

VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY TECHNICAL CAMPUS KILIMANOOR

(A Unit of Vidya International Charitable Trust)

Accredited by NAAC with B++ Grade



QUESTION BANK- 2019 SCHEME **S4 ECE (2023-27 Batch)**

Question Bank

Fourth Semester

MAT 204: PROBABILITY DISTRIBUTIONS, RANDOM PROCESS AND

NUMERICAL METHODS

CLASS: S4 ECE

Sl. No	QUESTIONS	Marks	KU/KTU (Month/Year)
MODULE 1			
1	<p>(1) A random variable X takes values 0,1, 2 and 3 with probabilities $P(X = 0) = \frac{8}{15}, P(X = 1) = \frac{1}{3}, P(X = 2) = P(X = 3) = \frac{1}{15}$</p> <p>(a) Find the mean and variance of X. If $Y = 1000 + 300X$</p> <p>(b) Find $P(Y \geq 1500)$ and $E[Y]$</p> <p>(2) A random variable X takes the values -3, -2, -1, 0, 1, 2, 3 such that $P(X = 0) = P(X > 0) = P(X < 0)$ and $P(X = -3) = P(X = -2) = P(X = -1) = P(X = 1) = P(X = 2) = P(X = 3)$. Obtain the probability mass function and distribution function of X.</p>	7+7	KTU- July 2017 May 2019 July 2021 June 2023
2	<p>In an examination, a candidate has to answer 15 multiple choice questions each of which has 4 choices for the answer. He knows the correct answer to 10 questions and for the remaining 5 questions he chooses the answer randomly.</p> <p>(a) What is the probability that he answers 13 or more questions correctly?</p> <p>(b) What is the mean and variance of the number of correct answers he gives?</p>	7	KTU- July 20121
3	<p>The joint distribution of a two-dimensional random variable (X, Y) is given by $P(X, Y) = c(2x + 3y), x = 0, 1, 2 : y = 1, 2, 3$. Find</p> <p>i) the value of c</p> <p>ii) the marginal distributions</p> <p>iii) Are X and Y independent?</p>	7	KTU-May 2017

4	<p>1) A box contains 100 cell phones, 20 of which are defective. 10 cell phones are selected for inspection. Find the probability that</p> <p>i. at least one is defective</p>	7+7+7	KTU JULY 2017 May 2019
	<p>ii. at most three are defective</p> <p>iii. none of them are defective</p> <p>iv. all of them are defective.</p> <p>2) The monthly breakdown of a computer follows Poisson distribution with mean 1.2. Find the probability that this computer will function for a month</p> <p>i. without a break down ii. with only one breaks down</p> <p>iii. with at most two break down</p> <p>3) The probability of an item produced by a certain machine will be defective is 0.05.If the produced items are sent to the market in packets of 20, find the number of packets containing</p> <p>(a) at least 2</p> <p>(b) exactly 2</p> <p>(c) at most 2 defective items in a consignment of 1000 packets using Poisson distribution</p>		July 2021
5	<p>The probability that an electric component manufactured by a firm is defective is 0.01. If the produced items are sent to the market in packets of 10, find the number of packets containing exactly two defectives and at most two defectives in a consignment of 1000 packets using</p> <p>(i) binomial distribution and</p> <p>(ii) Poisson approximation to binomial distribution</p>	7	KTU-April 2024
6	<p>1) The probability distribution of a discrete random variable X is given by $p(X = x) = \frac{k}{2^x}, x = 0, 1, 2, 3, 4$. Find</p> <p>(a) the value of k</p> <p>(b) the probability that X is even</p> <p>(c) $P(X \leq 2)$ (d) $E(X)$.</p> <p>2) The probability mass function of a discrete random variable is $p(x) = kx, x = 1, 2, 3$ where k is a positive constant. Find</p> <p>(a) The value of k</p> <p>(b) $P(X \leq 2)$</p> <p>(c) $VAR(1 - X)$</p>	7+3	KTU MAY 2019 JULY-2021

7	(a) Show that Poisson distribution is the limiting case of binomial distribution. (b) Derive the mean and variance of Binomial distribution (c) Derive the mean and variance of Poisson distribution	7+7+7	KTU JULY-2021 JUNE-2022
8	The probabilities that there will be 0, 1, 2, 3 power failures for a certain machine in the month of June are 0.4, 0.3, 0.2, 0.1 respectively. Find the mean and variance for the number of failures.	3	KTU- JUNE 2022

9	If X is a Poisson variable such that $[X = 1] = P[X = 2]$, then find $P[X = 3]$.	3	KTU- JUNE 2022
10	The number of gamma rays emitted per second by a certain radioactive substance follows a Poisson distribution with mean 8. Determine the probability that (i) three particles are emitted in one second (ii) at most one particle is emitted in one second (iii) more than one particle is emitted in one second.	7	KTU- JUNE 2022 APR2024

MODULE 2

1	<p>i. The time for super glue to set can be treated as a random variable having a normal distribution with mean 30 seconds. Find the standard deviation if the probability is 0.20 that it will take on a value greater than 39.2 seconds.</p> <p>ii. 1000 light bulbs with mean length of life 120 days are installed in a factory. Their length of life is assumed to follow normal distribution with S.D 20 days. How many bulbs will expire in less than 90 days? If it is decided to replace all the bulbs together, what interval should be allowed between replacements if not more than 10% should expire before replacement?</p> <p>iii. The mileage which a car owner gets with a certain kind of tyre is a random variable having an exponential distribution with mean 60,000 km .Find the probability that one of the tyres will last(i) at least 50,000km (ii)at most 60,000 km</p>	7+7+7	KTU- May 2017 May 2019 July 2021
2	Buses arrived at a specific stop at 15 minutes interval starting at 7 am. A passenger arrives at the stop at random time between 7 and 7.30 am. Find the probability that he waits 1) less than 5 minutes 2) at most 12 minutes?	7	KTU-MAY 2017

3	<p>Suppose a new machine is put into operation at time zero. Its life time is an exponential random variable with mean life 12 hours.</p> <p>(i) What is the probability that the machine will work continuously for one day?</p> <p>ii) Suppose the machine has not failed by the end of the first day, what is the probability that</p>	7	KTU-March 2017
	it will work for the whole of the next day?		
4	The lifetime of a battery is exponentially distributed. 40% of such batteries do not last longer than 1000 hours. Mr. Kumar purchased such a battery which is already used for 500 hours. What is the probability that it will last another 1000 hours?	7	KTU-March 2017
5	<p>b) Find the mean and variance of uniform distribution</p> <p>c) Find the mean and variance of exponential distribution</p>	7+7	KTU- May 2019 May 2017
6	<p>The probability density function of a random variable is given by</p> $f(x) = \begin{cases} kx^2, & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$ <p>Find (a) k (b) Mean (c) $p\left(\frac{1}{4} < X < \frac{3}{4}\right)$ (d) $p\left(X > \frac{2}{3}\right)$</p>	7	KTU- July 2017 APR 2024 JUNE 2022
7	<p>1) The joint pdf of two continuous random variables X and Y is</p> $f(x,y) = \begin{cases} 8xy, & 0 < y < x < 1 \\ 0, & \text{otherwise} \end{cases}$ <p>i. Check whether X and Y are independent ii. Find $p(X + Y < 1)$</p> <p>2) The joint pdf of two continuous random variables X and Y is given by</p> $f(x,y) = \begin{cases} kxy, & 0 < x < 4, 1 < y < 5 \\ 0, & \text{otherwise} \end{cases}$ <p>Find</p> <p>(i) k</p> <p>(ii) The marginal distributions of X and Y</p> <p>(iii) Check whether X and Y are independent</p>	7+7	KTU April 2019 June 2022
8	<p>A factory has two outlets to sell its products. The daily sale from the first outlet is uniformly distributed between Rs. 50,000 and 60,000 and from the second outlet is uniformly distributed between 40,000 and 60,000. The sales of the outlets are independent.</p> <p>(i) What is the probability that the total sales from both the outlets combined is more than RS.100000.</p> <p>If 20% of the amount from the sales is profit, find the expected daily profit from both the outlets combined, and the variance of the profit.</p>	7	KTU- July 2017

9	A continuous random variable X is uniformly distributed in $(-k, k)$. Find k if $P[X \geq 2] = 0.25$.	3	KTU- June 2022
10	If X_1, X_2, \dots, X_n are random variables with mean $\mu = 2$ and variance $\sigma^2 = 2$, then use central limit theorem to estimate $P[110 \leq S_n \leq 150]$, where $S_n = X_1 + X_2 + \dots + X_n$ and $n = 75$.	3	KTU- JUNE 2022

