

**S4 ME QUESTION
BANK 2024 JANUARY**

Question Bank

SUBJECT: MAT202 - PROBABILITY, STATISTICS AND NUMERICAL METHODS - 2023

CLASS: S4 ME & CE

Sl. No	Questions	Marks	KU/KTU (Month/Year)
Module 1			
1	<p>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>	7	KTU- July 2017
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>(i) What is the probability that he answers 13 or more questions correctly?</p> <p>(ii) What is the mean and variance of the number of correct answers he gives?</p>	7	KTU- July 2017
3	<p>(1) 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> <p>(2) The joint probability distribution of X and Y is given by $f(x, y) = \frac{2x+3y}{54}$ for $x = 1, 2$; $y = 1, 2, 3$. Find the</p> <p>(i) marginal distribution of x and y</p> <p>(ii) the conditional distribution of X for $Y = y$</p>	7+7	KTU- May 2017 May 2019 June 2023
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>(a) at least one is defective</p> <p>(b) at most three are defective</p> <p>(c) none of them are defective</p> <p>(d) 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>(a) without a break down</p> <p>(b) with only one breaks down</p> <p>(c) with at most two break down</p>	7	KTU- JULY 2017
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</p>	7	KTU- April 2019

	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		June 2022					
6	(1) Show that Poisson distribution is the limiting case of binomial Distribution. (2) Find the mean and variance of a Binomial random variable (3) Find the mean and variance of a Poisson distribution	7+7+7	KTU May 2015 June 2022 June 2023					
7	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 2 defective items in a consignment of 1000 packets using Poisson distribution	7	KU- MAY 2019					
8	(a) Suppose X is binomial random variable with parameters $n = 100$ and $p = 0.02$. Find $P(X < 3)$ using Poisson approximation to X . (b) 8 coins are tossed 256 times. In how many tosses do you expect no heads? (c) Determine the Binomial distribution for which mean is 5 and variance $15/4$.	3+3+3	KTU June 2022 June 2023					
9	(1) The probability mass function of a discrete random variable is $p(x) = kx$, $x = 1, 2, 3$ where k is a positive constant. Find (i) the value of k (ii) $P(X \leq 2)$ (iii) $E[X]$ and (iv) $Var(1 - X)$. (2) The joint pdf of X, Y is given by $f(x, y) = k(x + 2y)$, $x = 1, 2, 3$; $y = 1, 2, 3$. Find (i) k (ii) marginal pdf of X, Y (iii) $P(X < 3, Y \geq 2)$.	7	KTU AUG2021 June 2022 June 2023					
10	The joint probability distribution of two discrete random variables X and Y is given by $(x, y) = 130(x + y)$, $x = 0, 1, 2$; $y = 0, 1, 2, 3$. Find the correlation coefficient between X and Y .	7	KTU- JULY 2017					
11	(i) In a city, 4% of all licensed drivers will be involved in at least one road accident in any given year. Use Poisson distribution to determine the probability that among 150 licensed drivers randomly chosen in this city only 5 will be involved in at least one road accident in any given year. (ii) It is known that 2% of the bolts produced by a company are defective. The bolts are supplied in boxes of 200 bolts. What is the probability that a randomly chosen box contains not more than 5 defective bolts? In a consignment of 1000 such boxes how many can be expected to have more than 5 defective bolts? (Use Poisson distribution)	7+7	KTU- AUG2021 June 2022 June 2023					
12	(1) The probability distribution function of a random variable X is given below. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>X</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> </table>	X	0	1	2	3	3+7+7	KTU Aug 2023 June 2022
X	0	1	2	3				

	<table border="1"> <tr> <td>f(x)</td> <td>0.1</td> <td>0.3</td> <td>0.4</td> <td>0.2</td> </tr> </table> <p>Find $E(Y)$ where $Y = X^2 + X$.</p> <p>(2) A random variable X has the following probability distribution:</p> <table border="1"> <tr> <td>X</td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>f(x)</td> <td>0.1</td> <td>$15k^2$</td> <td>0.2</td> <td>2k</td> <td>0.3</td> <td>3k</td> </tr> </table> <p>i) Find the value of k, ii) the mean and variance of X</p> <p>(3) Find a, b if $Y = aX + b$ has mean 4 and variance 16, where X is a random variable with mean 8 and variance 4.</p>	f(x)	0.1	0.3	0.4	0.2	X	-2	-1	0	1	2	3	f(x)	0.1	$15k^2$	0.2	2k	0.3	3k		
f(x)	0.1	0.3	0.4	0.2																		
X	-2	-1	0	1	2	3																
f(x)	0.1	$15k^2$	0.2	2k	0.3	3k																

Module 2

1	<p>(1) The time required to repair a machine is exponentially distributed with a parameter 0.5. What is the probability that a repair time exceeds 2 hours? What is the conditional probability that a repair time takes at least 10 hours given that the duration exceeds 9 hours?</p> <p>(2) 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	KTU AUG 2021 May 2019
2	<p>In an intelligence test administered to 1000 children the average mark was 60 and SD was 20. Assuming the marks the SD was 20 Assuming the marks obtained follow Normal distribution. Find the number of children who have scored (i) Above 90 marks (ii) below 40 marks (iii) between 50 and 80 marks?</p>	7	KTU- AUG2021
3	<p>A random sample of size 100 is taken from a population whose mean is 60 and variance is 400. Using Central Limit Theorem, find with what probability can we assert that the mean of the sample will not differ from $\mu = 60$ by more than 4?</p>	7	KTU- AUG2021
4	<p>(a) Find the mean and variance of a random variable X which is uniformly distributed in the interval $[a, b]$ (b) Find the mean and variance of exponential distribution</p>	7+7	KTU- March 2017, 2021 June 2022
5	<p>A printer ink cartridge has a life of X hours under normal usage. The variable X is modelled by the probability density function $F(x) = \begin{cases} kx^2, & x \geq 400 \\ 0, & \text{otherwise} \end{cases}$ (a) Find k (b) Find the probability that such a cartridge has a life of at least 600 hours of normal usage. (c) Find the probability that two cartridges will have to be replaced before each has been used for 600 hours.</p>	7	KTU- JULY 2017
6	<p>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.</p>	7	KTU- MARCH

	Find the probability that he waits (i) less than 5 minutes, (ii) at least 12 minutes		2017, JUNE 2022
7	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 50,000 km (ii) at most 60,000 km	7	KTU – May 2019
8	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?	3	KTU-May 2017
9	The probability density function of a random variable is given by $f(x) = \begin{cases} kx^2, & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$ Find a) k b) Mean c) $p(14 < X < 34)$ d) $p(X > 23)$	7	KTU- July 2017
10	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 that 100 of these electric bulbs will provide a total of more than 6000 hours of burning time.	7	KTU June 2022
11	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. (i) What is the probability that the total sales from both the outlets combined is more than Rs.100000. (ii) 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
12	(1) The joint probability density of a two-dimensional random variable is $f(x,y) = \begin{cases} \frac{xy}{96}, & 0 < x < 4, 1 < y < 5 \\ 0, & \text{Otherwise} \end{cases}$ Find $P(1 < X < 2, 2 < Y < 3)$. (2) If X is a random variable with PDF $f(x) = \begin{cases} \frac{x^2}{3}, & -1 < x < 2 \\ 0, & \text{Otherwise} \end{cases}$ Find (i) Mean of X (ii) Variance of X (iii) Cdf of X. (3) The joint probability density function of a two-dimensional random variable (X, Y) is given by $f(x,y) = xy^2 + \frac{x^2}{8}, 0 \leq x \leq 2, 0 \leq y \leq 1$ Compute (i) $P(X > 1)$ (ii) $P(Y < 1/2)$ (iii) $P(X < Y)$	3+7+7	KTU- AUG2021 JUNE 2022 June 2023
13	(1) For a normally distributed population, 31% of the items have their values less than 45 and 8% are above 64. Find the mean and standard deviation of the distribution. (2) If X follows a normal distribution with mean 65 and SD 9, Find (a) $P(X < 54)$ (b) $P(X \geq 80)$ (c) $P(70 < X < 86)$	7+7	KTU- JUNE 2022 June 2023

Module 3

1	A Sample of 20 items has mean 42 and SD 5. Test whether the sample is from a population with mean 45 (5% level of significance)	7	KTU JULY 2021												
2	The mean life time of certain products is 1800 hours with SD of 100 hrs. By applying a new technique, it is claimed that the mean life has increased. To test the claim a sample of 50 products were taken and it is found that the mean life time is 1850 hrs. Can we support the claim at 1% level of significance?	7	KTU JULY 2021												
3	In a university 325 out of 600 students are boys. Does this information support the conclusion that majority of students in this university are boys? (Use 5% level of significance)	7	KTU JULY 2021												
4	<p>Random samples drawn from two countries gave the following data relating to height of adult males.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;"></th> <th style="width: 20%;">Country A</th> <th style="width: 20%;">Country B</th> </tr> </thead> <tbody> <tr> <td>Mean Height</td> <td style="text-align: center;">67.42</td> <td style="text-align: center;">67.25</td> </tr> <tr> <td>Standard Deviation</td> <td style="text-align: center;">2.58</td> <td style="text-align: center;">2.5</td> </tr> <tr> <td>Number in Samples</td> <td style="text-align: center;">1000</td> <td style="text-align: center;">1200</td> </tr> </tbody> </table> <p>Is the difference between the means significant? (5% level of Significance)</p>		Country A	Country B	Mean Height	67.42	67.25	Standard Deviation	2.58	2.5	Number in Samples	1000	1200	7	KTU JULY 2021
	Country A	Country B													
Mean Height	67.42	67.25													
Standard Deviation	2.58	2.5													
Number in Samples	1000	1200													
5	The proportion of a characteristic of a population is $p = 0.37$. Find the mean and variance of the sample proportion obtained from a sample of size 100	3	KTU JULY 2021												
6	A Sample of size 49 is taken with mean 35 and standard deviation 11 from a population. Find the 99% confidence interval for the population mean.	3	KTU JULY 2021												
7	The mean blood pressure of 100 randomly selected person from a target population is 127.3 units. Find a 95% confidence interval for the mean blood pressure of the population.	7	KTU- AUG 2021 June 2023												
8	<p>(1) The CEO of a large electric utility claims that 80 percent of his 1,000,000 customers are very satisfied with the services they receive. To test this claim, the local newspaper surveyed 100 customers, using simple random sampling. Among the sampled customers, 73 percent say they are very satisfied. Based on these findings, do you think that the CEO is making a false claim of high satisfaction level among his customers? Use a 0.05 level of significance.</p> <p>(2) 23% of people used a particular brand of tea. After providing a special offer 312 out of 1200 randomly selected people found to be consumers of the brand. State the null hypothesis and alternative hypothesis to test whether the data provide sufficient evidence to conclude that there is an increase in the proportion of people using the brand after providing the offer.</p>	7+7	KTU May 2019 June 2022 June 2023												
9	<p>Two types of cars are compared for acceleration rate 40 test runs are recorded for each car and the result for the mean elapsed time recorded below:</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 40%;">Simple Mean</th> <th style="width: 50%;">Sample standard Deviation</th> </tr> </thead> <tbody> <tr> <td style="height: 20px;"></td> <td></td> <td></td> </tr> </tbody> </table>		Simple Mean	Sample standard Deviation				7	KTU May 2019 JULY 2021						
	Simple Mean	Sample standard Deviation													

