



**VIDYA ACADEMY OF SCIENCE &
TECHNOLOGY - TECHNICAL CAMPUS**

**Malakkal P.O, Kilimanoor, Thiruvananthapuram – 695 602
(Accredited by NAAC with 'B++' Grade)**

DEPARTMENT OF CIVIL ENGINEERING

S4 - Question Bank

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 $F(x) = \begin{cases} kx^2, & x \geq 400 \\ 0, & \text{otherwise} \end{cases}$ <p>(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> </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. 100,000. (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- AUG 2021 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: 30%;">Simple Mean</th> <th style="width: 30%;">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											
θ	45	50	55	60	65																			
$\sin \theta$	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											
x	0.01	0.02	0.03	0.04	0.05																			
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												

CET204:GEOTECHNICAL ENGINEERING 1			
MODULE -1			
Sl. No.	Question	Mark	Year
1	Using phase diagram, define the terms (i) void ratio,(ii)degree of saturation (iii) water Content (iv) Specific Gravity	10	Sep.2020
2	A partially saturated soil sample from a borrow pit has natural water content 14% and bulk unit weight 19 kN/m ³ .specific gravity of solids is 2.70. Determine the void ratio and degree of saturation	10	Dec.2022
3	Define <i>sensitivity</i> and <i>Activity</i> of soil.	6	May 2018
4	Define the terms Sensitivity and thixotrophy in realtion to geotechnical Engineering	6	Dec.2018
5	Explain three phase diagram and define density index and degree of saturation	8	Dec.2022
6	A fully saturated clay sample has a mass of 101.5g and volume of 50 cc. After oven drying, clay of mass 84.5g. Assuming that the volume does not change during drying, determine the specific gravity, void ratio, porosity, dry unit weight of soil	10	June.2022
7	A compaction test in laboratory give max dry density of 18.5 kN/m ³ of water content 15%. The specific gravity of soil is 2.7. Find out degree of saturation, air content ,percentage air voids	10	May 2023
8	Define Water Content, Degree of Saturation and Air Content.	3	June.2022
9	a) Draw the three phase block diagram and derive the relation between Void Ratio, Specific Gravity, Water Content and Degree of Saturation. b) The field dry unit weight of a soil is 15.50 kN/m ³ . The weight of dry soil filled in a container of volume 1 litre in its loosest state and densest state are 14N and 18 N respectively. What is the density index of the soil? $G = 2.70$	5 9	June.2022
10	a) Compare the engineering features of any three major soil deposits of India. b) A partially saturated sample has a natural water content of 10% and bulk unit weight of 17 kN/m ³ . The specific gravity of solids is 2.67. Determine the void ratio and degree of saturation. What will be the Saturated unit weight of the sample?	5 9	June.2023

MODULE -2			
1	Explain the basis of hydrometer analysis. How will you classify soil according to this?	5	Dec.2022
2	Differentiate between (i) Plastic limit and plasticity index (ii) Liquid limit and water plasticity ratio	10	Dec.2022
3	Differentiate (i) well graded and gap graded soil (ii) shrinkage index and toughness index (iii)uniformity coefficient and coefficient of curvature	5	May 2019

4	A fully saturated clay has a water content of 30% and bulk unit weight of 18.64 kN/m ³ . After drying the dry unit weight is 17.66 kN/m ³ . Find the specific gravity and shrinkage limit	5	Dec.2022
5	For a soil sample, the liquid limit is 52%, plastic limit 30%, shrinkage limit is 18%. If the specimen of the soil shrinks from a volume of 39.5 cm ³ at the liquid limit to a volume of 24.2 cm ³ at the shrinkage limit. Calculate the true specific gravity	14	May 2019
6	The Atterberg Limit of a clay soil are LL=75%, PL=45%, SL=25%. If a sample of this soil has a volume of 30 cm ³ at the liquid limit and volume of 16.6 cm ³ at the shrinkage limit, determine the specific gravity of soils, shrinkage ratio, volumetric shrinkage	5	Dec.2022
7	Explain Consistency limits of soils? how will you describe consistency if the soil has a LL = 50%, PI = 30%, Natural water content = 25%	9	May 2018
8	What are the different methods to determine the coefficient of permeability in laboratory? Explain them in detail	7	May 2023
9	a) A clay has a liquid limit of 60% and shrinkage limit of 20%. If a specimen of this soil shrinks from a volume of 15000 mm ³ at liquid limit to 9000 mm ³ at shrinkage limit determine the specific gravity of soil solids. b) Sketch the plasticity chart used for classifying a fine-grained soil. Classify the soil as per IS classification system Percentage of soil finer than 75-micron sieve = 15% Percentage of soil finer than 4.75 mm sieve = 73% Liquid limit = 28%, Plasticity index = 12%	7 7	June 2022
10	a) A soil sample in a variable head permeameter is 100 mm in diameter and 120 mm high. The permeability of the sample is	7	June 2023

	known to be 3×10^{-3} m/sec. If it is desired that the head in the stand pipe should fall from 550 mm to 300 mm in 200 seconds, determine the diameter of the stand pipe to be used. b) Determine the ratio of average coefficient of permeability in the horizontal to vertical direction for a deposit consists of three layers 2 m, 1.5 m and 4 m and having coefficient of permeability 3.5×10^{-5} m/sec, 4.5×10^{-5} m/sec, 1.5×10^{-5} m/sec.	7	
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MODULE -3

