S4 QUESTION BANK

Electronics & Communication Engineering

(2021-25 Batch)

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DEPARTMENT OF ELECTRONICS & COMMUNICATION NGINEERING

VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY TECHNICAL CAMPUS, KILIMANOOR

INDEX

MAT 204 PROBABILITY DISTRIBUTIONS, RANDOM PROCESS AND NUMERICAL METHODS

Module 1

Sl. No	QUESTIONS	Marks	KU/KTU (Month/ Year)	Instructional Objectives
1	A random variable X takes values 0,1, 2 and 3 with probabilities $P(X = 0) = 8/15$, $P(X = 1) = 1/3$, $P(X = 2) = P(X = 3) = 1/15$ (i) Find the mean and variance of X. If $Y = 1000 + 300X$ (ii) find $P(Y \geq 1500)$ and $E[Y]$	7	KTU-July 2017	Evaluate
2	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. (i) What is the probability that he answers 13 or morequestions correctly? (ii) What is the mean and variance of the number of correct answers he gives?	8	KTU-July 2017	Remember
3	The joint distribution of a two-dimensional random variable (X,Y) isgiven by P(X, Y) =c(2x +3y) ,x = 0,1,2 : y = 1,2,3 . Find (i) the value of c (ii) the marginal distributions (iii) Are X and Y independent?	8	KTU-May 2017	Understand
4	a) A box contains 100 cell phones, 20 of which are defective. 10 cellphones are selected for inspection. Find the probability that 1) at least one is defective 2) at most three are defective 3) none of them are defective 4) all of them are defective.	8	KTU-JULY 2017	Evaluate
5	The monthly breakdown of a computer follows Poisson Distribution with mean 1.2. Find the probability that this computer will functionfor a month a) without a break down b) with only one breaks down c) with at most two break down	8	KTU-JULY 2017	Evaluate

6	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 (i) binomial distribution and (ii) Poisson approximation to binomial distribution	8	KTU-April 2018	Apply
7	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 (i) the value of k (ii) the probability that X is even and (iii) E(X).	7	KTU-MAY 2017	Evaluate
8	The joint probability distribution of X and Y is given byf(x,y)=(2x+3y)/54 for x=1,2 y=1,2,3 Find the (i) marginal distribution of x and y (ii) the conditional distribution of X for Y=y	7	KTU-May 2019	Evaluate
9	Show that Poisson distribution is the limiting case of binomial Distribution .	7	KU-MAY 2015	Understand
10	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 (i) at least 2 (ii)exactly 2 (iii) at most 2defective items in a consignment of 1000 packets using Poisson distribution	8	KU-MAY 2019	understand
11	Suppose X is binomial random variable with parameters $n = 100$ and $p = 0.02$. Find $P(X < 3)$ using Poisson approximation to X.	3	Model qp	understand
12	The diameter of circular metallic discs produced by a machine is a random variable with mean 6cmand variance 2cm. Find the mean area of the discs.	3	Model qp	Evaluate
13	The probability mass function of a discrete random variable is $p(x) = kx, x = 1, 2, 3$ where k isa positive constant. Find $(i) find\ the\ value\ of\ k$ $(ii)\ P(X \leq 2)$ $(iii)\ E(X)$ $(iv)\ VAR(1 - X)$	7	Model qp	Apply

14	Accidents occur at an intersection at a Poisson rate of 2 per day. what is the probability that there would be no accidents on a given day? What is the probability that in January there are atleast 3 days (not necessarily consecutive) without any accidents?	7	Model qp	Apply
15	Find the mean and variance of a binomial random variable	7	Model qp, KTU-JUNE 2022	Understan
16	The joint probability distribution of two discrete random variables X and Y is given by $p(x,y) = \frac{1}{30}(x+y)$,x =0,1,2 y = 0,1,2,3 Find the correlation coefficient between $X$and Y.	7	KTU-JULY 2017	Understand
17	Two fair dice are rolled. Let X denote the number on the first die and Y = 0 or 1, according as the first die shows an even number or odd number. Find (i) the joint probability distribution of$X$ and Y, (ii) the marginal distributions. (iii) Are X and Y independent	7	Model qp	Understan
18	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	
19	If X is a Poisson variable such that $P[X = 1] = P[X = 2]$, then find $P[X = 3]$.	3	KTU-JUNE 2022	
20	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	
21	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.	7	KTU-JUNE 2022	
22	The joint probability mass function of two random variables X and Y is given by $p(x,y) = k(x + 2y)\ for\ x = 1,2,3\ \ y = 1,2$ $= 0,\ otherwise$ where k is a constant. (i) Find the value of k (ii) Find $P[X + Y \leq 3]$	7	KTU-JUNE 2022	

	(iii) Find the marginal density functions of X and Y and (iv) Are X and Y independent?			

MODULE 2

1	The time for super glue to set can be treated as a random variable having a normal distribution with mean30 seconds. Find the standard deviation if the probability is 0.20 that it will take on a value greater than 39.2 seconds	8	KTU-MAY 2017	create
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	Analyze
3	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?	8	KTU-MAY 2017	Understand
4	Suppose a new machine is put into operation at time zero. Its life time is an exponential random variable with mean life 12 hours. (i) What is the probability that the machine will work continuously for one day? ii) Suppose the machine has not failed by the end of the first day, what is the probability that it will work for the whole of the next day?	8	KTU-March 2017	Analyze
5	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?	5	KTU-March 2017	Remember
6	Find the mean and variance of a random variable X which is uniformly distributed in the interval $[a,b]$	5	KTU-March 2017	Understand
7	A printer ink cartridge has a life of X hours under normal usage. The variable X is modelled by the probability density function $F(x) = \begin{cases} \frac{k}{x^2}, & x \geq 400 \\ 0 & otherwise \end{cases}$	8	KTU-JULY 2017	Evaluate

	(i) Find k (ii) Find the probability that such a cartridge has a life of at least 600 hours of normal usage. (iii) Find the probability that two cartridges will have to be replaced before each has been used for 600 hours.			
8	Find the mean and variance of uniform distribution	5	KTU-May 2017	Remember
9.	Buses arrived at a specified stop at 15 minute intervals starting at 8AM. A passenger arrives at the stop at random time between 8 AM and 8.30 AM. Find the probability that he waits (i) less than 5 minutes, (ii) at least 12 minutes	7	KTU-MARCH2017	Understand
10.	Find the mean and variance of exponential distribution	5	KTU – May 2017	Remember
11	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	7	KTU – May 2019	Apply
12	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?	5	KTU-May 2017	understand
13	The probability density function of a random variable is given by f(x) = kx^2 ,0 < x < 1 =0 ,otherwise Find a) k b) Mean c)p ($\frac{1}{4} < X < \frac{3}{4}$) d) p(X > $\frac{2}{3}$)	7	KTU-July 2017	Evaluate
14	Find the mean and variance of the continuous random variable X with probability density function f(x) = $2x - 4$, $2 \le x \le 3$ = 0 otherwise	3	Model qp	Evaluate
15	The random variable X is exponentially distributed with mean 3.Find $P(X > t + 3 \, X > t)$ where t is any positive real number.	3	Model qp	Evaluate
16	The joint density function of random variables X and Y is given by f(x,y) = $e^{-(x+y)}$, $x > 0$, $y > 0$	7	Model qp	Evaluate

	= 0 otherwise. Find $P(X + Y \leq 1)$. Are X and Y independent? Justify			
17	A continuous random variable X is uniformly distributed with mean 1 and variance 4/3. Find $P(X < 0)$	7	Model qp	Evaluate
18	The IQ of an individual randomly selected from a population is a normal distribution with mean100 and standard deviation 15. Find the probability that an individual has IQ (i) above 140 (ii)between 120 and 130	7	Model qp	Evaluate
19	The lifetime of a certain type of electric bulb may be considered as an exponential random variable with mean 50 hours. Using central limit theorem, find the approximate probability that100 of these electric bulbs will provide a total of more than 6000 hours of burning time.	7	Model qp	Evaluate
20	A pair of random variables X and Y have a joint probability density function given by $f(x,y) = \begin{cases} \frac{1}{\pi}, & x^2 + y^2 \leq 1 \\ 0, & otherwise \end{cases}$ Show that X and Y are not independent , but uncorrelated .	8	KTU-March 2018	Understand
21	The joint pdf of two continuous random variables X and Y is $F(x,y) = \begin{cases} 8xy, & 0 < y < x < 1 \\ 0, & otherwise \end{cases}$ 1) Check whether X and Y are independent 2) Find p(X +Y) < 1)	8	KTU - APRIL 2018	Analyze
22	A factory has two outlets to sell its products. The daily sales 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. (i) What is the probability that the total sales from both the outlets combined is more than RS.100000. 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.	7	KTU-July 2017	Evaluate
23	The joint pdf of two continuous random variables X and Y is given by $f(x, y) = \begin{cases} kxy, & 0 < x < 4, 1 < y < 5 \\ 0, & otherwise \end{cases}$ Find i)k ii) The marginal distributions of X and Y iii) Check whether X and Y are independent.	8	KTU-April 2018	Evaluate
24	A continuous random variable X is uniformly distributed in$(-k, k)$.Find k if $P[X \geq 2] = 0.25$.	3	KTU-JUNE 2022	

25	If $X1,X2,\ldots,Xn$ are random variables with mean μ=2 and variance $\sigma 2$=2, then use central limit theorem to estimate $P[110 \leq Sn \leq 150]$, where $Sn=X1+X2+\cdots+Xn$ and n=75.	3	KTU-JUNE 2022	
26	A continuous random variable has the distribution function $F(x)= 0 \quad if\ x<0$ $= k(x-1)3 \quad if\ 0 \leq x \leq 4$ $=1 \quad if\ x>4.$ Find (i) value of k (ii)probability density function $f(x)$ of $F(x)$ (iii) $P[X \geq 1]$.	7	KTU-JUNE 2022	
27	Suppose the diameter at breast height (in.) of trees of a certain typeis normally distributed with mean 8.8 and standard deviation 2.8 (i) What is the probability that the diameter of a randomly selected tree will be at least 10 in.? (ii) What is the probability that the diameter of a randomly selected tree will exceed 20 in.? (iii) What is the probability that the diameter of a randomly selected tree will be between 5 in and 10 in.?	7	KTU-JUNE 2022	
28	The time (in hours) required to repair a machine is exponentially distributed with mean 2. (i) What is the probability that the repairing time exceeds 2 hours? (ii) What is the conditional probability that a repair takes at least 10 hours given that its duration exceeds 9 hours?	7	KTU-JUNE 2022	
29	The joint probability density function of two continuous random variables X and Y is given by $f(x,y) = kx^2y \ if\ 1 \leq x \leq 4,\ 0 \leq y \leq 4$ $= 0 \quad otherwise.$ Find (i) value of k (ii)$P[X \geq 2, Y \leq 2]$ and (iii) $P[X+Y<3]$.	7	KTU-JUNE 2022	

