec 2018
4	Derive Poisson's and Laplace's equations in electrostatics	6	Dec 2024 June 2023 June 2022 Dec 2018
5	A point charge of 100 pc is located at origin and the plane $z = 5m$ also carri charge of 5nc/m². Find $\vec{E}$ at point (1, 1, 1).	7	June 2023
	Point charges 5nC and -2nC are located at (2, 0, 4) and (-3, 0, 5) respectively. Calculate the electric force on a 1nC charge located at (1,-3, 7) and the E at that point.	3	June 2022
6	Given $W = x^2 y^2 + xyz$. Compute ∇W and the directional derivative $\frac{dW}{dl}$ in direction $3\,\vec{a_x} + 4\,\vec{a_y} + 12\,\vec{a_z}$ at (2,-1,0).	7	June 2023
7	Show that from the conservative property, the curl of a static electric field has zero value everywhere.	3	June 2022
	Define curl of a vector field. Derive the equation for curl of a vector field in Cartesian co-ordinate system	3	April 2018
8	State and prove Ampere's circuit law.	6	May 2019 April 2018 Sept 2020
9	State and explain Gauss Law.	5	Dec2019
10	Derive an expression for magnetic energy of a continuous distribution of current in a volume.	7	May 2019

3

MODULE 2

Sl.No.	Questions	Marks	KTU/YEAR
1	What are the equations representing the governing laws for time-varying electric and magnetic fields.	3	Dec 2024 June 2023
	State and express Maxwell's equations for time varying field in point form.	3	June 2022
	State and explain Maxwell's equations in the integral and differential forms.	8	Dec 19, May 19 Dec 2018,Dec17
2	Derive the expression for the inductance of a co-axial cable.	3	June 2023
	Derive the expression of capacitance and inductance of two wire transmission line.	8	Dec 2024 Dec 2019 Dec 2018 Dec 2017
3	Define magnetic scalar and vector potentials, stating the conditions under which each of them exist.	6	June 2023
	Explain Scalar and vector magnetic potential.	7	Dec 2019
4	Derive the expression for energy stored in a charge distribution and hence in an electric field.	8	June 2023
	Derive the expressions for Energy stored in Electric Field.	8	Dec 2017
	Derive the expressions for Energy stored in Magnetic Field.	8	June 2022
5	A cylindrical capacitor with a= 1.5 cm, and b=4 cm has an inhomogeneous dielectric of $\varepsilon_r = \frac{10\varepsilon_o}{r}$, where r is in cm. Calculate the capacitance per meter of the capacitor.	6	June 2023
	A cylindrical capacitor has radii a= 1 cm, and b=2.5 cm. If the space between the plates is filled with an in homogeneous dielectric with $\varepsilon_r = \frac{10+r}{r}$, where r is in cm. Find the capacitance per meter of the capacitor.	6	June 2022
	An air filled parallel plate capacitor is with following specification, area =2 m^2 and spacing between the plates = 0.1 m. If a voltage = $20cos10^3 t$ is applied across the capacitor plates, find the magnetic field between the capacitor plates.	5	May 2019
6	Derive the boundary conditions for electric field at the interface between two dissimilar dielectric materials, for zero and nonzero surface charge conditions..	8	June 2022
	State and prove boundary conditions for E and H in accordance with Maxwell's Equations	7	June 2024 Dec 2018 Dec 2017 Sept 2020

4

7	Starting from Maxwell equation, derive the wave equation for a conducting medium.	7	April 2018 Dec 2017
8	A radial field $\vec{H} = \dfrac{2.39 \times 10^6}{r} \cos\phi\, \vec{a_r}$ A/m exist in free space. Find the magnetic crossing the surface defined by $0 \le \phi \le \pi/4$ and $0 \le z \le 1m$	7	June 2022
9	Define electric field intensity. Derive the equation for electric field intensity at a distance 'r' from a point charge of Q coulombs	7	April 2018