1	Discuss the effect of capillarity water on effective stress of soil	5	June 2023
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2	A 6m thick sand layer having dry unit weight of 17kN/m ³ lies above a clay layer. The water table is 1m below ground level and the unit weight of saturated sand above water table is 20kN/m ³ . Plot the effective stress variation in sand layer assuming sand is saturated by the capillary action	10	Dec.2018, Dec.2019
3	Distinguish clearly between capillarity and permeability	5	June 2023
4	Differentiate between total, effective and pore water pressure in soil	5	June 2023
5	A soil profile has a surface layer of clay 4 m. thick and density 19.5 kN/m ³ and a sand layer of 2 m. thick with a density of 18.5 kN/m ³ lies below the clay layer. Water table is at the ground surface, if a stand pipe is driven into the clay up to the sand layer water level in the stand pipe rises 2 m. Above the ground surface. Find the stresses.	14	Dec.2018
6	A sand deposit of 8 m thick was loaded with a uniform surcharge of 10kN/m ² . Water table (WT) is at 3 m below GL. Density of sand is 18kN/m ³ above WT and 19kN/m ³ below WT. Draw Total, Neutral and Effective Stress Diagrams up to 8 m below GL. Take $\gamma_w = 10\text{kN/m}^3$.	9	Dec.2018,

7	A concentrated load of 500 kN is applied at ground surface. Compute the vertical pressure (i) at a depth of 5m below the load, (ii) at a distance of 3m at the same depth. Use Boussinesq's theory.	7	May 2023
8	A water tank is founded on a circular ring type of foundation. The ring is of 2.5m width and its external diameter is 10m. Compute the vertical stress at 4m depth beneath the centre of the foundation, if pressure on the foundation is 100kPa	7	Dec.2022

9	<p>a) Explain Quick Sand Condition.</p> <p>b) A soil profile consists of top layer of sand 3 m thickness having bulk unit weight 16kN/m³, an intermediate layer of clay 3.5m thickness having saturate unit weight 20kN/m³ and bottom layer of sand 5 m thickness having saturated unit weight of 18kN/m³. The water table is observed at 3m below ground level. Determine the total stress, neutral stress and effective stress at top, bottom and interface of layers and plot the variation of these stresses with depth.</p>	5 9	May 2023
10	<p>a) Determine the vertical stress intensity at a point 4 m below ground level and 1.5m away from the line of action of a vertical point load of 250kN acting on the ground surface by Boussinesq's equation</p> <p>b) A water tank is supported on a circular ring type of foundation. The ring is of 1.5m width and its external diameter is 8m. Compute the vertical stress at 1.5m depth beneath the centre of the foundation, if pressure on the foundation is 150kPa.</p>	5 9	June 2022
MODULE -4			
1	<p>An oedometer test is performed on a 4 cm thick clay sample. After 5 minutes, 50% consolidation is reached. After how long a time would the same degree of consolidation is achieved in the field where the clay layer is 8 m thick? Assume the sample and the clay layer has the same drainage boundary conditions (double drainage).</p>	8	June 2023
2	<p>(a) Explain Compression Index and Swelling Index</p> <p>(b) Define coefficient of consolidation and give its relations with other soil parameters</p>	4 4	Sep.2020
3	<p>A 20 cm. thick specimen of clay taken into reach 50 % consolidation in 2 mins, when drained on both sides, when percentage of volume compressibility is 2.5×10^{-2}kg. Calculate coefficient of consolidation and coefficient of permeability.</p>	8	June 2023
4	<p>A 20m thick isotropic clay stratum overlies an impervious rock. The coefficient of consolidation is 5×10^{-2} mm²/s. Find the time required for 50% and 90 % consolidation</p>	10	May 2018
5	<p>(a) Differentiate between primary and secondary consolidation</p> <p>(b) Discuss Terzaghi theory of consolidation</p>	3 5	Dec. 2018

6	A 8 m thick clay layer with double drainage settles by 120 mm in 2 years. $C_v = 1.5 \times 10^{-3} \text{ cm}^2/\text{sec}$. Calculate the likely ultimate consolidation settlement and find out how long it will take to undergo 90% of this settlement.	5	June 2023												
7	A 3m square footing at a depth of 2m from ground level carries a net load intensity of 150 kN/m^2 . If a compressible clay layer 3m thick exists at a depth of 5m below the footing, determine the settlement of the footing due to consolidation of clay layer. Assume the water table at a depth of 3m below GL. For sand, density = 18 kN/m^3 above water table and 19 kN/m^3 below water table. For clay layer, $LL = 65\%$, $w_n = 40\%$ and $G = 2.7$. Take $\gamma_w = 10 \text{ kN/m}^3$.	9	June 2023												
8	The following are results of a standard proctor compaction test performed on a sample of soil <table border="1" data-bbox="311 806 1133 929"> <tr> <td>Water Content %</td> <td>6</td> <td>8</td> <td>10</td> <td>12</td> <td></td> </tr> <tr> <td>Bulk Density (kN/m^3)</td> <td>17.7</td> <td>19.8</td> <td>21</td> <td>21.3</td> <td>21.5</td> </tr> </table> Plot the water content – dry density curve and obtain Moisture content and Maximum dry density. Also plot the zero air voids curve. Take $G = 2.65$.	Water Content %	6	8	10	12		Bulk Density (kN/m^3)	17.7	19.8	21	21.3	21.5	9	June 2023
Water Content %	6	8	10	12											
Bulk Density (kN/m^3)	17.7	19.8	21	21.3	21.5										
9	a) Explain the method of determination of pre-consolidation pressure on clay	5	June 2023												