MODULE 3

1	<p>(a) A computer generates 100 random numbers which are uniformly distributed between 0 and 1. Find approximately the probability that their sum is at least 50.</p> <p>(b) Assume that $X(t)$ is a random process defined as follows: $X(t) = A \cos(2\pi t + \phi)$ where A is a zero-mean normal random variable with variance $\sigma_A^2 = 2$ and ϕ is uniformly distributed random variable over the interval $-\pi \leq \phi \leq \pi$. A and ϕ are statistically independent. Let the random variable Y be defined as $Y = \int_0^1 X(t) dt$. Determine (i) the mean of z (ii) the variance of Y.</p>	7+7	KTU- MAY 2017 June 2022
2	Prove that the random process $X(t)$ is defined by $X(t) = a \sin(\omega t + \theta)$, where a and ω are constants and θ is a random variable Uniformly distributed in $[0, 2\pi]$ is WSS process.	7	KTU-MAY 2018
3	<p>(a) Consider the random process $X(t) = A \cos(\omega t + \theta)$ where A and θ. Is uniformly distributed random variable in $(0, 2\pi)$. Check whether or not the process is WSS.</p> <p>(b) A random process $X(t)$ is defined by $X(t) = Y(t) \cos(\omega t + \theta)$, where ω is a constant and θ is a random variable which is uniformly distributed in $[0, 2\pi]$ and is independent of $Y(t)$. Show that $X(t)$ is a WSS process</p>	7+7	KTU-April 2018
4	If $X(t) = f(t)$ is a stochastic process, find $E(X(t))$, $R(t_1, t_2)$ and $C(t_1, t_2)$	7	KTU-April 2018
5	Let $X(t) = A \sin t + B \cos t$ be a process where A and B are	7	KTU-

	independent random variables with zero mean and equal variance show that the process is WSS.		APRIL 2018
6	Find the spectral density function of the WSS process whose auto correlation function is e^{-xy^2}	7	KTU-May 2019
7	Find the power spectral density of a wide sense stationary process (t) with autocorrelation function $R_X(\tau) = e^{-3 \tau }$.	7	KTU- JULY 2017

8	<p>(a) Find the autocorrelation function and average power of a wide sense stationary process $X(t)$ with power spectral density given</p> $S_X(\omega) = \begin{cases} 1 - \omega, & \omega \leq 1 \\ 0, & \text{otherwise} \end{cases}$ <p>by</p> <p>(b) Car arrives at a gas station according to a Poisson process at an average rate of 12 cars per hour. The station has only one attendant. If the attendant decides to take a 2-minute coffee break when there are no cars at the station. What is the probability that one or more cars will be waiting when he comes back from the break given that any car that arrives when he is on coffee break waits for him to get back?</p>	7	KTU- April 2018 June 2022 APR 2024
9	<p>(a) Show that the random telegraph signal process is WSS.</p> <p>(b) Given any two example of a continuous time discrete random processes.</p> <p>(c) How will you calculate the mean, variance and total power of a WSS process from its auto correlation function?</p>	7+3+7	KTU- April 2017
10	<p>The number of enquiries arriving at a call centre is a Poisson process with rate 5 per hour.</p> <p>(i) Find the probability that there would be 3 calls between 10 AM and 11 AM and 4 calls between 2 PM and 4 PM.</p> <p>(ii) A call is categorized as 'long' if it lasts more than 10 minutes.</p> <p>(iii) The probability that an arriving call is long is 0.2. Find the probability that the time between two consecutive long calls is less than 1 hour.</p>	10	KTU-JULY 2017 APR 2024

MODULE 4

1	<p>(a) Using Newton-Raphson method, compute a real root of $e^{2x} - x - 6 = 0$ lying between 0 and 1.</p> <p>(b) Write the Newton-Raphson iteration formula to find the cubic root of a positive number</p> <p>(c) Using Newton Raphson method to solve the equation $x^3 + x - 1 = 0$ correct to 4 decimal places</p> <p>(d) Using Newton-Raphson method to find a non-zero solution of $f(x) = 2x - \cos x = 0$</p>	7+7+7	KTU- April 2018 June 2022 July 2021
2	<p>Using Lagrange's interpolation method find the polynomial $f(x)$ which agree with the data $f(-1) = 3, f(0) = -4, f(1) = 5$ and $f(2) = -6$</p>	7	KTU- MAY 2017 APR 2024

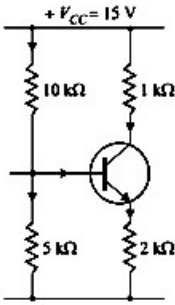
3	The speed of a moving particle was measured at different points of time. The time t when the first measurement was recorded is taken as t =0. Subsequent speeds at different times are as shown in the following table							7	KTUAPRIL 2018	
	Time(t) in seconds	0	10	20	30	40	50			60
	Velocity (v) in m/sec	35	39	44	50	56	43			40
	Using Simpson’s one-third method, evaluate the distance travelled by the particle in 60 seconds.									
4	Health surveys are conducted in a city every 10 years. The following data gives the number of people (in thousands) having heart diseases as found from the records of the survey							7	KTU-MAY 2024	
	Year	: 1961	1971	1981	1991	2001	2011			
	No. of people	: 16	19	23	28	34	41			
	Use Newton’s interpolation method to estimate the number of people with heart diseases in the year 2005									
5	(a) Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ using (1) Trapezoidal rule (2) Simpson’s rule with 6 equal intervals.							7+7	KTU- MAY 2017 June 2022	
	(b) Use trapezoidal rule to evaluate $\int_0^1 y dx$ for the following data									
	x	0	0.2	0.4	0.6	0.8	1			
	y	0	0.04	0.16	0.36	0.64	1			

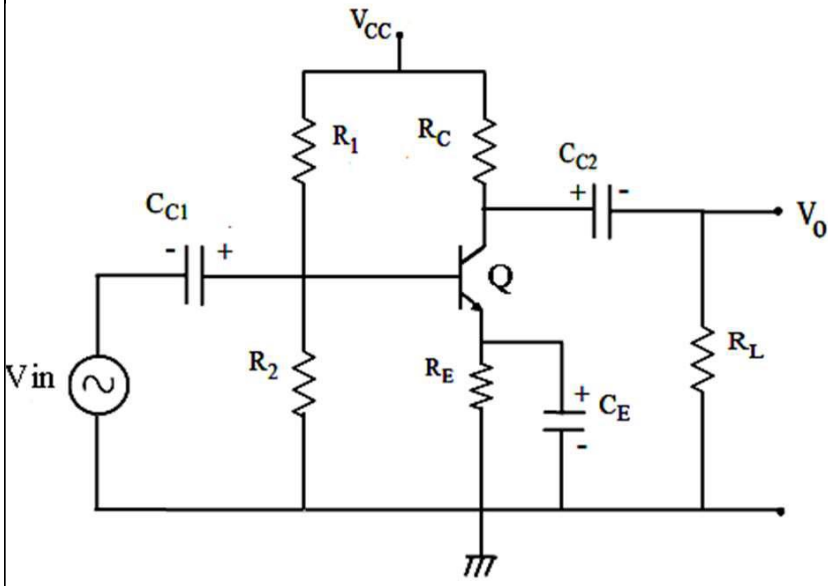
6	Using Newton's forward interpolation formula estimate sin 52 given						7	KTU-MAY 2017
	θ	45	50	55	60	65		
	sin θ	0.7071	0.7660	0.8192	0.8660	0.9036		
7	Using Lagrange's polynomial estimate $f(1.5)$ for the following data						7	
	x	0	1	2	3			
	f(x)	0	0.9826	0.6299	0.5532			
8	Find the root of the equation $\cos x - xe^x = 0$ that lies between 0 and 1, using Regula- falsi method, correct to four decimal places.						7	KTU June 2022
9	Find the equation of the curve that passes through the points (0, 2), (1, 3), (2, 12) and (5, 147) by Lagrange's interpolation formula. Also find (3).						7	KTU June 2022
10	Given a $y = f(x)$ function by the following table. Using Newton's interpolation formula, find (0.2).						7	KTU June 2022 APR 2024
	x	0	1	2	3	4	5	6
	y	176	185	194	203	212	220	229

