



2021 BATCH QUESTION BANK

SEMESTER 6, 2023-2024

Staff Advisors:- Mr. Chandu C.B. and Ms. Sreejitha S.G.

QUESTIONS COMPILED BY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING



VIDYA ACADEMY OF SCIENCE & TECHNOLOGY TECHNICAL CAMPUS, KILIMANOOR

INDEX

SUBJECT CODE	SUBJECT NAME	PAGE NUMBER
ECT304	VLSI CIRCUIT DESIGN	02
ECT306	INFORMATION THEORY AND CODING	06
ECT362	INTRODUCTION TO MEMS	17
HUT300	INDUSTRIAL ECONOMICS AND FOREIGN TRADE	24
ECT302	ELECTROMAGNETICS	32

2021 Batch S6
(2023 – 2024)

ECT304

VLSI CIRCUIT DESIGN

Faculty – Ms. Sreejitha S.G.

MODULE 1

SI 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) Differentiate between ASIC and FPGA b) With a neat flow chart, explain ASIC design flow.	3 8	Model Que June 2023
5	Differentiate between full custom and semi-custom ASIC.	10	June 2022 June 2023
6	Describe Gate array based ASIC with neat diagram.	8	Model Que
7	What are the processes involved in Soc design. List its advantages	6	Model Que
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	Explain the significance of power considerations in VLSI	4	June 2022

MODULE 2

SI No	Question	Marks	KTU year
1	Draw the circuit of a MOS inverter with saturated NMOS load	3	June 2022
2	Illustrate CMOS inverter DC characteristics with neat diagrams. Explain the different regions	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
5	Why PMOS transistor can pass only strong ones and NMOS can transfer only strong zeros.	6	Model Que
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. $Y=(A(B+C))'$	7	April 2018 June 2023
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 Model Que
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	3	Model Que
8	Compare the advantages of three transistor and one transistor DRAM cell.	3	Sep 2020
9	Design a 4x4 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
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

MODULE 5

SI 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	4 10	May 2019 Sep 2020 June 2022 June 2023
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 SiO ₂ 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	5	Sep 2020

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ECT306 INFORMATION THEORY AND CODING

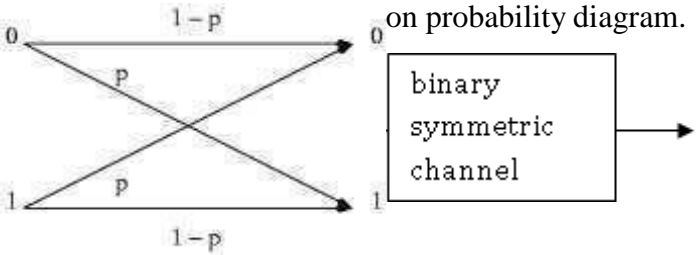
Faculty – Ms. Abha M.L.

Module 1

SI No	QUESTIONS		Marks
1	A source emits one four symbols, s_0, s_1, s_2, s_3 with probabilities $1/3, 1/6, 1/4$ and $1/4$ respectively. The successive symbols emitted by the source are statistically independent. Calculate the entropy of the source.	Model qn	3
2	State Shannon's channel coding theorem. What is its significance in digital Communication system?	Model qn	3
3	A source transmits two independent messages with probabilities p and $(1-p)$ respectively. Prove that the entropy is maximum when both the messages are equally likely and plot the graph for Entropy H	KTU June 2022	3
4	An analog signal band limited to 'B' Hz is sampled at Nyquist rate. The samples are quantized into 4 levels. The quantization levels are assumed to be independent and occur with probabilities: $p_1 = p_4 = 1/8, p_2 = p_3 = 3/8$. Find the information rate of the source assuming $B = 100\text{Hz}$.	Model qn	8
5	a) Define mutual information $I(X; Y)$. Find the mutual information if X and Y are independent. b) A discrete source emits 7 symbols with probabilities, 0.15, 0.24, 0.13, 0.26, 0.12, 0.02, 0.08. Construct binary codes using Huffman algorithm	KTU DEC 2021	10
6	a) Explain the necessary and sufficient conditions for a code to be instantaneous. Give examples. b) A zero memory source has a source alphabet, $S = \{s_1, s_2, s_3\}$ with $P = \{0.5, 0.3, 0.2\}$. Find the entropy of the source. Find the entropy of its second extension and verify.	KTU DEC 2021	10
7.a	A discrete source emits one of six symbols once in every milliseconds. The source probabilities are $1/2, 1/4, 1/8, 1/16, 1/32$ and $1/32$. Find the source entropy and Information rate.	KTU June 2022	7
7.b	A DMS has 6 codes with probabilities as $p(x_1)=0.25, p(x_2)=0.3, p(x_3)=0.12, p(x_4)=0.2, p(x_5)=0.08$ and $p(x_6)=0.05$. Obtain the Huffman codes and find the code efficiency and redundancy	KTU June 2022	7
8.a	Calculate the information rate of a telegraphy system which uses a dash and dot as symbols. Assume that the dash is twice as long as dot and half as probable. The data last for 0.2 milliseconds and the same interval exists for the pause between the symbols.	KTU June 2022	7
8.b	State and prove Kraft's inequality	KTU June 2022	7