	b) In a soil profile, the top layer consists of sand up to 1.5m depth and is underlain by 3m thick normally consolidated clay. The water table is at 1m below ground level. The density of sand is 18 kN/m^3 above the water table and 19 kN/m^3 below the water table. The natural water content and specific gravity of clay are 30% and 2.70 respectively. The liquid limit of clay is 65%. Estimate the probable settlement of clay layer, if the pressure at mid-height of clay layer increases by 50kPa.	9	
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10	a) Explain the Proctor Needle method of Field Compaction Control with neat sketches.	7	June 2022
	b) Distinguish the laboratory and field equipment needed for compaction in sandy and clayey soils.	7	

MODULE -5

1	(a) Explain the basic mechanism of shear strength of soils. (b) Explain Mohr Coulomb's shear failure theory. (c) Explain three drainage conditions for conducting shear testing of soils.	8 4 3	June 2023
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2	<p>The following data refers to a CU test on a normally consolidated clay.</p> <p>Compute the total stress and effective shear strength parameters.</p> <table border="1"> <thead> <tr> <th>Sample no (kPa)</th> <th>Cell pressure (kPa)</th> <th>Deviator stress (kPa)</th> <th>Pore pressure (kPa)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100</td> <td>130</td> <td>48</td> </tr> <tr> <td>2</td> <td>300</td> <td>485</td> <td>140</td> </tr> <tr> <td>3</td> <td>500</td> <td>645</td> <td>290</td> </tr> </tbody> </table>	Sample no (kPa)	Cell pressure (kPa)	Deviator stress (kPa)	Pore pressure (kPa)	1	100	130	48	2	300	485	140	3	500	645	290	10	July 2019
Sample no (kPa)	Cell pressure (kPa)	Deviator stress (kPa)	Pore pressure (kPa)																
1	100	130	48																
2	300	485	140																
3	500	645	290																
3	<p>A saturated specimen is permanently under water. Its water content is 50% and $G=2.72$. What is the effective stress at 8 m below the clay surface? How many meters of clay must be removed by dredging to reduce the intergranular pressure at that point by 25 kPa. The water levels remain unchanged.</p>	10	Dec. 2019																
4	<p>A particular soil failed under a major principal stress of 300kN/m^2 with minor principal stress of 100kN/m^2. If for the same soil, the minor principal stress had been 200kN/m^2, Determine what the major principal stress would have been if (i) $\phi=30$ (ii) $\phi=0$</p>	10	June 2023																

5	<p>Determine the shear strength parameters using the following data using graphical method:</p> <table border="1"> <thead> <tr> <th>Sample</th> <th>Confining Pressure σ_c (kN/m²)</th> <th>Deviator Stress σ_d (kN/m²)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100</td> <td>600</td> </tr> <tr> <td>2</td> <td>200</td> <td>750</td> </tr> <tr> <td>3</td> <td>300</td> <td>900</td> </tr> </tbody> </table>	Sample	Confining Pressure σ_c (kN/m ²)	Deviator Stress σ_d (kN/m ²)	1	100	600	2	200	750	3	300	900	9	Sep 2020
Sample	Confining Pressure σ_c (kN/m ²)	Deviator Stress σ_d (kN/m ²)													
1	100	600													
2	200	750													
3	300	900													
6	<p>a) Explain the Swedish circle method for the analysis of slopes for a $c-\phi$ soil.</p> <p>b) Determine factor of safety of vertical foundation trench 5m deep if $c=50\text{kN/m}^2$, $\phi=25^\circ$, $\gamma=17\text{kN/m}^3$. Assume Taylor's stability no. $S_n=0.166$.</p>	5 9	June 2023												
7	<p>A cylindrical specimen of soil fails under axial vertical stress of 150kN/m^2, when it is laterally unconfined. Failure plane makes an angle of 53° with the horizontal. Determine shear strength parameters c & ϕ.</p>	5	June 2023												
8	<p>Explain Consolidated Undrained, Unconsolidated Undrained and Consolidated Drained Shear tests for soils</p>	3	June 2023												

9	<p>a) In a drained triaxial compression test on dense sand the cell pressure was 200kPa and the deviator stress to cause failure was 550kPa. Calculate the angle of shearing resistance. Also find the angle made by the failure plane with respect to the major principal plane.</p>	9	June 2022
10	<p>a) Explain Friction Circle method of slope stability analysis. b) A slope is to be made in clay for which the cohesion is 25kN/m² and $\Phi=0$. The density of soil is 18 kN/m³. Find the maximum height of slope if the side slope is 1.5 to 1, and the factor of safety is to be 1.5. Take Taylor's stability number as 0.17</p>	9 5	June 2022