MODULE 5													
1	Using Runge-Kutta method of order four, compute $\frac{dy}{dx} = e^x + y$ $y(0.2)$ given that , $y(0) = 0$. Take step size $h = 0.1$.	7	KTU-MAY 2017										
2	Use Euler Method with $h = 0.1$ to find y at $x = 0.3$ for the equation $\frac{dy}{dx} = \frac{y}{1+x}$, $y(0)=2$	3	KTU- May 2017										
3	Apply Runge-Kutta Method of order 4, find an approximate value of y when $x = 0.7$ given $\frac{dy}{dx} = y - x^2$ and $y(0.6) = 1.7379$.	7	KTUAPRIL 2018										
4	Use Runge-Kutta method of order 4 to find $y(0.2)$ for the differential equation $y' = 3x + 0.5y$, $y(0) = 1$ (Take $h = 0.2$)	7	KTU-MAY 2019										
5	Given the initial value $y = y + x$ problem ' , $y(0)=0$, find $y(0.1)$ and $y(0.2)$ using Euler method	3	KTU APR2024										
6	Explain the principle of least squares for determining a line of best fit to a given data	3	JUNE 2022										
7	a) Using Gauss-Seidel method, solve the following system of equations $\begin{aligned} 20x + y - 2z &= 17 \\ 3x + 20y - z &= -18 \\ 2x - 3y + 20z &= 25 \end{aligned}$ b) Solve the system of equations Using Gauss-Seidel iteration method starting with the initial approximation $(0, 0, 0)^T$	7+7	June 2022 July 2021										
	$\begin{aligned} 8x_1 + x_2 + x_3 &= 8 \\ 2x_1 + 4x_2 + x_3 &= 4 \\ x_1 + 3x_2 + 5x_3 &= 5 \end{aligned}$												
8	The table below gives the estimated population of a country (in millions) for during 1980 - 1995 <table><tr><td>year</td><td>1980</td><td>1985</td><td>1990</td><td>1995</td></tr><tr><td>population</td><td>227</td><td>237</td><td>249</td><td>262</td></tr></table> Plot a graph of this data and fit an appropriate curve to the data using the method of least squares. Hence predict the population for the year 2010.	year	1980	1985	1990	1995	population	227	237	249	262	7	APR 2023 JULY 2023
year	1980	1985	1990	1995									
population	227	237	249	262									

9	Use Runge-Kutta method of fourth order to find $y(0.2)$ given the $\frac{dy}{dx} = \frac{xy}{1+x^2}$ $y(0) = 1$ initial value problem. . Take step-size, $h = 0.1$.							7	APR 2024
10	Solve the initial value problem 1, $\frac{dy}{dx} = x + y$, $y(0) = 0$, $0 \leq x <$ taking step-size $h=0.2$. Calculate $y(0.2)$, $y(0.4)$ and $y(0.6)$ using Runge-Kutta second order method, and $y(0.8)$ and $y(1.0)$ using Adam-Moulton predictor-corrector method.							7	APR 2024 JULY 2022
	X	4	5	7	10	11	13		
	Y	48	100	294	900	1210	2028		

ECT 202: ANALOG CIRCUITS

MODULE 1			
Sl. No.	Questions	M	Year
1.	Design a differentiator circuit to differentiate a square wave input of 20V peak to peak amplitude and 1.5KHz frequency.	3	June 2023 May 2024
2.	Explain thermal run away. What is the need for biasing a transistor? What factors are to be considered for selecting the operating point Q?	3 3	June 2023 Jan 2024
3.	Draw the d.c. load line and determine the operating point of the given circuit. Assume the transistor to be of silicon. Take, $\beta=100$. 	8	June 2023
4.	a) Draw the circuit and explain the working of an RC integrator circuit for a square wave input with period T. Sketch its output waveform for $RC \gg T$, $RC \ll T$ and $RC = T$. b) Derive the design equation of RC Integrator. Show that output voltage is directly proportional to the integral of input voltage.	6 8	June 2023 May 2024
5.	With necessary diagrams, explain the voltage divider biasing method of BJT. Derive the expression for stability factor also.	8	June 2023
6.	Set up and explain a slicer circuit that clips an input sine wave at +3V and -6V. Draw the transfer characteristics.	6	June 2023 Jan 2024 May 2024
7.	Define Stability factor. Derive the expression for stability factor 'S'.	3	June 2022 Jan 2024
8.	a) With necessary diagrams, explain any two biasing method of BJT. b) Design an RC low pass filter with a cut off frequency 2 KHz. Also plot its frequency response.	8 6	June 2022 Jan 2024
9.	Given an input wave, $V_{in}=10\sin\omega t$. Setup and explain a clamper that clamps the wave to 22.3V at the positive peak, assuming a voltage drop of 0.7 V across the diode. Draw the output waveform and transfer characteristics also.	8	June 2022
10.	a) Design a fixed bias circuit for a CE amplifier such that operating point is $V_{CE} = 8V$ and $I_C = 2 \text{ mA}$. Given, a fixed 15V d.c supply and a silicon transistor with $\beta = 100$. Take base emitter voltage $V_{BE} = 0.6V$ and neglect R_E .	6	June 2022

	b) Draw the RC Coupled amplifier circuit and discuss the function of each components in the circuit.	8	May 2024
11	Derive the output voltage expression for an RC differentiator.	3	Jan 2024
MODULE 2			
1	State Miller's theorem and discuss its significance on high frequency performance of amplifiers.	3	June 2023 Jan 2024 May 2024
2	Explain how the presence of r_0 in hybrid π model of CE configuration justifies Early effect.	3	June 2023
3	Using small signal hybrid π model, obtain the expression for input impedance, output impedance and mid band voltage gain of a common emitter amplifier.	8	June 2023
4	Draw the high frequency hybrid π model of BJT in CE configuration and explain the significance of each parameter.	6	June 2023 Jan 2024
5	Using hybrid π model, calculate the small signal voltage gain, current gain, input impedance and output impedance of the given circuit, having $R_1=47K\Omega$, $R_2=10K\Omega$, $R_C=2.7K\Omega$, $R_E=680\Omega$, $R_L=22K\Omega$, $V_{CC}=15V$, $V_{BE}=0.7V$, $V_A=80V$, $I_c=2mA$ and $\beta=100$. (Neglecting r_0).	14	June 2023 Jan 2024
			
6	Given $K=0.4mA/V^2$ and $I_{D(ON)} = 3.5mA$ with $V_{GS(ON)} = 4V$. Determine the value of V_{TH} .	3	June 2022
7	Draw and explain the frequency response of RC coupled amplifier with a neat diagram. With a neat diagram explain high frequency equivalent circuit of BJT	6	June 2022 Jan 2024
8	Using hybrid π model, calculate the small signal voltage gain, input impedance and output impedance of the given circuit.	14	July 2021

	<p>Given, $V_{BE}=0.7V$, $V_A=80V$, $I_c = 2mA$ and $\beta=100$. (Neglecting r_n)</p>		
9	<p>Three stages of individual RC coupled amplifier having midband gain of 80 with lower cutoff frequency of 100Hz and upper cutoff frequency of 300MHz are cascaded. Find the resultant gain and cutoff frequencies.</p> <p>Derive small signal voltage gain, input and output resistance of CE RC coupled amplifier at midfrequency</p>	7 6	July 2021 May 2024
10	<p>Design an RC coupled amplifier for a gain of 200, given that $V_{CC}=15V$ and $I_c=3.2mA$ and required input impedance is $1.44K\Omega$. Find the lower cutoff frequency of the amplifier. Assume capacitor values appropriately if necessary. Draw the small signal high frequency CE model of a transistor and give the order of magnitudes of each capacitance and resistance.</p>	14	July 2021
11	<p>Design an RC coupled amplifier with $A_v=30$. Let $V_{CC}=12V$, $I_{CQ}=2mA$, $\beta_{dc}=250$. Choose Si Transistor</p>	9	May 2024
MODULE 3			
1	<p>Given $K=0.4mA/V^2$ and $I_{D(ON)} = 3.5mA$ with $V_{GS(ON)} = 4V$. Determine V_{TH}.</p>	3	June 2023
2	<p>What are the effects of cascading in gain and bandwidth of an amplifier? Draw the circuit of cascade amplifier and list any three advantages of this configuration.</p>	3 7	June 2023 Jan 2024
3	<p>Explain any two biasing techniques for enhancement MOSFET.</p>	8	June 2023 Jan 2024
4	<p>Calculate the drain current and drain-to-source voltage of a common source circuit with an n-channel enhancement mode MOSFET. Find the power dissipated in the MOSFET. $R_1=22K\Omega$, $R_2=10K\Omega$, $R_D=6.8K\Omega$, $V_{DD}=8V$, $V_T=1V$, $K_n=0.1mA/V^2$</p>	6	June 2023 Jan 2024
5	<p>Draw the circuit of a common source amplifier using MOSFET. Derive the expressions for voltage gain, input resistance and output resistance from small signal equivalent circuit.</p>	8	June 2023
6	<p>Briefly explain the Common Source stage with current source load.</p>	6	June 2023