MODULE 3

1	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.	7	KTU-MAY 2017	Evaluate
2	Prove that the random process X(t) is defined by X(t) =asin($\omega t + \theta$) ,where a and ω *are constants and* θ *is a random variable* Uniformly distributed in [0 , 2π] is WSS process .	7	KTU-MAY 2018	Evaluate
3	Consider the random process X(t) = A cos($\omega t + \theta$) where A and θ Is uniformily distributed random variable in (0 , 2π). Check whether or not the process is WSS .	7	KTU-April 2018	Analyze
4	A random process X(t) is defined by X(t) = Y(t) cos($\omega t + \theta$)where Is a WSS process ,ω is a constant and θ is a random variable which Is uniformly distributed in [0, 2π] and is independent of Y(t) .show That X(t) is a WSS	8	KTU-April 2018	Create
5	If X(t) = f(t) is a stochastic process , find E(X(t)) ,R(t1 ,t2) andC(t1,t2)	8	KTU-April 2018	Evaluate
6	Let X(t) =Asin $t + B \cos t$ be a process where A and B are independent random variables with zero mean and equal variance show that the process is WSS .	8	KTU-APRIL 2018	Create
7	Find the spectral density function of the WSS process whose auto correlation function is e^{-xy^2}	8	KTU-May 2019	Apply
8	A computer generates 100 random numbers uniformly distributed between 0 and 1. Use central limit theorem to find the probability that i) their sum is 60 or more, ii) their average is 0.7 or less	7	KTU-JULY 2017	Evaluate
9	A random process $X(t)$ is defined by $X(t) = \sin(t + \theta)$ where θ is a random variable taking values 0 or π with equal probability. Find the mean, autocorrelation and autocovariance of $X(t)$. Is it a wide sense stationary process?	7	KTU-JULY 2017	Analyze
10	Find the power spectral density of a wide sense stationary process $X(t)$ with autocorrelation function $RX(r) = e^{-3|r|}$.	8	KTU-JULY 2017	Evaluate
11	Find the autocorrelation function and average power of a wide sense stationary process $X(t)$ with power spectral density given by $SX(\omega) = \{ 1 - \omega, \quad |\omega| \leq 1$ $= 0$, otherwise	8	KTU-April 2018	Evaluate
12	Show that the random telegraph signal process isWSS	7	KTU-April 2017	Create

13	Show that the process X(t) = Ycos ωt ,where Y is uniformlydistributed in	8	KTU-July 2017	Create

14.	Give any two examples of a continuous time discrete state random processes.			
15	How will you calculate the mean, variance and total power of a WSS process from its autocorrelationfunction?			
16	A random process $X(t)$ is defined by $X(t) = Y(t)\cos(\omega t + \Theta)$ where $Y(t)$ is a WSS process, ω isa constant and Θ is uniformly distributed in $[0, 2\pi]$ and is independent of $Y(t)$. Show that $X(t)$is WSS			
17	Find the power spectral density of the random process $X(t) = a\sin(\omega_0 t + \Theta)$, ω_0 constant and Θ is uniformly distributed in$(0, 2\pi)$			
18	The number of enquiries arriving at a call centre is a Poisson process with rate 5 per hour. 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. ii) A call is categorized as `long' if it lasts more than10 minutes. 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.	10	KTU-JULY 2017	Evaluate
19	Find the probability distribution of the time between two consecutive arrivals in a Poisson process.	5	KTU-JULY 2017	Understand
20	The number of particles emitted by a radioactive source is Poisson distributed .The source emits particles at a rate of 6 per minute .Each emitted particle has a probability of 0.7 of being counted .Find the probability that 11 particles are conted in 4 minutes .	8	KTU-APRIL 2018	Remember
21	In each of the following examine whether f(ω) could be the power spectral density(PSD) of a wide sense stationary process. Explain your reasoning. $f(\omega) = \begin{cases} \frac{\sin\omega}{\omega}, \omega \neq 0 \\ 0, \omega = 0 \end{cases}$ If f(ω) is a valid PSD find the corresponding autocorrelation function.	7	KTU-May 2017	Understand
22	Let X_i are independent random variables taking values -1 and 1 with probability $\frac{1}{2}$ A random process $Z_n$is defined as $Z_n = X_1 + X_2 + \cdots\ldots\ldots + X_n, n=1,2,\ldots\ldots$ Is the process a WSS process?	5	KTU-MAY 2017	Understand

23	The arrival of patients at a doctor's consulting room is found to follow a Poisson process with an average of one in 5 minutes. The room can accommodate a maximum of 4 persons and if more people come, they wait outside the room. If patients start coming from 8 A.M. onwards, (i) What is the probability that the room is full when the doctor arrives at 9 A. M.? (ii) If the doctor takes a break from 11A.M. to 11.15 A.M., and a lunch break from 1 P.M to 1.30 P.M. what is the probability that no new patients arrive during both the tea break and lunch break?	8	Ktu-MA Y 2017	Evaluate
24.	Obtain the probability distribution of the time between two consecutive occurrences of a Poisson process	4	KTU-May 2017	Understand
25	The radio active source emits particle at the rate of 6 per minute in accordance with Poisson process .Each particle emitted has the probability of 1/3being recorded. Find the probability that at least 5 particles are recorded in 5 minutes	5	KTU-May 2019	Understand
26	A random process is defined by $X(t)=A\ cos\omega t, t\geq 0$ where ω is a constant and A is uniformly distributed in (0,3). Determine $E[X(t)]$.	3	KTU June 2022	
27	A random process X(t) has the auto correlation function $RX(r)=25+\frac{8}{4+c^2}$. Find the mean-square value and variance of the process	3	KTU June 2022	
28	Assume that X(t) is a random process defined as follows: X(t) = A cos $(2\pi t + \emptyset)$ where A is a zero-mean normal random variable with variance $\sigma A^2 = 2$ and $\emptyset$ is uniformly distributed random variable over the interval $-\pi \leq \varphi \leq \pi$. A and φ are statistically independent. Let the random variable Y be defined as $Y = \int X(t)\, dt$ Determine (i) the mean of Y (ii) the variance of Y.	7	KTU June 2022	
29	Show that the random process defined by $X(t)=A\sin(\alpha t+\theta)$, where A and α are constants and θ is a random variable uniformly distributed in $[0,2\pi]$ is a wide sense stationary process.	7	KTU June 2022	
30	Determine the autocorrelation function of the random process with the power spectral density given by $S_{XX}(w) = S_0 \quad |w|<w0$ $= 0 \quad otherwise$	7	KTU June 2022	
31	Car arrive 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?	7	KTU June 2022	

	MODULE 4			
1	Using Newton-Raphson method, compute a real root of $e^{2x} - x - 6 = 0$ lying between 0 and 1.	7	KTU-APRIL 2018	Evaluate
2	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	5	KTU-MAY 2017	Evaluate
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 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.		KTU-APRIL 2018	Understand
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 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	10	KTU-MAY 2017	Apply
5	Using Newton Raphson method to solve the equation $x^3 + x - 1 = 0$ correct to 4 decimal places	6	KTU-May 2017	Apply
6	Evaluate $\int_0^6 \frac{1}{1+x^2}$ dx using 1) Trapezoidal rule 2) Simpson's rule with 6 equal intervals.	7	KTU-MAY 2017	Apply
7	Using Newton's forward interpolation formula estimate sin52 given θ : 45 50 55 60 65 $\sin\theta$:0.7071 0.7660 0.8192 0.8660 0.9036	7	KTU-MAY 2017	Apply
8	Use Newton-Raphson method to find a non-zero solution of $x = 2\sin x$. Start with $x_0 = 1$	7	Model qp	Evaluate
9	Evaluate $\int_0^1 e^{-x^2/2}dx$ using Simpson's one-third rule, dividing the interval $[0, 1]$ into 8 subintervals	7	Model qp	Evaluate
10	Using Lagrange's interpolating polynomial estimate $f(1.5)$ for thefollowing data	7	Model qp	Evaluate

	x | 0 1 2 33 $y = f(x)$ | 0 0.9826 0.6299 0.5532			
11	Consider the data given in the following table x | 0 | 0.5 | 1 | 1.5 | 22 $f(x)$ | 1.0000 | 1.0513 | 1.1052 | 1.1618 | 1.22 4 Estimate the value of $f(1.80)$ using newton's backward interpolation formula.	7	Model qp	Evaluate
12	Find all the first and second order forward and backward differences of y for the following set of(x, y) values: $(0.5, 1.13)$,$(0.6, 1.19)$, (0.7, 1.26), $(0.8, 1.34)$	3	Model qp	Evaluate
13	The following table gives the values of a function $f(x)$ for certainvalues of x. x | 0 | 0.25 | 0.50 | 0.75 | 1 $f(x)$ | 1 | 0.9412 | 0.8 | 0.64 | 0.5 Evaluate $\int_0^1 f(x)dx$ using tra pezoidal rule.	3	Model qp	Evaluate
14	Write the Newton-Raphson iteration formula to find the cubic root of a positive number N.	3	KTU June 2022	
15	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	7	KTU June 2022	
16	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	
17	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 $y(3)$.	7	KTU June 2022	
18	Given a function $y=f(x)$ by the following table. Using Newton's interpolation formula, find $f(0.2)$. x | 0 | 1 | 2 | 3 | 4 | 5 | 6 y | 176 | 185 | 194 | 203 | 212 | 220 | 229	7	KTU June 2022	
19	Evaluate $\int_0^1 \frac{dx}{1+x}$ using Simpson's one third rule. Find the error by comparing with actual integration up to four decimal places. [Take h=1/6)	7	KTU June 2022	