9.a	Show that $H(X, Y) = H(X/Y) + H(Y)$.	KTU June 2023	7
9.b	Given the messages X1, X2, X3, X4, X5 and X6 with respective probabilities of 0.4, 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 June 2023	7
10.a	Construct an instantaneous binary code for a source producing 5 symbols S1 to S5 with respective probabilities of $\{1/2, 1/6, 1/6, 1/9, 1/18\}$. Also find the code efficiency and redundancy?	KTU June 2023	7
10.b	The joint probability of a pair of random variable is given below. Determine $H(X)$, $H(Y)$, $H(X,Y)$, $H(X/Y)$, $H(Y/X)$ and $I(X,Y)$. Verify the relation between joint, conditional and marginal entropies? $P(X, Y) = \begin{bmatrix} 1/3 & 1/3 \\ 0 & 1/3 \end{bmatrix}$	KTU June 2023	7

MODULE 2

1	Write short notes on: (a) Binary Communication channel (b) Binary symmetric channel.	KTU SEP 2019	7
2	Write notes on: a. Huffman coding b. Capacity of band limited Gaussian channels	KTU MAY 2019	10
3	Two binary symmetric channels are connected in cascade as shown in figure below. Find the overall channel capacity of the cascaded connection assuming  on probability diagram.	KTU MAY 2019	10
4	Consider a sequence of letters of English alphabet with their probabilities of occurrence as given here letters = [a, b, c, d, E, f, g, h]; [P] = [0.1 0.1 0.2 0.1 0.1 0.2 0.1 0.1]. Compute two different Huffman codes for this source. For these two codes find <ul style="list-style-type: none"> ● Average code word Length ● Variance of average code word. Entropy	KTU DEC 2020	10
5	Construct optimum code using Huffman coding with following data. Let $S = \{S_1, S_2, S_3, S_4, S_5\}$ occur with probabilities $P = \{0.55, 0.15, 0.15, 0.10, 0.05\}$, $X = \{0, 1\}$. Draw the code tree.	KTU SEP 2020	7
6	a) Find the differential entropy of a Gaussian distributed random variable. b) Derive the capacity of a Gaussian channel with bandwidth B and noise power spectral density N/2. Also, find the capacity when the bandwidth of the channel tends to infinity.	KTU DEC 2021	10
7.a	Explain the relation between differential entropy and entropy.	KTU June 2022	7
7.b	Derive the capacity of a Binary Symmetric Channel.	KTU June 2022	7

8.a	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 June 2023	7
8.b	Calculate the capacity of a Gaussian channel with a bandwidth of 1MHz and S/N ratio of 30dB.	KTU June 2023	7
9.a	Explain Binary Erasure Channel and derive its channel capacity.	KTU June 2023	7
9.b	Explain Bandwidth-efficiency relation and Shannon's Limit of a continuous Gaussian channel.	KTU June 2023	7
10	State the positive and negative statements of Shannon's channel coding theorem.	KTU June 2023	3

Module 3

1	<p>a) Draw a (2, 1,3) convolutional encoder with [1, 0, 1, 1] and [1, 1, 1, 1] as the impulse responses. Find the output of the convolutional encoder for input sequence 11011 using transform domain approach</p> <p>b) Given $G(D) = [1, 1 + D + D^3]$, design a (2, 1, 3) convolutional encoder of rate $=1/2$. Discuss properties of Hamming codes.</p>	KTU SEP 2019	20
2	What is Shannon's limit? Explain its significance.	KTU MAY 2019	5
3	<p>a) Define Ring and give two examples</p> <p>b) Parity matrix of a (7,4) systematic linear block code (LBC) is given as</p> $P = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ <p>1) Find the generator and parity check matrices. 2) Draw the syndrome calculation circuit. 3) Explain the decoding using the syndrome of a received vector.</p>	KTU MA Y 2019	10
4.a	State an explain shannon hartley theorem	KTU SEP 2020	5
4.b	Define standard array. How is it used in syndrome decoding? Explain with an example.	KTU SEP 2020	5
5.a	<p>For a systematic linear block code, the three parity check bits, c_4, c_5 and c_6 are given by:</p> $c_4 = d_1 \oplus d_2 \oplus d_3$ $c_5 = d_1 \oplus d_2$ $c_6 = d_1 \oplus d_3$ <p>i. Construct the Generator matrix ii. Decode the received code word 101100.</p>	KTU June 2022	7
5.b	<p>For a (7,4) linear block code, the Generator matrix is</p> $G = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$ <p>i. Find all the codewords. ii. Comment on the error detection and correction capability. Draw the encoder circuit</p>	KTU June 2022	7
6.a	<p>Write notes on</p> <p>i. Rings ii. Finite fields.</p>	KTU June 2022	7