7	Design two stage cascade amplifier with overall voltage gain=900. Let $V_{CC}=12V$, $I_{CQ}=2mA$, $\beta_{dc}=250$, Choose Si Transistor	7	May 2024
8	Draw the CS stage with diode connected load and deduce the expression for voltage gain of the amplifier.	8	June 2022 Jan 2024 May 2024
9	Calculate the drain current and drain-to-source voltage of a common source circuit with an n-channel enhancement mode MOSFET. Find the power dissipated in the transistor. $R_1=22K\Omega$, $R_2=10K\Omega$, $R_D=6.8K\Omega$, $V_{DD}=8V$, $V_T=1V$, $K_n=0.1mA/V^2$	6	June 2022 May 2024
10	Briefly explain a Cascode amplifier. Draw the block diagram of a multistage amplifier with n number of stages and give an expression for its overall voltage gain.	6 3	June 2022 Jan 2024
MODULE 4			
1	Explain Barkhausen criteria for sustained oscillations.	3	June 2023
2	a)List the advantages of negative feedback on gain of the amplifier. b)What are the four basic feedback topologies? Explain with block diagrams	3 8	June 2023 Jan 2024 Jan 2024
3	With neat circuit diagram, explain the working of Wien bridge oscillator. Explain how Barkhausen criterion for oscillation is satisfied by the circuit and derive the expression for the frequency of oscillation. In a Wein bridge oscillator given that $R_1 = R_2 = 200K\Omega$ and $C_1 = C_2 = 250pF$. Determine the frequency of oscillations.	14 6	June 2023 June 2024
4	Explain the working principle of crystal oscillator with neat diagram. Draw the equivalent circuit of a crystal. Crystal Oscillator provides good frequency stability. Justify the statement	5 6	June 2023 Jan 2024
5	A voltage series negative feedback amplifier has a voltage gain without feedback $A=500$. Input and output resistances are $3K\Omega$ and $20K\Omega$ respectively, feedback factor $\beta=0.01$. Calculate the voltage gain A_f , R_{if} , R_{of} of the amplifier with feedback	3	Jan 2024
6	Give the block schematic of current-series feedback amplifier configuration and deduce the expression for gain, input impedance and output impedance with feedback.	9	June 2023
7	An amplifier has a voltage gain of 400, $f_1=50Hz$, $f_2=200KHz$ and a distortion of 10% without feedback. Determine the amplifier voltage gain, f_{1f} , f_{2f} and D_f when a negative feedback is applied with feedback ratio of 0.01..	8	Jan 2024
8	With neat circuit diagram, explain the discrete BJT circuit in voltage-series feedback and derive the expression for voltage gain, input impedance and output impedance.	14	June 2022
9	Design wein-bridge oscillator using BJT to generate 1KHz sine wave.	9	June 2022

10	a) Show that negative feedback amplifier provides stability in gain when compared to basic amplifier (without feedback).	7	May 2024
	b) Draw the circuit diagram of Voltage shunt feedback amplifier and Voltage series feedback amplifier, each circuit deduce the expression for feedback factor(β).	7	May 2024
MODULE 5			
1	What is line regulation and load regulation in a voltage regulator?	3	June 2023 Jan 2024
2	What do you mean by crossover distortion? How it can be eliminated?	3	June 2023 Jan 2024
3	Explain the working of transformer coupled Class A power amplifier with a neat circuit diagram and collector waveforms. Derive the expression for collector efficiency.	14	June 2023 Jan 2024
4	With a neat circuit diagram, explain how output voltage can be regulated by using series feedback voltage regulator. How short circuit protection can be implemented in this?	14	June 2023
5	Illustrate the principle of output current boosting circuit in a voltage regulator?	3	June 2022
6	Explain the working of current boosting circuit. Draw the circuit diagram of series voltage regulator with current boosting circuit	8	May 2024
7	What are the factors affecting the variation in output voltage of voltage regulator? With a circuit diagram, explain how load and line regulations are achieved in a shunt voltage regulator.	14	June 2022
8	a) Draw the circuit of complementary symmetry class B push pull power amplifier and explain its operation. What are the advantages of complementary symmetry amplifiers when used at output stages?	8	May 2024
	b) What do you mean by Harmonic distortion? Define Second Harmonic distortion and Total Harmonic distortion (THD)	6	
9	Explain short-circuit protection with the support of figures. Also Design a short-circuit current limiting circuit to limit $I_{Lmax}=3A$.	8	KTU Model Question May 2024
10	a) Explain the working of a transformer coupled class A power amplifier	8	Jan 2024
	b) Describe the operation of a transistor shunt regulator.	6	

ECT 206 COMPUTER ARCHITECTURE AND MICROCONTROLLERS

MODULE 1			
Sl.No.	Questions	Marks	KTU, Year
1	Show the binary representation of $(-54.035)_{10}$ in Single precision floating point format	3	KTU JUNE 2023
	Write down the range of numbers that can be represented using IEEE 754 single precision floating point representation. How do we represent zero, infinity and 49 in IEEE 754 format.	8	KTU JULY 2021
	Represent the number -15.625 in IEEE754 single precision format	5	KTU MAY 2024
2	What are the functional units of a Computer?	3	KTU JUNE 2023
3	a) Explain “shift and add” algorithm for multiplying two numbers with an example	8	KTU JUNE 2023
	b) Differentiate RISC and CISC Computer Architecture	6	
4	a) Draw and explain the general internal architecture of a processor	8	KTU JUNE 2023
	b) Explain processor operations Instruction fetch, decode and execute.	6	
	Draw the internal architecture of a general processor and explain the various components	9	KTU MAY 2024
5	Differentiate between Von-Neumann and Harvard Architecture.	3	KTU JUNE 2022, MAY 2024
6	Define Address bus, Data bus and Control bus.	3	KTU JUNE 2022
	Explain the three major types of busses in a processor		KTU MAY 2024
7	What is Stack Pointer, Program Counter and Accumulator	3	KTU MAY 2024
8	Explain Non-restoring division algorithm with an example.	8	KTU JUNE 2022
9	Perform the division $9/5$ using any restoring division algorithm.	8	KTU MAY 2024
10	Explain Instruction Cycle with a sample timing diagram.	6 10	KTU JUNE 2022 MODEL

11	Illustrate the algorithm for division of two 4 bit signed binary numbers, -6/4. Write the algorithm or draw the flowchart also.	8	KTU JULY 2021
12	How does a computer go from a set of stored instructions to running them?	7	KTU JUNE 2022
MODULE-2			
1	Explain the memory organization of 8051 microcontroller.	3	KTU JUNE 2023
2	State how register bank selection is carried out in 8051.	3	KTU MAY 2024
3	Write down the function of following instructions (a) XRL A,@R1 (b) CLR A (c) XCH A,@R0	3	KTU JUNE 2023
	(b) ANL A,@R1 (b) RLC A (c) MOVX A,@R0	3	KTU JUNE 2022
4	a) Explain different Addressing Modes of 8051 Microcontroller with examples.	8	KTU JUNE 2023
	b) Explain Read/Write operation of any one port of 8051 microcontroller using port diagram.	6	
	Explain any three addressing modes used in 8051 with an example each.	6	KTU MAY 2024
5	a) Explain the interrupts of 8051 microcontroller	5	KTU JUNE 2023
	b) Draw and explain the architecture of 8051 microcontroller.	9	
	Describe the steps in executing an interrupt.	6	KTU MAY 2024
6	Draw and explain the PSW of 8051 microcontroller.	3	KTU JUNE 2022 KTU JULY 2021
7	Explain TCON and TMOD special function register in 8051 Microcontroller	6	KTU JUNE 2022
8	Write the functions of the pins in 8051 - EA, RST, XTAL and ALE	8	KTU MAY 2024
9	What are the alternative functions supported by Port 3 of 8051?	8	KTU MAY 2024
10	List the components of 8051 microcontroller	3	KTU JULY 2021 MODEL

11	Write the operations happening in the following instructions: ADD A, 56 XCHD A, @R1 DJNZ R6, LABEL DIV AB XRL A, #0FFh JB P1.2 LABEL	3	KTU JULY 2021 MODEL
12	Explain the following instructions a) ADDC A,20H b) DIV AB c) DJNZR0, Label	3	KTU MAY 2024
13	Explain the RAM memory organization of 8051 microcontroller using a schematic diagram. Also list the 8051 Special function registers and its functions.	9	KTU JULY 2021
14	What is stack? Explain the role of stack in program execution during a CALL instruction	5	KTU JULY 2021
MODULE -3			
1	Write an assembly language program to copy a block of 8 bytes of data to RAM locations starting at 80H from RAM locations 20H.	3	KTU JUNE 2023
2	Write an assembly language program to copy 10 bytes starting from 20H to location starting from 50H	3	KTU MAY 2024
3	What are the types of constants in embedded C?	3	KTU JUNE 2023
4	a) Explain the interfacing of stepper motor with the microcontroller. Write an assembly language program to rotate stepper motor in a clockwise direction continuously in full-step mode. b) Write an 8051 assembly language program to find the sum of 25 data bytes stored in array of external RAM starting with address 3200H. Store the 16 bit sum at the end of array.	9 5	KTU JUNE 2023
5	a) Explain interfacing of DAC with 8051 using a diagram and also write an embedded C program to generate staircase waveform. b) Write an assembly language program to interface a 7 Segment LED display with 8051 microcontroller.	7 7	KTU JUNE 2023
6	What is constant in embedded C?	3	KTU JUNE 2022