	MODULE 5			
1	Using Runge-Kutta method of order four, compute y(0.2) given that $\frac{dy}{dx} = e^x + y$, y(0) = 0. Take step size h = 0.1 .	8	KTU-MAY 2017	APPLY
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	6	KTU-May 2017	Apply
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	KTU-APRIL 2018	Apply
4	Use Runge Kutta method of order 4 to find y(0.2)for the differential equation y^1=3x+0.5 y,y(0)=1(Take h=0.2)	7	KTU-MAY 2019	Apply
5	Given the initial value problem $y^1 = y + x$, $y(0) = 0$, find $y(0.1)$ and $y(0.2)$ using Euler method	3	Model qp	Evaluate
6	Explain the principle of least squares for determining a line of best fitto a given data	3	Model qp	Evaluate
7	Using Gauss-Seidel method, solve the following system of equations $20x + y - 2z = 17$ $3x + 20y - z = -18$ $2x - 3y + 20z = 25$	7	Model qp	Evaluate
8	The table below gives the estimated population of a country (in millions) for during 1980-1995 year | 1980 | 1985 | 1990 | 1995 population | 227 | 237 | 249 | 262 Plot a graph of this data and fit an appropriate curve to the data using the method of leastsquares. Hence predict the population for the year 2010.	7	Model qp	Evaluate
9	Use Runge-Kutta method of fourth order to find $y(0.2)$ given the initial value problem.dy/dx= $\frac{xy}{1+x^2}$ $y(0) = 1$ Take step-size, $h = 0.1$.	7	Model qp	Evaluate

<table>
<tr><td>10</td><td>Solve the initial value problem
dy/dx=x+y, y(0) =0 , $0 \leq x < 1$, taking step-size $h = 0.2$. Calculate $y(0.2)$, $y(0.4)$ and $y(0.6)$ us- ing Runge-Kutta second order method, and $y(0.8)$ and $y(1.0)$ using Adam-Moulton predictor-corrector method.</td><td>7</td><td>Model qp</td><td>Evaluate</td></tr>
<tr><td>11</td><td>Write the normal equations obtained by the method of least squaresfor fitting a parabola $y=a+bx+cx^2$.</td><td>3</td><td>KTU June 2022</td><td></td></tr>
<tr><td>12</td><td>Given the initial value problem, $y'=f(x,y)$, with $y(x_0)= y_0$. Write the second order Runge-Kutta algorithm to find the value of y when $x=x_0+h$</td><td>3</td><td>KTU June 2022</td><td></td></tr>
<tr><td>13</td><td>Apply Gauss-Seidel method to solve the equations
$20x+y-2z=17$,
$3x+20y-z=-18$,
$2x-3y+20z=25$.</td><td>7</td><td>KTU June 2022</td><td></td></tr>
<tr><td>14</td><td>Given $dy/dx=x+y$, $y(0)=1$. Using Euler’s method, find $y(0.1)$,$y(0.2)$ and $y(0.3)$ by taking $h=0.1$. Hence obtain $y(0.4)$ using Adams-Moulton predictor- corrector method.</td><td>7</td><td>KTU June 2022</td><td></td></tr>
<tr><td>15</td><td>Given $y'=1+xy$, $y(0)=2$. Find y at $x=0.1$, using fourth order Runge-Kutta method, by taking $h=0.1$.</td><td>7</td><td>KTU June 2022</td><td></td></tr>
<tr><td>16</td><td>By the method of least squares, find the straight line that best fits the following data
<table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>14</td><td>27</td><td>40</td><td>55</td><td>68</td></tr></table></td><td>7</td><td>KTU June 2022</td><td></td></tr>
</table>

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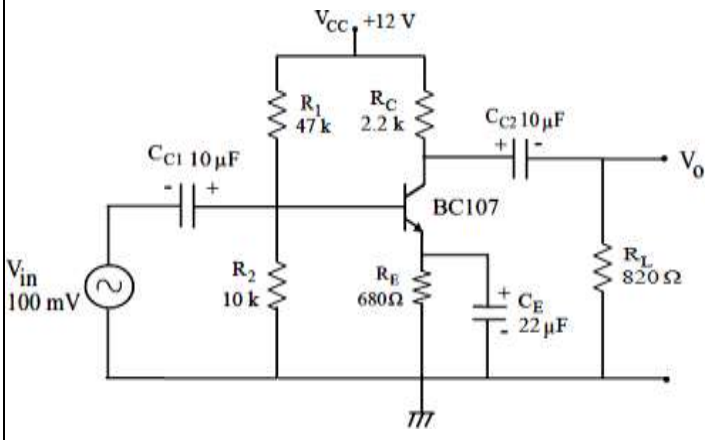
ECT 202: ANALOG CIRCUITS

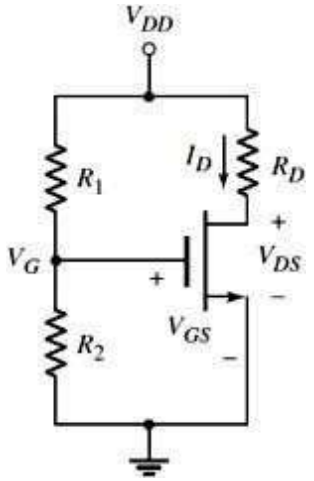
MODULE 1			
Sl. No.	**Questions**	**M**	**Year**
1.	Explain the working of (a) RC integrator (b) RC differentiator. Provide the condition to be satisfied by the time constant in each case.	8	KTU Model Question
2.	With the help of the circuit, explain the frequency response of (a) RC low-pass filter (b) RC high-pass filter.	8	KTU Model Question
3.	What is a clipper? Differentiate between positive and negative clippers using sample circuits.	6	KTU Model Question
4.	Provide the circuit diagram of a biased clipper and explain its working.	7	KTU Model Question
5.	What is a clamper circuit? Draw a sample circuit and explain its working.	6	KTU Model Question
6.	Identify the different types of clamper circuits with suitable examples.	8	KTU Model Question
7.	What is transistor biasing? Explain the need for biasing.	6	KTU Model Question
8.	What are the considerations when fixing an operating point in a BJT to be operated as an amplifier?	6	KTU Model Question
9.	Define DC load line.	4	KTU Model Question
10.	With the aid of circuit diagrams, distinguish between the given biasing circuits: (a) fixed bias (b) self bias (c) voltage divider bias.	9	KTU Model Question
11	Draw the amplitude and phase responses of an RC Low Pass Filter. Mark the cut off frequency point on both. What is the phase difference at cut off frequency?	5	July 2021
12	Explain working of a self bias circuit?	4	July 2021
13	Design a high pass filter for a cutoff frequency of 5KHz. Plot the frequency response indicating roll off rate in terms of dB/decade and dB/octave. Also, draw output wave form for triangular input at i) 500Hz ii) 5KHz iii) 10KHz	14	July 2021
14	Design a clamper circuit to clamp a 10V sine wave so that its negative peak is clamped at +2V. Assume diode drop is 0.7V. Draw and explain the output waveform and transfer characteristics	14	July 2021

15	A CE amplifier with voltage divider biasing has V=15V, I_{CQ}=3mA and ß=200. Find R_1, R_2,R_E=1.5V, V_{RC} =6V, V, Q-point.	7	July 2021
16	Draw the circuit of an RC integrator. Give the conditions for an RC circuit to act as integrator.	3	June 2022
17	Define Stability factor. Derive the expression for stability factor 'S'.	3	June 2022
18	Differentiate between dc and ac load lines.	3	June 2022
19	Given an input wave,Vin=10sinωt. Setupand explain a clamper that clamps the wave to 22.3V at the positive peak, assuming a voltage drop of 0.7 V across 8the diode. Draw the output waveform and transfer characteristics also.	8	June 2022
20	Design a fixed bias circuit for a CE amplifier such that operating point is V_{CE} =8V and I_C = 2 mA. Given, a fixed 15V d.c supply and a silicon transistor with β= 100. Take base emitter voltage V_{BE} = 0.6V and neglect R_E.	6	June 2022
21	With necessary diagrams, explain any two biasing methods of BJT.	8	June 2022
22	Set up and explain a slicer circuit that clips an input sine wave at +2V and +4V. Draw the transfer characteristics	6	June 2022
	MODULE 2		
1	Draw the circuit of an RC-Coupled CE amplifier. Explain the function of each component in the circuit.	4	KTU Model Question
2	Give a detailed description of design considerations while designing an RC-coupled CE amplifier.	4	KTU Model Question
3	What is an AC load line? Explain.	4	KTU Model Question
4	Write the expression for voltage gain of RC-Coupled CE amplifier. Explain the terms.	4	KTU Model Question
5	Draw the frequency response of an RC-coupled CE amplifier. Explain the important characteristics of the graph.	6	KTU Model Question
6	Draw and explain the small-signal hybrid-pi model of BJT.	6	KTU Model Question

7	Derive the voltage gain of RC-Coupled CE amplifier using small signal hybrid-pi model of BJT.	7	KTU Model Question
8	Derive the input impedance of RC-Coupled CE amplifier using small-signal hybrid-pi model of BJT.	6	KTU Model Question
9	Derive the output impedance of RC-Coupled CE amplifier using small-signal hybrid-pi model of BJT.	6	KTU Model Question
10	Draw and explain the HF small-signal hybrid-pi model of BJT.	4	KTU Model Question
11	Explain Miller effect. Why is it significant in frequency response analysis?	4	KTU Model Question
12	Perform HF analysis of RC-Coupled CE amplifier using small-signal hybrid-pi model of BJT.	7	KTU Model Question
13	Explain the hybrid-p parameters of BJT in CE configuration.	3	July 2021
14	Design an RC coupled amplifier for a gain of 200, given that Vcc=15V and Ic =3.2mA and required input impedance is 1.44KΩ. 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.	14	July 2021
15	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.	7	July 2021
16	Explain the concept of operating point with help of dc and ac load lines. Why is voltage divider biasing superior to other biasing circuits?	4	July 2021
17	Derive R_i, R_o, A_I and A_V using hybrid-pi parameters for CE configuration at low and mid frequencies. Define f_T. How can it be measured?	14	July 2021
18	What is the significance of Miller effect on high frequency amplifiers?	3	June 2022
19	Given K=0.4mA/V² and ID(ON) = 3.5mA with VGS(ON) = 4V.Determine the value of VTH.	3	June 2022
20	Analyse the high frequency response of an amplifier in CE configuration using hybrid π model.	8	June 2022

21	Draw and explain the frequency response of RC coupled amplifier.	6	June 2022
22	Using hybrid π model, calculate the small signal voltage gain, input impedanceand output impedance of the given circuit. Given,V_{BE}=0.7V, V_A=80V, Ic = 2mA and β=100. **(Neglecting r_0)** 	14	June 2022