CET 202 ENGINEERING GEOLOGY

MODULE -1

SI No.	Question	Mark	Year
1	Define weathering of rocks	3	Jan 2022
2	. Describe different types of weathering and their products.	7	Sep 2022
3	Explain chemical weathering	3	Dec.2018
4	Explain soil erosion and classification of soils	7	Dec.2018, Dec.2019
5	Define soil profile with neat diagram.	5	May 2018
6	Classify landslides	6	Dec.2018
7	Describe various methods used to protect the coastal areas from marine erosion	10	Dec.2018
8	Evaluate the negative effects of seawalls and groins as shore protection structures.	10	
9	Give brief account of relevance of Geology in civil engineering	10	May 2018
10	. What are the causes of landslides? Add a note on their preventive measures	10	Dec.2018

MODULE -2

1	Discuss seismic waves and their properties	5	Sep 2022
2	What is an earthquake	3	Jan 2022
3	Describe the terms: intensity and magnitude of earthquake	5	May 2019
4	Write a note on plate tectonics	7	Dec. 2018
5	Discuss seismic waves? How do body waves differ from surface waves	10	May 2019
6	Briefly explain the concept of plate tectonics	5	Dec. 2018
7	Explain hardness of minerals	9	May 2018
8	Discuss any five rocks of Kerala	7	Dec. 2018
9	Examine liquid nature of outer core	7	May 2018
10	Compare P and S waves	3	June 2022

MODULE -3

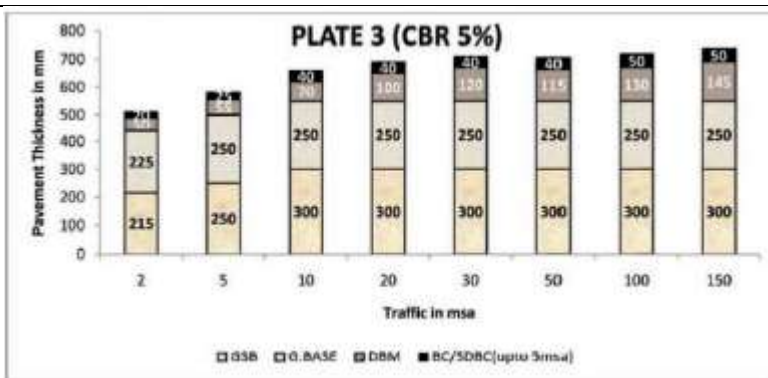
1	Describe vertical distribution of groundwater	5	Sep 2022
2	Give an account of factors controlling groundwater movement	10	Dec.2018, Dec.2019
3	Write notes on different groundwater zones.	5	May 2018
4	What is an aquifer? Describe the different types of aquifers.	5	Dec.2018
5	Explain Artesian aquifer.	14	Dec.2018
6	Explain Hydraulic conductivity	5	Dec.2018

7	Describe the methods to control of subsurface water.	9	Dec.2018,
8	Differentiate unconfined and confined aquifer with figure	7	May 2018
9	Explain how ground water can pose problems during the construction of tunnels.	7	Dec.2018
10	Explain unconfined aquifer.	3	Dec.2018
MODULE -4			
1	Explain cleavage, lineation and foliation scale of hardness.	8	Dec. 2018
2	Explain chemical formula of calcite and quartz.	4 4	Sep.2020
3	Elucidate classification of rocks based on their origin.	8	May 2018
4	Write the distinguishing properties with the chemical composition of the following minerals. a) Orthoclase b) Hornblende c) Kaolinite	10	May 2018
5	Why colour and streak of minerals are not always identical	3 5	Dec. 2018
6	How do sedimentary rocks differ from metamorphic rocks	5	Dec. 2018
7	Write short note on rock types of Kerala	9	Dec. 2018
8	Describe any three physical properties which affect the strength of minerals.	5	May 2019
9	Discuss the origin of igneous rocks and sedimentary rocks	9	May 2018
10	Explain strike and dip with figures	3	June 2022
11	Discuss Mohr scale of hardness	3	June 2022
MODULE -5			
1	Explain fold,fault,joints	3	Jan 2022
2	Elucidate on engineering significance of dip and strike Explain the significance of faults in civil engineering	10	July 2019
3	Explain the significance of faults in civil engineering	10	Dec. 2019
4	What are the geological factors to be considered in Dam construction	6	Sep 2020
5	Discuss the origin of folding and faulting of rocks	10	Dec. 2019
6	Briefly discuss why the knowledge on rock joints is important for the construction of engineering structures	6	Sep 2020
7	Describe geological factors considered in the construction of dams and tunnels		
8	Describe any two geological factors considered essential in the construction of tunnels	9	Sep 2020
9	Examine strike slip fault Explain the significance of faults in civil engineering	5	Dec. 2019
10	Examine significance of faults with regard to the construction of engineering structures	5	July 2019