	Car A	7.4	1.5			June 2023				
	Car B	7.1	1.8							
	Determine if there is a difference in the mean elapsed times of the two cars at 95% confidence level.									
10	The 95% confidence interval for the mean mass (in grams) of tablets produced by a machine is [0.56, 0.57], as calculated from a random sample of 50 tablets. What do you understand from this statement				3	KTU JULY 2021				
11	A company manufacturing tyres claims that its deluxe tyre averages at least 50000 miles before it needs to be replaced. From the past studies of this tyre, the standard deviation is known to be 8000. A survey of owners of the tyre design is conducted. From the 38 tyres surveyed, the mean lifespan was 46500 miles. Using the level of significance 1% test the claim of the company.				7	KTU- JUNE 2022				
12	The manufacturer of a certain type of metal wire claims that the mean breaking strength of the wire is more than 575 kg. A sample of 6 metal tires gives the mean of 573 with a variance of 14. Test whether the manufacturer's claim can be accepted at 5% level of significance.				7	KTU- JUNE 2022				
13	A shopkeeper claims that at most 60% of customers entering the shop leaves without making a purchase. Out of a random sample of 50 customers, 35 found to left without making a purchase. Does this data support the claim of the shopkeeper at 5% level of significance?				7	KTU- JUNE 2022				
14	From the given data test at 5% level of significance whether there is any significance difference between means of A and B.				7	KTU- JUNE 2022				
	Sample	Sample size	Mean	SD						
	A	645	7.90	0.47						
	B	450	7.88	0.42						
Module 4										
1	(1) Using Newton-Raphson method, compute a real root of $e^{2x} - x - 6 = 0$ lying between 0 and 1. (2) Using Newton Raphson method to solve the equation $x^3 + x - 1 = 0$ correct to 4 decimal places. (3) Use Newton-Raphson method to find a non-zero solution of $x = 2 \sin x$. Start with $x_0 = 1$				7+3+7	KTU April 2019 June 2022 June 2023				
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 $f(2) = -6$				3	KTU April 2019 June 2021 Aug 2021				
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	KTU- April 2019 Aug 2021				
	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				7	KTU May 2017				

	from the records of the survey		June 2023 June 2022																					
	<table border="1"> <tr> <td>Year</td> <td>1961</td> <td>1971</td> <td>1981</td> <td>1991</td> <td>2001</td> <td>2011</td> </tr> <tr> <td>No. of people</td> <td>16</td> <td>19</td> <td>23</td> <td>28</td> <td>34</td> <td>41</td> </tr> </table>	Year	1961	1971	1981	1991	2001	2011	No. of people	16	19	23	28	34	41									
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	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 June 2022,2021																					
6	Using Newton's forward interpolation formula estimate $\sin 52^\circ$ given	7	KTU- MAY 2017																					
	<table border="1"> <tr> <td>θ</td> <td>45</td> <td>50</td> <td>55</td> <td>60</td> <td>65</td> </tr> <tr> <td>$\sin \theta$</td> <td>0.7071</td> <td>0.7660</td> <td>0.8192</td> <td>0.8660</td> <td>0.9036</td> </tr> </table>	θ	45	50	55	60	65	$\sin \theta$	0.7071	0.7660	0.8192	0.8660	0.9036											
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$\sin \theta$	0.7071	0.7660	0.8192	0.8660	0.9036																			
7	Evaluate $\int e^{-\frac{x^2}{2}} dx$ using Simpson's one-third rule, dividing the interval [0, 1] into 8 subintervals	7	Model qp																					
8	Using Lagrange's interpolating polynomial estimate $f(1.5)$ for the following data	7	KTU May 2017 June 2022, 2021																					
	<table border="1"> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>$y = f(x)$</td> <td>0</td> <td>0.9826</td> <td>0.6299</td> <td>0.5532</td> </tr> </table>	x	0	1	2	3	$y = f(x)$	0	0.9826	0.6299	0.5532													
x	0	1	2	3																				
$y = f(x)$	0	0.9826	0.6299	0.5532																				
9	Using regula-falsi method to compute the real root of the equation $e^{2x} - x - 6 = 0$ correct to 4 decimal places.	7	KTU - JUNE 2022																					
10	Calculate $y(0.015)$ using Newton's forward interpolation formula.	7	KTU - JUNE 2022																					
	<table border="1"> <tr> <td>x</td> <td>0.01</td> <td>0.02</td> <td>0.03</td> <td>0.04</td> <td>0.05</td> </tr> <tr> <td>y</td> <td>1.2</td> <td>2.5</td> <td>3.6</td> <td>4.6</td> <td>5.3</td> </tr> </table>	x	0.01	0.02	0.03	0.04	0.05	y	1.2	2.5	3.6	4.6	5.3											
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y	1.2	2.5	3.6	4.6	5.3																			
11	Evaluate $\int_1^2 \frac{dx}{x}$ using Simpson's $\frac{1}{3}$ rule. (Take $h = 0.25$)	7	KTU - JUNE 2022																					
12	The following table gives the values of $\cos \theta$ where θ is in degrees. Using Newton's backward interpolation formula estimate the value of $\cos 53^\circ$.	7	KTU - JUNE 2022																					
	<table border="1"> <tr> <td>θ</td> <td>10</td> <td>20</td> <td>30</td> <td>40</td> <td>50</td> <td>60</td> </tr> <tr> <td>$\cos \theta$</td> <td>0.984</td> <td>0.9</td> <td>0.866</td> <td>0.766</td> <td>0.642</td> <td>0.5</td> </tr> <tr> <td></td> <td>8</td> <td>397</td> <td>0</td> <td>0</td> <td>8</td> <td>000</td> </tr> </table>	θ	10	20	30	40	50	60	$\cos \theta$	0.984	0.9	0.866	0.766	0.642	0.5		8	397	0	0	8	000		
θ	10	20	30	40	50	60																		
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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 $h = 0.1$	7	KTU- MAY 2017																					
2	Use Euler Method with $h = 0.1$ to find y at $x = 0.3$ for the equation $\frac{dy}{dx} = \frac{y}{1+x}$, $y(0) = 2$	7	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	KTU- APRIL 2019																					

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 problem $y' = y + x$, $y(0) = 0$, find $y(0.1)$ and $y(0.2)$ using Euler method	3	KTU- June 2022 June 2023												
6	<p>The table below gives the estimated population of a country (in millions) for during 1980-1995</p> <table border="1"> <thead> <tr> <th>year</th> <th>1980</th> <th>1985</th> <th>1990</th> <th>1995</th> </tr> </thead> <tbody> <tr> <td>population</td> <td>227</td> <td>237</td> <td>249</td> <td>262</td> </tr> </tbody> </table> <p>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.</p>	year	1980	1985	1990	1995	population	227	237	249	262	7	KTU- June 2022 June 2023		
year	1980	1985	1990	1995											
population	227	237	249	262											
7	Use Runge-Kutta method of fourth order to find $y(0.2)$ given the initial value problem. $\frac{dy}{dx} = xy + x^2$, $y(0) = 1$. Take step-size, $h = 0.1$.	7	KTU- June 2022 June 2023												
8	Solve the initial value problem $\frac{dy}{dx} = x + y$, $y(0) = 0$, $0 \leq x < 1$, taking step-size $h = 0.2$. Calculate $y(0.2)$, $y(0.4)$ and $y(0.6)$ using Runge-Kutta second order method, and $y(0.8)$ and $y(1.0)$ using Adam-Moulton predictor- corrector method.	7	KTU- June 2022 June 2023												
9	Use Runge-kutta method to find $y(0.2)$ for the equation $\frac{dy}{dx} = y - xy + x$, $y(0) = 1$ take $h = 0.2$	7	KTU- AUG 2021 June 2022												
10	<p>(1) Using Gauss-Seidal iteration method, find an approximate solution to the following system of equations correct to 4 decimal places.</p> $8x - 3y + 2z = 20, 4x + 11y - z = 33, 6x + 3y + 12z = 36$ <p>(2) Using Gauss-Seidel method, solve the following system of equations</p> $20x + y - 2z = 17, 3x + 20y - z = -18, 2x - 3y + 20z = 25$	14+14	KTU- June 2022 June 2023												
11	Use Runge-Kutta method of order 4 to find $y(0.7)$ if $\frac{dy}{dx} = y - x^2$ given $y(0.6) = 1.737$. (Choose $h = 0.1$)	7	KTU- JUNE 2022												
12	<p>Fit a second degree parabola of the form $y = a + bx + cx^2$ to the following data.</p> <table border="1"> <thead> <tr> <th>x</th> <th>0</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>y</td> <td>1.2</td> <td>1.7</td> <td>2.1</td> <td>2.8</td> <td>5.9</td> </tr> </tbody> </table>	x	0	1	2	3	4	y	1.2	1.7	2.1	2.8	5.9	7	KTU- JUNE 2022
x	0	1	2	3	4										
y	1.2	1.7	2.1	2.8	5.9										
13	Solve $\frac{dy}{dx} = x^2(1 + y)$ for $x = 1.4$ using Adams-Moulton Method, given $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$ and $y(1.3) = 1.979$.	7	KTU- JUNE 2022												
14	<p>(1) Write the normal equations for fitting the curve $y = a + bx^2$</p> <p>(2) Explain the principle of least squares for determining a line of best fit to a given data</p>	3+3	KTU- Aug 2021 June 2022												
15	Use Euler's method with $h = 0.2$, to find $y(0.2)$ if $\frac{dy}{dx} = y + e^x \cos x$, $y(0) = 0$	3	KTU- JUNE 2022												