MODULE 3			
1	Explain how a MOSFET functions as an amplifier.	3	KTU Model Question
2	Explain the biasing techniques of a MOSFET amplifier.	6	KTU Model Question
3	Draw and explain the small-signal equivalent of a MOSFET.	4	KTU Model Question
4	Derive the voltage gain of CS amplifier using small-signal model of MOSFET.	8	KTU Model Question
5	Derive the input impedance of CS amplifier using small-signal model of MOSFET.	6	KTU Model Question
6	Derive the output impedance of CS amplifier using small-signal model of MOSFET.	7	KTU Model Question
7	What is the advantage of using current source loads? Explain.	4	KTU Model Question
8	Explain the advantages of using diode-connected MOSFETs as load.	4	KTU Model Question
9	What is meant by cascading of amplifiers? What are its effects on circuit performance?	7	KTU Model Question
10	What is a cascode amplifier? Why is it used?	8	KTU Model Question
11	Compare the small signal equivalent of MOSFET and BJT.	3	July 2021
12	State Barkhausen criteria. How it is achieved in Wienbridge oscillators?	5	July 2021
13	How does cascode attain large bandwidth without compromising on voltage or current gains? For a CS MOSFET amplifier, what is the input capacitance for the following conditions Cgs= 4pF, Cgd=1pF and Av=-5?	14	July 2021
14	Draw a CS MOSFET amplifier. With the help of small signal equivalent circuit, compute its voltage and current gains. How can you increase the gain of this single stage without additional stages?	14	July 2021
15	What are the effects of cascading in gain and bandwidth of an amplifier?	3	June 2022
16	Draw the CS stage with diode connected load and deduce the expression for voltage gain of the amplifier.	8	June 2022
17	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=22KΩ, R_2=10KΩ, R_D=6.8KΩ, V_{DD}=8V, V_T=1V, Kn=0.1mA/V^2	6	June 2022

			
18	Draw the circuit of a common source amplifier using MOSFET. Derive the expressions for voltage gain, input resistance and output resistance from smallsignal equivalent circuit	8	June 2022
19	Briefly explain a Cascode amplifier.	6	June 2022
	MODULE 4		
1	What is feedback? What are the types of feedback?	4	KTU Model
2	Explain the impact of feedback on circuit performance.	4	KTU Model Question
3	Explain the 4 basic feedback topologies with sample circuits.	4	KTU Model Question
4	Derive the voltage gain of a voltage-series circuit.	7	KTU Model Question
5	Derive the input impedance of a voltage-series circuit.	7	KTU Model Question
6	Derive the output impedance of a voltage-series circuit.	7	KTU Model Question
7	Derive the voltage gain of a voltage-shunt circuit.	6	KTU Model Question
8	Derive the input impedance of a voltage-shunt circuit.	6	KTU Model Question
9	Derive the output impedance of a voltage-shunt circuit.	6	KTU Model Question
10	What is an oscillator? How are oscillators classified?	4	KTU Model Question
11	What is the criterion for oscillation?	4	KTU Model Question
12	Provide the working principle and design equations of Wein bridge oscillator.	7	KTU Model Question

13	Derive the frequency of oscillation of a Wein Bridge Oscillator.	6	KTU Model Question
14	Provide the working principle and design equations of Hartley oscillator.	7	KTU Model Question
15	Provide the working principle and design equations of crystal oscillator.	7	KTU Model Question
16	Draw the equivalent circuit of a crystal. Explain crystal oscillator. Given the parameters of a crystal as Ls=0.8H, Cs= 0.08pF, Rs=5KΩ and Cp=1pF, determine the resonant frequencies. How does negative feedback affect input and output impedances in feedback amplifiers?	14	July 2021
17	Derive the input resistance, output resistance and gain of voltage series feedback amplifier. Draw an example circuit and derive the same for the circuit from its equivalent circuit. Design an oscillator to obtain sinusoidal waveform of 1MHz.	14	July 2021
18	Differentiate positive feedback and negative feedback.	3	June 2022
19	Draw the block diagrams of current series and current shunt feedback.	3	June 2022
20	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
21	Design wein-bridge oscillator using BJT to generate 1KHz sine wave.	9	June 2022
22	With neat circuit diagram, explain the working of Hartley oscillator	5	June 2022
MODULE 5			
1	What are power amplifiers? How are they classified?	4	KTU Model Question
2	With suitable diagrams, explain the operation of a transformer coupled Class-A power amplifier.	6	KTU Model Question
3	With suitable diagrams, explain the operation of a push-pull Class-B power amplifier.	7	KTU Model Question
4	With suitable diagrams, explain the operation of a Class-AB power amplifier.	6	KTU Model Question
5	With suitable diagrams, explain the operation of a complementary symmetry class B power amplifier.	6	KTU Model Question
6	With suitable diagrams, explain the operation of a complementary symmetry class AB power amplifier.	6	KTU Model Question
7	Compare the efficiency and distortion of different power amplifiers.	5	KTU Model Question
8	What are voltage regulators? Explain the types.	4	KTU Model Question

9	With an appropriate circuit, explain the working of a series voltage regulator.	8	KTU Model Question
10	With an appropriate circuit, explain the working of a series voltage regulator.	8	KTU Model Question
11	Explain short-circuit protection with the support of figures.	8	KTU Model Question
12	Explain foldback protection with the support of figures.	7	KTU Model Question
13	Explain current boosting with the support of figures.	8	KTU Model Question
14	With the help of VI characteristics, explain foldback protection.	3	July 2021
15	Why is class C amplifier highly efficient? Why are they not preferred in audio applications	3	July 2021
16	What do you mean by harmonic distortion in a power amplifier? How is it reduced in a push-pull amplifier circuit? Design a simple shunt regulator for an output voltage of 10V, when input varies from 14 to 24V and load current varies from 10mA to 40mA.Assume the Zener voltage stabilizes at a minimum current of 15 mA.	14	July 2021
17	A class-A series fed amplifier has $V_{CE(max)}$ =20V, $V_{CE(min)}$=5V, $I_{C(max)}$=8mA and $I_{C(min)}$=2mA. Determine the RMS value of current and voltage. Also determine the ac power and conversion efficiency given V_{CC}=25V and I_{CQ}=3mA. What is crossover distortion? How can it be overcome and what compromise do we make in power amplifier performance?	14	July 2021
18	Illustrate the principle of output current boosting circuit in a voltage regulator?	3	June 2022
19	What do you mean by crossover distortion? How can it be eliminated?	3	June 2022
20	What are the factors affecting the variation in output voltage of voltage regulator? With a circuit diagram,explain how load and line regulations areachieved in a shunt voltage regulator.	14	June 2022
21	Explain the working of Class B push-pull power amplifier with a neat circuit diagram and output waveforms. Derive the expression for collector efficiency	14	June 2022

ECT 206 COMPUTER ARCHITECTURE AND MICROCONTROLLERS

MODULE 1			
Sl.No.	**Questions**	**Marks**	**KTU, Year**
1	Differentiate between Von-Neumann and Harvard Architecture.	3	KTU JUNE 2022
2	Define Address bus, Data bus and Control bus.	3	KTU JUNE 2022
3	Explain Non-restoring division algorithm with an example.	8	KTU JUNE 2022
4	Explain Instruction Cycle with a sample timing diagram.	6 10	KTU JUNE 2022 MODEL
5	Differentiate RISC and CISC Computer Architecture.	7 3 4	KTU JUNE 2022 KTU JULY 2021 MODEL
6	How does a computer go from a set of stored instructions to running them?	7	KTU JUNE 2022
7	Explain the significance of accumulator, program counter and stack pointer in processor operation	3	KTU JULY 2021
8	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
9	Explain the basic operations of a general processor in executing aninstruction	6	KTU JULY 2021
10	Write down the range of numbers that can be represented using IEEE754 single precision floating point representation. How do we represent zero, infinity and 49 in IEEE 754 format.	8	KTU JULY 2021
11	Draw the internal architecture of a general processor and explain the various components.	6	KTU JULY 2021
12	Which is more important for the functioning of a basic processor, Program Counter or Stack Pointer. Justify your answer.	3	MODEL
13	With an example explain the “shift and add” algorithm for multiplyingtwo binary numbers.	5	MODEL

14	With relevant diagrams illustrate the functioning of a basic (non – pipelined) processor	9	MODEL
15	Represent 4946.278941 as a 32 bit number in IEEE 754 format	3	MODEL
	MODULE-2		
1	Draw and explain the PSW of 8051 microcontroller.	3	KTU JUNE 2022 KTU JULY 2021
2	Write down the function of following instructions (a) ANL A,@R1 (b) RLC A (c) MOVX A,@R0	3	KTU JUNE 2022
3	Draw and explain the architecture of 8051 microcontroller.	9	KTU JUNE 2022
4	List the interrupts available in the 8051 microcontroller. Explain IE and IP Special Function register	5	KTU JUNE 2022
5	Explain TCON and TMOD special function register in 8051 Microcontroller	6	KTU JUNE 2022
6	Explain different Addressing Modes of 8051 Microcontroller with examples.	8 7	KTU JUNE 2022 MODEL
7	List the components of 8051 microcontroller	3	KTU JULY 2021 MODEL
8	Write the operations happening in the following instructions: ADD A, 56 XCHD A, @R1 DJNZ R6, LABELDIV AB XRL A, #0FFh JB P1.2 LABEL	3	KTU JULY 2021 MODEL
9	List the interrupts of 8051 and its ROM locations	3	KTU JULY 2021
10	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

11	What is stack? Explain the role of stack in program execution during a CALL instruction	5	KTU JULY 2021
12	Explain about the ports of 8051 and also illustrate the Port 0 circuit readand write operation.	8	KTU JULY 2021
13	Explain the 'Rotate' instructions used in 8051 microcontroller.	6	KTU JULY 2021
14	Differentiate microprocessors and microcontrollers	4	MODEL
15	Describe the classification of the Instruction Set of the 8051 microcontroller with example	7	MODEL
16	Illustrate the complete memory organisation of 8051 microcontroller	10	MODEL
	MODULE -3		
1	What is constant in embedded C?	3	KTU JUNE 2022
2	Write an ALP to copy a block of 8 bytes of data to RAM locations starting at 80H from RAM locations 20H.	3	KTU JUNE 2022
3	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
4	Explain interfacing of stepper motor with microcontroller. Write an embedded C language program to rotate stepper motor in clockwise direction continuously in full step mode.	8	KTU JUNE 2022
5	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
6	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
7	Write an 8051 C program to send values 00-FF to port P1.	3	KTU JULY 2021
8	Write an 8051assembly language program to add two 8bit numbers storedin external RAM memory	3	KTU JULY 2021
9	Write an 8051 assembly language program to sort the ten numbers stored in memory locations 30H to 39H in ascending order. Comment all lines of the program.	8	KTU JULY 2021