SUB CODE	CET206	SUBJECT NAME	TRANSPORTATION ENGINEERING
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MODULE 1		Marks	Year	Instructional Objectives
1	Write a note on transition curves and its functions	8	KTU 2021	
2	Derive an equation for equilibrium super elevation. Determine the super elevation required for a horizontal curve of radius 300m with a design speed of 80kmph under mixed traffic condition in an urban area.	7	KTU 2022	
3	Define stopping sight distance (SSD). List the factors affecting stopping distance. Derive an expression for SSD on level roads.	7	KTU 2022	
4	Why transition curves are provided on a horizontal curve? What are the requirements of an ideal transition curve? How do you determine the length of transition curves?	7	KTU 2022	
5	While aligning a highway in a built up area, it was necessary to provide a horizontal curve of radius 300 m for a design speed 65 kmph, length of wheel base-6m and pavement width 10.5m. Assume rate of introduction of super elevation as 1 in 100 and super elevation is provided by rotating about centre line. Design super elevation, extra widening of pavement and length of transition curve.	8	KTU 2018	
6	Calculate the extra width of pavement required on a horizontal radius of 650m on a two lane highway having design speed of 70kmph. Assume all other data.	7	KTU 2022	
7a)	What are the points to be kept in view while selecting the alignment between two terminal stations	6	KTU 2023	
7b)	A car is moving with a speed of 80 kmph on a highway at a descending gradient of 4%. If coefficient of friction between the road surface and the tyres is 0.35, calculate the required minimum stopping sight distance.	8	KTU 2023	
8a)	The speed of overtaking and overtaken vehicles is 80 kmph and 60 kmph respectively on a two-way traffic road. If the acceleration of the overtaking vehicle is 0.9 m/sec ² , calculate the safe overtaking sight distance.	10	KTU 2023	
8b)	Enumerate the steps for practical design of super elevation of a highway under mixed traffic conditions	4	KTU 2023	
9	Why extra widening is provided at curves?	3	KTU 2023	
10	Why are overtaking Zones provided? Draw a neat sketch showing the signs to be installed and their positions	3	KTU 2023	
MODULE 2				
1	State three major differences between flexible and rigid pavements.	3	KTU 2023	
2	List the steps involved in the construction of bituminous pavement	3	KTU 2023	
3a)	What are the desirable properties of bitumen to be used in pavement construction?	4	KTU 2023	
3b)	Design the pavement for construction of a new bypass with the following data: 1. Two lane carriage way 2. Initial traffic in the year of completion of construction = 400 CVPD (sum of both directions) 3. Traffic growth rate = 7.5 % 4. Design life = 15 years 5. Vehicle damage factor based on axle load survey = 2.5 standard axle per commercial vehicle 6. Design CBR of subgrade soil = 5%	10	KTU 2023	

	<p style="text-align: center;">For CBR 5%</p> <table border="1" style="width:100%; border-collapse: collapse; margin: 0 auto;"> <tr> <td>Traffic msa</td> <td>5</td> <td>10</td> <td>20</td> <td>30</td> <td>40</td> <td>50</td> </tr> <tr> <td>GSB(mm)</td> <td>150</td> <td>200</td> <td>200</td> <td>200</td> <td>200</td> <td>200</td> </tr> <tr> <td>WMM(mm)</td> <td>250</td> <td>250</td> <td>250</td> <td>250</td> <td>250</td> <td>250</td> </tr> <tr> <td>Base/Binder Course (mm)</td> <td>65</td> <td>80</td> <td>105</td> <td>115</td> <td>130</td> <td>140</td> </tr> <tr> <td>Surface Course(mm)</td> <td>30</td> <td>40</td> <td>40</td> <td>40</td> <td>40</td> <td>40</td> </tr> </table>	Traffic msa	5	10	20	30	40	50	GSB(mm)	150	200	200	200	200	200	WMM(mm)	250	250	250	250	250	250	Base/Binder Course (mm)	65	80	105	115	130	140	Surface Course(mm)	30	40	40	40	40	40			
Traffic msa	5	10	20	30	40	50																																	
GSB(mm)	150	200	200	200	200	200																																	
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Base/Binder Course (mm)	65	80	105	115	130	140																																	
Surface Course(mm)	30	40	40	40	40	40																																	
4a)	List out the desirable properties of aggregates to be used in pavement construction. Explain in detail two tests for judging the suitability of aggregates.	8	KTU 2023																																				
4b)	Discuss the significance of the various factors to be considered in pavement design	6	KTU 2023																																				
5	Differentiate between tack coat and prime coat.	3	KTU 2022																																				
6	State the major differences between flexible and rigid pavements	7	KTU 2022																																				
7	Describe the specifications of materials and construction steps of granular sub base course.	7	KTU 2022																																				
8	<p>The soil subgrade sample was obtained from the project site and the CBR tests conducted at field density gave the following readings. Draw the load penetration curve and determine the CBR value and find the total thickness of the pavement by CBR method as recommended by IRC for commercial vehicles 1500 per day, with 7% growth rate. The pavement construction is to be completed in three years after last traffic count.</p> <table border="1" style="width:100%; border-collapse: collapse; margin: 0 auto;"> <thead> <tr> <th>Penetration (mm)</th> <th>Load (Kg)</th> <th>Penetration (mm)</th> <th>Load (Kg)</th> </tr> </thead> <tbody> <tr> <td>0.0</td> <td>0.0</td> <td>3.0</td> <td>58.0</td> </tr> <tr> <td>0.5</td> <td>5.0</td> <td>4.0</td> <td>70.0</td> </tr> <tr> <td>1.0</td> <td>16.0</td> <td>5.0</td> <td>77.0</td> </tr> <tr> <td>1.5</td> <td>30.0</td> <td>7.5</td> <td>89.0</td> </tr> <tr> <td>2.0</td> <td>42.0</td> <td>10.0</td> <td>100.0</td> </tr> <tr> <td>2.5</td> <td>50.0</td> <td>12.5</td> <td>110.0</td> </tr> </tbody> </table>	Penetration (mm)	Load (Kg)	Penetration (mm)	Load (Kg)	0.0	0.0	3.0	58.0	0.5	5.0	4.0	70.0	1.0	16.0	5.0	77.0	1.5	30.0	7.5	89.0	2.0	42.0	10.0	100.0	2.5	50.0	12.5	110.0	10	KTU 2018								
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2.0	42.0	10.0	100.0																																				
2.5	50.0	12.5	110.0																																				
9	Explain the bitumen tests to be conducted for quality checking	9	KTU 2021																																				
10	Define CBR. Design a flexible pavement for the construction of a new highway with the following data: Category of road - four lane dual carriage way, number of commercial vehicles in the year of completion of construction = 2400 CVPD per direction, design life = 15 year, annual growth rate of vehicles = 5%, design CBR value of soil subgrade = 5%, vehicle damage factor = 3.5, lane distribution factor = 0.75	7	KTU 2022																																				