Question Bank Thermodynamics (MET 202)

MET 202	ENGINEERING THERMODYNAMICS	Credit: 4	
SI NO	Module 1	Mark	Year
1.	State the three conditions to be satisfied for a system to be in thermodynamic equilibrium.	3	2023 June
2.	Give the definition and a brief description of the term thermodynamic property of a system. Give the classification of property with exactly one example for each	3	2023 June
3.	Differentiate between macroscopic and microscopic analyses in thermodynamics. How does the concept of continuum relate to the above?	3	2023 June
4.	what is a thermocouple? How does it work? State the thermometric property used in thermocouples.	3	2023 June
5.	Distinguish between thermodynamic system and control volume	3	2022 June
6.	Describe quasi static process undergone by a system with the help of neat sketches including the pv diagram.	3	2022 June
7.	Distinguish between reversible and irreversible processes with the help sketches.	3	2022 June
8.	What do you mean by macroscopic and microscopic approaches in thermodynamics?	3	July 2021
9.	What do you mean by ideal gas temperature scale	3	July 2021
10.	Differentiate between thermodynamic system and control volume with the help of at least one example for each. What is meant by thermodynamic equilibrium of a system? Give a brief description on the conditions to be satisfied for a system to be in thermodynamic equilibrium.	8	2023 June
11.	With the help of an example, describe the concept of a quasi-static process Illustrate isobaric, isothermal, and adiabatic processes on p-v plot within the same diagram.	6	2023 June
12.	State Zeroth law of thermodynamics. What is its significance? Describe Celsius scale and its corresponding absolute scale. Which is the fixed point used in the measurement of temperature in Celsius scale? Show the mathematical relation connecting the absolute temperature and the thermometric property, in terms of the fixed point.	8	2023 June
13.	The temperature 't' on a thermometric scale is defined in terms of property K by the relation $t = a \ln K + b$, where a and b are constants. The values of K are found to be 1.52 and 8.79 at the ice point and steam point, the temperatures of which are assigned the numbers 00C and 100C respectively. Determine the value of K at 25°C and 50°C?	6	2023 June
14.	What are meant by a thermometric property and a thermometric substance? Enlist any four types of thermometers with the thermometric substance and thermometric property used in them	6	2023 June
15.	Explain the working of constant volume gas thermometer. Explain how a constant volume gas thermometer can be used to measure the correct value of steam point.	8	2023 June
16.	Explain the concept of continuum in thermodynamics. How will you define density as a macroscopic property using this concept.	6	2023 June
17.	A temperature scale of certain thermometer is given by the relation $t = a \ln p + b$ where a and b are constants and p is the thermometric property of the fluid in the	8	2023 June

	thermometer. If at the ice point and steam point, the thermometric properties are found to be 1.5 and 7.5 respectively, what will be the temperature corresponding to the thermometric property of 3.5 on Celsius scale?		
18.	Define the following terms associated with a thermodynamic system: i. properties. ii. State iii. path iv. Process v. Cycle vi. Intensive property (give at least one example) vii. Extensive property (give at least one example)	7	2022 June
19.	What was the temperature measurement method used before 1954? Derive the equation used for temperature measurement in this method.	7	2022 June
20.	i) What do you mean by thermodynamic equilibrium of a-system? What are the conditions required for a system to exist in thermodynamic equilibrium? Explain. ii) Consider a system whose temperature is 18°C. Express this temperature in R, K, and F.	7	2022 June
21.	i) The temperature t on a thermometric scale is defined in terms of a property K by the relation $t = a \ln K + b$, where a and b are constants. The values of K are found to be 1.83 and 6.78 at the ice point and the steam point, the temperatures of which are assigned the numbers 0 and 100 respectively. Determine the temperature corresponding to a reading of K equal to 2.42 on the thermometer.	7	2022 June
22.	What is the working principle of a constant volume gas thermometer? Explain with neat sketches.	7	2022 June
23.	Explain quasi static process with suitable sketches.	7	2021 July
24.	Describe about (i) system and control volume (ii) properties, state, path and process with respect to thermodynamics.	7	2021 July
25.	Explain different types of temperature scales.	7	2021 July
26.	A new absolute temperature scale is proposed. On this scale the ice point of water is 150°S and the steam point is 300°S. Determine the temperature in °C that corresponds to 100°S and 400°S respectively. What is the ratio of the size of the °S to the Kelvin? At what temperature both the Celsius and the new temperature scale reading would be the same?	7	2021 July

Module 2			
1.	What is a steady flow process	3	2023 June
2.	Describe the limitations of first law of thermodynamics, with the help of an example case.	3	20123 June
3.	Why does free expansion have zero work transfer?	3	2023 June
4.	How does flow work differ from displacement work?	3	2023 June
5.	A gas enclosed in a cylinder piston assembly expands from 2 m ³ to 4 m ³ . The pressure volume correlation is given by $p = V^2 + \frac{6}{V}$ where p is in bar. Determine the work done by the system, considering the process as non-flow and reversible.	3	2023 June
6.	Describe the limitations of first law of thermodynamics, with the help of suitable example.	3	2023 June
7.	Derive the equation for pdv work in a polytropic expansion process	3	2022 June

8.	State and explain the first law of thermodynamics for a closed system undergoing a cyclic process with the help of neat sketches	3	2022 June
9.	Explain positive and negative heat and work interactions.	3	July 2021
10.	Which property of system increases when heat is transferred: (a) at constant volume, (b) at constant pressure? Give the expressions for these properties in terms of specific heats.	3	July 2021
11.	State first law of thermodynamics for a cycle, and for a closed system undergoing a change of state. Explain the terms in the above relationships' What is a PMMI? Is a PMMI Possible?	7	2023 June
12.	A stationary mass of gas is compressed without friction from an initial state of 0.3 m ³ and 0.105 MPa to a final state of 0.15 m ³ and 0.105 MPa, the pressure remaining constant during the process. There is a transfer of heat 37.6kJ from the gas during the process. How much does the internal energy of the gas change?	7	2023 June
13.	Derive Steady flow energy equation (for one inlet and one outlet stream each), and from it deduce an expression for the work done by a steam turbine, with proper simplifications.	7	2023 June
14.	Air at 110 K and 101 .32kPa is passing through a converging nozzle and leaves at 300 K. Determine the velocity of air at nozzle outlet. The nozzle is laid horizontal. The inlet velocity of air is 10 m/s. Write the assumptions made.	7	2023 June
15.	A three-process cycle operating with nitrogen as the working fluid has constant temperature compression at 300°C with initial pressure 100 kPa. Then the gas undergoes a constant volume heating and then polytropic expansion with 1.35 as index of expansion. The isothermal compression requires -67 kl/kg of work. Determine 1. Pressure, volume, and temperature around the cycle 2. Heat in and out 3. Net work For Nitrogen gas $c_v = 0.7431\text{kf/kgK}$	10	2023 June
16.	Explain the first law of thermodynamics as referred to closed systems undergoing a cyclic change.	4	2023 June
17.	A compressor receives carbon dioxide gas at 140 kPa with a specific volume of 0.37 m ³ /kg and compresses it to a temperature of 325 K. The work per unit mass for compression is 80 kf/kg. The gas enters through a 15 cm diameter line with a velocity of 10m/s and leaves with a velocity of 25 m/s. Determine the heat transfer in kW. Take c, of CO2 as 0.88b kJ/kgK.	10	2023 June
18.	Derive an expression for work done in an adiabatic process.	4	2023 June
19.	Give an account of various forms of energy that may be stored in a system. Write the first-law equation for a system undergoing change of state accounting all forms of above energies.	7	2022 June
20.	Assume that a battery is connected to an external electrical load in a closed circuit for a period of time so that the battery is discharged as a result of the electric current flow. Apply first law of thermodynamics for this case, assuming no dissipation of energy into heat.	7	2022 June
21.	A turbine operates under steady flow conditions, receiving steam at the following state: Pressure 1.2 MPa, temperature 188°C, enthalpy 2785 Kj/kg, velocity 33.3 m/s and elevation 3 m. The steam leaves the turbine at the following state: Pressure ZO W1 enthalpy 2512kJ/kg, velocity 100 m/s and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29 kJ/s. If the rate of steam flow through the turbine is 0.42kg/s, what is the power output of the turbine in kW?	7	2022 June
22.	Derive the general energy equation for a variable flow process using control volume technique. What happens to this equation for a steady flow?	7	2022 June
23.	1.5kgof liquid having a constant specific heat of 2.5 kJ/kg is stirred in a well-insulated chamber causing the temperature rise by 15°C. Find AEand W for the process. If the same liquid is stirred in a conducting chamber, the temperature of	7	2022 June

	the liquid is increased to 15°C, and the heat transfer from the liquid to the surroundings was 1.7 kJ. Find AE and W for the process		
24.	The properties of a certain fluid are related as follows: $u = 196 + 0.718 t$ $pv = 0.287 (t + 273)$ where u is the specific internal energy (kJ/kg), t is in °C, p is pressure (kN/m ²) and v is the specific volume (v/kg).	7	2022 June
25.	Explain first law of thermodynamics for a closed system undergoing change of state. Show that energy is a property of the system	7	2021 July
26.	A fluid is confined in a cylinder by spring-loaded, frictionless piston so that the pressure in the fluid is a linear function of the volume ($p = a + bV$). The internal energy of the fluid is given by the equation ($U = 34 + 3.15 pV$), where U in kJ, p in kPa, and V in cubic metre. If the fluid changes from an initial state of 170 kPa, 0.03 m ³ to a final state of 400 kPa, 0.06 m ³ , with no work other than that done on the piston. Find the direction and magnitude of the work and heat transfer.	7	2021 July
27.	Discuss the application of steady flow process in following engineering systems: (i) Nozzle and Diffuser (ii) Throttling device (iii) Turbine and Compressor	7	2021 July
28.	Air at a temperature of 15°C passes through a heat exchanger at a velocity of 30 m/s where its temperature is raised to 800°C. It then enters a turbine with the same velocity of 30 m/s and expands until the temperature falls to 650°C. On leaving the turbine, the air is taken at a velocity of 60 m/s to a nozzle where it expands until the temperature has fallen to 500°C. If the air flow rate is 2kg/s, calculate: (a) The rate of heat transfer to the air in the heat exchanger, (b) The power output from the turbine assuming no heat loss, and (c) The velocity at exit from the nozzle, assuming no heat loss. Take the enthalpy of air as $h=c_p t$; where c_p is the specific heat equal to 1.005 kJ/kg K and t is the temperature.	7	2021 July

