S6 QUESTION BANK

Electronics & Communication Engineering

(2020-24 Batch)

Ac. Yr. 2022-23

DEPARTMENT OF ELECTRONICS & COMMUNICATION NGINEERING

VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY TECHNICAL CAMPUS, KILIMANOOR

INDEX

ECT302
ELECTROMAGNETIC THEORY

MODULE 1			
Sl. No	**Questions**	**Marks**	**KTU/YEAR**
1	Show that from the conservative property, the curl of a static electric field has zero value everywhere.	3	June 2022
2	State and express Maxwell's equations for time varying field in point form.	3	June 2022
3	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 $\vec{E}$ at that point.	7	June 2022
4	From Maxwell's equations, derive Poisson's and Laplace's Equation in electrostatics.	7	June 2022
5	Determine $\vec{D}$ 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.	7	June 2022
6	An infinite line charge lies along z-axis. Find the electric field intensity 'r' from the origin on the y-axis.	7	June 2022
7	State and prove Ampere's circuit law.	6	May 2019 April 2018 Sept 2020
8	State and explain Gauss Law.	5	Dec2019
9	Derive an expression for magnetic energy of a continuous distributionof current in a volume.	7	May 2019
10	Find the potential function and electric field intensity for the region between concentric right circular cylinders, where V = 0 at r =1 mm and V = 100 V at r = 30 mm.	5	May 2019
11	A square loop of 4m side is placed in *xy*- plane with its centre at the origin and sides long the coordinates axes. If the magnetic flux density in the region is given by $B = (0.28a_x - 0.3a_y + 0.4a_z)^{-0.1t}$ Wb/m^2, find the induced EMF in the loop at t=10s.	8	May 2019
12	Point charges 5 nC and -2 nC are located at (2, 0, 4) and (-3, 0, 5),respectively. (i) Determine the force on a 1nC point charge locatedat(1,-3,7). (ii) Find the electric field E at (1, - 3, 7).	7	Dec 2018

13	Give Poisson's and Laplace equation in electrostatics. Giveapplication.	7	Dec 2018
14	Define curl of a vector field. Derive the equation for curl of avector field inCartesian co-ordinate system	10	April 2018
15	Eight identical charges, Q each are placed on the corners of a cube of side 'a'.Find the resultant force on a charge.	7	Dec 2017
16	A Spherical volume charge distribution is given by $\rho = \rho_0(1-\frac{r^2}{a^2}); r \le a$ $\rho = 0; r > a$ Find the electric field intensity E; i) inside and ii) outside the charge distribution	7	May 2019

MODULE 2

Sl.No.	Questions	Marks	KTU/YEAR
1	Distinguish between scalar potential and vector potential.	3	June 2022
2	Calculate the inductance per unit length of an air-filled co-axial cable with inner diameter 6 mm and outer diameter 18 mm.	3	June 2022
3	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.	7	June 2022
4	Derive the expression for energy stored in a Magnetic field.	7	June 2022
5	Derive the matching boundary conditions at the interface between two dissimilar dielectric materials.	7	June 2022
6	A radial field $\vec{H} = \frac{2.39\times10^6}{r}\cos\phi\,\vec{a_r}$ A/m exist in free space. Find the magnetic crossing the surface defined by $0 \le \phi \le \pi/4$ and $0 \le z \le 1\,m$	7	June 2022
7	Explain Scalar and vector magnetic potential.	7	Dec 2019
8	An air filled parallel plate capacitor is with following specification, area = 2 m^2 and spacing between the plates = 0.l m. If a voltage = $20cos10^3t$ is applied across thecapacitor plates, find the magnetic field between the capacitor plates.	5	May 2019

9	Derive the expression of capacitance and inductance of two wire transmission line.	8	Dec 2019 Dec 2018 Dec 2017
10	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
11	Derive the expressions for Energy stored in Electric Field.	8	Dec 2017
12	State and explain Maxwell's equations in the integral and differential forms.	8	Dec 2019 May 2019 Dec 2018 Dec 2017
13	State and prove boundary conditions for E and H in accordance with Maxwell's Equations	7	Dec 2018 Dec 2017 Sept 2020
14	Starting from Maxwell equation, derive the wave equation for a conducting medium.	7	April 2018 Dec 2017

MODULE 3

Sl.No	Questions	Marks	KTU/Year
1	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
2	Why the Brewster angle is also called the polarizing angle?	3	June 2022
3	Show that the electric field leads magnetic field by 45^0, when an electromagnetic wave propagates in a good conducting medium.	7	June 2022
4	The magnetic field component of an EM wave propagating through a non-magnetic dielectric medium is given by $\overrightarrow{H} = 6\cos(2\times10^8 t - 6x)\overrightarrow{a_y}$ A/m. Determine the permittivity of the medium and the electric field intensity.	7	June 2022
5	Assuming free space conditions and expressing Maxwell's equation in $\overrightarrow{H}$ only, Show that an electromagnetic wave can be written as $\nabla^2\vec{H} = \mu_0\varepsilon_0\frac{\partial^2\vec{H}}{\partial t^2}$	7	June 2022
6	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
7	Derive the solution of uniform plane wave in lossy dielectric medium.	6	May 2019

8	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
9	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
10	Derive the boundary conditions for electric field at the interface of two dielectrics.	6	Dec 2017
11	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
12	Derive an expression for reflection coefficient of a plane wave incidence with parallel polarization(or perpendicular polarization) at a dielectricinterface.	6	Dec 2019 May 2019 Sept 2020
13	Derive an expression for net outward power flow associated with an electromagnetic wave, from a surface.	8	May 2019
14	What is Snell's law?	3	May 2019
15	Derive the expression for the ratio of reflected to incident electric field strength for an insulator with oblique incidence.	8	Dec 2018
16	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
17	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

MODULE 4

Sl.No	Questions	Marks	KTU/Year
1	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.	3	June 2022
2	What is Wave polarization? What are the different types of polarisation?	3	June 2022

3	Define transmission line equations and obtain an expression for characteristic impedance and propagation constant.	7	June 2022
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 $E = 4\,Sin\left(2\pi \times 10^7 t - 0.8x\right)\overrightarrow{a_z}$ V/m is passing through this medium.	7	June 2022
5	Derive the expression for average power transmitted by an electromagnetic wave.	7	June 2022
6	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_0, α, β *and* v_p ,at $\omega = 5000 rad/s$	3	June 2022
7	What is Polarisation? Explain the different types of Polarisation?	7	Dec 2018 Dec 2017 Sept 2020
8	State Poynting theorem. Derive the equation of complex vector.	8	Dec 2017
9	Define reflection coefficient and VSWR of a transmission line and derive the relation between reflection coefficient and VSWR.	7	May 2019 Dec 2018
10	A lossless transmission line has primary constant L=0.01μH/m, C=100pF/m. Find the characteristic impedance or the line.	5	May 2019
11	Derive an expression for characteristic impedance of a transmission lineand show that it is resistive at radio frequencies	7	Dec 2018
12	Derive the ABCD parameters of a transmission line.	8	Dec 2017
13	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
14	Derive standard Transmission line equations.	6	Dec 2017
15	Derive the equation of input impedance of a transmission line dueto line terminated by a load	7	Dec 2019
16	Derive the expression for characteristic impedance of a transmission line	8	Dec 2019
17	What are distributed elements?	3	May 2019