7	Write an ALP to find the largest number in an array of 10 bytes, stored in the internal memory block starting with 21H. Store the result at 50H.	6	KTU JUNE 2022
8	Write any five data types used in Embedded C	5	KTU MAY 2024
9	Draw the block diagram to show how 8051 is connected to DAC 0808 at port P1. Write a program to generate Ramp signal.	8	KTU JUNE 2022
10	With necessary diagram explain interfacing of 8051 with DAC module and write assembly language program to generate a staircase waveform	9	KTU MAY 2024
11	Write an 8051 C program to get a byte of data from Port P1. If it is less than 100, send it to P0; otherwise, send it to P2	6	KTU JUNE 2022
12	With a neat diagram explain how a Seven Segment Display can be interfaced with 8051 and write an assembly language program to display the character P.	7	KTU MAY 2024
13	Write an 8051 C program to send values 00-FF to port P1.	3	KTU JULY 2021
14	write an assembly language program to add three, 8-bit numbers stored in external RAM memory.	7	KTU MAY 2024
15	Write an 8051 C program to send values 00H to FFH to port P	3	KTU MAY 2024
16	Write an 8051 C program to send letters 'M', 'D' to LCD using delays.	7	KTU JULY 2021

MODULE -4

1	Explain how the baud rate is configured in 8051 serial port	3	KTU JUNE 2023
2	Explain assembler, interpreter and compiler.	3	KTU JUNE 2023
3	a) Explain 8051 timer mode 1 and mode 2 characteristics and operations using diagrams. b) Write an 8051 C program to transfer the message "FOLLOW THIS" serially at baud rate of 9600, 8bit data with 1 stop bit continuously.	8 6	KTU JUNE 2023
4	a)Write an 8051 assembly language program to generate a square wave of 1KHz frequency at pin P0.1 using Timer 0. Explain how timer modes are selected using TMOD register. OR Write an ALP to generate a square wave of frequency 100KHz on	8 7	KTU JUNE 2023 KTU JUNE 2022

	pin P1.0, using Timer 1 operating in mode 0. Assume Crystal frequency 11.0592 MHz b) Draw and explain ARM7 register architecture.	6	KTU JUNE 2023 KTU JUNE 2022
5	What is the difference between a Timer and Counter?	3	KTU JUNE 2022
6	Explain the different modes of operation of Timers in 8051.	8	KTU MAY 2024
7	Draw the TMOD register and mention the function of each bit in the register	3	KTU MAY 2024
8	Name the SFRs (any three) used for serial communication in 8051. What is their function?	3	KTU MAY 2024
9	Describe CPSR of ARM processor.	4	KTU MAY 2024
10	Explain the operation of following System Software. a) Assembler b) Compiler c) Debugger	6	KTU MAY 2024
11	Explain the format of SCON Special Function Register.	3	KTU JUNE 2022
12	Explain various System software.	8	KTU JUNE 2022
13	Write an embedded C program for the 8051 to transfer letter "A" serially at 9600 baud, continuously. OR Explain the steps to transfer data serially in 8051. Write an 8051 assembly language program to transfer 'Y' serially at baud rate 9600 continuously through Port 0 OR Assume a switch is connected to pin P1.7. Write an embedded C program for 8051 microcontroller to monitor its status and send two messages to serial port continuously as follows: SW=0 send "NO" SW=1 send "YES" Assume XTAL = 11.0592 MHz, 9600 baud, 8-bit data, and 1 stop bit OR Write an embedded C program for 8051 microcontroller to send the message "Hello World !" to serial port. Assume a SW is connected to pin P1.2. Monitor its status and set the baud rate as follows: SW = 0 , 4800 baud rate SW = 1 , 9600 baud rate Assume XTAL = 11.0592 Mhz, 8 – bit data, and 1 stop bit	6	KTU JUNE 2022
		8	KTU JULY 2021
		10	MODEL
		10	MODEL

14	Assume XTAL=11.0592. Compute the value to be loaded into TH0 and TL0 (mode 1) to incorporate a time delay of 5ms	3	KTU JULY 2021
15	Explain the steps to transfer data serially in 8051 . Write an assembly language program to transfer "YES" serially at baud rate 9600 continuously through Port 0.	10	KTU MAY 2024
16	Explain the procedure of doubling the baud rate of data transfer in 8051 serial communication.	3	KTU JULY 2021
MODULE -5			
1	Write a short note on memory hierarchy	3	KTU JUNE 2023 KTU JUNE 2022
2	Write a short note on memory hierarchy with block diagram	3	KTU MAY 2024
3	What is meant by paging?	3	KTU MAY 2024
4	Draw the circuit diagram and explain the working of DRAM.	3	KTU MAY 2024
5	Explain the replacement algorithm used in cache memory.	3	KTU JUNE 2023
6	a) Explain programmed I/O and interrupt driven I/O. b) What is the role of TLB (Translation Look aside Buffer) in virtual address to physical address translation?	8 6	KTU JUNE 2023 KTU JULY 2021
7	a) Explain about DMA data transfer methods. b) Explain set associative mapping technique used in cache memory. How it is different from direct mapping.	4 10	KTU JUNE 2023
8	Define Virtual memory.	3	KTU JUNE 2022
9	Why does dynamic RAM need constant refreshing? How is this done?	3	KTU JUNE 2022
10	Explain direct mapping of cache memory with an example	6	KTU MAY 2024
11	Explain different mapping techniques in cache memory.	8	KTU JUNE 2022
12	Explain the Asynchronous input/output transfer with proper timing diagram.	6	KTU JUNE 2022

13	Explain the address translation mechanism in Virtual Memory.	8	KTU JUNE 2022
14	Explain the virtual memory address translation procedure with necessary diagram	8	KTU MAY 2024
15	Explain the working of DRAM and SRAM with neat diagram.	6	KTU JUNE 2022
16	Differentiate between programmed I/O and interrupt driven I/O data transfer. Mention the advantages of Interrupt driven I/O.	9	KTU MAY 2024

MCN202CONSTITUTIONOFINDIA

<u>Module1</u>			
SINo	Questions	Marks	KTU,Year
1a	Explain the salient features of Indian Constitution	3	July2021 (FN),Jan 2024
1b	Provide a comprehensive overview of the historical background leading to the adaptation of the constitution of india.		
2	What do you mean by federal system of government? Give an example	3	July2021 (FN)
3a	What is preamble? Explain the importance of preamble in the implementation of Constitution	6	July2021 (FN)
b	Explain different ways for acquiring Indian citizenship. Explain the concept of citizenship in india.Discuss the provisions for acquiring and losing citizenship according to the constitution.	8	July2021 (FN), Jan 2024
4a	Explain the salient features of Indian constitution.	8	July2021 (FN)
b	Write notes on methods of termination of Indian citizenship.	6	July2021 (FN)
5	Define Constitution.Why is it necessary for a Country	3	July2021 (AN)
6	Explain the need and importance of Preamble	3	July2021 (AN)
7a	What is Preamble? Can it be used for the interpretation of the constitution? Also explain its significance.	8	July2021 (AN)
b	Describe the salient feature of Indian Constitution	6	July2021 (AN)
8a	Give detail account on the historical background of Indian Constitution	6	Jan2024(A N)
b	What is citizenship?Discuss the various method of acquiring Indian citizenship	8	July2021 (AN)
9a	List out the salient features of Indian Constitution	7	June2023
b	Discuss the various aspects in the preamble of Indian Constitution.	7	June2023

10a	Discuss the various methods to acquire Indian citizenship.	8	June2023
b	Explain any three citizenship amendment act	6	June2023
<u>Module 2</u>			
SINo	Questions	Marks	KTU,Year
1	Explain the concept of“Equality before Law”	3	July2021 (FN)
2	“No person shall be prosecuted and punished for the same offence more than once”. Discuss this clause	3	July2021 (FN)
3a	Explain the concept of appeal by special leave	6	July2021 (FN)
b	Discuss the classification of Directive Principles of State Policy in detail.	8	JAN 2024 (FN)
4a	What do you mean by right against exploitation .	7	July2021 (FN)
b	Distinguish between fundamental rights and directive principles of state policy	7	July2021 (FN)
5	How is State defined under Article12 of Indian Constitution	3	July2021 (AN)
6	What is the basic difference between Fundamental Rights and Directive Principles of State Policy?	3	July2021 (AN)
7a	Describe the Rights to Constitutional Remedies and explain its significance.	6	July2021 (AN), JAN 2024
b	Explain the needs and importance of fundamental duties of Indian Citizen.	8	July2021 (AN) ,JAN 2024
8a	What are Fundamental Rights? Examine each of them.	8	July2021 (AN)
b	State the Directive Principles of State Policy and explain its significance.	6	July2021 (AN), JAN 2024
9a	What are the features of fundamental rights? Explain any two types of fundamental right.	9	June2023
9b	List out the Gandhian ideology included in directive principle.	5	June2023