Module 3			
1.	A cyclic heat engine operates between a source temperature of 700°C and a sink temperature of 28°C. What is the least rate of heat rejection per KW net output of the engine?	3	2013 June
2.	An inventor claims that he invented a cyclic heat engine that can produce work continuously by receiving heat from a higher temperature reservoir, and without leaving any heat to the lower temperature reservoir. Is his claim correct or not? Justify your answer.	3	2013 June
3.	Define a PMM2. Why is it impossible?	3	2022 June
4.	What are the causes of irreversibility of a process?	3	July 2021
5.	Give the Kelvin-Planck and Clausius' statements of second law of thermodynamics.	3	July 2021
6.	With the help of schematic diagrams describe cyclic heat engine, cyclic heat pump and cyclic refrigerator. How they differ purpose wise? Define the performance parameters of the above three machines.	7	2023 June
7.	Two reversible heat engines operate in series between two end temperatures 600K and 300K via an intermediate thermal reservoir. Both the engines develop the same power. Determine the temperature of the intermediate thermal reservoir.	7	2023 June
8.	Give the statement of third law of thermodynamics and explain it. Will a reversible and adiabatic process surely be isentropic? Justify your answer.	7	2023 June

	Comment on the reverse statement; that is, Will an isentropic process surely be reversible and adiabatic? Justify your answer.		
9.	A heat engine is embedded between two temperature reservoirs 500 K and 300 K. In three different cycles which it rejects 210 kW, 180 kW and 150 kW, while receiving heat at the rate of 300 kW in each case. Justify in which case the engine runs reversibility and irreversibility. Also look for the impossible.	7	2023 June
10.	Two reversible heat engines operating in series are giving equal amount of work. The total work is 50 kJ. If the reservoirs are 1000 K and 250 K, find the intermediate temperature and the efficiency of each engine. Also, find the heat extracted from the source.	10	2023 June
11.	Determine the temperature ratio T_2/T_1 (T_1 = source temperature and T_2 = sink temperature) for a Carnot refrigerator whose COP is 5. If the cycle is used as heat pump, find the COP for heating cycle.	4	2023 June
12.	Define the term 'Entropy'. Derive an expression for change of entropy for an isothermal process.	7	2023 June
13.	5 kg of air at 550 K and 4 bar is enclosed in a closed vessel. Determine the availability of the system if the surrounding pressure and temperature are 1 bar and 290K respectively.	7	2023 June
14.	With the help of neat sketches, prove that Kelvin Planck and Clausius statements of second law are equivalent. (Both the proofs are required)	7	2022 June
15.	Prove the inequality of Clausius for defining the reversibility condition for a cycle. Write also the criterion for reversible cycle, irreversible cycle and impossible cycle	7	2022 June
16.	A fluid undergoes a reversible adiabatic compression from 0.5MPa, 0.2m ³ to 0.05 m ³ according to the-law, $pv^{1.3}$ =constant. Determine the change in enthalpy, internal energy, entropy, heat transfer and the work transfer during the process	7	2022 June
17.	With neat sketches, explain the concept of construction of absolute thermodynamic temperature scale between the ice point and the steam point.	7	2022 June
18.	Derive Clausius inequality and explain the criteria with respect to a cyclic process.	7	2021July
19.	A heat pump working on the Carnot cycle takes in heat from a reservoir at 10°C and delivers heat to a reservoir at 80°C. The heat pump is driven by a reversible heat engine which takes in heat from a reservoir at 1000°C and rejects heat to a reservoir at 80°C. The reversible heat engine also drives a machine that absorbs 50 kW. If the heat pump extracts 10 kJ/s from the 10°C reservoir, determine (a) The rate of heat supply from the 1000°C source, and (b) The rate of heat rejection to the 80°C sink.	7	2021July
20.	Explain the mixing of two fluids with respect to entropy principle.	7	2021July
21.	Calculate decrease in available energy when 25 kg of water at 95°C mix with 35kg of water at 35°C, the pressure being taken as constant and the temperature of the surroundings being 15°C (cp of water = 4.2 kJ/kg K)	7	2021July

Module 4			
1.	What is the difference between critical point and triple point?	3	2023 June
2.	Give a description on the law of corresponding states.	3	2023 June
3.	Write the ideal gas equation for n moles of a gas. Explain each term used in the equation with proper units in SI. How the characteristic gas equation can be obtained from this equation	3	2023 June

4.	Define Joule-Thomson coefficient. Prove that Joule-Thomson coefficient is zero for an ideal gas.	3	2023 June
5.	what are compressed liquid, superheated v6frou., and quality of vapour	3	2023 June
6.	Write a short note on Mollier diagram.	3	2023 June
7.	what are steam tables and saturation states? what for they are used?	3	2022 June
8.	Draw the T-s plot of a pure substance, and show various constant property lines on it.	3	2022 June
9.	What is critical state? Explain the terms critical pressure, critical temperature and critical volume of water.	3	July 2021
10.	What is the fundamental property of gas with respect to the product pv? Differentiate Universal and characteristic gas constants.	3	July 2021
11.	What are reduced properties?	3	July 2021
12.	Explain the terms - critical state, critical pressure, critical temperature, and critical volume. Show the critical state point on any suitable phase change diagram. Differentiate between sensible heat and latent heat.	7	2023 June
13.	A steam at 2 MPa has a specific volume of 0.09 m ³ /kg. Determine the dryness fraction of the steam. Also calculate the specific enthalpy and specific entropy. Use steam table for the above calculation	7	2023 June
14.	Give descriptions on the following. Virial expansions, Law of corresponding states and generalized compressibility chart.	7	2023 June
15.	Determine the specific volume of nitrogen at 100 atm and 300 K. For nitrogen P=3390 kPa, T=126.2K	7	2023 June
16.	A rigid closed tank of volume 3 m ³ Contains 5 kg of wet steam at a pressure of 200 kPa. The tank is heated until the steam becomes dry saturated. Determine final pressure and heat transfer to the tank.	9	2023 June
17.	Consider the cases of vaporization of saturated liquid to a saturated vapour at pressure of 100 kPa and 500 kPa. Which case requires more energy? Explain with enthalpy - temperature Plots.	5	2023 June
18.	Explain the significance of Vander walls equation and its limitation	6	2023 June
19.	A 5 m ³ tank contains 1.0 kmol of an ideal gas at 400 kPa with a molar weight of 31 kg/kmol. i. Determine the gas temperature. ii. Gas is removed from the tank, temperature remaining constant, until the pressure decreases to 100 kPa. What mass of gas was removed?	8	2023 June
20.	Explain the p-v diagram of a pure substance other than water with the help of neat sketches. Write the critical pressure, critical temperature, and critical volume of water?	7	2022 June
21.	Steam initially at 0.3 MPa, 250°C is cooled at constant volume. Determine the following: (a) At what temperature will the steam become saturated vapor? (b) What is the quality at 80°C? (c) What is the heat transferred per kg of steam in cooling from 250°C to 80°C?	7	2022 June
22.	i) What are Virial equations of state? ii) Define compressibility factor. Also derive the relation between Virial expansion coefficients B' and B, C' and C, and D' and D for a real gas	7	2022 June
23.	Derive the equation of law of corresponding states from Vander Waals equation of state? What is the significance of this expression? Explain.	7	2022 June

24.	Explain with P-V diagram, the different stages for a substance whose volume decreases on melting.	7	2021July
25.	Steam at 0.8 MPa, 250°C and flowing at the rate of 1kg/s passes into a pipe carrying wet steam at 0.8 MPa, 0.95 dry. After adiabatic mixing the flow rate is 2.3 kg/s. Determine the condition of steam after mixing and degree of superheat.	7	2021July
26.	Explain Compressibility factor with respect to Virial expansions.	7	2021July
27.	What are reasons for the deviation of the real gas behaviour from the ideal gas behaviour? With reference to van der Waals correction, explain the deviation of equation of state of a real substance from ideal gas.	7	2021July