MODULE 5

Sl.No	Questions	Marks	KTU/Year
1	Differentiate between half wave transformer and quarter wave transformer.	3	June 2022
2	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
3	A lossless line with $Z_0 = 50\Omega$ is 30m long and operates at 2MHz. The line is 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	7	June 2022

	coefficient at load (ii) VSWR (iii) Input impedance		
4	Explain the following terms. i) Dominant mode (ii) Cut off frequency iii) Group velocity and phase velocity (iv) Degenerate modes	7	June 2022
5	Using transmission line equation, discuss the two different parameters to define transmission line as circuit element.	7	June 2022
6	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	7	June 2022
7	Derive the current and voltage equation of a transmission line.	7	May 2019
8	Draw the circuit of small section of transmission line of differential length and label the circuit parameters.	3	May 2019
9	Derive the expression for r-circles and x-circles in Smith chart.	10	Dec 2018 Sept 2020
10	A load impedance 90 - j25 is to be matched to 50 Ω using single stub matching. Find the length and location of stub using smith chart.	10	May 2019
11	How a smith chart is useful in finding the stub length for impedance matching.	4	April 2018
12	Write note on half wave and quarter wave transmission lines.	5	Dec 2017 Sept 2020
13	A lossless 60Ω line is terminated by a 60 + j60Ω load. Find Γ and s, if Z_{in} =120 - j60Ω. How far is the load from generator (Solve with Smith chart)?	6	Dec 2017
14	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
15	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
16	With a neat diagram explain the propagation of electromagnetic wave in a rectangular wave guide?	8	Dec 2019 April 2018
17	Derive the expressions for TE(or TM) mode in a rectangular wave guide.	10	Dec 2019 May 2019 April 2018
12	Explain waveguides and its different modes of wave propagation.	10	Dec 2017

13	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 , guidewavelength , phase velocity and group velocity . and the wave impedance for TE10 mode.	7	Model 2022
14	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
15	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

ECT 304 VLSI

MODULE 1

Sl No	Question	Marks	KTU Year
1	What is FPGA? What are the characteristics and applications of FPGA	3	JUNE 2022
2	Compare Top down and Bottom up approach in VLSI design	3	JUNE 2022
3	What is Moore's law in VLSI Design	3	Model Que
4	Differentiate between ASIC and FPGA	3	Model Que
5	Differentiate between full custom and semi-custom ASIC.	10	JUNE 2022
6	With a neat flow chart, explain ASIC design flow.	8	Model Que
7	Describe Gate array based ASIC with neat diagram.	8	Model Que
8	What are the processes involved in Soc design.	6	Model Que
9	Compare different ASIC design methodologies.	6	Model Que
10	List the advantages of SOC	6	Model Que
11	Explain logical and physical design in VLSI design	6	Model Que
12	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
13	Explain the significance of power considerations in VLSI	4	JUNE 2022

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	10	JUNE 2022
3	Derive an expression for Switching Threshold of a CMOS inverter	7	Model Que
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
5	What are the different types of power dissipation in CMOS inverter	8	
6	Why PMOS transistor can pass only strong ones and NMOS can transfer only strong zeros.	6	Model Que
7	With a neat diagram explain static and transient analysis of CMOS inverter	8	May 2019
8	Realize the given logic function using static CMOS logic and transmission gate logic.	7	April 2018
9	Compare the advantages and disadvantages of static and dynamic circuits	6	Model Que
10	Explain the concept of Noise Margin in CMOS inverter circuit.	6	Sep 2020

11	What are the different types of power dissipation in a CMOS inverter? What is the expression for total power dissipation?	10	April 2018

MODULE 3

Sl No	Question	Marks	KTU Year
1	What are the issues associated with NP domino logic	3	JUNE 2022
2	Compare DRAM and SRAM cells	3	JUNE 2022
3	a) Design three transistor and one transistor DRAM cells and explain the working of each types (10) b) Explain the basic principle of operation of dynamic logic	10 4	JUNE 2022
4	a) Design a 4x4 NAND based MOS ROM Cell Array and explain its operation (10) b) Compare the performance of dynamic and domino logic	10 4	JUNE 2022
5	List the advantages of dynamic logic over static logic circuits.	3	Model Que
6	Differentiate between volatile and non-volatile memories	3	
7	Draw the circuit diagram and explain the principle of operation of a CMOS based static RAM cell. Explain the read and write operations. What are the constraints on the sizes of transistors?	7	April 2018
8	Draw the circuit diagram and explain the principle of operation of a one transistor dynamic RAM cell. Explain the read, write and refresh operations	7	Model Que
9	Explain the read and write operation of a three-transistor DRAM cell	7	May 2019
10	Explain the read and write operation of a six transistor CMOS SRAM cell.	7	Sep 2020, May 2019
11	Compare different ROM structures.	3	Model Que
12	Compare static and dynamic RAM structures.	3	Model que
13	Compare the advantages of three transistor and one transistor DRAM cell.	3	Sep 2020
14	Design a 4×4 bit NOR based ROM array and explain its working	5	May 2019

MODULE 4

Sl No	Question	Marks	KTU Year
1	Mention the worst-case delay associated with Carry-Bypass adder, Linear Carry-Select adder, Square- root carry select adder	3	JUNE 2022
2	What is the need for array multipliers	3	JUNE 2022
3	a) With diagram illustrate the principle of operation of an array multiplier b) Design a 16-bit square-root carry select adder and indicate the worst-case delay	4 10	JUNE 2022
4	a) Design a 4X4 array multiplier. Show the critical path and also estimate the delay of the multiplier.	10 4	JUNE 2022

	b) Write the advantages of square-root carry select adder compared to linear carry select adder		
5	Design a full adder with static CMOS logic	7	April 2018
6	Compare the delay of Carry-Bypass adder, Linear Carry- Select adder, Square- root carry select adder.	7	April 2018
7	With diagram, illustrate the principle of operation of an array multiplier. Show the critical path. Estimate the delay of the multiplier.	8	Model Que
8	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
9	Draw circuit diagram of a full adder with not more than 28 transistors in standard CMOS logic	8	April 2018
10	Explain the working a 16-bit carry-by pass adder and write down the expression for worst-case delay.	8	May 2019
11	With a neat diagram, explain the working of carry by pass adder and linear carry select adder.	3	Sep 2020
12	With a neat diagram, explain 4×4 array multiplier	7	Sep 2020