MODULE 3

Sl.No	Questions	Marks	KTU/Year
1	An EM wave in free space is incident normally on a dielectric with. Find the reflection and transmission coefficients.	3	June 2024 June 2023
	Write the differential equation for E-field of a uniform plane wave travelling in y direction. Write also its solution in sinusoidal form.	3	June 2023
2	The skin depth of Cu at 3GHz is $2\mu m$. Calculate the skin depth at 3GHz for another conductor whose conductivity is 1/10 times that of Cu.	3	June 2022
	Define skin depth for a conductive medium? If σ denotes the Conductivity, Derive the equation for skin depth for a good conductor.	5	April 2018 Sept 2020
3	The magnetic field component of an EM wave propagating through a non magnetic dielectric medium is given by $\vec{H} = 6\cos(2\times10^8 t - 6x)\vec{a_r}$ A/m Determine the permittivity of the medium and the electric field intensity.	7	Dec 2024 June 2022
4	Assuming free space conditions and expressing Maxwell's equation in $\vec{H}$ only, Show that an electromagnetic wave can be written as $\nabla^2 \vec{H} = \mu_0 \varepsilon_0 \dfrac{\partial^2 \vec{H}}{\partial t^2}$	7	June 2022
5	Derive the expression for reflection and transmission coefficients when a uniform plane electromagnetic wave is incident obliquely on a dielectric surface with perpendicular polarization.	7	June 2022
	Derive the solution of uniform plane wave in lossy dielectric medium.	6	May 2019
	Derive the equation for Electric and Magnetic field intensities for an electromagnetic wave propagating in the z-direction in a dielectric medium. Find the following: (i) Attenuation constant; (ii) Phase velocity; (iii) Phase constant; (iv) Intrinsic impedance.	9	April 2018 Sept 2020

Sl.No	Questions	Marks	KTU/Year
	Explain Group velocity and Phase velocity. When a wave of 6 GHz propagates in parallel conducting plates separated by 3 cm, find the V_p and V_g of the wave fordominant wave.	8	Dec 2017
6	Derive an expression for reflection coefficient of a plane wave incidence with parallel polarization (or perpendicular polarization) at a dielectric interface.	6	Dec 2019 May 2019 Sept 2020
7	Derive an expression for net outward power flow associated with an electromagnetic wave, from a surface.	8	June 2023 May 2019
9	Derive the expression for refraction and reflection coefficient of plane electromagnetic waves that undergoing oblique incidence with vertical polarization (considering boundary separation).	7	April 2018 Sept 2020
10	Derive Brewster angle. A parallel-polarized plane wave is incident from air onto a dielectric medium with $\varepsilon_r = 9$ at the Brewster angle. What is the refraction angle?	9	Dec 2017 Sept 2020
	What is Snell's law?	3	May 2019

MODULE 4

Sl.No	Questions	Marks	KTU/Year
1	Define Standing wave ratio and explain the relation with reflection co-efficient of a transmission line.	3	June 2023 June 2022
	Define reflection coefficient and VSWR of a transmission line and derive the relation between reflection coefficient and VSWR.	7	June 2023 May 2019 Dec 2018
2	What is a quarter-wave transformer?	3	June 2023
	If Z_{oc} and Z_{sc} denote input impedance if a transmission line is terminated by open and a short circuit loads respectively, prove that $Z_{oc}Z_{sc} = Z_o^2$ where Z_o is the characteristic impedance.	7	Dec 2024 June 2023
3	State Poynting theorem. Derive the equation of complex vector.	8	June 2023. June 2022, Dec 2017
4	In a non-magnetic medium, find (i) ε_r, η (ii) time average power carried by the wave (iii) total power crossing 100 cm² of plane $2x + y = 5$, if the field $E = 4 Sin(2\pi \times 10^7 t - 0.8x)\vec{a_z}$ V/m is passing through this medium.	7	June 2022
5	A transmission line has the following constants, $R = 10.4 \Omega/m, L = 3.66 mH/m$ $C = 0.00835\mu F/m$ and $G = 0.08\mu$ mho/m .Calculate, Z_o, α, β and v_p ,at $\omega = 5000 rad/s$	7	June 2022
	Derive an expression for characteristic impedance of a transmission lineand	7	Dec 2018