MODULE 5					
1.	State Dalton's law of partial pressure. How is the partial pressure of a component in a gaseous mixture related to the mole fraction of that component?	3	2023 June		
2.	Show, with the help of appropriate property relation, that the saturation pressure of a liquid increase with temperature, in a phase change process from liquid to vapour.	3	2023 June		
3.	Draw the isenthalpic curve and inversion curve in the T-p coordinates. Explain how these curves are obtained?	3	2022 June		
4.	Derive the clausius-crapeyron equation-from the first T-ds equation. what is the significance of this equation?	3	2022 June		
5.	Why there is no temperature change when ideal gas is throttled?	3	July 2021		
6.	State and prove Dalton'S law of partial pressures. Obtain the relationships for the characteristic gas constant and molecular weight of a gas mixture from their component characteristics.	7	2023 June		
7.	<p>A vessel divided into two chambers by a partition wall contains oxygen gas in either chamber</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> Chamber -I P= 1500 kPa T= 323 K Mass of oxygen = 0.5 mol </td> <td style="width: 50%; padding: 5px;"> Chamber -II P= 600kPa T= 292K Mass of oxygen =2.5 kg </td> </tr> </table> <p>Determine the final equilibrium pressure? Assume oxygen behaves ideally throughout the process?</p>	Chamber -I P= 1500 kPa T= 323 K Mass of oxygen = 0.5 mol	Chamber -II P= 600kPa T= 292K Mass of oxygen =2.5 kg	7	2023 June
Chamber -I P= 1500 kPa T= 323 K Mass of oxygen = 0.5 mol	Chamber -II P= 600kPa T= 292K Mass of oxygen =2.5 kg				
8.	What is a throttling process? Give a description on Joule Thomson coefficient with its significance. What would be the value of Joule Thompson coefficient for ideal gas and how would it adversely influence the refrigeration effect in a throttling process?	7	2023 June		
9.	Derive Maxwell relations, beginning from the appropriate combined first and second laws.	7	2023 June		
10.	Give the statement of Amagat's Law of partial volume for analysis of gas mixtures' Clearly define the terms used in the statements. Write the mathematical equation.	5	2023 June		
11.	The products of combustion from a diesel engine have the following molar analysis: CO ₂ = 10.2%, CO= 0.4 %, H ₂ O= 14.3%, O ₂ = 1.9 % and N ₂ =73.2% Determine the mass fraction of each component. What is the molar mass of the mixture?	9	2023 June		
12.	Derive energy equation in the form $du = c_v dT + \left\{ T \left(\frac{\partial p}{\partial T} \right)_v - p \right\} dv$	8	2023 June		
13.	A gas obeys $p(v-b) = RT$, where b is a positive constant. Find the expression for its Joule-Thomson coefficient. Can this gas be cooled effectively by throttling?	6	2023 June		
14.	i) State and derive Dalton's law of partial pressures and Amagat's law of partial volumes for an ideal gas mixture.	7	2022 June		

	ii) Derive the expression for partial pressure of component gas in terms of mole fraction										
15.	A vessel is divided into three compartments (a), (b), (c) by two partitions. Part (a) contains oxygen and has a volume of 0.1 m^3 , Part (b) has a volume of 0.2 m^3 and contains nitrogen, while part (c) is 0.05 m^3 and holds CO_2 . All three parts are at a pressure of 2 bar and a temperature of 13°C . When the partitions are removed and the gases mix, determine the change in entropy of each constituent, the final pressure in the vessel and the partial pressure of each gas. The vessel may be taken as being completely isolated from its surroundings.	7	2022 June								
16.	Two vessels, A and B, both containing nitrogen, are connected by a valve which is opened to allow the contents to mix and achieve an equilibrium temperature of 27°C . Before mixing, the details of gases in the two vessels are as given below: <table border="1"> <tr> <td>Vessel A</td> <td>Vessel B</td> </tr> <tr> <td>p = 1.5 MPa</td> <td>p = 0.6 MPa</td> </tr> <tr> <td>t = 50°C</td> <td>t = 20°C</td> </tr> <tr> <td>Contents = 0.5 kg mol</td> <td>Contents = 2.5 kg</td> </tr> </table> <p>Calculate the final equilibrium pressure and the amount of heat transferred to the surroundings.</p>	Vessel A	Vessel B	p = 1.5 MPa	p = 0.6 MPa	t = 50°C	t = 20°C	Contents = 0.5 kg mol	Contents = 2.5 kg	7	2022 June
Vessel A	Vessel B										
p = 1.5 MPa	p = 0.6 MPa										
t = 50°C	t = 20°C										
Contents = 0.5 kg mol	Contents = 2.5 kg										
17.	Derive the TdS equations for a pure substance undergoing an infinitesimal reversible process.	7	2022 June								
18.	State and explain Dalton's law of partial pressures and Amagat's laws of additive volumes.	7	2021 July								
19.	A mixture of ideal gases consists of 3kg of nitrogen and 5kg of carbon dioxide at a pressure of 300 kPa and a temperature of 20°C . Find, <ol style="list-style-type: none"> The mole fraction of each component. The equivalent molecular weight of the mixture. The equivalent gas constant of the mixture. The partial pressure and the partial volumes. 	7	2021 July								
20.	Explain Joule-Kelvin effect with respect to significance of inversion curve. Show that for an ideal gas, Joule-Kelvin coefficient is zero	7	2021 July								
21.	Derive Maxwell's equations	7	2021 July								

CODE MET206	COURSE NAME: FLUID MACHINERY	CREDIT:4	
Q.No	Module -1 PART A	Marks	Year
1	Obtain the expression for the force exerted by the jet of water on a fixed inclined plate in the direction of jet	3	2022 JUNE
2	Show that the angle of swing of a vertical hinged plate when a jet of water strike at its centre is given by $\sin \theta = \frac{\rho a V^2}{W}$	3	2021 JULY
3	Show that the force exerted by a jet of water on an inclined fixed plate in the direction of jet is given by $F_x = \rho A V^2 \sin^2 \theta$	3	2021 JULY
4	Sketch the velocity triangles for the inlet and outlet of the buckets of a Pelton turbine and label all the salient velocities and angles.	3	2021 JULY
5	Differentiate between inward flow and outward flow reaction turbines	3	2022 JUNE
6	In a Pelton wheel turbine, the runner of the turbine is provided with double hemispherical cup shaped buckets instead of single curved blade. why?	3	2019 MAY
7	Give the comparison between impulse and reaction turbines	3	2019 MAY
8	Define the following terms of Turbine: (i) Gross head (ii) Net head (iii) Hydraulic efficiency (iv) Mechanical efficiency	3	2019 MAY
PART B			
9(i)	A square plate weighing 15N and uniform thickness and 30cm edge is hung so that horizontal jet 2cm diameter and having velocity of 15 m/sec impinges on the plate. The centre line of jet is 15cm below the upper edge of the plate, and when the plate is vertical the jet strikes the plate normally and at its centre. Find the force must be applied at the lower edge of the plate in order to keep the plate.	7	2022 JUNE
ii)	Find an expression for the efficiency of a series of moving curved vanes when a jet of water strikes the vanes at one of its tips and show that the maximum efficiency is 50%.	7	
10	A Pelton wheel has a bucket speed of 35m/sec with a jet of water flowing at the rate of 1 m ³ /sec under a head of 270m. The bucket deflected the jet through an angle of 170°. Calculate the power delivered to the runner and the hydraulic efficiency of the runner. Assume coefficient of velocity as 0.98	7	2022 JUNE
ii)	Describe briefly the function of various main components of a Pelton turbine with neat sketches.	7	

11	An inward flow reaction turbine has external and internal diameters as 0.9m and 0.45 m respectively. The turbine is running at 200 r.p.m and the width of the turbine at the inlet is 0.2 m. The velocity of flow through the runner is constant and is equal to 1.8 m/s. The guide blades make an angle of 10° to the tangent of the wheel and discharge at the outlet of turbine is radial. Draw the inlet and outlet velocity triangles and determine: - (i) Relative velocity at inlet (ii) The runner blade angles (iii) Width of the runner at outlet (iv) Head at the inlet of the turbine (v) Power developed (vi) Hydraulic efficiency of the turbine.	14	2019 MAY
	Module -2 PART A		
1	Define the following terms of centrifugal pump (i) Suction head (ii) Delivery head (iii) Static head (iv) Manometric head.	3	2019 MAY
2	What is priming and explain the necessity of priming	3	2019 MAY
3	Write short note on 'multi stage centrifugal pumps	3	2021 JULY
4	With neat sketch explain the performance characteristic curves of a centrifugal pump.	3	2022 JUNE
5	What is meant by cavitation in centrifugal pump? What are the effects of cavitation? How it can be eliminated	3	2018 DEC
	PART B		
6	(a) Derive an expression for the minimum starting speed of a centrifugal pump	7	2022 JUNE
	(b) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1200 rpm works under total head of 32m. The velocity of flow through the impeller is constant and equal to 3m/sec. The vanes are set back at an angle of 30° at the outlet. If the outer diameter of the impeller is 600mm and width at outlet is 50mm, determine (i) vane angle at inlet (ii) work done per sec by the impeller (iii) manometric efficiency.	7	
7	A centrifugal pump discharges $0.15 \text{ m}^3/\text{s}$ of water against a head of 12.5 m, the speed of the impeller being 600 r.p.m. The outer and inner diameters of impeller are 500 mm and 250 mm respectively and the vanes are bent back at 35° to the tangent at exit. If the area of flow remains 0.07 m^2 from inlet to outlet, calculate: (a) Manometric efficiency of pump, (b) Vane angle at inlet, and (c) Loss of head at inlet to impeller when discharge is reduced by 40% without changing the speed.	14	2018 MAY