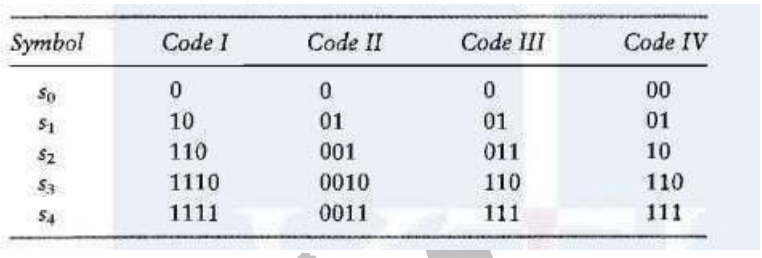
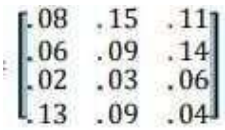
MODULE 5

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 in VLSI design	3	JUNE 2022
3	a) What are the steps in wafer preparation fabrication b) Describe in detail about the production of single crystalline silicon from CZ process	4 10	JUNE 2022
4	a) With neat diagram explain molecular beam epitaxy b) What is meant by design rules? Write short notes on various rules in VLSI chip design.	8 4	JUNE 2022
5	Explain how electronic grade silicon (EGS) is developed	7	May 2019
6	Explain the necessity of single crystalline silicon in VLSI fabrication and how single crystal silicon is made.	7	May 2019
7	Explain diffusion and ion implantation techniques.	8	Model que
8	Explain the advantages of SiO2 and the oxidation techniques.	6	April 2018
9	Illustrate with diagram the principle of crystal growth by Czochralzki method.	7	Sep 2020
10	What is photolithography? With diagram illustrate the steps involved in photolithography process.	7	May 2019
11	Explain the principle of molecular beam epitaxy, with schematic diagram of an MBE system. What are its advantages and disadvantages?	8	Model que
12	With schematic diagram and chemical reactions involved, illustrate wet and dry oxidation processes	6	April 2018
13	Draw the layout of a CMOS 2 input NAND Gate	6	Sep 2020
14	Draw the layout of a CMOS inverter	6	May 2019

15	Explain the chemical reactions involved in wet and dry oxidation process	5	April 2018
16	What is annealing? Explain various types	5	Sep 2020

ECT 306 Information Theory and Coding

Module 1

Sl No	QUESTIONS		Marks
1	A source emits one four symbols, s0, s1, s2, s3 with probabilities 1/3, 1/6,1/4 and ¼ respectively. The successive symbols emitted by the source are statistically independent. Calculate the entropy of the source.	Model qn	3
2	Identify the instantaneous codes from the code sets listed below. 	Model qn	3
3	State Shannon's channel coding theorem. What is its significance in digital Communication system?	Model qn	3
4	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
5	Define i. Entropy ii. Information rate	KTU June 2022	3
6	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: p1= p4 = 1/8, p2 = p3 = 3/8. Find the information rate of the source assuming B = 100Hz.	Model qn	8
7	a) Define the term marginal entropy and give its units? What will be the marginal entropy if a source emits all the M messages with equal probability? b) Let X and Y be two discrete random variables and their joint probability is given by  Find marginal, conditional and joint entropies and verify the relation	KTU DEC 2021	5 10
8	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

Symbol	*Code I*	*Code II*	*Code III*	*Code IV*
s_0	0	0	0	00
s_1	10	01	01	01
s_2	110	001	011	10
s_3	1110	0010	110	110
s_4	1111	0011	111	111

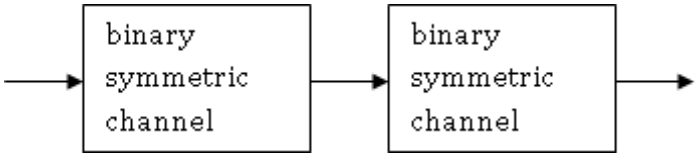
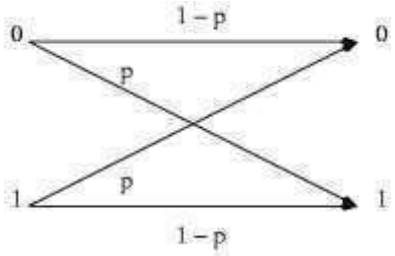
$$\begin{bmatrix} .08 & .15 & .11 \\ .06 & .09 & .14 \\ .02 & .03 & .06 \\ .13 & .09 & .04 \end{bmatrix}$$

9	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 = {s1, s2, s3} 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
10	A discrete source emits one of six symbols once in every milliseconds. The source probabilities are ½,¼,1/8,1/16,1/32 and 1/32. Find the source entropy and Information rate.	KTU June 2022	7
11	State and prove Kraft's inequality	KTU June 2022	7
12	A DMS has 6 codes with probabilities as p(x1)=0.25, p(x2)=0.3, p(x3)=0.12, p(x4)=0.2, p(x5)=0.08 and p(x6)=0.05.Obtain the Huffman codes and find the code efficiency and redundancy	KTU June 2022	7
13	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
14	Obtain the relation for H(Y/X) of a communication channel	KTU DEC 2021	5
15	Explain the terms: Amount of information, entropy and mutual information.	KTU MAY 2019	5
16	State Kraft's inequality. Also explain source coding Theorem and code rate	KTU DEC 2021	5
17	Derive the equations of conditional entropies H(X/Y) and H(Y/X). Hence show that H(X, Y) =H(X)+ H(X/Y)+H(Y)+ H(Y/X).	KTU DEC 2021	10

18	Prove that the entropy of a discrete memory less source S is upper bounded by average code word length L for any distortion less source encoding scheme. b) Given a binary source with two symbols x1 and x2. Given x2 is twice as long as x1 and half as probable. The duration of x1 is 0.3 seconds. Calculate the information rate of the source. Consider a source with 8 alphabets, a to h with respective probabilities 0.2, 0.2, 0.18, 0.15, 0.12, 0.08, 0.05 and 0.02. Construct a minimum redundancy code and determine the code efficiency.	KTU DEC 2021	10
19	Write the properties of instantaneous code with examples.	KTU SEP 2019	5
20	A discrete memory less source has an alphabet of five symbols with there are given by, [X] = [X1, X2, X3, X4, X5] ; [P] = [0.45, 0.15,0.15,0.10,0.15]. Compute Entropy & second order Extension for the Symbol. Find the amount of Information gained by observing the source.	KTU SEP 2018	10
21	A Source emitting 4 symbols with probability 0.4, 0.3, 0.2, and 0.1. Find the amount of information gained by observing the source.	KTU SEP 2018	5
22	Prove that maximum entropy of M messages can be obtained when messages are equally probable.	KTU SEP 2018	5
23	Write the properties of mutual information	KTU Sep 2020	7