10	Write an 8051 C code to convert the analog input provided to ADC chip to the digital value and store the result in memory location.	6	KTU JULY 2021
11	Write an 8051 C program to send letters ‘M’, ‘D’ to LCD using delays.	7	KTU JULY 2021
12	Using a schematic diagram explain the procedure of interfacing KEYBOARD to 8051 microcontroller	7	KTU JULY 2021
13	Write an embedded C program for 8051 microcontroller to continuously rotate a stepper motor clockwise.	3	MODEL
14	Write an embedded C program for 8051 microcontroller to blink P2.5 every 2 second	3	MODEL
15	Write an embedded C program for 8051 microcontroller to read an analogue signal from an ADC and reproduce the same using a DAC	9	MODEL
16	Write an assembly language program for 8051 microcontroller to sort N number in ascending order. Assume that the numbers are stored in continuous locations starting from 0x4321 onwards.	5	MODEL
17	Write an embedded C program for 8051 microcontroller to repeatedly display the sequence 1,5,8,0,2,6,4,9,3,7 using a 7 – segment display witha delay of 1.5 seconds between each number	9	MODEL
18	Write an assembly language program for 8051 microcontroller to find the cube of an 8 – bit number	5	MODEL
	MODULE -4		
1	What is the difference between a Timer and Counter?	3	KTU JUNE 2022
2	Explain the format of SCON Special Function Register.	3	KTU JUNE 2022
3	Draw and explain ARM 7 register architecture.	7 8 4	KTU JUNE 2022 KTU JULY 2021 MODEL
4	Write an ALP to generate a square wave of frequency 100KHz on pin P1.0, using Timer 1 operating in mode 0. Assume Crystal frequency 11.0592 MHz	7	KTU JUNE 2022
5	Explain various System software.	8	KTU JUNE 2022

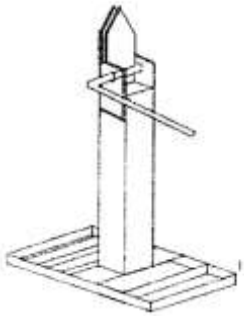
6	Write an embedded C program for the 8051 to transfer letter "A" serially at 9600 baud, continuously.	6	KTU JUNE 2022
7	Assume XTAL=11.0592. Compute the value to be loaded into TH0 andTL0 (mode 1) to incorporate a time delay of 5ms	3	KTU JULY 2021
8	Explain the procedure of doubling the baud rate of data transfer in 8051serial communication.	3	KTU JULY 2021
9	Explain characteristics and operations of mode 1 programming of Timers in 8051 microcontroller.	6	KTU JULY 2021
10	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	8	KTU JULY 2021
11	Explain the operation of a) Assembler b) compiler c) Debugger	6	KTU JULY 2021
12	List the different modes and give corresponding uses of timers in 8051 microcontroller	3	MODEL
13	Which are the SFRs used for serial communication in 8051 microcontroller. Give functions.	3	MODEL
14	Assume a switch is connected to pin PL7. Write a 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	10	MODEL
15	Write a 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	10	MODEL
16	Explain how a HLL program is executed as machine language in a processor	4	MODEL
	MODULE -5		
1	Define Virtual memory.	3	KTU JUNE 2022
2	Why does dynamic RAM need constant refreshing? How is this done?	3	KTU JUNE 2022
3	Explain different mapping techniques in cache memory.	8	KTU JUNE 2022

4	Explain the Asynchronous input/output transfer with proper timing diagram.	6	KTU JUNE 2022
5	Explain the address translation mechanism in Virtual Memory.	8	KTU JUNE 2022
6	Explain the working of DRAM and SRAM with neat diagram.	6	KTU JUNE 2022
7	Explain programmed I/O and interrupt driven I/O for data transfer incomputers.	8	KTU JULY 2021
8	Explain RAM and ROM memory chips.	6	KTU JULY 2021
9	Explain associative mapping of cache memory for a 4K cache with block size 128 and word size 16. Draw necessary figures. Specify the mainmemory address.	8	KTU JULY 2021
10	Explain the memory hierarchy model using a layout diagram.	6 3	KTU JULY 2021 MODEL
11	Differentiate synchronous and asynchronous I/O. Which is more efficientwith respect to processor utilisation? Justify your answer	8	MODEL
12	Explain direct mapping of cache memory with an example	6	MODEL
13	Differentiate interrupt driven and programmed I/O. Which is more efficient with respect to processor utilisation? Justify your answer	8	MODEL
14	Explain about memory management using virtual memory	6	MODEL

EST 200 DESIGN AND ENGINEERING

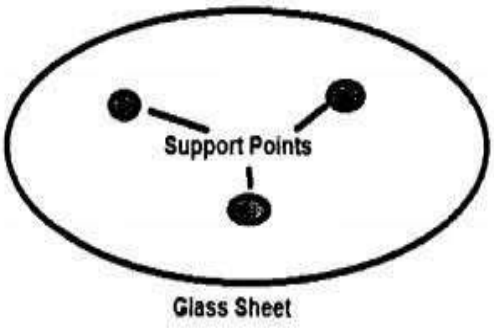
EST 200 DESIGN AND ENGINEERING

MODULE I			
Sl.No.	**Questions**	**Marks**	**KTU, Year**
1	Outline the significance of understanding customer requirements in the design process	3	KTU JUL 2021
2	Describe any three constraints that can occur in the design process of a lunch box	3	KTU JUL 2021
3	Explain the design process of designing a handbag for women in the age group of 15 to 25 years. Use hand sketches to support your idea	14	KTU JUL 2021
4	Describe the concept of generating design alternatives and choosing a design through designing a coffee mug with the help of sketches	14	KTU JUL 2021
5	Discuss the importance of design constraints?	3	KTU DEC 2020
6	Describe how to select the "best possible design" from the generated design alternatives.	3	KTU DEC 2020
7	Design two alternatives of a chair suitable for a five-year-old child, and then narrow down to the best design based on objectives and constraints. Sketch both the designs.	14	KTU DEC 2020
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 DEC 2020
9	Write about the basic design process.	4	MODEL
10	Describe how to finalize the design objectives.	4	MODEL
11	List the constraints and objectives of designing a lunch box for the school students	5	KTU MAY 2019
12	Design a length-adjustable mop to clean the ceiling fan	5	KTU MAY 2019
13	What are the objectives and constraints of the below design	5	KTU MAY 2019

14	Prepare the objective tree for the product coconut peeling machine given below. 	5	KTU MAY 2019
15	Give the main objectives and constraints for the design a)Main entrance door of a house b)The door of a room within the house c)The door to a bathroom within the house	5	KTU MAY 2019
16	What is engineering design? Draw a diagram to represent the engineering design process?	3	KTU JUNE 2022
17	How will a prototype help to identify the best possible solution for the problem?	3	KTU JUNE 2022
18	Design the interface of a simple calculator explaining each stage in the design process. Use hand sketches wherever necessary.	14	KTU JUNE 2022
19	An electric car recharging station has to be designed. Find the customer requirements and explain how it can be materialized. Include the detailed layout of the station?	14	KTU JUNE 2022
	MODULE II		
1	Explain convergent questioning in design thinking	3	KTU JUL 2021
2	Explain how the conflict in a team environment helps in better design of products	3	KTU JUL 2021
3	Illustrate the design thinking process through designing a walking stick for elderly people.	14	KTU JUL 2021

4	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 JUL 2021
5	Discuss how to manage the conflicts in a team executing the design thinking process.	3	KTU DEC 2020
6	How does the design thinking approach help engineers in creating innovative and efficient designs?	3	KTU DEC 2020
7	Design a water bottle that can be opened with one hand. Illustrate the various stages involved in design thinking. Sketch the final design.	14	KTU DEC 2020
8	During the Covid-19 pandemic, people have to wear a mask, but wearing a mask is not comfortable. Empathize about this design problem and arrive at a solution using the design thinking process, so that people can select the level of protection provided by masks according to different situations. Illustrate the solution using sketches.	14	KTU DEC 2020
9	State the role of divergent-convergent questioning in design thinking	3	MODEL
10	Discuss how to perform design thinking in a team managing the conflicts.	3	MODEL
11	Construct a number of possible designs and then refine them to narrow down to the best design for a drug trolley used in hospitals. Show how divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.	14	MODEL
12	Illustrate the design thinking approach for designing a bag for college students within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.	14	MODEL
13	Design a manual mango plucker (with a height adjusting mechanism that can be used by a common man to pluck and collect safely the mangoes from the mango tree in his yard. ● Prepare a detailed design highlighting the benefits of our design ● Draw a neatly labeled sketch showing your design	10	KTU JULY 2018
14	Explain and differentiate conceptual design and detailed design?	3	KTU JUNE 2022
15	Explain the five different stages of design thinking? Illustrate it with the help of a face mask design	14	KTU JUNE 2022

16	Show how divergent and convergent thinking process will help to choose the best design from a list of possible solutions, considering water jug as a case study.	14	KTU JUNE 2022
	MODULE III		
1	Describe how prototyping helps in the design process	3	KTU JUL 2021
2	Explain any three advantages of communicating designs in writing.	3	KTU JUL 2021
3	Design an office chair and communicate your design using sketches with design detailing, material selection, scale drawings, and dimensions	14	KTU JUL 2021
4	Describe the role of mathematical modeling in design engineering citing an example	14	KTU JUL 2021
5	Clarify the part of mathematics and physics in the design engineering process.	3	KTU DEC 2020
6	What are factors to be considered in preparing technical reports to communicate a design efficiently?	3	KTU DEC 2020
7	Design a foldable steel table. Draw the detailed 2D drawings of the same with design detailing, scale drawings, and dimensions. Use only hand sketches.	14	KTU DEC 2020
8	Prepare a technical report for a newly designed website for online training of students with neat diagrams for presenting to a client.	14	KTU DEC 2020
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
11	Graphically communicate the design of a thermos flask used to keep hot coffee. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.	14	MODEL
12	Describe the role of mathematical modeling in design engineering. Show how mathematics and physics play a role in designing a lifting mechanism to raise 100 kg of weight to a floor at a height of 10 meters on a construction site	14	MODEL

13	Explain the general guidelines for technical communication. Justify each point with an example.	14	KTU JUNE 2022
14	A web page has to be maintained to store the details of covid patients in Kerala district wise. Design a web page and its popups with neat sketches and necessary documentation. The design must include the specification of softwares required for the page development.	14	KTU JUNE 2022
15	"Sketching is a powerful tool in design engineering". Justify this statement.	3	KTU JUNE 2022
16	What is a mathematical model? State the significance?	3	KTU JUNE 202
17	A round glass of 600 mm diameter and 6mm thick is available. This is to be designed as a table supported at three points by a steel tube bent conveniently. The height of the table is to be 300 mm and the total length of the tube used should not exceed 1.8 m, The tube should not be out or joined. Design the bent tube for supporting the table	10	KTU SEP 2020
			