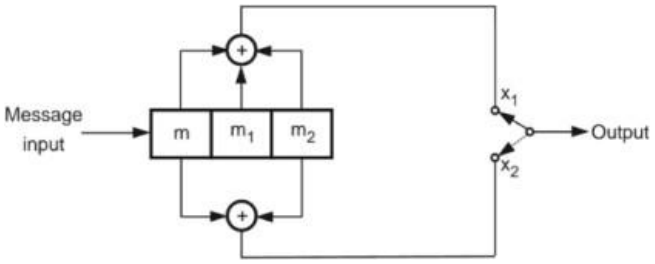
6.b	<p>The Parity check matrix of a (7,4) linear block code is given as</p> $H = \begin{bmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$ <p>Construct the code words and show that this is a Hamming code.</p>	KTU June 2022	7
7	Distinguish between block codes and convolutional codes.	KTU June 2023	3
8	Explain how generator matrix is obtained for a linear block code.	KTU June 2023	3
9.a	<p>Explain the procedure to prepare the standard array of LBC. Also construct the standard array of (4,2) LBC whose parity matrix is given by $P = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$</p>	KTU June 2023	7
9.b	<p>For a systematic (7,4) linear block code, the parity matrix P is given by,</p> $P = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ <p>A single error has occurred in the received vectors [0111110] and [1011100]. Detect and correct the error? Also draw the syndrome calculation circuit?</p>	KTU June 2023	7
10.a	<p>Construct the encoding circuit of a systematic (6,3) LBC with the parity matrix given by</p> $P = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ <p>Also find all possible code vectors.</p>	KTU June 2023	7
10.b	Explain the error detection and correction capabilities of linear block code.	KTU June 2023	7

Module-4

1	Explain generation of systematic cyclic code using polynomial description.	Model qn	3
2	List the features of Reed Solomon code.	Model qn	3
3.a	Consider a (7, 4) cyclic code with generator polynomial, $g(x) = 1 + x + x^3$. Express the generator matrix and parity-check matrix in systematic and non-systematic form	Model qn	8
3.b	Find the generator polynomial for single, double and triple error correcting BCH code of block length, $n = 15$.	Model qn	6
4	Construct the following for a non-systematic hamming codes <ul style="list-style-type: none"> ● Parity check matrix ● Generator matrix Code words for messages from 0001 to 1100	KTU MAY 2019	10
5.a	Explain encoding and decoding schemes using BCH codes.	KTU SEP 2020	7
5.b	The generator polynomial of (7,4) cyclic code is $G(P)=P^3+P+1$, Find all code vectors for all the code in non systematic form?	KTU SEP 2020	6
6.a	The generator polynomial of a (7,4) Cyclic code is $G(p) = p^3 + p + 1$. Find the code vectors corresponding to the message vectors 1011 and 1101 in Non Systematic form.	KTU June 2022	7
6.b	Draw the encoder circuit for a (7,4) Cyclic code with $G(p) = p^3 + p + 1$ and obtain the codeword for the message sequence 1001.	KTU June 2022	7
7.a	Obtain the generator matrix of a (7,4) Cyclic code for the generator polynomial $G(p) = p^3 + p^2 + 1$ in Non-systematic form and using that find the codeword for the message vector 1100 and 1111.	KTU June 2022	7
7.b	For a (7,4) Cyclic code, the received vector Y is 1110101 and the generator polynomial is p^3+p+1 . Draw the syndrome calculation circuit and correct the single error in the received vector.	KTU June 2022	7
8.a	Draw the general encoding circuit for (n,k) cyclic code and explain its operation.	KTU June 2023	7
8.b	Find the generator and parity check matrices of (7,4) cyclic code where $x^n+1 = x^7+1 = (1+x+x^3)(1+x+x^2+x^4)$.	KTU June 2023	7

9	For a (7,4) cyclic code, the received vector $Z(x)$ is 1110101 and the generator polynomial is $g(x)=1+x+x^3$. Draw the syndrome calculation circuit and explain the procedure with the register contents. Also correct the single error in the received vector.	KTU June 2023	14
10	List any three properties of cyclic code	KTU June 2023	3

Module-5

1	Explain the concatenated block codes?	Model qn	10
2	Draw a (3,2,1) convolutional encoder with generator sequences, $g_1(1)=(11)$, $g_1(2)=(01)$, $g_1(3)=(11)$ and $g_2(1)=(01)$, $g_2(2)=(10)$, $g_2(3)=(10)$	Model qn	3
3	Draw the tanner graph of rate 1/3 LDPC code for the given parity check matrix $H = \begin{bmatrix} 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$	Model qn	3
4	Draw the encoder circuit of a (2, 1, 3) convolutional encoder, if the generator sequences are $g(1)=(1\ 0\ 0\ 1)$ and $g(2) = (1\ 1\ 0\ 1)$ respectively. Explain the concept of Tanner graph in LDPC Code?	KTU June 2022	3
5	Explain the concept of Tanner graph in LDPC Code?	KTU June 2022	3
6.a	For a Convolutional encoder, the generator sequences are given as, $g(1) = (1,1,0)$ and $g(2) = (1,0,1)$. Obtain the a. Code Tree for the message sequence 1011 b. State diagram	KTU June 2022	7
6.b	For a Convolutional encoder, the generator sequences are given as, $g(1) = (1,0,1)$ and $g(2) = (0,1,1)$. a. Draw the encoder circuit. b. Output sequence for a message sequence 1011 using Time domain approach.	KTU June 2022	7
7.a	For the convolutional encoder shown in figure , decode the sequence , $Y = 11\ 01\ 11\ 00\ 01\ 10$ using Viterbi algorithm 	KTU June 2022	7
7.b	Explain the Message-passing decoding scheme for LDPC codes	KTU June 2022	7
8.a	For a (2,1,2) convolutional encoder with impulse response $g(1)=[111]$ and $g(2)=[101]$, find the output sequence for the message $D = 1\ 0\ 0\ 1\ 1$ by time domain approach.	KTU June 2023	3