Module 2

1	a) State and prove Kraft's inequality (7) b) Two symbols x1, x2 with probabilities P(x1) = 0.4 and P(x2) = 0.6 are transmitted through a discrete channel given below b) $P(Y/X)=\begin{bmatrix}0.8 & 0.2\\ 0.2 & 0.8\end{bmatrix}$. Identify the channel and calculate the capacity and the efficiency of the channel.	KTU DEC 2021	8
2	Illustrate channel diagram for a Discrete memoryless channel with an example.	KTU June 2022	3
3	State Shannon's second theorem on channel capacity. Give the Positive and Negative statements.	KTU June 2022	3
4	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
5	State & Explain Shannon first theorem. Discuss its limitations.	Model Qn	5
6	Write short notes on: (a) Binary Communication channel (b) Binary symmetric channel.	KTU SEP 2019	7
7	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 ● Average code word Length ● Variance of average code word. ● Entropy	KTU DEC 2020	10
8	Construct optimum code using Huffman coding with following data. Let S={S1,S2,S3,S4,S5} 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
9	Write notes on: a. Huffman coding b. Capacity of band limited Gaussian channels	KTU MAY 2019	10

10	Two binary symmetric channels are connected in cascade as shown in figure below. Find the overall channel capacity of the cascaded connection assuming both channel has same transition probability diagram.  	KTU MAY 2019	10
11	a) State Shannon's channel coding theorem. Give its positive and negative statements. b) An information source produces sequences of independent symbols A,B,C,D,E,F,G with corresponding probabilities 1/3,1/27,1/3,1/9,1/9,1/27,1/27. Construct a binary code and determine its efficiency and redundancy using • Huffman coding procedure.	KTU SEP 2018	10
12	What is meant by a symmetric channel? How do we find the capacity? Discuss binary symmetric and binary erasure channel? Draw the channel diagrams and derive the expressions for their channel capacities.	KTU SEP 2019	7
13	For the Channel matrix given below, find H(X), H(Y) and H(X,Y). Assume all input symbols are equally likely. $P(Y/X) = \begin{bmatrix} \frac{1}{6} & 0 & \frac{2}{3} & \frac{1}{6} \\ 0 & \frac{1}{2} & \frac{1}{2} & 0 \\ 0 & 0 & \frac{2}{3} & \frac{1}{3} \\ \frac{1}{4} & \frac{1}{4} & 0 & \frac{1}{2} \end{bmatrix}$ Explain the relation between differential entropy and entropy.	KTU June 2022	7
14	Given an AWGN channel with 5 KHz bandwidth and the noise power spectral density $\eta/2$ =10-9 W/Hz. The signal power required at the receiver is 0.2 mW. Calculate the capacity of this channel.	KTU June 2022	7

15	Explain the relation between differential entropy and entropy.	KTU June 2022	7
16	Derive the capacity of a Binary Symmetric Channel.	KTU June 2022	7

Module 3

1	What is Shannon's limit? Explain its significance.	KTU MAY 2019	5
2	a) Define Ring and give two examples b) Parity matrix of a (7,4) systematic linear block code (LBC) is given as $P = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ 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.	KTU MAY 2019	10
3	Differentiate i. Systematic and nonsystematic codes ii. Linear and non-linear codes	KTU June 2022	3
4	For a (7,4) linear block code, the Parity Check matrix is $H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$ Obtain the Generator matrix	KTU June 2022	3
5	For a systematic linear block code, the three parity check bits, c4, c5 and c6 are given by: $c_4 = d_1 \oplus d_2 \oplus d_3$ $c_5 = d_1 \oplus d_2$ $c_6 = d_1 \oplus d_3$ i. Construct the Generator matrix ii. Decode the received code word 101100.	KTU June 2022	7

6	For a (7,4) linear block code, the Generator matrix is $G = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$ i.Find all the codewords. ii. Comment on the error detection and correction capability. iii. Draw the encoder circuit	KTU June 2022	7
7	Write notes on i. Rings ii.Finite fields.	KTU June 2022	7
8	The Parity check matrix of a (7,4) linear block code is given as $H = \begin{bmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$ Construct the code words and show that this is a Hamming code.	KTU June 2022	7
9	a) Construct standard array of an Linear Block Code with generator matrix, $G = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$. Find the transmitted codeword corresponding to the received vector, '111110'. b) A continuous channel has a bandwidth of 4.8 KHz. For a signal to noise ratio of 20dB, calculate the channel capacity. Also, calculate the minimum SNR in dB required to support information transmission at the rate of 4800 bits/sec through the channel	Model qn	14
10	According to the Shannon-Hartley law, what is the maximum achievable bit-rate for a computer modem operating over a telephone channel with 3 kHz bandwidth and a maximum allowed signal power that guarantees only a 30dB SNR?	KTU DEC 2019	7
11	State an explain shannon hartley theorem	KTU SEP 2020	5
12	Define standard array. How is it used in syndrome decoding? Explain with an example.	KTU SEP 2020	5

13	Show that, according to the Shannon-Hartley law, if the signal power is equal to the noise power, the channel capacity in b/s is equal to the bandwidth B Hz.	KTU SEP 2020	6
14	A channel has an SNR of 15. If the channel bandwidth is reduced by half,determine the increase in the signal power required to maintain the same channel capacity.	KTU SEP 2018	7
15	The parity matrix of a (6,3) linear systematic block code is given below. $P = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$ Construct standard array. State and derive Shannon-Hartley theorem. Explain the implications.	Model qn	10
16	a) Derive the expression for channel capacity when bandwidth becomes infinite. b) A voice grade channel of the telephone network has a bandwidth of 3.4 KHz.	KTU SEP 2019	10
17	(a) Calculate channel capacity of the telephone channel for signal to noise ratio of 30 dB. (b) Calculate the minimum SNR required to support information transmission through the telephone channel at the rate of 4800 bits/sec.	KTU SEP 2019	10
18	a) Define ring and field. Discuss properties. b) The parity matrix for a (7,4) linear block code is given below: $[P] = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$ (i) Find generator and parity check matrices (ii) Draw the encoder circuit. Sketch the syndrome calculation circuit (iii) Illustrate the decoding of the received vector corresponding to the message vector 1001, if it is received with 5th bit in error.	KTU May 2019	10