10a	What are the duties of Indian Citizens according to Constitution?	8	June2023, JAN 2024
10b	List out the features of directive principles of state.	6	June2023
<u>Module3</u>			
SINo	Questions	Marks	KTU,Year
1	Explain the procedure for impeachment of the President of India.	3	July2021 (FN)
2	Explain the role of the Attorney General for India	3	July2021 (FN)
3a	Explain the powers of President of India.	8	July2021 (FN)
b	Explain the constitutional position and essential qualifications of Vice-president of India.	6	July2021 (FN), JAN 2024
4a	Explain the qualification and disqualification for membership in the house of the people.	8	July2021 (FN), JAN 2024
b	Explain various kinds of jurisdiction of Supreme Court	6	July2021 (FN)
5	Explain the procedure for impeachment of the President of India.	3	July2021 (AN)
6	Mention the Powers and Functions of the Attorney General for India	3	July2021 (AN), JAN 2024
7a	Explain various kinds of jurisdiction of Supreme Court of India	7	July2021 (AN)
b	Explain the constitutional duties and powers of the Prime Minister	7	July2021 (AN)
8a	Explain the functions and powers of the President of India.	8	July2021 (AN)
b	Explain in detail about the Union Government structure and functions	6	July2021 (AN)
9.a	Describe the procedure for election and removal of the president of India	8	June2023
9.b	Explain any three functions of Parliament	6	June2023, JAN 2024

10.a	Explain the powers and functions of the Prime Minister	9	June2023
10.b	SupremeCourt may in its discretion to grant to special leave to appeal. Examine the situation	5	June2023
<u>Module 4</u>			
SlNo	Questions	Marks	KTU,Year
1	Explain the procedure for the appointment of chief minister	3	July2021 (FN)
2	Explain the duties of advocate general of the state.	3	July2021 (FN)
3a	Explain the powers and functions of the Governor of Kerala state.	6	July2021 (FN)
b	Explain the composition and duration of state legislative council Explain the composition and functions of State executive.	8	July2021 (FN), JAN 2024
4a	Explain the qualification and disqualification for membership of the state legislature	7	July2021 (FN)
b	Explain the constitution of High court. What are the essential qualifications required for the appointment of High court Judge?	7	July2021 (FN), JAN 2024
5	What are the constitutional provisions relating to freedom of trade ,commerce and intercourse	3	July2021 (AN)
6	List out the three types of emergencies under Indian constitution	3	July2021 (AN)
7a	Describe the duties and role of Comptroller and Auditor General of Indian (CAG)	8	July2021 (AN)
b	Examine the administrative and financial relation between the Union and the State	6	July2021 (AN)
8a	Enumerate the powers and functions of Public Service Commission	8	July2021 (AN)
b	Explain the characteristics of Administrative Tribunals. What are the reasons for the growth of Administrative Tribunals in India	6	July2021 (AN)

9.a	Discuss the qualification and disqualification of the membership of state legislature	10	June2023,
9.b	What are the duties and functions of Advocate general of the state	4	June2023, JAN 2024
10.a	List out the different jurisdiction and powers enjoyed by the High Court and explain original and writ jurisdiction in detail	10	June2023
10.b	What are the powers enjoyed by the Governor	4	June2023

Module 5

SINo	Questions	Marks	KTU, Year
1	Discuss the functions of comptroller and auditor general of India	3	July2021 (FN), JAN 2024
2	Explain the distribution of tax revenue with respect to centre-state financial relation.	3	July 2021 (FN)
3a	Explain parliamentary legislation in the state field	6	July2021 (FN)
b	Discuss the effects of national and financial emergencies	8	July2021 (FN), JAN 2024
4a	Explain the procedure for amendment of the constitution	6	July2021 (FN)
b	What is the need for administrative tribunals? Explain the functions of state administrative tribunals	8	July2021 (FN)
5a	Why do we need to form separate Union Territories	3	July2021 (AN), JAN 2024
5b	Discuss the role of finance commission in the distribution of financial resources	6	
6	Distinguish between an 'Ordinary Bill' and 'Money Bill'	3	July2021 (AN)
7a	Explain the various writs issued by High court of Kerala	6	July2021 (AN)
b	Discuss the constitutional position and powers of Governor	8	July2021 (AN)
8a	Explain the functions of the State Legislature	8	July2021 (AN)
b	Explain the responsibilities and functions of Council of Ministers to State Legislative Assembly	6	July2021 (AN)

9.a	What are the five extra ordinary circumstances on which the Constitution empowers the Parliament to make laws on any matter enumerated in the State list?	10	June2023
9.b	Briefly explain the grants– in– aid the state	4	June2023
10.a	Explain three types of emergencies under Indian Constitution	10	June2023, JAN 2024
10.b	What are the functions of interstate council	4	June2023

EST 200 DESIGN AND ENGINEERING

MODULE I			
Sl.No.	Questions	Marks	KTU, Year
1	Define engineering design.	3	KTU JUNE 2023
2	What is the importance of systematic design.	3	KTU JUNE 2023
3	Explain in detail the different stages of a design process.	14	KTU JUNE 2023
4	Find the customer requirements for designing a new wrist watch. Identify the design constraints. Explain, how were the design objectives finalized Considering the design constraints? Use hand sketches.	14	KTU JUNE 2023
5	Explain the three objectives in the design of a glass bottle for Ayurvedic medicine.	3	KTU JAN 2024
6	Describe any three constraints that can occur in the design process of a lunch box.	3	KTU JAN 2024
7	Discuss the design process of designing a handbag for women of the age group of 15 to 25 years. Use hand sketches to support your idea	3	KTU JAN 2024
8	Identify the objectives, functions and constraints for designing a water level indicator. Illustrate the various stages of the design process. Provide suitable sketches.	14	KTU JAN 2024
9	.-.,:.. a. Explain clean development mechanism	7	KTU DEC 2022
10	What are the challenges for sustainable development?	5	KTU DEC 2022

MODULE II			
1	what are the most popular techniques used in convergent thinking.	3	KTU JUNE 2023
2	Describe three steps to facilitate design thinking in your team.	3	KTU JUNE 2023
3	Explain the five stages of design thinking process in detail and justify why design thinking is a nonlinear process.	14	KTU JUNE 2023
4	Create three numbers of possible designs for a pocket sized umbrella and then refine them to the best design using divergent thinking and convergent thinking	14	KTU JUNE 2023
5	Explain the role of divergent-convergent questioning in design thinking	3	KTU JAN 2024
6	Explain the role of mathematics and physics in the Engineering design process	3	KTU JAN 2024
7	Design a parachute mechanism for the safe landing of an egg that is dropped from a height of 3 meters using an iterative design thinking process with the help of sketches	14	KTU JAN 2024
8	Design a water bottle that can be opened with one hand. Illustrate the various (14) stages involved in design thinking. Sketch the final design	14	KTU JAN 2024
9	Explain the five different stages of design thinking? Illustrate it with the help of a face mask design	14	KTU JUNE 2022
10	Explain the term design functions as applicable to engineering design.	3	KTU JUNE 2023

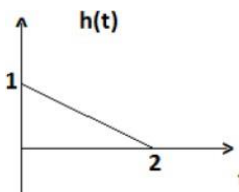
MODULE III			
1	What are factors to be considered in preparing technical reports to communicate a design efficiently?	3	KTU JAN 2024
2	Distinguish between project-based learning and problem-based learning in design engineering.	3	KTU JAN 2024
3	Design an office chair and communicate your design using sketches with design detailing, material selection, scale drawings, and dimensions	14	KTU JAN 2024
4	Develop a technical report for a newly designed website for online training of students with neat diagrams for presenting to a client	14	KTU JAN 2024
5	What is visual communication in design		KTU JUNE 2023
6	Why prototyping is important in the design process		KTU JUNE 2023
7	What are the different types of sketches used by designers to communicate their design? How will you graphically communicate the design of a creative coloring 'book with design detailing, material selection, scale drawings and dimension. Use hand sketches.	14	KTU JUNE 2023
8	Why do designers use mathematical modeling in the design process? Show an example of how mathematics and physics play a role in design.	14	KTU JUNE 2023
9	Show how engineering sketches and drawings convey designs.	4	MODEL
10	Explain the role of mathematics and physics in design engineering process.	3	MODEL