MODULE 3

1	Explain the terms traffic volume and traffic capacity	3	KTU 2023																
2	What are the various traffic control devices	3	KTU 2023																
3a)	How are the speed and delay studies carried out? What are the various uses of speed and delay study?	8	KTU 2023																
3b)	Explain the factors affecting level of service of a multilane highway	6	KTU 2023																
4a)	Define the terms basic capacity, possible capacity and practical capacity and its importance in traffic engineering	8	KTU 2023																
4b)	What are the different types of road intersections? Illustrate with the help of sketches.	6	KTU 2023																
5	<p>A fixed time 2-phase signal is to be provided at an intersection having four arms. The design hour traffic and saturation flow are</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>North</th> <th>South</th> <th>East</th> <th>West</th> </tr> </thead> <tbody> <tr> <td>Design hour flow (pcu/hr)</td> <td>800</td> <td>400</td> <td>750</td> <td>600</td> </tr> <tr> <td>Saturation flow (pcu/hr)</td> <td>2400</td> <td>2000</td> <td>3000</td> <td>3000</td> </tr> </tbody> </table> <p>Time lost per phase due to starting delay is 2 sec and All red period is 4 sec. Design two phase traffic signal using Webster's method. Draw the phase diagram also.</p>		North	South	East	West	Design hour flow (pcu/hr)	800	400	750	600	Saturation flow (pcu/hr)	2400	2000	3000	3000	10	KTU 2018	
	North	South	East	West															
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6	Explain various Levels of Services (LOS) as per HCM. What are the factors affecting capacity and LOS?	7	KTU 2022																
7	<p>A fixed time 2 phase signal is to be provided at an intersection having a N-S and E-W road where only straight ahead traffic is permitted. The hour flows are given in the table. Calculate the optimum cycle time and green time for the minimum overall delay. The integration time should be the minimum necessary for efficient operation. The time lost per phase due to starting delays can be assumed to be 2 seconds. The value of the amber period is 2 seconds. Sketch the timing diagram for each phase.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>N</th> <th>S</th> <th>E</th> <th>W</th> </tr> </thead> <tbody> <tr> <td>Design hour flow (q) in PCUs/ hour</td> <td>800</td> <td>400</td> <td>750</td> <td>1000</td> </tr> <tr> <td>Saturation flow (s) in PCUs/ hour</td> <td>2400</td> <td>2000</td> <td>3000</td> <td>3000</td> </tr> </tbody> </table>		N	S	E	W	Design hour flow (q) in PCUs/ hour	800	400	750	1000	Saturation flow (s) in PCUs/ hour	2400	2000	3000	3000	7	KTU 2022	
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Saturation flow (s) in PCUs/ hour	2400	2000	3000	3000															
8a)	Explain how spot speed data are presented and the results used in traffic engineering	7	KTU 2022																
8b)	List the various devices used in traffic controlling and their general	7	KTU 2022																

SUB CODE	CET206	SUBJECT NAME	TRANSPORTATION ENGINEERING
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	requirements. What are the different systems of traffic signal coordination?			
9	What is the significance of passenger car unit in traffic studies?	3	KTU 2022	
10	Discuss the advantages and disadvantages of rotary intersections	3	KTU 2022	