19	(a) Define ring and field. Discuss properties. (b) The parity matrix for a (7,4) linear block code is given below: $[P] = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$ (i) Find generator and parity check matrices (ii) Draw the encoder circuit. Sketch the syndrome calculation circuit. (iii) Illustrate the decoding of the received vector corresponding to the message vector 1001, if it is received with 5th bit in error.	KTU May 2019	20
20	What is a Linear Block code? How you decode the Linear Block code?	KTU SEP 2020	
21	What is syndrome? What are the properties of Syndrome	KTU SEP 2020	5
22	The parity check matrix of a particular (7,4) linear block code is given by, $H = \begin{array}{l} 1\,1\,1\,0 : 1\,0\,0 \\ 0\,1\,1\,1 : 0\,1\,0 \\ 1\,1\,0\,1 : 0\,0\,1 \end{array}$ a. Find the generator matrix b. List all the code vectors c. What is the minimum distance between odd vectors? d. how many errors can be detected? e. how many errors can be corrected?	Model qn	20

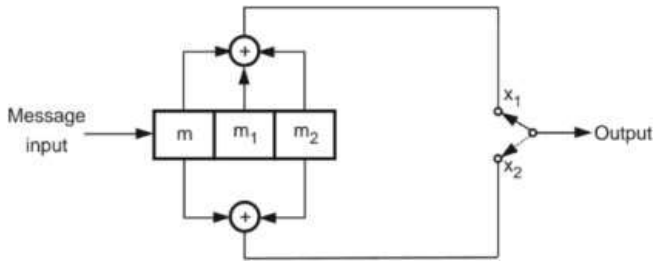
23	The parity check matrix of a (7,4) hamming code is given as follows: $H = \begin{matrix} 1\,1\,1\,0 : 1\,0\,0 \\ 0\,1\,1\,1 : 0\,1\,0 \\ 1\,1\,0\,1 : 0\,0\,1 \end{matrix}$ Calculate the syndrome vector for single bit errors?	KTU MAY 2019	7
24	Explain why decoding based on standard array is maximum likelihood decoding or minimum distance decoding.	KTU SEP 2019	6
25	$\begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{bmatrix}$ Construct the standard array and determine the correctable error pattern	KTU SEP 2020	7
26	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 inputsequence 11011 using transform domain approach b) Given G(D) = [1, 1 + D + D^3], design a (2, 1, 3) convolutional encoder of rate = ½. c) Discuss properties of Hamming codes.	KTU SEP 2019	20

Module-4

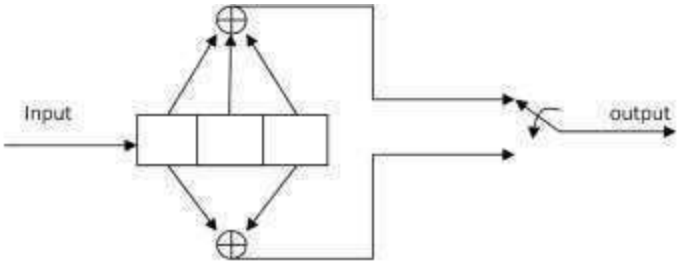
1	Explain generation of systematic cyclic code using polynomial description.	Model qn	3
2	List the features of Reed Solomon code.	Model qn	3
3	Consider a (7, 4) cyclic code with generator polynomial, g(x) = 1 + x + x3 . Express the generator matrix and parity-check matrix in systematic and non-systematic form	Model qn	8
4	Find the generator polynomial for single, double and triple error correcting BCH code of block length, n = 15.	Model qn	6
5	Draw syndrome circuit for a (7,4) cyclic code generated by g(x)=1+x+x3 . If the received vector r is [0010110] what is the syndrome of r? Explain the circuit with a table showing the contents of the syndrome register.	Model qn	8
6	What are the features of Hamming code? Find the parity check matrix for (15, 11) Hamming code	Model qn	6
7	Explain the various parameters of RS codes?	KTU June 2022	3
8	The generator polynomial of a (15,7) Cyclic code is, Find the code vector in $G(p) = p^8 + p^7 + p^6 + p^4 + 1$ Systematic form for the message vector 1101100	KTU June 2022	3
9	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
10	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
11	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
12	For a (7,4) Cyclic code, the received vector Y is 1110101 and the generator polynomial is p3+p+1. Draw the syndrome calculation circuit and correct the single error in the received vector.	KTU June 2022	7
13	The generator polynomial of (7,4) cyclic code is ,G(P)=P3+P+1, Find all code vectors for all the code in non systematic form?	KTU SEP 2020	6
14	Explain the operation of encoders for cyclic codes?	KTU MAY 2019	5

15	Write short notes on: ● BCH code ● Reed Solomon code	KTU SEP 2020	6
16	Construct the following for a non-systematic hamming codes ● Parity check matrix ● Generator matrix ● Code words for messages from 0001 to 1100	KTU MAY 2019	10
17	Explain encoding and decoding schemes using BCH codes.	KTU SEP 2020	7
18	Obtain systematic generator and parity check matrix for (7,4) cyclic codes. Draw the general decoder scheme for (n,k) cyclic codes.	Model qn	10
19	(a) Draw syndrome circuit for a (7,4) cyclic code generated by $g(x)=1+x+x^3$. If the received vector r is [0010110] what is the syndrome of r? Explain the circuit with a table showing the contents of the syndrome register. (b) What are the features of Hamming code? Find the parity check matrix for (15,11) Hamming code	KTU SEP 2019	8 4
20	Construct systematic and non systematic cyclic codes for a (7,4) cyclic code for messages 1011, 1111, 0011, 1100.	KTU SEP 2019	8

Module-5

1	Explain the concatenated block codes?	Model qn	10
2	Draw a (3,2,1) convolutional encoder with generator sequences, g1 (1)=(11) , g1 (2)=(01) , g1 (3)=(11) and g2 (1)=(01) , g2 (2)=(10) , g2 (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	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
7	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
8	For the convolutional encoder shown in figure , decode the sequence , Y= 11 01 11 00 01 10 using Viterbi algorithm 	KTU June 2022	7
9	Explain the Message-passing decoding scheme for LDPC codes	KTU June 2022	7
10	Draw the state diagram of a convolution encoder with rate 1/3 and constraint length 3 for generator sequences g(1) = (1 0 0), g(2) = (1 0 1), g(3) = (1 1 1).	Model qn	7