MODULE IV			
1	Illustrate advantages of reverse engineering in design	3	KTU JUL 2021
2	Explain biomimicry in design with an example	3	KTU JUL 2021
3	Illustrate modular design approach for designing desktop computers	14	KTU JUL 2021
4	Demonstrate the concept of ergonomics through the design of a table lamp	14	KTU JUL 2021

5	Describe the use of value engineering in the design process.	3	KTU DEC 2020
6	How does intelligence in nature inspire engineering designs?	3	KTU DEC 2020
7	Apply value engineering to a pen, and design a lightweight pen torch. Illustrate the solution using sketches.	14	KTU DEC 2020
8	Design waste bins to be kept at bus stops for waste collection enabling source separation. The bin should be theft-resistant and protect the contents of the bin from external weather conditions. Design the bins with ergonomic consideration for waste collection workers. Sketch the design using hand drawings.	14	KTU DEC 2020
9	What is meant by modular design?	5	KTU MAY 2019
10	Apply the modular design concept for a product bicycle	5	KTU MAY 2019
11	How modular design is realized in i) Umbrella and ii) Ink Pen? Draw the different modules involved in each of these products.	4	KTU MAY 2019
12	Apply the principles of value engineering, and design a school bag for the students residing in poor homes. Neatly sketch the design and prepare a description for the same	5	KTU JUL 2018
13	Show the development of a nature-inspired design for a solar-powered bus waiting shed beside a highway. Relate between natural and man-made designs. Use hand sketches	14	MODEL
14	Show the design of a simple sofa and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.	14	MODEL
15	Distinguish between project-based learning and problem-based on learning in design engineering.	3	MODEL
16	Describe how concepts like value engineering, concurrent Engineering, and reverse engineering influence engineering designs?	3	MODEL
17	Considering the principle of value engineering. Design a suitable product for easy cleaning of dust from windows, fans, and lampshades.	5	KTU JUN 2017
18	Draw the figure of a smartphone which is both aesthetic and ergonomic	5	KTU JUN 2017
19	A class room has to be designed in such a way that it should	14	KTU JUNE 2022

	support the faculty for taking both online and offline mode class in the same room. Prepare a bill of material and draw a neat sketch showing the seating arrangement, cable layout, projector and smartboard position, podium, camera and the teacher position.aesthetic, ergonomics and convenience must be considered.		
20	(a) Write the significance of life cycle design? (b) Apply the ergonomic design concepts to design a knife for various purposes. Illustrate each design with a neat sketch?	4 10	KTU JUNE 2022
21	Write and differentiate problem based and project based learning?	3	KTU JUNE 2022

	MODULE V		
1	Describe ethics to be followed in engineering design	3	KTU JUL 2021
2	Explain the significance of sustainability in engineering design	3	KTU JUL 2021
3	Illustrate the changes in the design of disposable tea cups in terms of production, use, and sustainability	14	KTU JUL 2021
4	Describe how to estimate the cost of a table in the design stage? Show how economics will influence engineering designs.	14	KTU JUL 2021
5	How to estimate the cost of a particular design?	3	KTU DEC 2020
6	How do ethics play a decisive role in engineering design?	3	KTU DEC 2020
7	Design a fan that automatically reduces speed or stops when the temperature reduces during the night for energy conservation. Use hand sketches to support your design.	14	KTU DEC 2020
8	Describe how to estimate the cost of a pen and list the various parts. Show how economics will influence engineering designs. Use hand sketches to support your arguments.	14	KTU DEC 2020
9	Examine the changes in the design of footwear with constraints of 1) production methods, 2) life span requirement, 3) reliability issues and 4) environmental factors. Use hand sketches and give proper rationalization for the changes in design.	14	MODEL
10	Show how designs are varied based on the aspects of production methods, life span, reliability, and environment?	3	MODEL

11	Explain how economics influences engineering designs?	3	MODEL
12	Describe the how to estimate the cost of a particular design using ANY of the following: i) a website, ii) the layout of a plant, iii) the elevation of a building, iv) an electrical or electronic system or device and v) a car. Show how economics will influence engineering designs. Use hand sketches to support your arguments.	14	MODEL
13	A table has to be designed as a study table, but it must include a provision to place your computer. Calculate the cost difference if you want to convert it as a dining table. The cost calculation must include labor, material and overhead costs.	14	KTU JUNE 2022
14	An umbrella has to be designed for daily use. Show how the cost will vary based on material, design and labor using suitable neat hand sketches?	14	KTU JUNE 2022
15	Explain the cost factor calculation of a particular design?	3	KTU JUNE 202
16	Write the role of economics in engineering design?	3	KTU JUNE 2022

MCN 202 CONSTITUTION OF INDIA

Module 1			
Sl No	**Questions**	**Marks**	**KTU,Year**
1	Explain the salient features of Indian Constitution	3	July 2021 (FN)
2	What do you mean by federal system of government? Give an example	3	July 2021 (FN)
3 a	What is preamble? Explain the importance of preamble in the implementation of Constitution	6	July 2021 (FN)
b	Explain different ways for acquiring Indian citizenship.	8	July 2021 (FN)
4a	Explain the salient features of Indian constitution.	8	July 2021 (FN)
b	Write notes on methods of termination of Indian citizenship.	6	July 2021 (FN)
5	Define Constitution. Why is it necessary for a Country	3	July 2021 (AN)
6	Explain the need and importance of Preamble	3	July 2021 (AN)
7 a	What is Preamble? Can it be used for the interpretation of the constitution? Also explain its significance	8	July 2021 (AN)
b	Describe the salient features of Indian Constitution	6	July 2021 (AN)
8 a	Give detail account on the historical background of Indian Constitution	6	July 2021 (AN)
b	What is citizenship? Discuss the various methods of acquiring Indian citizenship	8	July 2021 (AN)
9	Explain the preamble of Indian Constitution.	3	June 2022
10	Give any five features of Constitution of India	3	June 2022
11 a	Define Constitution of India with comparison with other countries	7	June 2022

11 b	Discuss the term-.Union and its Territory.	7	June 2022
12 a	Explain the term citizenship and its types.	7	June 2022
12 b	How Indian Citizenship can be acquired.?	7	June 2022

Module 2			
Sl No	**Questions**	**Marks**	**KTU,Year**
1	Explain the concept of " Equality before Law"	3	July 2021 (FN)
2	"No person shall be prosecuted and punished for the same offence more than once". Discuss this clause	3	July 2021 (FN)
3 a	Explain the concept of appeal by special leave	6	July 2021 (FN)
b	Discuss the classification of Directive Principles of State Policy in detail	8	July 2021 (FN)
4 a	What do you mean by right against exploitation? Explain	7	July 2021 (FN)
b	Distinguish between fundamental rights and directive principles of state policy	7	July 2021 (FN)
5	How is State defined under Article 12 of Indian Constitution	3	July 2021 (AN)
6	What is the basic difference between Fundamental Rights and Directive Principles of State Policy?	3	July 2021 (AN)
7 a	Describe the Rights to Constitutional Remedies and explain its significance	6	July 2021 (AN)
b	Explain the needs and importance of fundamental duties of Indian Citizen	8	July 2021 (AN)
8 a	What are Fundamental Rights? Examine each of them	8	July 2021 (AN)
b	State the Directive Principles of State Policy and explain its significance	6	July 2021 (AN)

9	Differentiate Rights and Duties with example	3	June 2022
10	What protections are available to the Indian citizen against conviction?	3	June 2022
11 a	Explain the term fundamental rights and its classification.	7	June 2022
11 b	Explain right against exploitation and right to constitutional remedies.	7	June 2022
12 a	What do you mean by Directive principles of state policy?	7	June 2022
12 b	What are the fundamental duties of an Indian citizen?	7	June 2022

Module 3			
Sl No	**Questions**	**Marks**	**KTU,Year**
1	Explain the procedure for impeachment of the President of India.	3	July 2021 (FN)
2	Explain the role of the Attorney General for India	3	July 2021 (FN)
3 a	Explain the powers of President of India.	8	July 2021 (FN)
b	Explain the constitutional position and essential qualifications of Vice-president of India.	6	July 2021 (FN)
4 a	Explain the qualification and disqualification for membership in the house of the people.	8	July 2021 (FN)
b	Explain various kinds of jurisdiction of Supreme Court	6	July 2021 (FN)
5	Explain the procedure for impeachment of the President of India.	3	July 2021 (AN)
6	Mention the Powers and Functions of the Attorney General for India	3	July 2021 (AN)
7 a	Explain various kinds of jurisdiction of Supreme Court of India	7	July 2021 (AN)

b	Explain the constitutional duties and powers of the Prime Minister	7	July 2021 (AN)
8 a	Explain the functions and powers of the President of India.	8	July 2021 (AN)
b	Explain in detail about the Union Government structure and functions	6	July 2021 (AN)
9	Give the duties of Attorney General.	3	June 2022
10	Write five specialities of Supreme court.	3	June 2022
11 a	Explain how Union Executive is elected and formed	7	June 2022
11 b	What are the different functions of Parliament?	7	June 2022
12 a	Differentiate Rajya Sabha and Lok Sabha points	7	June 2022
12 b	How can a citizen be qualified and disqualified as an MP?	7	June 2022

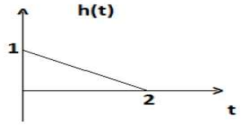
Module 4			
Sl No	**Questions**	**Marks**	**KTU,Year**
1	Explain the procedure for the appointment of chief minister	3	July 2021 (FN)
2	Explain the duties of advocate general of the state.	3	July 2021 (FN)
3 a	Explain the powers and functions of the Governor of Kerala state.	6	July 2021 (FN)
b	Explain the composition and duration of state legislative council	8	July 2021 (FN)
4 a	Explain the qualification and disqualification for membership of the state legislature	7	July 2021 (FN)