8.b	Explain trellis diagram	KTU June 2023	3
9	Consider a (3,1,2) convolutional code with $g^{(1)}=(1\ 1\ 0)$, $g^{(2)}=(1\ 0\ 1)$ and $g^{(3)}=(1\ 1\ 1)$. i) Draw the encoder block diagram. ii) Find the generator matrix. Find the code vector corresponding to the information sequence (1 1 1 0 1) using time domain and transfer domain approach.	KTU June 2023	14
10	Explain Viterbi algorithm for decoding of convolutional code with example with the help of figure.	KTU June 2023	14

2021 Batch S6
(2023 – 2024)

ECT362

INTRODUCTION TO MEMS

Faculty – Ms. Devikrishna B.

ECT 362 INTRODUCTION TO MEMS

MODULE I			
Sl No:	Questions	Marks	KTU, Year
1	<p>Explain the basic block diagram of Microsensors & Actuators with neat sketches.</p> <p style="text-align: center;">OR</p> <p>Explain Lorentz force. Explain the operating principle of magnetic actuators with relevant figures.</p> <p style="text-align: center;">OR</p> <p>Explain the working principle of Piezoelectric Sensors and Actuators with one example.</p>	10 10 6	KTU JUN 2022 KTU MAY 2019 KTU JUN 2022
2	<p>Explain the working principle of micro inertia sensor</p> <p style="text-align: center;">OR</p>	3	KTU JUN 2022
3	<p>Describe the operating principle of Linear Micromotors with neat diagrams</p>	6	KTU JUN 2022
4	<p>Compare between Electrostatic sensing and Piezoelectric sensing in microsystems. Illustrate the sensing principle in each of these schemes with figures</p> <p style="text-align: center;">OR</p> <p>Explain the principle of operation of MEMS-based electrostatic sensors and actuators</p>	10	KTU DEC 2021 KTU JUN 2022
5	<p>Explain the basis of shape memory effect exhibited by Nitinol with graphs/figures</p>	5	KTU DEC 2021
6	<p>Explain the pull-in effect of parallel plate actuators. Derive the expression for pull-in voltage</p>	10	KTU DEC 2021
7	<p>Explain different types of micro accelerometer with diagrams</p> <p style="text-align: center;">OR</p> <p>Explain the operating principle of the cantilever beam accelerometer with a neat sketch.</p> <p style="text-align: center;">OR</p> <p>Describe the working principle of micro accelerometer with neat schematic diagrams. Give two applications.</p>	7	KTU SEP 2020 KTU JUN 2023 KTU JUN 2023
8	<p>Explain the operating principle of thermal bimorphs with figures. State any two applications of thermal sensors</p> <p style="text-align: center;">OR</p> <p>Explain the operating principle of thermal bimorphs with neat sketches</p>	7	KTU SEP 2020 KTU DEC 2018 KTU JUN 2023

9	<p>State a commercial product that uses MEMS technology. Explain with figures its operating principle of product</p> <p style="text-align: center;">OR</p> <p>Give one application of MEMS in automobiles. Illustrate its working with neat sketches.</p> <p style="text-align: center;">OR</p> <p>List three applications of MEMS systems.</p>	5	KTU MAY 2019
		5	KTU DEC 2018
			KTU JUN 2023
10	<p>a) With necessary diagrams explain the working of linear micro motors and rotary micro motors.</p> <p>b) Draw and explain the working of a micro valve</p>	8	KTU JUN 2023
		6	

MODULE II

1	Define normal stress and strain, how it is different from shear stress and strain	3	KTU JUN 2022
2	Explain the different boundary conditions and the types of beams with figures	3 5	KTU JUN 2022 KTU DEC 2021
3	Identify the relation between tensile stress and strain in terms of compliance matrix	6	KTU JUN 2022
4	Determine the moment of inertia for a beam under longitudinal strain and also find Flexural formula. OR Derive flexural formula for a beam with rectangular cross-section under pure bending. Also find the equation for maximum longitudinal strain.	8 7 3	KTU JUN 2022 KTU DEC 2020 KTU SEP 2020 KTU DEC 2019 KTU MAY 2023
5	State the reasons for intrinsic stress in thin film materials under room temperature and zero loading conditions	6 10	KTU DEC 2021 KTU DEC 2018
6	With reference to the general stress-strain relations, state the principle stress components and derive the stiffness matrix of Silicon <100> OR Explain sketches the general stress-strain relationship with neat diagram OR In terms of the compliance matrix, Identify the relation between tensile stress and strain	10 7 7	KTU DEC 2021 KTU SEP 2020 KTU JUN2023
7	Define the terms stress, strain, and modulus of elasticity.	3	KTU MAY 2023
8	List any three strategies for minimizing undesirable intrinsic bending.	3	KTU JUN2023
9	List any 3 commonly used mechanical structures in MEMS. Explain the operation of any one of the mechanical structures mentioning its application.	7	KTU JUN2023
10	State the reasons for intrinsic stress in thin film materials under room temperature. Describe anyone method for stress compensation.	4	KTU MAY 2023