11	For a (2,1,2) convolutional encoder with generator sequences g(1) = (1 1 1) and g (2) = (1 0 1). Draw Trellis and perform Viterbi decoding on this trellis for the received sequence {01, 10, 10, 11, 01, 01, 11} and obtain the estimate of the transmitted sequence.	Model qn	14
12	Explain message passing decoding algorithm for LDPC codes with the help of an example.	Model qn	7
13	Construct a convolution encoder, given rate 1/3, constraint length L = 3. Giveng$^{(1)}$ = (1 0 0), g$^{(2)}$ = (1 0 1), g$^{(3)}$ = (1 1 1). Sketch state diagram and trellis diagram of this encoder.	Model qn	10
14	Discuss syndrome decoding of cyclic code. Draw syndrome decoder circuit for (15, 9) cyclic code with generator polynomial g(X)= 1+ X^3+ X^4+ X^5+ X^6	KTU MAY 2019	
15	Explain the operation of Convolutional coding with an example?	KTU MAY 2019	10
16	A convolutional encoder has the following generating sequence, g(1)=[1 1 1],g(2)=[1 0 1]. Apply Viterbi algorithm for the decoding of the received sequence 1101110001100011.	KTU SEP 2020	7
17	For a (2, 1, 3) encoder with g(1)=(1101), g(2)=(1111), Draw the trellis for L=5.		6
18	A rate 1/3 non-systematic code has generator sequence as given below: g^{11}=(1101);g^{12}=(1001); g^{13}=1110 ● Construct the encoder ● Draw the code tree for the convolutional code.	KTU DEC 2018	10
19	Explain maximum likelihood decoding for a convolutional code.	KTU SEP 2019	10
20	List the different methods used for graphical representation of convolutional code.	KTU MAY 2019	5

21	Compare convolutional codes with block codes. Draw a (2,1,2) convolutional encoder and write the generator sequences.	KTU MAY 2019	7
22	Distinguish between a trellis diagram and tree diaram		7
23	A rate ½ k=3 binary convolutional encoder is shown in figure below  a. Draw the state diagram for the code b. Find the transfer function of the code c. Find the minimum free distance, d_{free} of the code.	KYU MAY 2018	20
24	a) Draw a (2,1,2) convolutional encoder with the feedback polynomials as $g_1(X)=1+X+X^2$ and $g_2(X)= 1+X^2$. Draw the code tree and trace output for inputsequence 10011.	KTU MAY 2018	20

ECT 362 INTRODUCTION TO MEMS

ECT 362 INTRODUCTION TO MEMS

MODULE I			
Sl No:	**Questions**	**Marks**	**KTU, Year**
1	Explain the basic block diagram of Microsensors & Actuators with neat sketches	3	KTU JUN 2022
2	Explain the working principle of micro inertia sensor	3	KTU JUN 2022
3	Explain the principle of operation of thermal sensors and actuators with neat diagrams. State any two applications	6 7	KTU JUN 2022 KTU DEC 2019
4	Explain the working principle of Piezoelectric Sensors and Actuators with one example.	8	KTU JUN 2022 KTU DEC 2020
5	Describe the operating principle of Linear Micromotors with neat diagrams	6	KTU JUN 2022
6	Explain the principle of operation of MEMS-based electrostatic sensors and actuators	8	KTU JUN 2022 KTU SEP 2020
7	Compare between Electrostatic sensing and Piezoelectric sensing in microsystems. Illustrate the sensing principle in each of these schemes with figures	10	KTU DEC 2021
8	Explain the basis of shape memory effect exhibited by Nitinol with graphs/figures	5	KTU DEC 2021
9	Explain the pull-in effect of parallel plate actuators. Derive the expression for pull-in voltage	10	KTU DEC 2021
10	Explain the working principle of micro pumps with relevant figures	5	KTU DEC 2021
11	Describe the basic building blocks of MEMS with neat diagrams.	8	KTU DEC 2020 KTU DEC 2019
12	Explain the operating principle of Micropump with suitable schematics	7	KTU DEC 2020
13	Explain different types of micro accelerometer with diagrams	7	KTU SEP 2020
14	Explain the working principle of microgrippers and micropumps	8	KTU SEP 2020
15	Explain the operating principle of thermal bimorphs with figures. State any two applications of thermal sensors	7	KTU SEP 2020 KTU DEC 2018

16	Derive the equation for pull-in voltage. Also, explain the advantages and limitations of electrostatic actuation methods.	8	KTUDEC 2019

17	Explain the operating principle of two types of micro motors with suitable schematics	8	KTU DEC 2019 KTU DEC 2018
18	Describe the principle of micro-accelerometer with a neat schematic.	7	KTU DEC 2019
19	State a commercial product that uses MEMS technology. Explain with figures its operating principle of product	5	KTU MAY 2019
20	Explain Lorentz force. Explain the operating principle of magnetic actuators with relevant figures.	10	KTU MAY 2019
21	Explain with figures the working principle of micro grippers.	5	KTU MAY 2019
22	State five characteristics of microsensors and actuators	10	KTU MAY 2019
23	Give one application of MEMS in automobiles. Illustrate its working with neat sketches.	5	KTU DEC 2018
24	Explain with figures two types of sensing schemes used in inertial sensors and micro accelerometer.	10	KTU DEC 2018

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	Discriminate how plates and diaphragms can be used for the design of MEMS with examples	8	KTU JUN 2022
5	Determine the moment of inertia for a beam under longitudinal strain and also find Flexural formula.	8 7	KTU JUN 2022 KTU DEC 2020 KTU SEP 2020 KTU DEC 2019
6	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
7	With reference to the general stress-strain relations, state the principle stress components and derive the stiffness matrix of Silicon <100>	10	KTU DEC 2021
8	Explain the general stress-strain relationship with neat sketches	7	KTU SEP 2020
9	With reference to pure bending of the longitudinal beam, derive the expression for the magnitude of applied bending moment.	5	KTU MAY 2019

10	Explain the purpose of microcantilevers in MEMS systems. What is the relevance of spring constant (k) of the mechanical structure in the microsystem?	10	KTU MAY 2019

11	Explain the constitutive relations between electrical displacement and stress of piezoelectric sensors.	5	KTU DEC2018

MODULE III

	Define Trimmer force scaling vector	3	KTU JUN 2022
	State three relevant properties of Silicon for use in Microsystem	3	KTU JUN 2022
	Derive the expressions for Electromagnetic potential energy reference to scaling of electromagnetic forces	8	KTU JUN 2022
	Explain the Langmuir-Blodgett process with relevant figures. What are the advantages of LB films?	6 10	KTU JUN 2022 KTU DEC 2018
1	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 100 times greater power loss due to increase of resistivity"	10	KTUDEC 2021
2	Derive the equations for scaling of heat transfer in convection for fluids in micrometer and sub-micrometer regime.	10	KTU DEC 2021
3	By giving the significance of the S/V ratio explain scaling in geometry for designing a microsystem.	5	KTU DEC 2021
4	By giving the significance of S/V ratio explain scaling in geometry for designing a microsystem	5	KTU DEC 2021
5			
6	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
7	Explain the scaling in heat conducting and heat convection methods	7	KTU DEC 2020
8	Explain various laws in miniaturization	7	KTU SEP 2020
9	Compare the properties of silicon, SiO2 and SiC	7	KTU SEP 2020
10	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 DEC2018