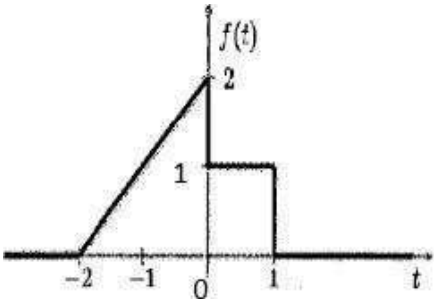
b	Explain the constitution of High court. What are the essential qualifications required for the appointment of High court Judge?	7	July 2021 (FN)
5	What are the constitutional provisions relating to freedom of trade ,commerce and intercourse	3	July 2021 (AN)
6	List out the three types of emergencies under Indian constitution	3	July 2021 (AN)
7 a	Describe the duties and role of Comptroller and Auditor General of Indian (CAG)	8	July 2021 (AN)
b	Examine the administrative and financial relation between the Union and the State	6	July 2021 (AN)
8 a	Enumerate the powers and functions of Public Service Commission	8	July 2021 (AN)
b	Explain the characteristics of Administrative Tribunals. What are the reasons for the growth of Administrative Tribunals in India	6	July 2021 (AN)
9	Explain Writ Jurisdiction.	3	June 2022
10	Explain the role of Governor	3	June 2022
11a	Differentiate State Government and Union Territory.	7	June 2022
11 b	Explain, State Legislative Assembly in detail.	7	June 2022
12 a	Discuss about Jurisdiction of High court	7	June 2022
12 b	Explain State Legislative Council in detail	7	June 2022

Module 5			
Sl No	**Questions**	**Marks**	**KTU,Year**
1	Discuss the functions of comptroller and auditor general of India	3	July 2021 (FN)
2	Explain the distribution of tax revenue with respect to centre-state financial relation.	3	July 2021 (FN)
3 a	Explain parliamentary legislation in the state field	6	July 2021 (FN)
b	Discuss the effects of national and financial emergencies	8	July 2021 (FN)

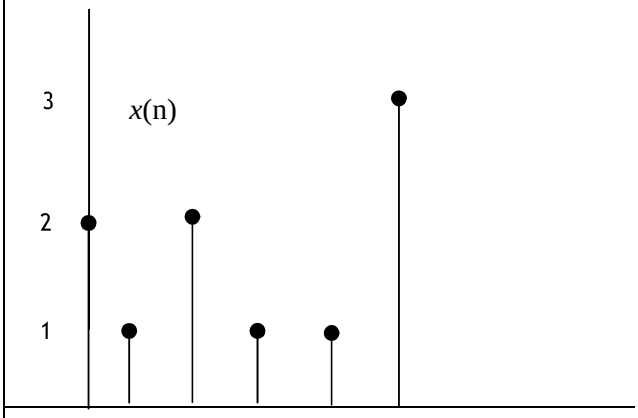
4 a	Explain the procedure for amendment of the constitution	6	July 2021 (FN)
b	What is the need for administrative tribunals? Explain the functions of state administrative tribunals	8	July 2021 (FN)
5	Why do we need to form separate Union Territories	3	July 2021 (AN)
6	Distinguish between an ‘ Ordinary Bill’ and ‘Money Bill’	3	July 2021 (AN)
7 a	Explain the various writs issued by High court of Kerala	6	July 2021 (AN)
b	Discuss the constitutional position and powers of Governor	8	July 2021 (AN)
8 a	Explain the functions of the State Legislature	8	July 2021 (AN)
b	Explain the responsibilities and functions of Council of Ministers to State Legislative Assembly	6	July 2021 (AN)
9	What is the procedure for amending the Constitution?	3	June 2022
10	Why administrative tribunals are established?	3	June 2022
11 a	How is Central and State Government related on economic basis?	7	June 2022
11 b	Explain how the constition handles an emergency situation in the country.	7	June 2022
12 a	Which are the functions of Comptroller and Auditor General of India?	7	June 2022
12 b	Explain the role of Public Service commission	7	June 2022

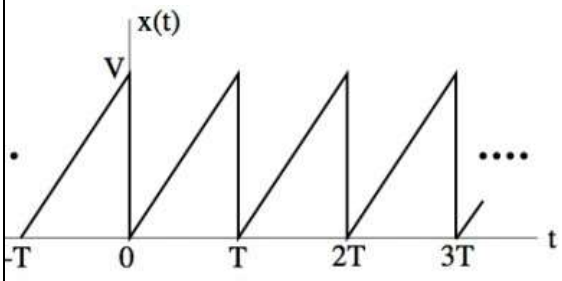
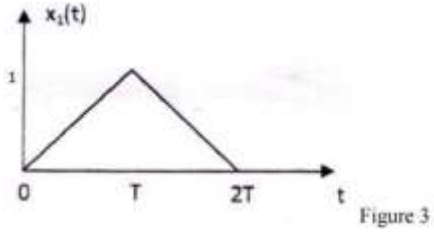
ECT 204 SIGNALS & SYSTEMS

Module 1			
Sl No	**Questions**	**Marks**	**KTU,Year**
1	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	July 2022
2	Plot the waveform of the following signal x(t) = u(t + 1) - 2u(t) + u(t - 1)	3	July 2021
3	Determine energy of the signal $x(t) = e^{-2t}\,u(t)$	3	July 2021
4	Check whether the following signals are energy or power signals. i) $x(t) = e^{-a\|t\|}$; a>0 \ii) $x(t) = tu(t)$	6	July 2022
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	July 2022
6	Sketch the signals (i) y(t) = u(0.5t + 2) (ii) $y(n) = u(n) + u(n-5)$	**6**	**July 2022**
	Plot the waveform of the following signal x(t) = u(t + 1) - 2u(t) + u(t - 1)	**3**	**July 2021**

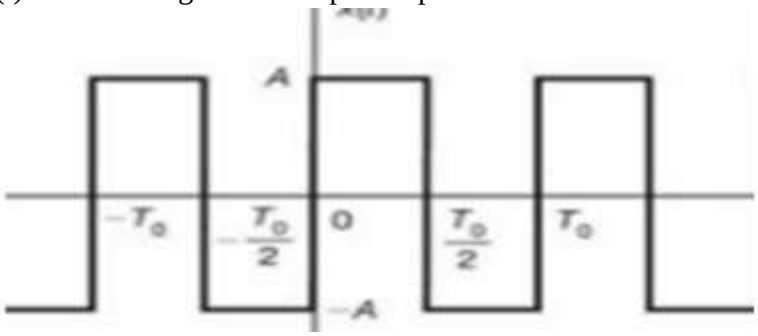
7	Determine energy of the signal $x(t) = e^{-2t}u(t)$	3	July 2021
8	Test whether the following signals are periodic or not. If periodic, determine the fundamental period and frequency. 1) $x(t) = 3\cos(5t + \pi/6)$ 2) $x(t) = e^{(j\pi - 2)t}$	6	July 2021
9	Evaluate the discrete-time convolution sum with required plots for the following signal $y[n] = 3^n u[-n + 3] * u[n - 2]$	8	July 2021
10	Evaluate the continuous time convolution integral for the following with proper plots. $y(t) = \{u(t) - u(t - 2)\} * u(t)$	8	July 2021
11	Evaluate the autocorrelation of the signal $x(t) = e^{-t}u(t)$	6	July 2021
12	Determine whether the signal $x[n] = 1 + \sin\left(\frac{5\pi n}{3} + \frac{\pi}{2}\right)$ is periodic. Find the fundamental period if it is periodic.	2	APRIL2018
13	For the signal f(t) shownbelow: i) Sketch f(3-2t) ii) Find the energy of the signalf (t). 	7	APRIL2018

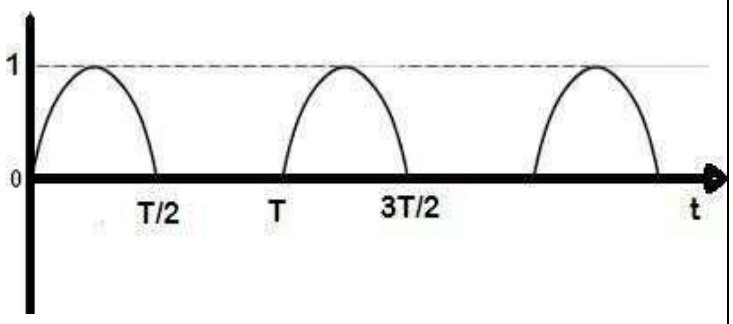
14	Check whether the following systems are linear and stable. (i) $y(t) = e^{x(t)}$ (ii) $y[n] = x[n-1]$	6	APRIL2018
15	Determine the power and energy of the following signals. Classify them as energy/power signals. (i) $x(t) = A\sin(\Omega t)$ (ii) $x(t) = (-0.5)^t u(t)$ (iIi) $x[n] = u[n]$.	6	SEPTEMBER 2020
16	Observe the given signal and sketch the following: $y(n) = 2x(-2n+1)$ $z(n) = -x(n/2-2)$	6	DECEMBR 2018

			
17	Compute the power and energy of the following signals and check whether they are power signals or energy signals i)$x(n)=(1/3)^n u(n)$ ii)$y(t)=(1+e^{-5t})u(t)$.	6	DECEMBR 2018
18	Define, sketch and list the properties of continuous time impulse function	3	DECEMBR 2018
19	Show that any signal can be represented as the summation of an odd and an even signal. Write down the expression for the odd and even components of the signalsx(t) and x(n) .Find the odd and even components of the signal x(n) = {−2,1,2,−1,3}	7	DECEMBR 2018
20	Distinguish between energy and power signals. Give an example for each category	4	July 2017
21	A system has input - output relation given by $y[n] = nx[n]$.Determine whethethe system is memoryless, causal, linear, time invariant or stable.	5	July 2017
22	A signal is given by x(t)={1;-1≤t≤1 0;otherwise Sketch x(3t+2),x(2(t-2)) and x(-2t-1)	6	July 2017
23	Determine the energy of the signal $x(t)=e^{-2t}u(t)$	3	July 2021

Module 2			
Sl No	**Questions**	**Marks**	**KTU,Year**
1	State the Dirichlet's conditions for the convergence of Fourier series	**3**	**July 2021**
2	Prove time-shifting property of Laplace transform	**3**	**July 2022**
3	Perform linear convolution of signals x1[n] = [2, 2, 2, 2] and x2[n] = [1, 1, 1, 1]	**3**	**July 2021**
4	 Figure 2 Find the complex exponential Fourier series of the periodic signal shown in Figure 2.	**8**	**July 2022**
5	If x(t) has a Fourier Transform , find the Fourier Transform of i) $x_1(t) = x(4t-3)$ ii) $x_2(t) = \frac{d}{dt}x(t-3)$	**6**	**July 2022**
6	Find the Fourier Transform of the signal $x_1(t)$ shown in Figure 3 using convolution property and time shift property of Fourier Transform.  Figure 3 Find the Laplace Transform and ROC of the signal $x(t) = (e^{-2t} + 3e^{-3t})u(t)$	**8**	**July 2022**
7	Define Energy Spectral Density of a discrete time signal? How can you relate it to the DTFT of the signal?	**3**	**July 2022**
8.	Find Laplace Transform and sketch ROC for the signal $x(t) = e^{2t}\,u(t) + e^{-3t}\,u(t)$	**3**	**July 2021**