	show that it is resistive at radio frequencies		
	A lossless transmission line has primary constant L=0.01μH/m, C=100pF/m. Find the characteristic impedance or the line.	5	May 2019
6	What is Polarisation? Explain the different types of Polarisation?	7	Dec 2018 Dec 2017 Sept 2020
7	A 10GHz plane wave linearly polarized in x-direction and travelling in a free space in positive z-direction has amplitude, $E = 10V/m$. Find a) Velocity of propagation c) wavelength Intrinsic impedance d) amplitude and direction of H-field.	7	June 2023
8	Derive the decoupled differential equations for voltage and current in a transmission line. Write the expressions for i) propagation constant and ii) the solutions for the differential equations.	7	June 2022
9	Derive the ABCD parameters of a transmission line.	8	Dec 2017
	Derive standard Transmission line equations.	6	Dec 2017
10	A lossless 50-Ω transmission line is terminated in a load with ZL = (50+ j25) Ω. Calculate(i)The reflection coefficient Γ.(ii)The standing-wave ratio.	7	Dec 2017
	Derive the equation of input impedance of a transmission line due to line terminated by a load	7	Dec 2019
	Derive the expression for characteristic impedance of a transmission line	8	Dec 2019
	What are distributed elements?	3	May 2019

MODULE 5

Sl.No	Questions	Marks	KTU/Year
1	Explain term wave impedance in a waveguide. Compare the wave impedance of TE and TM waves.	3	Dec 2024 June 2023
	Explain why TEM wave cannot propagate in a single conductor hollow waveguide.	3	June 2023
	With a neat diagram explain the propagation of electromagnetic wave in a rectangular wave guide?	8	Dec 2019 April 2018
	Derive the expressions for TE(or TM) mode in a rectangular wave guide.	10	Dec 2019 May 2019 April 2018
	Explain waveguides and its different modes of wave propagation.	10	Dec 2017
	Give the dominant modes for TE and TM modes in a rectangular waveguide, with reason derive the expressions for cut off frequency for dominant mode.	3	June 2022
2	A lossless line with Z0 = 50Ω is 30m long and operates at 2MHz. The line is	7	June 2022

	terminated with a load, ZL = 60 + j40 Ω . If u = 0.6c on the line, where c is the velocity of light, then using Smith chart, Find (i) Reflection coefficient at load (ii) VSWR (iii) Input impedance		
	A lossless 60Ω line is terminated by a 60 + j60Ω load. Find Γ and s, if Zin =120 - j60Ω. How far is the load from generator (Solve with Smith chart)?	6	Dec 2017
	At a frequency of 80 MHz, a lossless transmission line has a characteristic impedance of 300Ω and a wavelength of 2.5m. Find: i) L ii) C iii) If the line is terminated with a parallel combination of 200Ω and 5pF, determine the reflection co-efficient and the standing waveratio.	7	Model 2022
	A 50 + j200 Ω load is connected to a 100Ω lossless transmission line . Using smithchart , find i. Reflection coefficient at load ii. VSWR iii. Load admittance	7	Model 2022 Sept 2020
3	Explain the following terms. i) Dominant mode (ii) Cut off frequency iii) Group velocity and phase velocity (iv) Degenerate modes 7 June 2022 5	8	June 2022
	An air filled rectangular waveguide has dimensions of a = 5cm, b = 2 cm. The signal frequency is 10 GHz. Calculate the following for TE10 and TE11 modes. a) Cut off frequency c) phase constant and phase velocity b) Guide wavelength d) wave impedance	8	June 2022
	A rectangular wave guide has a dimension of 3cm x 5cm , and is operating at a frequency of 10 GHz . Calculate the cutoff wavelength, cutoff frequency , guide wavelength , phase velocity and group velocity . and the wave impedance for TE10 mode.	7	Model 2022
4	Using transmission line equation, discuss the two different parameters to define transmission line as circuit element.	9	June 2022
	Derive the current and voltage equation of a transmission line.	7	May 2019
	Draw the circuit of small section of transmission line of differential length and label the circuit parameters.	3	May 2019
5	Derive the expression for r-circles and x-circles in Smith chart.	10	Dec 2018 Sept 2020
6	How a smith chart is useful in finding the stub length for impedance matching.	4	April 2018
7	A hollow rectangular waveguide has dimensions of a= 4 cm and b= 2 cm. Calculate the amount of attenuation if the frequency is 3.5 GHz. Assume dominant mode.	10	Dec 2018

| 8 | Determine, assuming TE_{10} mode of propagation ,the cut-off frequency, cut- off wavelength, guide wavelength, phase constant, phase velocity, group velocity and wave impedance in the case of a hollow rectangular metallic waveguide of dimensions 6cm and 3 cm, respectively, when the applied

signal frequency is 5 GHz. | 10 | Dec 2018 |

9