8	(i)The diameter of an impeller of a centrifugal pump at inlet and outlet are 30cm and 60cm respectively. Determine the minimum starting speed of the pump if it works against a head of 30cm.	8	2029 MAY
	(ii)With neat sketch explain the performance characteristic curves of a centrifugal pump.	6	
9	(i)A centrifugal pump is running at 1000 r.p.m and working against head of 20 m. The rate of flow through the pump is 0.2 m ³ /s. The outlet vane angle of impeller is 45° and velocity of flow at outlet is 2.5 m/s. If the Manometric efficiency of the pump is 80 percent, calculate the diameter and width of impeller at outlet.	7	2021 JULY
	(ii)A centrifugal pump with 40 cm impeller diameter delivers 75 L/s of oil of relative density 0.85 at a tip speed of 25.1 m/s. The flow velocity is constant at 2.0 m/s and the outlet blade is curved backwards at an angle of 35°. The overall efficiency is 0.88. (a) Calculate the brake power and torque applied to the pump shaft. (b) If the inlet diameter is 25 cm, calculate the inlet-blade angle.	7	
10	A centrifugal pump lifts 2.5m ³ /min of water to a height of 20m through a pipe line of 10cm diameter. The total length of the pipe line is 11 0m. Assuming an overall efficiency of 75% and an inlet loss of 0.3m, find the power required to drive the pump. Take coefficient of friction f = 0.012	8	2018 DEC
	(ii)What is meant by Manometric head of a centrifugal pump? What are the different ways of finding it?	7	
	Module -3 PART A		
1	Define slip, percentage slip and negative slip of a reciprocating pump	3	2018 MAY
2	What do you mean by NPSH?	3	2019 DEC
3	Reciprocating pumps are called positive displacement pump why?	3	2022 JULY
4	what is a hydraulic intensifier? Explain its principle and working	3	2022 JUNE
5	What is an air vessel? Describe the function of the air vessel for reciprocating pumps	3	2021 JULY
6	Explain the term negative slip of a reciprocating pump. why and when negative slip occurs?	3	2021 JULY
	PART B		
7	(i)Draw an indicator diagram, considering the effect of acceleration and friction in suction and delivery pipes. Find the	7	2022 JUNE

	expression for work done per second in the case of single acting reciprocating pump.		
	(ii) A double acting reciprocating pump, having cylinder diameter 15 cm and stroke length 30 cm is used to raise the water through a height of 30 meters. If the pump is working at 30 rpm and the pump efficiency is 73%, what power is required to drive the pump?	7	
8	a) Explain with neat sketch, the principle and working of the following hydraulic devices i) hydraulic ram, ii) Accumulator iii) intensifier b) Explain with neat sketch, the working of jet pump, vane pump and lobe pump	7 7	2022 JUNE
9	(i) A single-acting reciprocating pump has a stroke length of 15 cm. The suction pipe is 7 m long. The water level in the sump is 2.5 m below the cylinder. The diameters of the suction pipe and the plunger are 7.5 cm and 10.0 cm. If the speed of the pump is 75 rpm, determine the pressure head on the piston at the (a) beginning, (b) middle, and (c) end of the suction stroke. Take Darcy-Weisbach friction factor $f = 0.02$.	8	2021 JULY
	(ii) With a neat sketch, explain the working of any one rotary displacement pump? Give two applications of this pump	6	
10	(a) (i) Define ideal indicator diagram. ii) Show that area of indicator diagram is proportional to the work done by the reciprocating pump	7	2019 MAY
	(b) A single acting reciprocating pump, running at 50 r.p.m delivers $0.01 \text{ m}^3/\text{s}$ of water. The diameter of the piston is 200 mm and stroke length 400 mm. determine: i) The theoretical discharge of the pump. ii) Co-efficient of discharge iii) Slip and percentage slip of the pump.	7	
	Module -4 PART A		
1	Compare reciprocating and rotary air compressors	3	2022 JUNE
2	Explain the advantages of multistage compression of air.	3	2021 JULY
3	Derive an expression for indicated work of a reciprocating air compressor by neglecting clearance volume	3	2019 MAY
4	Explain the construction and working of an axial flow air compressor	3	2018 DEC
5	Explain surging and choking in centrifugal compressors	3	2022 JUNE
6	Derive the relation between suction pressure, intermediate pressure and delivery of a reciprocating compressor	3	2018 DEC
7	Define the following with reference to reciprocating compressors	3	2022 JUNE

	i) Isothermal efficiency ii) Adiabatic efficiency iii) Volumetric efficiency		
	PART B		
8	a) A single stage single acting compressor has a delivers 0.6kg of air per minute at 6 bar. The temperature and pressure at the end of suction stroke are 30 ⁰ C and 1 bar. The bore and stroke length of the compressor are 100mm and 150mm respectively. The clearance is 3% of the stroke volume. Assume n =1.3. Find (i)volumetric efficiency of the compressor ii) power required to drive the compressor if mechanical efficiency 85% and speed of the compressor	7	2022 JUNE
	b) Derive the expression of degree of reaction of an axial flow air compressor in terms of blade angles and blade velocity.	7	
9	(a)An axial flow compressor having eight stages and with 50% reaction design compresses air in the pressure ratio of 4:1. The air enters the compressor at 20 ⁰ C and flows through it with a constant speed of 90m/s. The rotating blades of compressor rotates with a mean speed of 180m/s, isentropic efficiency of the compressor may be taken as 82%. Calculate work done by the machine and Blade angles	7	2022 JUNE
	(b)Explain the working of (i) vane compressor and (ii) screw compressor	7	
10	(a)Derive an expression for the work done in a reciprocating compressor with and without clearance volume	7	
	(b)A single-stage, single-acting, reciprocating air compressor takes in 1 m ³ air per minute at 1 bar and 17 ⁰ C and delivers it at 7 bar. The compressor runs at 300 rpm and follows the law $pV^n = \text{constant}$. Calculate the cylinder bore and stroke required, assuming stroke-to-bore ratio of 1.5. Calculate the power of the motor required to drive the compressor, if the mechanical efficiency of the compressor is 85% and that of motor transmissions is 90 %. Neglect clearance volume and take R= 0.287 kJ/kg'K for air.	7	2021 JULY
	Module -5 PART A		
1	State the assumptions made in an ideal cycle analysis of gas turbines.	3	2022 JUNE
2	Describe with neat schematic and T-s diagrams, the working of a simple constant pressure combustion gas turbine cycle.	3	2022 JUNE
3	Briefly explain the various fuels used in Gas turbine and list the application of Gas Turbines	3	2021 JULY

4	Explain the different methods employed to increase the specific output and thermal efficiency of open cycle Gas Turbine Plant.	3	2021 JULY
5	Derive the expression for maximum specific work output of a gas turbine considering machine efficiencies.	3	2019 MAY
6	Write a short note on different type of combustion chambers used in a gas turbine engine.	3	2019 MAY
7	Differentiate between closed and semi closed gas turbine cycle	3	2018
8	Find the required air fuel ratio in a gas turbine whose turbine and compressor efficiencies are 85% and 80% respectively. Maximum cycle temperature is 875°C. The working fluid can be taken as air ($C_p = 1\text{kJ/kgK}$, $\gamma=1.4$) which enters the compressor at 1 bar and 27°C. The pressure ratio is 4. The fuel used has calorific value of 42000kJ/kg. There is a loss of 10% of calorific value in the combustion chamber.	7	2022 JUNE
9	The gas turbine unit has a pressure ratio of 6: 1 and maximum cycle temperature of 610 °C. The isentropic efficiencies of compressor and turbine are 80% and 82% respectively. Calculate the power output in kilowatts of an electric generator geared to the turbine when the air enters the compressor at 15°C at the rate of 16kg/s. Assume $C_p: 1.005\text{kJ/kgK}$ and $\gamma:1.4$ for the compression process, and take $C_p= 1.11 \text{ kJ/kgK}$ and $\gamma = 1.3333$ for the expansion process.	7	2021 JULY
10	(a)A gas turbine unit operates at a mass ow of 30 kg/s. Air enters the compressor at a pressure of 1 bar and temperature 15°C and is discharged from the compressor at a pressure of 10.5 bar. Combustion occurs at constant pressure and results in a temperature rise of 420 K. If the ow leaves the turbine at a pressure of 1.2 bar, determine the net power output from the unit and also the thermal efficiency. Take $C_p = 1:005\text{kJ/kg K}$ and $\gamma = 1:4$.	8	2021 JULY
	(b)Draw a neat sketch and T-S diagram of a regenerative gas turbine plant and deduce an expression its thermal efficiency	6	

Dr H. THILAKAN

CODE: MET204	COURSE NAME: MANUFACTURING PROCESS		Credit: 4
Q.No	Module I	Month & Year	Marks
1	List any three causes of occurrence of shrinkage in castings.	July 2021	3
2	Differentiate between composite moulds, permanent moulds and expendable moulds	July 2021	3
3	Write a note on selection of patterns for castings. Sketch any two types of patterns	July 2021	8
4	Explain i) permeability, ii) cohesiveness and iii) refractoriness of moulding sand.	July 2021	6
5	Represent the temperature-time graph of i) pure metal, and ii) alloy. Draw the heat extraction pattern in i) sand mould and ii) metal mould	July 2021	8
6	What are the requirements of an ideal gating system?	July 2021	6
7	How do patterns differ from casting	June 2022	3
8	What is the role of core and chill in casting process?	June 2022	3
9	What are the steps involved in a sand casting process?	June 2022	7
10	Sketch and explain the components of a gating system in casting process.	June 2022	7
11	Explain the salient features of investment casting process.	June 2022	7
12	Two solids of the same material, one a cube and the other a sphere, are cast. Volume of the cube of side 'a' and that of the sphere of radius 'r' are equal. Find the ratio of the solidification time of the cube to that of the sphere	June 2022	7
13	List out the four features of casting process that made it one among the most preferable manufacturing process.	August 2021	5
14	Describe any two properties of the moulding sand and explain the testing method for checking the corresponding properties	August 2021	5
15	A cylindrical-shaped component is to be cast out of the aluminium metal. The radius of the cylinder is 250 mm and its height is 20 mm. If the mould constant $C = 2.0 \text{ sec/mm}^2$ in the Chvorinov's rule, how long will it take the casting to solidify?	August 2021	5
16	Explain the accessories used in the gating system to filter the impurities present in the liquid molten metal.	June 2022	4
17	What are the advantages of using wax as the pattern material?	June 2022	3
18	List the name of any six types pattern used for casting process?	September 2020	3
19	Write any six types of casting defects with simple diagram?	September 2020	6
20	What is vacuum casting operation?	September 2020	4
21	Explain any one type of centrifugal casting process with a neat sketch	May 2019	4
Q.No	Module II	Month & Year	Marks
1	Write down any three practical applications of thermit welding.	July 2021	3
2	How is welding performed in a thermit welding process?	June 2022	6
3	What are the causes of porosity in welds? How can it be controlled?	July 2021	3
4	Draw a neat sketch of friction welding and explain the mechanisms of welding.	July 2021	6
5	Define weldability. Explain the weldability characteristics of i) stainless steels, ii) copper alloys and iii) tungsten.	July 2021	8
6	Draw a schematic of various regions in a fusion weld zone. Write a note on HAZ	July 2021	6
7	Describe Heat Affected Zone (HAZ) in fusion welding. Explain various regions of heat affected zone with a sketch	August 2021	5
8	Explain any four destructive tests for testing welded joints	July 2021	8
9	What is shielded metal arc welding?	June 2022	3
10	Explain the principle and equipments of arc welding with neat labelled sketches	August 2021	5
11	Explain the plasma arc welding with a neat labelled diagram. List out the major advantages and disadvantages of the plasma arc welding process.	August 2021	5
12	Describe resistance seam welding with a neat sketch.	August 2021	5
13	What are the components in oxy-acetylene welding operation? How is the flame adjusted in gas welding?	June 2022	8
14	Resistance flash welding using 30 V power supply is done to join two pipes each having inner diameter 100 mm and outer diameter 110 mm. At the interface, 1 mm of material melts from each pipe which has a resistance of 42.4Ω . If the unit melt energy is 64.4 MJ/m^3 , find the time required for welding.	June 2022	6
15	Define weldability. List out any two factors that influence weldability	August 2021	5
16	Explain any three defects that may be formed in welded joints.	August 2021	5
17	Write any four types of welding defects with simple diagram?	September 2020	6
18	List any four functions of flux in welding.	August 2021	5