MODULE III

1	Define Trimmer force scaling vector OR	3	KTU JUN 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	KTU MAY 2023
2	State three relevant properties of Silicon for use in Microsystem	3	KTU JUN 2022
3	Derive the expressions for Electromagnetic potential energy reference to scaling of electromagnetic forces OR	8	KTU JUN 2022
	With reference to scaling of electrostatic forces, derive the expressions for Electrostatic potential energy and force.	8	KTU DEC 2020 KTU SEP 2020 KTU MAY 2019
4	Explain the Langmuir-Blodgett process with relevant figures. What are the advantages of LB films?	6 10	KTU JUN 2022 KTU DEC 2018
5	By deriving the power loss to energy ratio in the microsystem justify the following statement. "10 times reduction in the size of a power supply system would lead to 100 times greater power loss due to increase of resistivity"	10	KTU DEC 2021
6	Derive the equations for scaling of heat transfer in convection for fluids in micrometer and sub-micrometer regime.	10	KTU DEC 2021
7	Explain various laws in miniaturization	7	KTU SEP 2020
8	Compare the properties of silicon, SiO ₂ and SiC OR	7	KTU SEP 2020
	State three relevant properties of Silicon Carbide and Silicon Nitride for use in Microsystems	8	KTU MAY 2023
9	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	KTU SEP 2020 KTU DEC 2018
10	Explain scaling in fluid mechanics. What are the advantages of piezoelectric pumping? OR	7	KTU DEC 2019
	State the constraints in pumping fluids in micro channels. What pumping scheme is usually used in micro fluidics, give one example.	7	KTU MAY 2019

MODULE IV

1	Explain the features of Isotropic etching. Why isotropic etching is hardly used for micro manufacturing?	5	KTU DEC 2021
2	Explain with figures the Micro stereo lithography process. What are its advantages over micromachining techniques?	10	KTU DEC 2021
3	Explain with figures the fabrication of a diaphragm based pressure sensor using bulk micromachining	10	KTU DEC 2021
4	Explain Deep reactive ion etching process with neat sketches OR Explain with figure the Deep Reactive Ion Etching (DRIE) and Plasma etching processes.	5 10	KTU DEC 2021 KTU DEC 2020
5	Explain the fabrication of a Micro gear using LIGA process with neat sketches. OR Explain steps of fabrication of a Square tube using LIGA process	10 10	KTU DEC 2020 KTU SEP 2020
6	Explain with figures the steps in surface micromachining. Discuss the various fabrication challenges associated with surface micromachining	10	KTU SEP 2020

7	Explain two processes used for doping silicon substrate and also specify two n and p type dopants	7	KTU SEP 2020
8	Explain the steps involved in photolithography with neat sketches. OR Explain the steps involved in photolithography. State the chemicals used in each of the stages along with the operating conditions.	7 10	KTU DEC 2019 KTU MAY 2019
9	A silicon substrate is doped with boron ions at 100 KeV. Assume the maximum concentration after the doping is $30 \times 10^{18}/\text{cm}^3$. Find (a) the dose, Q, (b) the dopant concentration at the depth $0.15 \mu\text{m}$ and (c) the depth at which the dopant concentration is at 0.1% of the maximum value. (Given: $R_p = 307 \text{ nm} = 307 \times 10^{-7} \text{ cm}$ and $\Delta R_p = 69 \times 10^{-7} \text{ cm}$ at 100 KeV energy level).	10	KTU DEC 2018
11	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 micromach	8 6	KTU JUN 2023

MODULE V			
1	With necessary diagrams, explain the anodic bonding process	10	KTU DEC 2021
2	Write a brief note on I. RF MEMS II NEMS	10	KTU DEC 2021
3	State the objectives and explain the levels of micro system packaging.	10	KTU DEC 2021 KTU SEP 2020 KTU MAY 2019
4	What is meant by BioMEMS. Discuss the challenges involved in BioMEMS. List two applications of BioMEMS. OR	10	KTU DEC 2020 KTU MAY 2019
5	Explain the different stages in the Assembly of micro systems.	10	KTU DEC 2020
6	Explain with figures two RF MEMS applications	10	KTU SEP 2020 KTU DEC 2019 KTU MAY 2023
7	Explain the following bonding techniques with figures a) Silicon-on-Insulator b) Wire bonding	10	KTU SEP 2020 KTU DEC 2018
8	a) With neat sketches, explain sealing in micro pressure sensors, microvalves, and micropumps. b)) Explain the various applications of RF MEMS.	10 3	KTU JUN 2023
9	a) Describe different levels of microsystem packaging. b) Describe SOI process and wire bonding.	8 6	KTU MAY 2023
10	Describe any one sealing method used in assembly of micro systems.	3	KTU MAY 2023

2021 Batch S6
(2023 – 2024)

HUT300

INDUSTRIAL ECONOMICS AND FOREIGN TRADE

Faculty – Mr. Sajeer A.