11	Explain scaling in fluid mechanics. What are the advantages of piezoelectric pumping?	7	KTU DEC 2019
12	Discuss different types of polymers used in MEMS	8	KTU DEC 2019
13	With reference to scaling of electrostatic forces explain why electrostatic actuation is preferred over electromagnetic actuation in micro motors.	8	KTU DEC 2019 KTU DEC 2018
14	State the constraints in pumping fluids in micro channels. What pumping scheme is usually used in micro fluidics, give one example.	10	KTU MAY 2019
15	State three relevant properties of Silicon Carbide and Silicon Nitride for use in Microsystems.	5	KTU MAY 2019
16	With relevant figures/ schematics state one application of Silicon Piezo resistors.	5	KTU MAY 2019
17			
18	What are the advantages of use of polymers in micro systems? Give two examples of polymers (full chemical /commercial names)	5	KTU DEC 2018

MODULE IV

1	Explain the features of Isotropic etching. Why isotropic etching is hardly used for micromanufacturing?	5	KTU DEC 2021
2	Explain chemical vapour deposition process with figures	10	KTU DEC 2021 KTU SEP 2020
3	Explain with figures the Micro stereo lithography process. What are itsadvantages over micromachining techniques?	10	KTU DEC 2021
4	Explain with figures the fabrication of a diaphragm based pressure sensor using bulk micromachining	10	KTU DEC 2021
5	Explain Deep reactive ion etching process with neat sketches	5	KTU DEC 2021
6	Explain the fabrication of a Micro gear using LIGA process with neat sketches.	10	KTU DEC 2020
7	Explain with figure the Deep Reactive Ion Etching(DRIE) and Plasma etching processes.	10	KTU DEC 2020 KTU MAY 2019
8	Explain the oxide growth process in Silicon with relevant figures.	8	KTU DEC 2020 KTU MAY 2019
9	Explain with figures the steps in surface micromachining. Discuss the various fabrication challenges associated with surface micromachining	10	KTU SEP 2020

10	Explain steps of fabrication of a Square tube using LIGA process	10	KTU SEP 2020

11	Explain two processes used for doping silicon substrate and also specify two n and p type dopants	7	KTU SEP 2020
12	Explain surface micro machining process for fabricating a mechanical structure with neat sketches.	10	KTU DEC 2019
13	Explain the steps involved in photolithography with neat sketches.	7	KTU DEC 2019
14	Explain LIGA process in detail	10	KTU DEC 2019 KTU DEC 2018
15	Explain with figures one method to produce single crystal silicon. Why is silicon used as a substrate material for MEMS?	7	KTU DEC 2019
16	Give five relevant points of comparison between bulk and surface micromachining.	5	KTU MAY 2019
17	Discuss the criteria for selecting materials for the masks used in etching	5	KTU MAY 2019
18	Explain the steps involved in photolithography. State the chemicals used in each of the stages along with the operating conditions.	10	KTU MAY2019
19	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 = 307 nm = 307x10^{-7} cm and ΔRp = 69 x 10^{-7} cm at 100 KeV energy level).	10	KTU DEC 2018
21	Describe the role of sacrificial layers in surface micromachining with figures. Give examples of two sacrificial materials used in micro system fabrication.	5	KTU DEC 2018

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	Explain with figures any three surface bonding techniques.	10	KTU DEC 2021
4	State the objectives and explain the levels of micro system packaging.	10	KTU DEC 2021 KTU SEP 2020 KTU MAY2019
5	What is meant by BioMEMS. Discuss the challenges involved in BioMEMS. List two applications of BioMEMS.	10	KTU DEC 2020 KTU MAY 2019
6	Explain the different stages in the Assembly of micro systems.	10	KTU DEC 2020
7	Explain with figures two application which use NEMS technology	10	KTU SEP 2020 KTU MAY 2019
8	Explain with figures two RF MEMS applications	10	KTU SEP 2020 KTU DEC 2019 KTU DEC 2018
9	Explain the following bonding techniques with figures a) Silicon-on-Insulator b) Wire bonding	10	KTU SEP 2020 KTU DEC 2018
10	Explain Anodic bonding and Silicon Fusion Bonding.	10	KTU DEC 2019 KTU MAY 2019
11	State the challenges involved in designing packages for micro systems.	5	KTU DEC 2018
12	Explain any one application of MOEMS with figures.	5	KTU DEC2018

INDUSTRIAL ECONOMICS AND FOREIGN TRADE

(HUT 300)

MODULE 1

1	What is Industrial Economics ?	3	KTU
2	Why does an economic problem arise ?	3	KTU
3	What are the basic economic problems ?	3	KTU Dec 2021
4	Explain Production possibility curve?	3	Ktu Dec 2021
5	Explain consumer equilibrium ?	3	KTU
6	What should be percentage change in price a product if the sale is to be increased by 50% and its price elasticity of demand is2	3	KTU
7	Demand function of a product is given as D = 50-2p and supply function S + 20 + 3p. What will be the equilibrium price and quantity of the product.	3	KTU
8	Explain consumer surplus?	3	KTU
9	Explain producer surplus?	3	KTU
10	Explain Dead weight loss.	3	KTU
11	Difference between micro and macroeconomics?	3	KTU
12	What are the merits and demerits of Joint stock companies?	7	KTU
13	A consumer purchases 50 units of commodity× 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.10to 12. Calculate cross elasticity of demand and interpret the result.	7	KTU
14	Explain the concepts consumer surplus and producer surplus.	7	KTU
15	Suppose the govt. imposes a tax on a commodity where the tax burden is met by the consumers. Draw diagram and explain dead	7	KTU

	weight loss. Mark consumer surplus, producer surplus, tax revenue and dead weight loss in the diagram		
16	Prepare a utility schedule showing units of consumption, total utility and marginal utility. Point out any three limitation of the law.	7	KTU
17	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
18	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?	7	KTU
19	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?	7	KTU
20	With the help of diagram explain Deadweight loss	7	KTU
21	Draw total utility and marginal utility curves and derive the three relations between marginal utility and total utility.	7	KTU Dec 2022
22	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?	7	KTU Dec 2022
23	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 Dec 2022
24	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?	7	KTU Dec 2022
MODULE 2			
1	In the production function θ = 2L½ K ½If L + 36 how many units of capital one needed to produce 60 units of output.	3	KTU
2	In the short run AVC <P <AC. Will the firm produce or shut down? Give reason ?	3	KTU