MODULE 4

1	What is a dry dock?	3	KTU 2023	
2	What is coning of wheels? Why is it necessary?	3	KTU 2023	
3a)	What should be the actual ruling gradient if the ruling gradient is 1 in 130 on a MG and a curve of 4 degree is super imposed on above track section?	4	KTU 2023	
3b)	What are the component parts of a railway track? Explain the functions and requirements of sleepers.	10	KTU 2023	
4a)	What are the requirements of a good harbour?	6	KTU 2023	
4b)	Compare mound type break water with wall type breakwater with the help of sketches	8	KTU 2023	
5	Draw typical cross sections of tunnels and mention their applications.	6	KTU 2021	
6	Draw the cross section of a permanent way on an embankment. List the component parts of a railway track and explain their function	7	KTU 2022	
7	List the different types of breakwaters. What factors would guide the selection of a particular type?	7	KTU 2022	
8	List and explain the different stages of setting out of centreline of tunnels.	7	KTU 2022	
9	What are docks? Differentiate between dry dock and wet dock.	7	KTU 2022	
10	Explain wheel gauge. What are the different types of when gauge used in India?	3	KTU 2022	

MODULE 5

1	<p>The length of a runway under standard conditions is 1500m. The airport is to be provided at an elevation of 110m above mean sea level. The airport reference temperature is 32.0 C. Following data refers to the proposed longitudinal section of runway. Determine the corrected length of runway</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>End to end of runway (m)</th> <th>Grade(%)</th> <th>End to end of runway (m)</th> <th>Grade(%)</th> </tr> </thead> <tbody> <tr> <td>0 to 300</td> <td>+1</td> <td>1500 to 1800</td> <td>+1</td> </tr> <tr> <td>300 to 900</td> <td>-0.2</td> <td>1800 to 2100</td> <td>-0.3</td> </tr> <tr> <td>900 to 1500</td> <td>+0.5</td> <td></td> <td></td> </tr> </tbody> </table>	End to end of runway (m)	Grade(%)	End to end of runway (m)	Grade(%)	0 to 300	+1	1500 to 1800	+1	300 to 900	-0.2	1800 to 2100	-0.3	900 to 1500	+0.5			10	KTU 2018	
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0 to 300	+1	1500 to 1800	+1																	
300 to 900	-0.2	1800 to 2100	-0.3																	
900 to 1500	+0.5																			
2	What are the primary functions of air traffic control?	3	KTU 2023																	
3	List the components of an airport	3	KTU 2023																	
4a)	Enumerate the various factors which would be kept in view while selecting suitable site for an airport.	10	KTU 2023																	
4b)	What is a wind rose diagram? How is it useful in fixing the best orientation of runway?	4	KTU 2023																	
5a)	The length of runway under standard conditions is 1620 m. The airport site has an elevation of 270 m. Its reference temperature is 32.9°C. If the runway is to be constructed with an effective gradient of 0.2 percent, determine the corrected runway length.	10	KTU 2023																	

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5b)	Explain the function of following components in an airport. i) Taxiway ii) Apron	4	KTU 2023	
6	Distinguish between runway and taxiway	3	KTU 2022	
7	Explain with sketches, the basic patterns of runway configurations.	7	KTU 2022	
8	Draw the layout of a typical airport and label the different components. Explain the functions of (a) Aprons (b) Hangars.	7	KTU 2022	
9	The runway length required for landing at sea level in standard atmospheric conditions is 3000m. Runway length required for take-off at sea level in standard atmospheric condition is 2500m. Aerodrome reference temperature is 25 0C and that of the standard atmosphere at aerodrome elevation of 150m is 14.025 0C. If the effective runway gradient is 0.5 percent, determine the runway length to be provided.	7	KTU 2022	
10	Explain any six site selection criteria related with the airport site selection	7	KTU 2022	



**VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY TECHNICAL CAMPUS,
KILIMANOOR, THIRUVANANTHAPURAM-695602**

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**QUESTION BANK
PROFESSIONAL ETHICS**

MODULE 1

1	a. Academic integrity b. Importance of Work Ethics	KTU Model question paper	5 5
2	a. Distinguish Caring and Sharing b. What do you mean by Empathy	KTU Model question paper	5 5
3	a. Significance of Service Learning b. Explain Cooperation and commitment	KTU Model question paper	5 5
4	a. Differentiate morals and values b. How does civic virtues play a vital role in a life of a professional	KTU Model question paper	5 7
5	a. Compare between courage and self – confidence. b. Exemplify a comprehensive review about integrity and respect for others.	KTU Model question paper	5 9
6	a. What is the significance of work ethic in an organization b. Classify the relationship between ethical values and law?	KTU Model question paper	5 9
7	a. List the factors that enhance the self confidence in a person b. How does integrity help to build up the values of a professional	KTU June2022	3 3
8	a. Describe the qualities required live a peaceful life b. Explain the different aspects of honesty	KTU June2022	7 7
9	Classify courage based on the type of risk	KTU June2023	6
10	a. Explain the principles required to respect others b. Explain the role of commitment in the life of a professional	KTU June2023	7 7