INDUSTRIAL ECONOMICS AND FOREIGN TRADE

(HUT 300)

MODULE 1			
Sl. No	Questions	Mark	Month and Year
1	Why does an economic problem arise? What are the basic economic problems?	7	KTU,KTU Dec 2021
2	Explain Production possibility curve? With the help of a production possibility curve, explain (i) Trade Off (ii) Why PPC is concave to the origin?	3, 7	KtuDec2021 KTU June 2023
3	Explain consumer equilibrium? Explain consumer surplus? Explain producer surplus?	3	KTU
4	<p>a. What should be percentage change in price a product if the sale is to be increased by 50% and its price elasticity of demand is 2</p> <p>b. A consumer purchases 50 units of commodity x when its price is Rs.8/- per unit. In the next month he purchased 60 units at the same price. this was due to an increase in the price of another commodity y from Rs.10 to 12. Calculate cross elasticity of demand and interpret the result.</p> <p>c. Define the cross elasticity of demand a tea manufacturing company was able to sell 800kg of the price of coffee was Rs 70 per kg. Later they were able to sell 9000 kg when the price of coffee became Rs80 per kg. Calculate the cross elasticity of demand for tea. Are the commodities substitute or complimentary?</p> <p>d. Define price elasticity of demand. A company producing soft drink is selling its product for Rs.22. It sells 1000 units, and then increases the price to Rs.24. Now sales fall to 900 units. What is the price elasticity of soft drink? Is the demand elastic or inelastic? Why?</p> <p>e. What is cross elasticity of demand? Suppose cross elasticity of demand between X and Y is 0.5. If there is a 50 percent change in the price of Y, what will be the percentage change in the quantity demanded of X?</p>	7	KTU KTU DEC 2022
5	a. Demand function of a product is given as $D = 50 - 2p$ and supply function $S = 20 + 3p$. What will be the equilibrium	3	KTU, KTU Dec 2022

	price and quantity of the product. b. The demand function of a product is given as $D = 60 - 2P$ and the supply function $S = 30 + 4P$. Estimate equilibrium price and equilibrium quantity. Also find the excess supply when Price equals Rs.6?																				
6	a. Explain Dead weight loss. b. Suppose the govt. imposes a tax on a commodity where the tax burden is met by the consumers. Draw diagram and explain dead weight loss. Mark consumer surplus, producer surplus, tax revenue and dead weight loss in the diagram c. What is deadweight loss of a tax? Examine the consumer and producer surplus before and after a tax with the help of a diagram.	7	KTU, KTU Dec 2022 KTU June 2023																		
7	What are the merits and demerits of Joint stock companies?	7	KTU, KTU June 2023																		
8	a. Prepare a utility schedule showing units of consumption, total utility and marginal utility. Point out any three limitation of the law. b. Draw total utility and marginal utility curves and derive the three relations between marginal utility and total utility.	7	KTU, KTU Dec 2022																		
9	How is elasticity of demand measured according to the percentage method? How is the measurement of elasticity of demand useful for the government.	7	KTU																		
10	Calculate the marginal utility from the following data <table border="1" style="margin-left: 20px;"> <tr> <td>X</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> </tr> <tr> <td>TU</td> <td>11</td> <td>19</td> <td>26</td> <td>31</td> <td>34</td> <td>36</td> <td>36</td> <td>30</td> </tr> </table>	X	1	2	3	4	5	6	7	8	TU	11	19	26	31	34	36	36	30	4	KTU June 2023
X	1	2	3	4	5	6	7	8													
TU	11	19	26	31	34	36	36	30													
MODULE 2																					
1	a. In the production function $\theta = 2L^{1/2} K^{1/2}$ If $L = 36$ how many units of capital one needed to produce 60 units of output. b. A firm's total cost function is given by the equation, $TC = 4500 + 10Q + 25Q^2$.Write the expression for the following cost concepts. (a) AFC (b) AVC (c) AC (d) MC	3 4	KTU KTU June 2023																		
2	a. In the short run $AVC < P < AC$. Will the firm produce or shut down? Give reason ? b. Explain shut down point in the short run with the help of diagram	3 4	KTU KTU June 2023																		
3	Define Isoquants and properties, Explain Isocost line, Explain	7	KTU																		

	Expansion path, Explain Cobb-Douglas production function		
4	Differentiate explicit cost and implicit cost, Explain Sunk cost	3	KTU
5	<p>Suppose monthly fixed cost of a firm is Rs.40000 and its monthly total variable cost is Rs.60000. If the monthly sales is Rs.120000 estimate contribution and break even sales. ii. If the firm wants to get a monthly profit of Rs.40000 what should be the sales? iii. The total cost function of a firm is given as $TC=100+50Q-0.2Q^2+0.3Q^3$. Find marginal cost when output equals 5 units.</p> <p>b. The total sales of a manufacturing firm are Rs.20000 in this year. Its variable costs one Rs.8000 where its fixed costs are Rs.6000 for that year. Find out the break-even point of this firm.</p> <p>c. Suppose a firm pays Rs.10000 as monthly rent and Rs.10000 as interest payment. Its monthly expenditure on raw materials is Rs.40000 and it get monthly sales revenue of Rs.80000. The price of one unit of output is Rs.40. Estimate i) PV Ratio ii) Break even sales iii) Break-even output iv) Profit earned v) Margin of safety</p> <p>d. Consider the following data of a company for the year 2022. Sales Rs.80000, Fixed Cost is Rs. 15000, Variable cost is Rs. 35000. Find the following (a) Breakeven Sales (b) Contribution (c) Margin of safety (d) Profit.</p>	7 10	KTU, KTU Dec 2022 KTU June 2023
6	Explain Law of variable Proportions with a diagram.	7 10	KTU KTU June 2023
7	What are the advantages of large-scale production? Explain producer equilibrium with the help of a diagram.	7	KTU
8	Explain producer equilibrium with the help of isoquants and is cost line. What is expansion path.	7	KTU, KTU Dec 2022
9	Explain Returns to scale OR Long run production function, Represent it using a figure.	7	KTU, KTU Dec 2022
10	The total cost function of firm is given as $TC=500+5Q-4Q^2+Q^3$. Estimate TVC, TFC and MC when output equals 10 units.	7	KTU, KTU Dec 2022