3	Define Isoquants	3	KTU
4	Explain Isocost line	3	KTU
5	Explain Expansion path	3	Dec 2021
6	Explain Cobb-Douglas production function	3	KTU
7	Differentiate explicit cost and implicit cost	3	KTU
8	Explain Sunk cost	3	KTU
9	Explain Profit Volume Ratio. (PV Ratio)	3	KTU
10	Explain shut down point in the short run	3	KTU
11	What is margin of safety? What happens when margin of safety is low ?	7	Dec 2021
12	Explain Profit Volume Ratio. (PV Ratio)	3	KTU
13	Explain shutdown point with the help of diagram	7	KTU
14	What are internal and external economics of scale.	7	KTU
15	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+50θ- θ2+ θ3. Find marginal cost when output equals 5 units.	7	KTU
16	Explain Law of variable Proportions with a diagram.	7	KTU
17	Explain marginal Revenue and Average Revenue in perfect competition and imperfect competition with graph (7)	7	KTU
18	Define isoquant curve. Explain properties of isoquant curve.	7	KTU
19	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.	7	KTU
20	What are the advantages of large-scale production? Explain producer equilibrium with the help of a diagram.	7	KTU
21	Explain producer equilibrium with the help of isoquants and is cost line. What is expansion path.	7	KTU, KTU Dec 2022
22	Explain Returns to scale OR Long run production function,	7	KTU, KTU

	Represent it using a figure.		Dec 2022
23	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	7	KTU, KTU Dec 2022
24	The total cost function of firm is given as TC=500+5Q 4Q2+Q3. Estimate TVC, TFC and MC when output equals 10 units.	7	KTU, KTU Dec 2022
MODULE 3			
1	What is collusive oligopoly?	3	KTU Dec 2021
2	What is non-price competition under Oligopoly ?	3	KTU
3	What is collusive oligopoly?	3	KTU, KTU Dec 2022
4	What is non-price competition under Oligopoly ?	3	KTU
5	What is Predatory pricing?	3	KTU
6	What is Price skimming?	3	KTU
7	Give examples of non-price competition under oligopoly?	3	KTU
8	Explain the equilibrium of a firm earning supernormal profit under monopolistic competition.	3	KTU
9	Make comparison between monopoly and perfect competition.	3	KTU
10	What is inelastic demand?	3	KTU Dec 2022
11	Suppose AC>Price>AVC. Will a producer produce or shutdown in the short run? Give reason.	3	KTU Dec 2022
12	Why a firm under perfect competition is called a price taker?	3	KTU Dec 2022
13	Explain Price rigidity under oligopoly with the help of kinked demand curve. Why price is rigid under oligopoly?	7	KTU, KTU Dec 2022
14	With the help of a diagram explain equilibrium under monopolistic competition.	7	KTU
15	Distinguish between monopoly and Oligopoly/ Monopoly and perfect competition	7	KTU

16	Explain linked demand curve model.	7	KTU
17	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
18	Explain the equilibrium of a firm earning super normal profit under monopolistic competition.	7	KTU, KTU Dec 2022
19	Make a comparison between monopoly and monopolistic competition. Draw figures showing the determination of equilibrium under both.	7	KTU Dec 2022
20	Explain cost plus and going rate pricing.	7	KTU Dec 2022
21	Give examples of non-price competition under oligopoly?	7	KTU Dec 2020
MODULE 4			
1	What are important economic activities under primary	3	KTU
2	Explain the GNP Deflator.	3	KTU
3	Explain demand pull inflation	3	KTU
4	Explain cost push inflation.	3	KTU
5	Distinguish between a bond and a share?	3	KTU
6	Distinguish between NSE and BSE	3	KTU
7	Distinguish between NIFTY and SENSEX	3	KTU
8	Distinguish between Demat Account and Trading Account	3	KTU
9	Distinguish between final goods and intermediate goods.	3	KTU Dec 2022
10	GDP of a country = 1500 crores, Depreciation =150 Crores NFIA= 50 crores. Estimate GNP,NDP and NNP	7	KTU
11	Distinguish between money market and capital market ?	7	KTU Dec 2021
12	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	7	KTU

	Net internal tax - 300		
13	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	7	KTU
14	From the data given below estimate the NDP using Item Rs 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 Dec 2021
15	What is monetary policy? What are the monetary policy measures?	7	KTU Dec 2022
16	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.	7	KTU Dec 2022
17	Suppose the national income of a country is Rs1000 and depreciation equals Rs300. If NFIA equals Rs (-400) and Indirect Taxes equals Rs300, estimate NNP, NDP, GDP and GNP (all figures in Rs. Crores).	7	KTU Dec 2022
MODULE 5			
1	What is free trade?	3	KTU Dec 2021
2	What is Devaluation?	3	KTU Dec 2021
3	Explain the J-curve effect?	3	KTU
4	Suppose the sum of elasticity of export and import is less than one. What will be the effect of devaluation?	3	KTU

5	What are the merits of quota restrictions?		KTU
6	Explain Marshall- Learner condition.	3	KTU
7	How is National income estimated under Product method and expenditure method	3	KTU
8	What are the monetary and fiscal policy measures to control inflation?	3	KTU Dec 2021
9	What is international trade? List out the advantages of foreign trade ?	3	KTU
10	What do you mean by labour augmenting technical progress?	3	KTU Dec 2022
11	What is a Trading account?	3	KTU Dec 2022
12	Point out any three items coming under unilateral transfers account.	3	KTU Dec 2022
13	What is balance of payments?	3	KTU Dec 2022
14	What is SENSEX and NIFTY? (8)	7	KTU
15	Examine the comparative cost theory. Point out any two criticisms against this theory.	7	KTU Dec 2022
16	What is protection? State any five arguments in favour of protection.	7	KTU Dec 2022
17	What are the disadvantages of foreign trade? Examine the effects of quotas on international trade.	7	KTU Dec 2022
18	Income method and expenditure method.	7	KTU
19	What are the arguments in favour of free trade?	7	KTU
20	What are the tariff barriers? Explain its impact on the economy.	7	KTU
21	Explain absolute advantages theory with the help of an example	7	KTU
22	What are the advantages of foreign trade?	7	KTU
23	Evaluate the success or failure of devaluation when the demand for import is more elastic or less elastic.	7	KTU Dec 2022