MODULE IV

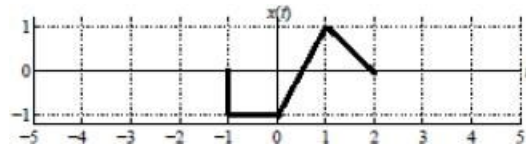
1	Describe the use of value engineering in the design process	3	KTU JAN 2024
2	Explain how to estimate the cost of a particular design	3	KTU JAN 2024
3	Design a nature inspired fashionable umbrella based on a banana leaf. Use hand sketches to support your arguments	14	KTU JAN 2024
4	Apply value engineering to a pen, and design a light Weight pen torch. Illustrate the solution using sketches	14	KTU JAN 2024
5	Explain life cycle design.	3	KTU JUN 2023
6	Describe how aesthetics is important in design process	3	KTU JUN 2023
7	What is mean by a modular design? Apply the modular design concept to design a bicycle.	14	KTU JUN 2023
8	What is the importance of project-based learning and problem-based learning? Use project based learning method to design a modern city for the year 2030.	14	KTU JUN 2023
9	Distinguish between project-based learning and problem-based on learning in design engineering.	3	MODEL
10	Describe how concepts like value engineering, concurrent Engineering, and reverse engineering influence engineering designs?	3	MODEL

MODULE V			
1	Explain design ethics and why is it important.	3	KTU JAN 2024
2	What is sustainable engineering	3	KTU JAN 2024
3	Describe the importance of evaluating economic considerations in product development with an example.	3	KTU JAN 2024
4	Illustrate the changes in design of a solar powered street light in terms of production, use, and sustainability with the help of sketches	14	KTU JAN 2024
5	How do ethics play a decisive role in engineering design?	3	KTU JAN 2024
6	Describe how intelligence affect in nature inspire engineering designs?	3	KTU JAN 2024
7	Illustrate the changes in design of disposable tea cup in terms of production	14	KTU JAN 2024
8	Design a fan which automatically reduces speed or stops when the temperature reduces during the night for energy conservation. Use hand sketches to support your design	14	KTU JAN 2024
9	Describe how to estimate the cost of a particular design of a smart bus for public use with wifi and proper cleaning facility. List the various components used. Show how economics will influence the engineering designs, use hand sketches to support the arguments.	14	KTU JUL2023
10	Explain how to estimate the cost of a particular design	3	KTU JUL2023

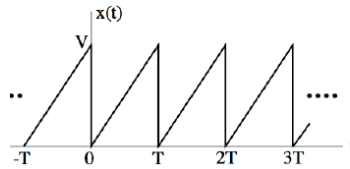
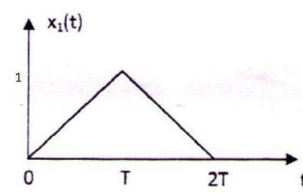
ECT 204 SIGNALS AND SYSTEMS

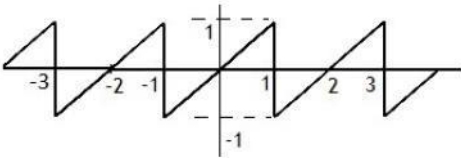
Sl No	Question	Marks	Month and Year of Exam
MODULE 1			
1	Sketch the signal $x(t) = [e^{-t}u(t)] \sum_{n=-a}^a \delta(t - nT)$ where T is any positive integer.	3	June 2022
2	What is the output sequence of an LTI system with impulse response $h(n)=[2, 2]$ to the input $x(n)=[1, 2, 3, 1]$?	3	June 2022
3	Determine whether the following system is static, time invariant, linear and causal. (x and y denote input and output respectively). Explain each. $y(t) = t^2x(t) + x(t - 2)$	8	June 2022
4	Check whether the following signals are energy or power signals. i. $x(t) = e^{-a t }$; $a > 0$ ii. $x(t) = tu(t)$ iii. $x(t) = e^{- t }$. Also find the energy & power	6 7	June 2022 May 2024
5	Find the output of an LTI system with impulse response $h(t)$ to the input $x(t)$. Given $x(t) = u(t) - u(t - 2)$ and $h(t)$ is shown in Figure 1.  Figure 1	8	June 2022
6	Sketch the signals (i) $y(t) = u(0.5t + 2)$ (ii) $y(n) = u(n) + u(n - 5)$	6	June 2022
7	Demonstrate the relationship between Unit step, Unit ramp and Unit Impulse functions.	3	June 2023
8	(i) Determine the period if the signal, $\cos\left(\frac{11\pi}{3}n\right) + \sin\left(\frac{\pi}{4}n\right)$ is periodic. (iii) A sinusoidal signal with angular frequency 5π radians / cycle is defined by $x[n] = 3^{1/2} \sin(5\pi n)$. Determine the condition under which sinusoidal signal is periodic.	3 3	June 2023 May 2024
9	(i) Find the convolution of signals given by $x(t) = \begin{cases} 1, 0 \leq t \leq 2 \\ 0, elsewhere \end{cases}$ $h(t) = \begin{cases} 1, 0 \leq t \leq 3 \\ 0, elsewhere \end{cases}$ Plot the output signal also (ii) Find the linear convolution of $x(n) = \{1, 2, 3, 4, 5, 6\}$ and $h(n) = \{2, -4, 6, -8\}$	8 6	June 2023 May 2024
	State and prove the time shifting property of Fourier Transform	3	May 2024
10	Check for shift invariance & linearity the systems represented by $y(t) = x^2(t - 1)$	3	

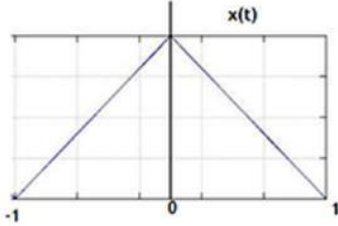
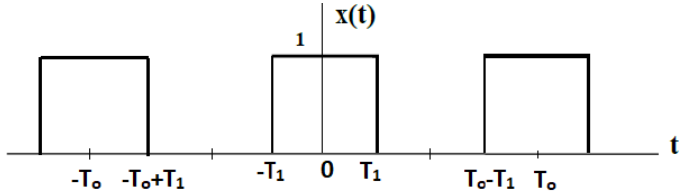
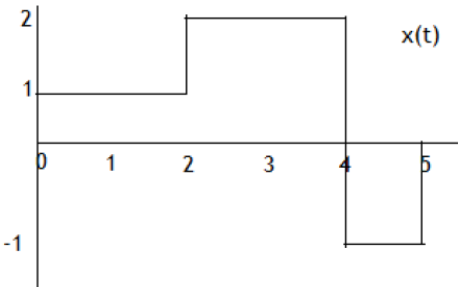
11	Given $x(t)$. Sketch a. $x(-t)$, b. $x(t+2)$ c. $x(t-1)$ d. $x(t/2)$ e. $x(2t)$	10	
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12	What is the output $y(n)$ for a LTI system with impulse response $h(n)=(1,2,1)$ for an input sequence $x(n) = (1,3,3,2,1)$.	6	

MODULE 2

1	State the Dirichlet's conditions for the convergence of Fourier series.	3	May 2024 June 2022
2	Prove time-shifting property of Laplace transform	3	June 2022
3	Find the complex exponential Fourier series of the periodic signal shown in Figure 2. 	8	June 2022
4	If $x(t)$ has a Fourier Transform, find the Fourier Transform of $x_1(t) = x(4t - 3)$ $x_2(t) = \frac{d}{dt}x(t - 3)$	6	June 2022
5	Find the Fourier Transform of the signal $x_1(t)$ shown in Figure 3 using convolution property and time shift property of Fourier Transform. 	8	June 2022
6	Find the Laplace Transform and ROC of the signal $x(t) = (e^{-2t} + 3e^{-3t})u(t)$	6	June 2023
7	Find the Laplace Transform of $x(t) = e^{-2t}[u(t) - u(t - 2)]$	3	June 2023
8	Using convolution property of Laplace transform, determine the Laplace transform of system response when the input signals and impulse responses are: $x(t) = u(t), h(t) = e^{-t}u(t) - e^{-2t}u(t)$	3	June 2023

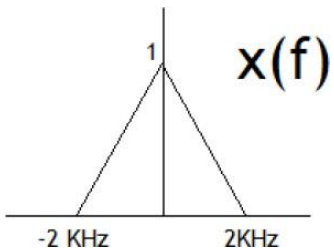
9	Determine the Trigonometric Fourier Series of the following waveform. 	8	June 2023
10	Find the inverse Laplace Transform of $X(S) = \frac{-5S - 7}{(s-1)(s+1)(s+2)}$. Assuming (i) $x(t)$ is causal (ii) ROC : $-1 < \text{Re } s < 1$	7	May 2024