MODULE 3			
1	What is collusive oligopoly? What is non-price competition under Oligopoly? Give examples of non-price competition under oligopoly? Explain linked demand curve model.	7	KTU Dec 2021
2	What is Predatory pricing? Describe on product pricing and explain the different methods used for pricing.	7 10	KTU Dec 2022 KTU June 2023
3	Explain the equilibrium of a firm earning supernormal profit under monopolistic competition. Draw figures showing the determination of equilibrium under both.	3	KTU KTU Dec 2022
4	Make comparison between monopoly and perfect competition and Oligopoly	7	KTU, KTU June 2023
5	What is inelastic demand?	3	KTU Dec 2022
6	Suppose $AC > Price > AVC$. Will a producer produce or shutdown in the short run? Give reason.	3	KTU Dec 2022
7	Why a firm under perfect competition is called a price taker?	3	KTU Dec 2022
8	Explain Price rigidity under oligopoly with the help of kinked demand curve. Why price is rigid under oligopoly?	7	KTU, KTU Dec 2022
9	a. With the help of a diagram explain equilibrium under monopolistic competition. b. What are the features of Monopolistic competition, Suppose a firm under monopolistic competition is getting supernormal profit. Draw a diagram and explain this situation	7	KTU, KTU Dec 2022
10	Explain Kinked Demand Curve	7 4	KTU KTU June 2023
MODULE 4			
1	Explain in detail the circular flow of income in a four sector model with a neat diagram.	3 10	KTU KTU June 2023
2	Explain the GNP Deflator, GDP and GNP	3	KTU KTU June 2023
3	Explain demand pull inflation , Explain cost push inflation. Are the monetary or fiscal measures more effective in controlling inflation?	7 10	KTU KTU June 2023

4	Distinguish between a bond and a share?	3 4	KTU KTU June 2023																				
5	Distinguish between NSE and BSE , Distinguish between NIFTY and SENSEX	7	KTU																				
6	Distinguish between Demat Account and Trading Account	3	KTU																				
7	Distinguish between final goods and intermediate goods.	3	KTU Dec 2022																				
8	<p>a. GDP of a country = 1500 crores, Depreciation =150 Crores NFIA= 50 crores. Estimate GNP,NDP and NNP</p> <p>b. Estimate GDPmp. GNPmp and National income. Private consumption expenditure - 2000 (in 1000 crores) Govt. Consumption - 500 ,NFIA - (300) ,Investment - 800 Net Export – 700, Depreciation - 400 Net internal tax – 300</p> <p>c. From the given below estimate Gross National Product, Net National Product and National Income. GDP - 5000 (in 100 billion) NFIA - 50 Indnet - 70 Subsidies- 20 Depreciation- 30</p> <p>d. From the data given below estimate the NDP using Item Rs</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">Consumption Expenditure</td> <td style="text-align: right;">3000</td> </tr> <tr> <td>Investment Expenditure</td> <td style="text-align: right;">2000</td> </tr> <tr> <td>Govt. Expenditure</td> <td style="text-align: right;">700</td> </tr> <tr> <td>Exports</td> <td style="text-align: right;">600</td> </tr> <tr> <td>Imports</td> <td style="text-align: right;">300</td> </tr> <tr> <td>Intermediate consumption</td> <td style="text-align: right;">2000</td> </tr> <tr> <td>Wages and Salaries</td> <td style="text-align: right;">2000</td> </tr> <tr> <td>Rent</td> <td style="text-align: right;">500</td> </tr> <tr> <td>Interest</td> <td style="text-align: right;">500</td> </tr> <tr> <td>Profit</td> <td style="text-align: right;">1000</td> </tr> </table> <p>e. How is national income estimated according to the income method? Estimate NDP and NNP from the given data (all figures in Rs. Crores). Wages and salaries = 800, Rent = 300, Depreciation = 200, Interest = 400, Net Indirect tax = 400, NFIA = 100, Profit = 400.</p> <p>f. Suppose the national income of a country is Rs1000 and</p>	Consumption Expenditure	3000	Investment Expenditure	2000	Govt. Expenditure	700	Exports	600	Imports	300	Intermediate consumption	2000	Wages and Salaries	2000	Rent	500	Interest	500	Profit	1000	7	KTU, KTU Dec2021, KTU Dec 2022, KTU June 2023
Consumption Expenditure	3000																						
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	<p>depreciation equals Rs300. If NFIA equals Rs (-400) and Indirect Taxes equals Rs300, estimate NNP, NDP, GDP and GNP (all figures in Rs. Crores).</p> <p>g. Estimate GDPMP , GNPMP and National Income. Private consumption expenditure = 2000 (in 000 crores), Government consumption = 500, NFIA= -300, Investment=800, Net exports=700, Depreciation=400 and Net-indirect tax=300.</p>		
9	Distinguish between money market and capital market ?	7	KTU Dec 2021
10	What is monetary policy? What are the monetary policy measures?	7	KTU Dec 2022
MODULE 5			
1	<p>What is free trade? What is Devaluation? Explain the J-curve effect? Suppose the sum of elasticity of export and import is less than one. What will be the effect of devaluation? What are the merits of quota restrictions?</p> <p>What are the arguments in favour of free trade?</p> <p>What are the tariff barriers? Explain its impact on the economy.</p>	7	KTU Dec 2021
2	Effects of International Trade	4	KTU June 2023
3	How is National income estimated under Product method and expenditure method, income method	7	KTU
4	What are the monetary and fiscal policy measures to control inflation?	3	KTU Dec 2021
5	<p>What is international trade? List out the advantages of foreign trade ?</p> <p>What are the disadvantages of foreign trade? Examine the effects of quotas on international trade.</p>	7	KTU, KTU Dec 2022
6	What do you mean by labour augmenting technical progress?	3	KTU Dec 2022
7	<p>What is a Trading account?</p> <p>Point out any three items coming under unilateral transfers account.</p> <p>What is balance of payments?</p>	3	KTU Dec 2022 KTU June 2023
8	Examine the comparative cost theory. Point out any two criticisms against this theory.	7	KTU Dec 2022 KTU June