19	Explain the working of Resistance Spot Welding. State their advantages and limitations	May 2019	7
20	With the help of neat diagrams illustrate the following: (i) Friction Welding (ii) Resistance Spot Welding	September 2020	10
21	Describe any two brazing methods.	August 2021	5
22	Distinguish between soldering and brazing	June 2022	4
23	What are the causes of Magnetic arc blow in Arc welding? How can it be rectified	June 2022	6
24	What are the basic functions of the electrode coatings used to coat electrodes in arc welding?	June 2022	4
25	With neat sketch explain the consumable electrode welding operation used to weld low carbon steel plate of thickness 150 mm.	June 2022	6
26	Neutral flame cannot be used for welding brass whereas oxidising flame can be used. Why?	June 2022	3
27	What is the role of filler rod in welding operation? What are its desirable properties?	June 2022	6
28	Define the following for a resistance welding operation i. Squeeze time ii. Weld time iii. Hold time iv. Off time	June 2022	4
29	Write any four factors influencing the solidification of the weld metal	September 2020	4
30	Explain the working principle of submerged arc welding process with neat sketch; also write any two advantages and two disadvantages of the submerged arc welding process.	September 2020	10
31	List out the five differences between the welding process and the brazing process.	September 2020	5
Q.No	Module III	Month & Year	Marks
1	Define (a) neutral point and (b) draft in a flat rolling process.	July 2021	3
2	Represent alligating in rolled sheets with a neat sketch and explain.	July 2021	3
3	Draw and explain any four roll arrangements in a rolling mill	July 2021	8
4	Write a note on residual stresses developed in rolling.	July 2021	6
5	Define hot working. List any four advantages of hot working	July 2021	6
6	Explain Von Mises' maximum distortion energy criterion in plastic flow. Draw a neat sketch and give an example.	July 2021	8
7	What is thread rolling? Compare it with thread cutting	June 2022	3
8	Sketch a typical rolling process and define (a) neutral point; (b) lagging and leading zones; (c) forward and backward slip.	June 2022	3
9	Narrate the features of (i) four high rolling mill (ii) planetary rolling mill (iii) cluster rolling mill.	June 2022	6
10	If μ is the coefficient of friction between metal and roll surface and R is the radius of the roll, obtain an expression for maximum possible reduction in a single pass	June 2022	8
11	Define (i) true stress; (ii) flow stress; (iii) average flow stress	June 2022	6
12	What is yield criterion? Explain Tresca and von Mises yield criteria	June 2022	8
13	Describe the features of the neutral point in the rolling process with a sketch.	August 2021	5
14	Compare the hot rolling and the cold rolling processes.	August 2021	5
15	Describe the alligating defect in the rolling process. Explain the reason for its formation during the rolling process.	August 2021	5
16	Explain the process of thread rolling with a neat sketch. Differentiate the microstructure of machined thread and rolled thread with sketches.	August 2021	5
17	Draw neat sketches of any five types of rolling mills used in rolling operation	June 2022	5
18	With a neat sketch explain the mechanics of flat rolling.	June 2022	5
19	List any four types of surface defects in Rolling.	June 2022	5
20	Explain any three different types of structural defects occurring in rolled plates and sheets?	June 2022	5
21	Describe the following operations with simple diagram. (i) Ring rolling (ii) Thread rolling	September 2020	6
22	Describe the working of planetary rolling mill with a neat sketch?	September 2020	4
Q.No	Module IV	Month & Year	Marks
1	Applying the slab method, obtain an expression for forging pressure under plane strain conditions with sliding friction.	June 2022	8
2	Define and explain forging process. Explain the method of choosing forging temperature range for metals	July 2021	8
3	Describe any four advantages of the forging process.	August 2021	5
4	Describe any four defects that may arise during the forging process.	August 2021	5
5	Describe the following processes with a neat sketch (a) Stretch forming (b) Deep drawing	August 2021	5

6	Differentiate between direct extrusion and indirect extrusion	June 2022	3
7	Differentiate between hot working and cold working of metals. Compare the relative merits and demerits of hot working and cold working.	June 2022	6
8	Differentiate between wire drawing and deep drawing.	June 2022	6
9	Distinguish between drawing and extrusion processes.	July 2021	3
10	Distinguish between drop forging and press forging.	June 2022	8
11	Distinguish between the direct extrusion and the indirect extrusion processes with the help of neat sketches	August 2021	5
12	Distinguish between wet drawing and dry drawing. Write a note on roll straightening of a drawn round rod	July 2021	6
13	Draw a neat sketch of a die used for wire drawing. Write a short note on die materials.	July 2021	8
14	Draw and explain any three defects in forged parts.	July 2021	3
15	Draw the sketches of any three extrusion-die configurations.	July 2021	6
16	Explain the process and set up used for manufacturing thin metallic wires with a schematic diagram	August 2021	5
17	List the advantages and limitations of open die forging operation	June 2022	6
18	What is open die forging?	June 2022	3
19	With neat sketch explain the manufacturing process by which collapsible tubes are made	June 2022	4
20	With neat sketches compare and contrast forward and backward extrusion.	June 2022	8
21	Write any four differences between hot extrusion and cold extrusion.	September 2020	4
Q.No	Module V	Month & Year	Marks
1	List any three press tool operations.	July 2021	3
2	Draw a neat sketch to represent shear action in die cutting operation	July 2021	3
3	Draw a neat sketch and explain: i) conical locators, ii) adjustable locators and iii) profile locators	July 2021	6
4	Draw and explain: i) location of bar in vee block, ii) location in two vees, iii) location of a rectangular job and iv) location of a job for drilled holes	July 2021	8
5	Draw the sketch of a die assembly for press working and explain all the components.	July 2021	6
6	Draw neat sketches of the following sheet metal bending operations: i) hemming, ii) flanging, iii) beading and iv) roll forming.	July 2021	8
7	What is stretch forming?	June 2022	3
8	Describe any three sheet metal operations.	June 2022	3
9	What is 3-2-1 principle?	June 2022	6
10	List the different locating methods and explain any two of them	June 2022	8
11	Explain spring back which is observed in sheet metal bending	June 2022	6
12	What are the main principles of clamping? Give a classification of clamps used.	June 2022	8
13	Describe the four principles of clamping	August 2021	5
14	Explain the 3-2-1 principle of locating with a neat sketch	August 2021	5
15	Differentiate between the vacuum clamping and the magnetic clamping	August 2021	5
16	Describe with the help of neat sketches the working principle of the following clamps (a) Swing clamps (b) Hinge clamps.	August 2021	5
17	List out any four factors on which the bending force on a sheet metal depends upon.	August 2021	5
18	With a neat sketch explain the following processes (a) Shear Spinning (b) Tube Spinning	August 2021	5
19	Explain any 2 basic principles of location	June 2022	4
20	List any four purposes of clamping devices	June 2022	4
21	With neat sketches explain any 4 different varieties of clamps used with jigs and fixtures	June 2022	10
22	With a neat sketch explain the 3-2-1 principle of locating.	September 2020	7
23	What are the advantages of the vacuum clamping technique?	September 2020	3
24	Explain the following clamping methods with suitable sketches: (i) Swing clamp (ii) Strap clamp	September 2020	10
25	Explain six point location principle and its importance in manufacturing	December 2019	6
26	Write a note on "bending" of sheet metal. What is spring back and how is its effect eliminated?	May 2019	5
27	Bring out the differences between punching and blanking	May 2019	3

CODE: EST 200	DESIGN AND ENGINEERING		Credit:
Q.No	Module I	Month & Year	Marks
1	Discuss the importance of design constraints?	Dec 2020	3
2	Describe how to select the "best possible design" from the generated design alternatives.	Dec 2020	3
3	Design two alternatives of a chair suitable for a five-year-old child, and then to narrow down to the best design based on objectives and constraints. Sketch both the designs.	Dec 2020	3
4	Identify the objectives, functions and constraints for designing a water level indicator. Illustrate the various stages of the design process. Provide suitable sketches.	Dec 2020	3
5	Outline the significance of understanding customer requirements in design process	July 2021	3
6	Describe any three constraints that can occur in design process of a lunch box	July 2021	3
7	Explain the design process through designing a handbag for women of age group of 15 to 25 years. Use hand sketches to support your idea	July 2021	14
8	Describe the concept of generating design alternatives and choosing a design through designing a coffee mug with the help of sketches	July 2021	14
9	What are the basic vocabularies in engineering design?	Dec 2021	3
10	How to identify the customer requirements of design?	Dec 2021	3
11	Find the customer requirements for designing a website for an educational institution. Show how the design objectives were finalized considering the design constraints. Sketch a layout of the website showing dropdown menus.	Dec 2021	14
12	Show the designing of an iron box going through the various stages of the design process. Use hand sketches to illustrate the processes.	Dec 2021	14
13	What is engineering design? Draw a diagram to represent the engineering design process?	June 2022	3
14	Explain and differentiate conceptual design and detailed design?	June 2022	3
15	Design the interface of a simple calculator explaining each stage in the design process. Use hand sketches wherever necessary.	June 2022	14
16	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?	June 2022	14
17	List the objectives and constrains for designing a school bag for school students.	Dec 2022	3