			
11	Find the Fourier Transform of a. $\cos(\omega_0 t) u(t)$ b. $e^{-t} \sin(5t) u(t)$	8	June 2023
12	Determine the Laplace Transform of $x(t) = \begin{cases} A, & 0 < t < \frac{T}{2} \\ -A, & -\frac{T}{2} < t < T \end{cases}$		June 2023
13	Find the complex exponential Fourier series for the function shown for $T_0=4, 8$. 	8	June 2023
14	Determine FT of the signal given below. 	6	June 2023

MODULE 3

1	A continuous time signal $x(t) = \cos 40t - \cos 60t$ is sampled with a time period T . Can $x(t)$ be recovered from the samples $x(nT)$ for $\pi/30$? State the reason for the same.	3	June 2022
2	Find the frequency response $H(\omega)$ and impulse response of an LTI system characterized by the differential equation $\frac{dy(t)}{dt} + ay(t) = x(t); a > 0$	3	June 2022

3	Find the impulse response and step response of a system with transfer function $H(s) = \frac{3s}{2s^2+10s+12}$	7	June 2022
4	Determine the Nyquist rate of sampling for the signals 1. $x(t) = \cos(150\pi t)\sin(50\pi t)$ 2. $x(t) = \sin(150\pi t)\sin^2(50\pi t)$	7	June 2022
5	Find the frequency response of an LTI system having an impulse response $h(t) = \delta(t+2) + 5\delta(t+1) + \delta(t-1) + 5\delta(t-2)$	5	May 2024
6	Consider an LTI system whose response to the input $x(t) = (e^{-t} + e^{-3t})u(t)$ is $y(t) = (2e^{-t} - 2e^{-4t})u(t)$. find the system's impulse response and transfer function.	9	May 2024
7	(i) Consider the continuous time signal	7	June 2022

	$x(t) = \cos(200\pi t) + \sin(320\pi t)$. What will be the Nyquist rate of sampling for the signal? If the signal is sampled at 300samples/sec, write the discrete time signal $[n]$ obtained after sampling. What will be the frequency components at the output if the sampled signal is passed through an ideal low pass filter with cut off frequency 250Hz? (ii) State and prove sampling theorem for a bandlimited signal. Also explain Aliasing and how it can be avoided	7	May 2024
8	Describe the aliasing effect in sampling with the help of sketches.	3	June 2023
9	Consider the LTI system with input $x(t) = e^{-t}u(t)$ and impulse response $h(t) = e^{-3t}u(t)$ 1. Using Convolution property, determine the Laplace Transform, $Y(s)$, of the output $y(t)$. 2. Find $y(t)$, from the $Y(s)$ obtained in (i).	6	June 2023
10	Explain with the help of figures, the effect of sampling in the frequency domain for the following cases: 1. Spectrum of sampled signal with $\omega_s > 2\omega_M$ 2. Spectrum of sampled signal with $\omega_s < 2\omega_M$ Assume an arbitrary message signal spectrum. Here ω_s is the sampling frequency and ω_M is the maximum frequency present in the signal.	8	June 2023
11	Consider the signal $x(t) = \cos 2000\pi t + 10 \sin 10000\pi t + 20 \cos 5000\pi t$. Determine 1. Nyquist rate for this signal 2. If the sampling rate is 5000 samples per second, then what is the discrete time signal $x(nT_s)$ obtained after sampling, where T_s is the sampling period and n is an integer.	6	June 2023
12	Consider the continuous time band-limited signal $x(t)$ with a spectrum $x(f)$ as shown in figure above. Sketch the spectrum of the discrete time signals $x_1[n]$ and $x_2[n]$ obtained from $x(t)$ by sampling at 5 KHz and 3 KHz respectively. 	8	June 2023

MODULE 4			
1	Define Energy Spectral Density of a discrete time signal? How can you relate it to the DTFT of the signal?	3	June 2022
2	Determine the Fourier series coefficients of the signal $x(n) = 2 + \cos\left(\frac{\pi}{3}n + \frac{\pi}{4}\right)$	3	June 2022
3	Find the DTFT of the following sequences using properties given $x(n)$ has a DTFT $X(e^{j\omega})$ 1. $x_1(n) = x(1 - n)$ 2. $x_1(n) = e^{j\frac{\pi}{4}n}x(n - 2)$	7	June 2022
4	(i) Consider an LTI system that is characterized by the difference equation	7	June 2022

	$y(n) - \frac{3}{4}y(n - 1) + \frac{1}{2}y(n - 2) = x(n)$ Find the frequency response $H(e^{j\omega})$ and the impulse response $h(n)$ of the system. (iii) What are the necessary and sufficient conditions of an impulse response of a discrete system to be causal, stable, and both with examples.	6	May 2024
5	Find the DTFT of the given signal $x(n)$ $x[n] = \begin{cases} 1, & n \leq N_1 \\ 0, & n > N_1 \end{cases}$	7	June 2022
6	State and prove the convolution property of DTFT.	7	June 2022
7	Define Discrete-Time Fourier Transform (DTFT) of a signal $[n]$. Prove that the DTFT is periodic with period 2π .	3	June 2023
8	What are the necessary and sufficient conditions of an impulse response of a discrete system to be causal, stable and both with examples.	3	June 2023
9	Fourier series coefficients of a discrete time periodic signal $x[n]$ is given by $C_k = \cos\frac{k\pi}{4} + \sin\frac{3k\pi}{4}$. Period of $x[n]$ is $N=8$. Determine the sequence $x[n]$.	6	May 2024
10	Determine and sketch the magnitude and phase spectra of the following periodic signal $x[n] = \cos\frac{2\pi}{3}n + \sin\frac{2\pi}{5}n$	8	June 2023
11	Determine the DTFT of the signal $[n]$ as give below. $3, -10 \leq n < 0$ $x = [n] = \begin{cases} -3, & 0 \leq n \leq 10 \\ 0, & \text{elsewhere} \end{cases}$ Obtain the final expression of DTFT in terms of trigonometric functions. Find the magnitude and phase spectra of $[n]$.	9	June 2023
12	Using DTFT, determine the impulse response of the discrete time system described by the difference equation $y[n-2]=x[n-1]+3y[n-1]-2y[n]$	5	June 2023
MODULE 5			
1	(i) What do you mean by ROC of z-transform and mention the properties of ROC	6	May 2024
	(ii) If the ROC of system function of an LTI system is $ z > 0.8$, comment on the stability and causality of the system with proper justification.	3	June 2022

2	Give the relation between DTFT and z-transform of a discrete time signal	3	June 2022
3	Determine the z-transform for the following signal. Sketch the pole-zero plot and indicate the ROC. $x(n) = \sum_{k=2}^1 n^{-1} u(n+3)$ 77	7	June 2022
4	For the LTI system with system function $H(z)$ find the impulse response so that the system is stable $H(z) = \frac{5 - 10z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}$ Can this system be both stable and causal?	7	June 2022
5	Find the inverse z-transform of $X(z) = \frac{2z^2 + 16}{(z+1)(z-2)}$ for all possible ROCs.	10	June 2022
6	Write down any four properties of ROC for Z transform.	4	June 2022

7	(i) Find the Z transform of $x(n) = r^n \sin \omega_n u(n)$ (ii) Find the ZT of following Discrete-time signals and plot the ROC a) $x[n] = 1/2^n u[n] * 1/4^n u[n]$ b) $x[n] = (1/4)^{ n }$	3	May 2024
8	What is the final value of $x(n)$, if $X(z) = \frac{z^2}{(z-1)(z-0.2)}$		June 2023
9	Obtain the transfer function and impulse response for a stable and causal system with difference equation $y[n] + \frac{1}{6}y[n-1] - \frac{1}{6}y[n-2] = 3x[n] - \frac{1}{6}x[n-1]$	8	June 2023
10	(i) Determine the impulse response of the system described by the difference equation $y(n) = ay(n-1) + x(n)$ (ii) An LTI system is described by the difference equation $y[n] - 9/4 y[n-1] + 1/2 y[n-2] = x[n] - 3 x[n-1]$. Determine the impulse response $h[n]$ for the following conditions (a) the system is stable (b) the system is causal	3	June 2023
11	Determine the Z transform and plot the ROC of the function given by $x(n) = \sum_{k=2}^1 n u(n) + \sum_{k=3}^1 n u(n)$	6	June 2023
12	A certain LTI system is described by the following system function $(z) = \frac{(z+1/2)}{(z-1)(z-1/2)}$. Find the system response to the input $x(n) = 4^{-(n+2)}u(n)$	4	June 2023
13	Determine the transfer function of the system given by the difference equation $y(n) + \frac{1}{4}y(n-1) = x(n) - x(n-1)$. Calculate the frequency response from its transfer function. Express the same in terms of trigonometric functions. Also obtain the magnitude and phase responses of the given system	10	June 2023