	Explain absolute advantages theory with the help of an example		2023
9	What is protection? State any five arguments in favour of protection.	7	KTU Dec 2022 KTU June 2023
10	Evaluate the success or failure of devaluation when the demand for import is more elastic or less elastic.	7	KTU Dec 2022 KTU June 2023

2021 Batch S6
(2023 – 2024)

ECT302 ELECTROMAGNETICS

Faculty – Dr. Jayarenjini N.

MODULE 1

Sl. No.	Questions	Marks	KTU/YEAR
1	Define divergence and state divergence theorem.	3	June 2023
2	Write all equations for transforming a vector field from cylindrical to rectangular coordinates.	3	June 2023
3	Given $\vec{D} = 2xy\vec{a}_x + x^2\vec{a}_y$ c/m ² in Cartesian co-ordinates. Verify Gauss diverg theorem for volume enclosed by $0 \leq x \leq 1, 0 \leq y \leq 2$ and $0 \leq z \leq 3$.	8	June 2023
	Determine D at (4, 0, -3) if there is a point charge -5π mc at (4, 0, 0) and a line charge 3π 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	June 2023 June 2022 Dec 2018
5	A point charge of 100 pc is located at origin and the plane $z = 5$ m also carries charge of 5nc/m ² . 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 $W = x^2y^2 + xyz$. 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	Dec 2019
10	Derive an expression for magnetic energy of a continuous distribution of current in a volume.	7	May 2019

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	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, Dec 17
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 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 $\epsilon_r = \frac{10\epsilon_0}{r}$, 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 $\epsilon_r = \frac{10+r}{r}$, 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 = $20\cos 10^3 t$ 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	Dec 2018 Dec 2017 Sept 2020
7	Starting from Maxwell equation, derive the wave equation for a conducting medium.	7	April 2018 Dec 2017

8	A radial field $\vec{H} = \frac{2.39 \times 10^6}{r} \cos\phi \vec{a}_r$ A/m exist in free space. Find the magnetic crossing the surface defined by $0 \leq \phi \leq \pi/4$ and $0 \leq z \leq 1$ m	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 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 $2\mu\text{m}$. 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 $\vec{H} = 6 \cos(2 \times 10^8 t - 6x) \vec{a}_y$ A/m Determine the permittivity of the medium and the electric field intensity.	7	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 $\nabla^2 \vec{H} = \mu_0 \epsilon_0 \frac{\partial^2 \vec{H}}{\partial t^2}$	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

	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 for dominant 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 $\epsilon_r = 9$ 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 coefficient 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 $Z_{oc}Z_{sc} = Z_0^2$ where Z_0 is the characteristic impedance.	7	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 cm^2 of plane $2x + y = 5$, if the field $E = 4 \sin(2\pi \times 10^7 t - 0.8x) \bar{a}_z \text{ V/m}$ is passing through this medium.	7	June 2022
5	A transmission line has the following constants, $R = 10.4 \Omega/m, L = 3.66 \text{ mH}/m, C = 0.00835 \mu\text{F}/m$ and $G = 0.08 \mu\text{mho}/m$. Calculate, Z_0, α, β and v_p , at $\omega = 5000 \text{ rad}/s$	7	June 2022
	Derive an expression for characteristic impedance of a transmission line and	7	Dec 2018

	show that it is resistive at radio frequencies		
	A lossless transmission line has primary constant $L=0.01\mu\text{H/m}$, $C=100\text{pF/m}$. Find the characteristic impedance of 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, $E = 10\text{V/m}$. 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 $50\text{-}\Omega$ transmission line is terminated in a load with $Z_L = (50 + j25)\ \Omega$. 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	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 $Z_0 = 50\Omega$ is 30m long and operates at 2MHz. The line is	7	June 2022

	terminated with a load, $Z_L = 60 + j40 \Omega$. 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 $60 + j60\Omega$ load. Find Γ and s , if $Z_{in} = 120 - j60\Omega$. 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 $50 + j200 \Omega$ 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 TE ₁₀ and TE ₁₁ 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 $3cm \times 5cm$, 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 TE ₁₀ 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
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