6

9	Using the standard transforms and properties find Fourier Transforms of the following signals i. $x(t) = t\,e^{-2t}\,u(t)$ ii. $x(t) = \sin(2\pi t)e^{-t}\,u(t)$	**7**	**July 2021**
10	Find the trigonometric Fourier Series of the given continuous time square wave x(t). Plot the magnitude and phase spectra. 	**7**	**July 2021**
11	Using the standard transforms and properties find Fourier Transforms of the following signals i. $x(t) = t\,e^{-2t}\,u(t)$ ii. $x(t) = \sin(2\pi t)e^{-t}\,u(t)$	**7**	**July 2021**
12	A periodic signal has the Fourier series representation $x(t) \xleftrightarrow{FS;\,\pi} X(k) = -k2^{-|k|}$ Without determining x(t), find the Fourier series Y(k) and ω_0' for i. $y(t) = x(3t)$ ii. $y(t) = dx(t)/dt$ iii. $y(t) = x(t - 1)$	**9**	**July 2021**

	) Find time domain signal represented by the Fourier Series coefficients $X(k) = j\delta(k-1) - j\delta(k+1) + \delta(k-3) + \delta(k+3), \omega_0 = 2\pi$		
13	State and prove the Parseval's theorem for continuous time Fourier transforms	5	APRIL2018
14	Determine the exponential Fourier series representation of half wave rectified sine wave as shown in the fig. below. 	3	APRIL2018
15	Let $F(\omega) = \mathcal{F}\{f(t)\}$ Determine the Fourier transform of in terms of $F(\omega)$ where $a \neq 0,\ a,\ b$ real. Handle thecases for a>0 and a<0 separately	6	APRIL 2018
16	State and prove time-shifting property of Laplace Transform	4	July 2017
17	Find the inverse Laplace transform of the following function $X(S)=3s^2 + 8s + 6/(s+2)(s^2 + 2s + 1)$ $Re(s) > -1$	5	DECEMBER 2018
18	Find the CTFT of the signal $x(t) = te^{-at}u(t)$ using anappropriate property. State and prove the property used.	7	DECEMBER 2018

Module 3			
Sl No	**Questions**	**Marks**	**KTU,Year**
1	Find the impulse response and step response of a system with transfer function $H(s) = \frac{3s}{2s^2 + 10s + 12}$	**7**	**July 2022**
2	Determine the Nyquist rate of sampling for the signals i) $x(t) = cos\ (150\pi t)\sin\ (50\pi t)$ ii) $x(t) = sin(150\pi t) + sinc^2\ (150\pi t)$	**7**	**July 2022**
3	A continuous time LTI system is described by the differential equation $\frac{dy(t)}{dt} + 5y(t) = x(t)$ Determine the response of the system to the input $x(t) = e^{-2t}u(t)$using Fourier Transform.	**7**	**July 2022**
4	Consider the continuous time signal $(t) = cos\ (200\pi t) + \sin\ (320\pi t)$. What will be the Nyquist rate of sampling for the signal? If the signal is sampled at 300samples/sec, write the discrete time signal $x[n]$ 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?	**7**	**July 2022**
5	State sampling theorem of a band limited Continuous time signal.	**3**	**July 2021**
6	Find the Nyquist rate and Nyquist interval of the following signal x(t) = 3 sin 100π t + 2 cos 200π t	**3**	**July 2021**
7	An arbitrary band-limited continuous time signal x(t) is sampled with an impulse train. With spectral details, explain the following conditions (i) Oversampling (ii) Critical Rate (iii) Aliasing	**6**	**July 2021**
8	Define Energy Spectral Density of a discrete time signal? How can you relate it to the DTFT of the signal?	**3**	**July 2022**
9	A second order LTI system is described by the given differential equation. Use Laplace Transform to determine the transfer function the system $\frac{d^2}{dt^2}$ y(t) + 4 $\frac{d}{dt}$ y(t) + 3y(t) = 4 x(t) +2 $\frac{d}{dt}$x(t) Also find the output y (t) of the system for a given input x (t) = e^{-2t} u(t).	8	July 2021

10	Determine a differential equation description for a system with the following transfer function $H(s) = \frac{2(s-2)}{(s+1)^2\ (s+3)}$	6	July 2021
11	Determine whether the system described by the following system is i. Both causal and stable ii. Whether a causal and stable inverse systems exist or not? $H(s) = \frac{(s+1)(s+2)}{(s+1)(s^2+2s+10)}$	8	July 2021
12	A second order LTI system is described by the given differential equation. Use Laplace Transform to determine the transfer function the system $\frac{d^2}{dt^2} y(t) + 4 \frac{d}{dt} y(t) + 3y(t) = 4\ x(t) + 2 \frac{d}{dt} x(t)$ Also find the output y (t) of the system for a given input x (t) = e^{-2t} u(t).	8	July 2021
13	What is aliasing? When does aliasing occur? How can we avoid aliasing?	4	DECEMBER 2019
14	State and prove sampling theorem for low pass signals	6	SEPTEMBER 2020
15	Determine the complex exponential Fourier Series representation of thesignal, x(t) = cos4t + sin6t	5	July 2017

Module 4

Sl No	Questions	Marks	KTU,Year
1	Define Energy Spectral Density of a discrete time signal? How can you relate it to the DTFT of the signal?	**3**	**July 2022**
2	Determine the Fourier series coefficients of the signal $x(n) = 2 + \cos\left(\frac{\pi}{3}n + \frac{\pi}{4}\right)$.	**3**	**July 2022**
3	Find the DTFT of the following sequences using properties given $x(n)$ has a DTFT $X(e^{j\omega})$ (i) $x_1(n) = x(1-n)$ (ii) $x_2(n) = e^{j\frac{\pi}{4}n}x(n-2)$	**7**	**July 2022**

4	Consider an LTI system that is characterized by the difference equation $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n)$ Find the frequency response $H(e^{j\omega})$ and the impulse response h(n) of the system.	**7**	**July 2022**
5	Find the DTFT of the given signal $x(n)$ $x[n] = \begin{cases} 1, & \lvert n \rvert \leq N_1 \\ 0, & \lvert n \rvert > N_1 \end{cases}$	**7**	**July 2022**
6	Find convolution of the following two sequences using DTFT $x_1[n]$ = [1, 2, 3, 1] $x_2[n]$ = [1, 2, 1, -1]	**4**	**July2021**
7	Find Inverse DTFT of $\lvert H(\omega) \rvert = 1 \quad -\omega_0 \leq \omega \leq \omega_0$ $0 \quad$ otherwise	**4**	**July2021**
8	Compute DTFS coefficients of the given discrete time signal. Plot its magnitude and frequency spectrum. $x[n] = \cos\left(\frac{6\pi}{13}n + \frac{\pi}{6}\right)$	**6**	**July2021**
9	Use the defining equation for the DTFS to determine the time domain signal represented by the following DTFS coefficients by inspection $X[k] = 2j\sin(\frac{4\pi}{19}k) + \cos\left(\frac{10\pi}{19}k\right)$	**7**	**July2021**
10	A discrete time LTI system is given byy[n] - ½ y[n-1] = x[n] + x [n-1]. Determine the frequency response and impulse response of the system.	7	July 2017

Module 5			
Sl No	**Questions**	**Marks**	**KTU,Year**
1	Derive the relation between DTFT and Z transform	**3**	**July 2021**
2	Evaluate the transfer function H(z) of an LTI system described by $y[n] - \frac{1}{2}\ y[n-1] = 2x[n]$	**3**	**July 2021**

3	Give the relation between DTFT and z-transform of a discrete time signal.	3	July 2022
4	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	July 2022
5	Determine the z-transform for the following signal $x(n) = \left(\frac{1}{2}\right)^{n-1} u(n+3)$. Sketch the pole-zero plot and indicate the ROC.	7	July 2022
6	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	July 2022
7	Find the inverse z-transform of $X(z) = \frac{2z^2 + 16}{(z+1)(z-2)}$ for all possible ROCs.	10	July 2022
8	Write down any four properties of ROC for Z transform.	4	July 2022
9	Determine the Z Transform and ROC for the following signal. Sketch the ROC, poles and zeroes in the Z-plane. $x[n] = (2/3)^{\|n\|}$	6	July 2021
10	Write the impulse response of the system function whose algebraic expression is given below. Also check and justify the causality and Stability	6	July 2021

	$H(z) = \frac{1}{\left(1 - \frac{1}{2}z^{-1}\right)} + \frac{1}{(1 - 2z^{-1})}, \quad \frac{1}{2} < \lvert z \rvert < 2$		
11	Evaluate the inverse Z-Transform by partial fraction method for the given X(z). $X(z) = \frac{3 - \frac{5}{6}z^{-1}}{\left(1 - \frac{1}{4}z^{-1}\right)\left(1 - \frac{1}{3}z^{-1}\right)}, \quad \lvert z \rvert > \frac{1}{3}$	7	July 2021
12	Explain the relation between DTFT and Z-transform. Explain whetherDTFT can be obtained from Z-transform for (i) x[n] = a^n u[n] (ii) x[n] = u[n]	7	July 2017
13	Evaluate Z-Transform of the following. i. $x[n] = [r^n cos\omega_0 n]\, u[n]$ ii. $x[n] = n\left(\frac{1}{3}\right)^n u[n]$	7	APRIL 2018

14	Consider a LTI system characterised by input output relationship $$y[n] - \frac{1}{4}y[n-1] = x[n] + \frac{1}{6}x[n-1]$$ a) Compute the systemfunction H(z). b) Sketch the possible ROCs forH(z). Compute the impulse response h[n] if it is known thatimpulse response is left sided	8	APRIL 2018
15	Find the Z transform and ROC of the following signals : (i) x(n) $=a^{\|n\|}$; |a| < 1 (ii) y(n) $=1/2n^2\,(1/3)^{n-1}$ u(n-1)	8	DECEMBER2018
16	The step response of a discrete time LTI system is given byS[n] = a^n u[n], 0< a < 1. Find the impulse response h[n] of the system using z-transform	7	JULY 2017
17	Evaluate the inverse Z-Transform by partial fraction method for the given X(z) X(z)=3 − 5/6z		