18	State how engineering design is different from other kinds of design.	Dec 2022	3
19	Show the designing of a length adjustable mop to clean ceiling fan. Use hand sketches to illustrate the various stages of the design process.	Dec 2022	14
20	In certain situations, users require extra length for their mobile charger cable. But offering extra cable length becomes an issue while normal usage. Develop a design to effectively solve this problem. Use necessary hand sketches. Also give the objectives and constraints of your design.	Dec 2022	14
21	Enumerate the two objectives and three constraints in the design of a table fan	Dec 2023	3
22	State how engineering design is different from other kinds of design.	Dec 2023	3
23	Show the designing of a length adjustable mop to clean ceiling fan. Use hand sketches to illustrate the various stages of the design process.	Dec 2023	14
24	In certain situations, users require extra length for their mobile charger cable. But offering extra cable length becomes an issue while normal usage. Develop a design to effectively solve this problem. Use necessary hand sketches. Also give the objectives and constraints of your design.	Dec 2023	14
Q.No	Module II	Month & Year	Marks
1	Discuss how to manage the conflicts in a team executing the design thinking process.	Dec 2020	3
2	How does the design thinking approach help engineers in creating innovative and efficient designs?	Dec 2020	3
3	Design two alternatives of a chair suitable for a five-year-old child, and then to narrow down to the best design based on objectives and constraints. Sketch both the designs.	Dec 2020	14
4	Identify the objectives, functions and constraints for designing a water level indicator. Illustrate the various stages of the design process. Provide suitable sketches.	Dec 2020	14
5	Explain convergent questioning in design thinking	July 2021	3
6	Explain how conflict in team environment helps in better design of products	July 2021	3
7	Illustrate the design thinking process through designing a walking stick for elderly people.	July 2021	14
8	Design a parachute mechanism for safe landing an egg which is dropped from a height of 3 meters using iterative design thinking process with the help of sketches	July 2021	14
9	Describe the iterative process involved in design thinking approach.	Dec 2021	3
10	Describe the importance of empathize phase in design thinking.	Dec 2021	3
11	Illustrate the design thinking approach for designing a wearable technology for a	Dec 2021	14

	college student. Describe each stage of the process. Illustrate the solution using sketches.		
12	Some of the vehicle drivers do not dim the headlights when facing another vehicle at night. Empathize about this design problem and arrive at a solution using the design thinking process. Illustrate the solution using sketches.	Dec 2021	14
13	How prototype will help to identify the best possible solution for the problem?	June 2022	3
14	Compare convergent thinking and divergent thinking?	June 2022	3
15	Explain the five different stages of design thinking? Illustrate it with the help of a face mask design	June 2022	14
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.	June 2022	14
17	How to perform design thinking as a team managing the conflicts?	Dec 2022	3
18	Explain divergent-convergent questioning in design thinking.	Dec 2022	3
19	Design a suitable product for easy cleaning of dust from the chalkboards in a classroom. Illustrate the various stages involved in design thinking. Sketch the final design.	Dec 2022	14
20	Construct two possible designs of a dining table set that occupies minimum space when not in use and then refine them to narrow down to the best design. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.	Dec 2022	14
21	Differentiate conventional thinking and creative thinking	Dec 2023	3
22	List the techniques to improve the thinking process in a design team	Dec 2023	3
23	Illustrate the design thinking approach for designing a study table for kids within a limited budget. Describe the design thinking process.	Dec 2023	14
24	Illustrate three possible conceptual designs of a writing aid for handless person and refine the concepts to obtain the best solution.	Dec 2023	14

Q.No	Module III	Month & Year	Marks
1	Clarify the part of mathematics and physics in the design engineering process.	Dec 2020	3
2	What are factors to be considered in preparing technical reports to communicate a design efficiently?	Dec 2020	3
3	Design a foldable steel table. Draw the detailed 2D drawings of the same with design detailing, scale drawings and dimensions. Use only hand sketches.	Dec 2020	14
4	Prepare a technical report for a newly designed website for online training of students with neat diagrams for presenting to a client.	Dec 2020	14
5	Describe how prototyping helps in design process	July 2021	3
6	Explain any three advantages of communicating designs in writing.	July 2021	3
7	Design an office chair and communicate your design using sketches with design detailing, material selection, scale drawings and dimensions	July 2021	14
8	Describe the role of mathematical modelling in design engineering citing an example	July 2021	14
9	How can a design be communicated through engineering sketches and drawings?	Dec 2021	3
10	Explain the role of Prototyping in evaluating a Design.	Dec 2021	3
11	Design an integrated water bottle with lunch box. Draw the detailed 2D drawings of the same with design detailing, material selection and dimensions. Use only hand sketches.	Dec 2021	14
12	Prepare a technical report for a newly designed portable ladder with neat sketches for presenting to a client.	Dec 2021	14
13	“Sketching is a powerful tool in design engineering”. Justify this statement.	June 2022	3
14	What is a mathematical model? State the significance?	June 2022	3
15	Explain the general guidelines for technical communication. Justify each point with an example.	June 2022	14
16	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 software’s required for the page development.	June 2022	14
17	List the factors to be considered in preparing oral presentations to communicate designs effectively to clients.	Dec 2022	3
18	How does prototyping help to predict whether the design will function well or not?	Dec 2022	3

19	Graphically communicate the design of a foldable ladder for electricians. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings and dimensions. Use only hand sketches.	Dec 2022	14
20	Describe the role of mathematical modelling in design engineering. Show how mathematics and physics play a role in designing a simple paper cutting scissor.	Dec 2022	14
21	Write down the name of the product were (i) aesthetic is essential factor (ii) reliability is most important (iii) aesthetic is not considered	Dec 2023	3
22	Compare prototype of a car with its model	Dec 2023	3
23	Explain the method of developing a mathematical model for a passenger lift.	Dec 2023	14
24	Assume that you have completed the design of a new model ceiling fan and a prototype is needed for testing. Communicate your idea to the production department effectively to manufacture the prototype.	Dec 2023	14
Module IV			
1	Describe the use of value engineering in the design process.	Dec 2020	3
2	How does intelligence in nature inspire engineering designs?	Dec 2020	3
3	Apply value engineering to a pen, and design a lightweight pen torch. Illustrate the solution using sketches.	Dec 2020	14
4	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.	Dec 2020	14
5	Illustrate advantages of reverse engineering in design	July 2021	3
6	Explain bio mimicry in design with an example	July 2021	3
7	Illustrate modular design approach for designing of desktop computers	July 2021	14
8	Demonstrate the concept of ergonomics through design of a table lamp	July 2021	14
9	Explain the importance of project-based learning in design engineering.	Dec 2021	3
10	Discuss the role of life cycle design approach in design decisions.	Dec 2021	3
11	Show the development of a nature-inspired design for a fashionable umbrella based on a banana leaf. Use hand sketches to support your arguments.	Dec 2021	14
12	Develop some design modification for sports utility bag, to improve its functionalities as well as product value. Sketch the design.	Dec 2021	14
13	Write and differentiate problem based and project-based learning?	June 2022	3

14	Compare sequential design and modular design techniques?	June 2022	3
15	A class room has to be designed in such a way that it should 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.	June 2022	14
16	(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?	June 2022	14
17	Relate how designs are inspired from nature.	Dec 2022	3
18	How the life cycle design approach influences design decisions?	Dec 2022	3
19	Design a nature inspired solar lamp for the students residing in urban areas. These students do not have proper availability of electricity and cannot afford highly priced products. Illustrate your design with sketches.	Dec 2022	14
20	Apply modular engineering to a conventional bicycle and design a bicycle which can used in different terrains. Illustrate the design using sketches.	Dec 2022	14
21	Enumerate six features of a modular design	Dec 2023	3
22	Concurrent engineering is better than sequential engineering- Justify	Dec 2023	3
23	Illustrate the modular design of a dining table where three different geometrical varieties can be developed as per the customer requirement.	Dec 2023	14
24	Explain the aesthetic, ergonomic and safety considerations incorporated in the design of a baby tricycle.	Dec 2023	14
Module V			
1	How to estimate the cost of a particular design?	Dec 2020	3
2	How do ethics play a decisive role in engineering design?	Dec 2020	3
3	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.	Dec 2020	14
4	Describe how to estimate the cost of a pen and list the various parts. Show how the economics will influence the engineering designs. Use hand sketches to support your arguments.	Dec 2020	14
5	Describe ethics to be followed in engineering design	July 2021	3
6	Explain the significance of sustainability in engineering design	July 2021	3
7	Illustrate the changes in design of disposable tea cup in terms of production, use and sustainability	July 2021	14
8	Describe the how to estimate the cost of a table in design stage? Show how economics will influence the engineering designs.	July 2021	14

9	What are the factors to be considered for a sustainable design?	Dec 2021	3
10	What are design rights, and how can an engineer put it into practice?	Dec 2021	3
11	Design a sustainable piping network for reuse of water in a residential building enabling water conservation. Sketch the design.	Dec 2021	14
12	Design a door handle with a lock which is easy to use. Use hand sketches and give rationalization for the various features in the design.	Dec 2021	14
13	Explain the cost factor calculation of a particular design?	June 2022	3
14	Write the role of economics in engineering design?	June 2022	3
15	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.	June 2022	14
16	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?	June 2022	14
17	What are design rights and how can an engineer put it into practice?	Dec 2022	3
18	Describe the role of ethics in the design of any two products.	Dec 2022	3
19	Examine the changes in the design of a footwear in terms of production methods, reliability issues and environmental factors. Use hand sketches and give proper rationalization for the changes in design.	Dec 2022	14
20	Describe how to estimate the cost of a residence house in design stage. Show how the economics will influence its design. Use hand sketches to support your arguments.	Dec 2022	14
21	List the factors affecting the cost of a product	Dec 2023	3
22	Enumerate the features of a sustainable product	Dec 2023	3
23	Describe how to estimate the cost of a chair. Identify the influence of cost on engineering design. Explain the difference in the design of low-cost chair and a high-quality chair.	Dec 2023	14
24	Explain the impact of electronic gadgets on environment and how to minimize the impact with design modification	Dec 2023	14