MODULE 2

1	a. Explain the three main levels of moral developments, devised by Kohlberg b. Differentiate moral codes and optimal codes.	KTU model question paper	10 4
2	a. Extrapolate the duty ethics and right ethics. b. Discuss in detail the three types of inquiries in engineering ethics	KTU Model question paper	8 6
3	a. Explain Moral dilemmas b. What do you mean by Moral Autonomy	KTU Model question paper	6 14
4	a. What is Profession and Professionalism b. Theories about right action	KTU Model question paper	7 7
5	a. Examine the Gilligan theory of moral development	KTU Model question paper	14
6	Describe the professional roles to be played by an engineer	KTU Model question paper	12
7	Evaluate the Utilitarian Ethics	KTU Model question paper	5
8	a. Differentiate consensus and controversy in Engineering ethics b. Explain the types of Ethical theories. c. Compare Gilligan's theory with Kohlberg's theory on moral development	KTU June 2022	5 7 7
9	a. List out the models of professional roles b. Explain the causes of Moral Dilemmas. c. Describe the different types of inquiries in solving ethical problems	KTU June 2022	5 5 7
10	a. What makes engineering ethics different from general ethics b. What do you understand by resource crunch c. Explain the types of inquiries in engineering ethics	KTU June 2023	3 3 7

MODULE 3

1	Summarize the following features of morally responsible engineers. (i) Moral autonomy (ii) Accountability	KTU Model question paper	8
2	a.Explain the rights of employees b. Explain the reasons for Chernobyl mishap ?	KTU Model question paper	6 6
3	a. Describe the methods to improve collegiality and loyalty b. Codes of Ethics	KTU Model question paper	8 6
4	a.Explain Plagiarism b.Role of experiments in engineering	KTU Model question paper	6 9
5	a.Investigate the Challenger space shuttle explosion b. Investigate the Bhopal gas tragedy	KTU Model question paper	10 10
6	a.List out the limitations of Codes of Ethics b. Illustrate the role of engineers as experimenters	KTU June 2022	7 6
7	a.Evaluate the importance of accountability in a professional's life. b.Explain the role of Codes of Ethics in the service life of a professional Engineer	KTU June 2022	7 7
8	a.What are the similarities between engineering ethics and standard experiment b.What are the significance of industrial standards. List the advantages of industrial standards	KTU June 2023	7 7
9	What does the balanced outlook on law stress in engineering profession	KTU June 2023	7
10	What are the safety lessons that we can be learned from space shuttle challenger tragedy	KTU June 2023	7

MODULE 4

1	a. Execute collegiality with respect to commitment, respect and connectedness. b. Identify conflicts of interests with an example	KTU Model question paper	8 6
2	a.Explain in detail about professional rights and employee rights b. Exemplify engineers as managers	KTU Model question paper	6 8
3	a. Steps to Manage conflict in an organization b. Explain Collective bargaining – Methods	KTU Model question paper	8 6
4	Explain Professional rights	KTU Model question paper	6
5	a.Explain the ways of IPR protection b.Elaborate on methods of managing conflict	KTU June 2022	7 7
6	a.Differentiate between Patents and Trademarks b.Explain the different steps in managing conflicts in an organization	KTU June 2022	3 6
7	a.Describe the major steps involved in the process of collective bargaining b.Exemplify conflicts of interest and conflicts in interest. Illustrate various rights of an engineer as a professional	KTU June 2022	5 7
8	a.What are conflict of interest b. What is meant by whistle blowing. List our aspects	KTU June 2023	3 7
9	Discuss detail about the employee rights and its role in organization	KTU June 2023	7
10	What does the term collective bargaining	KTU June 2023	7

MODULE 5

1	Evaluate the technology transfer and appropriate technology.	KTU Model question paper	8
2	a. Investigate the causes and effects of acid rain with a case study. b. Conclude the features of ecocentric and biocentric ethics	KTU Model question paper	6 6
3	a. Multinational Corporations –Features, Advantages & Disadvantages b. Role of Engineers as Managers	KTU Model question paper	14 5
4	Explain Moral leadership	KTU Model Question paper	6
5	Importance of Business Ethics	KTU Model question paper	8
6	Describe the various requirements for engineers who act as advisors	KTU June 2022	7
7	Describe the two world views on Environmental Ethics	KTU June 2022	7
8	What are the fundamental duties to be kept in mind while engineers fulfill their professional duties	KTU June 2023	3
9	Point out responsibilities of consulting engineers	KTU June 2023	7
10	What are the role of computers in technological development. Recall the ten commandments in computer ethics	KTU June 2023	7

MCN 202-CONSTITUTION OF INDIA

MODULE 1

Sl.No.	Questions	Question Paper	Mark
1	Define Constitution. Why is it necessary for a Country?	KTU July 2021 (2019 scheme)	6
2	Explain the salient features of Indian Constitution.	KTU July 2021 (2019 scheme)	7
3	Give detail account on the historical background of Indian Constitution.	KTU July 2021 (2019 scheme)	3
4	Define Constitution of India with comparison with Other countries.	KTU July 2021 (2019 scheme)	7
5	What do you mean by federal system of government? Give an example.	KTU July 2021 (2019 scheme)	8
6	Explain different ways for acquiring Indian citizenship.	KTU July 2021 (2019 scheme)	4

MODULE 2

1	How is State defined under Article 12 of Indian Constitution?	KTU June 2021 (2019 Scheme)	7
2	Explain the term fundamental rights and its classification.	KTU June 2021 (2019 Scheme)	5
3	What are Fundamental Rights? Examine each of them.	KTU 2021 June (2019 Scheme)	3
4	What do you mean by right against exploitation? Explain.	KTU 2021 June (2019 Scheme)	3
5	Explain the situation for Suspending the Fundamental Rights.	KTU Dec 2021 (2019 Scheme)	3
6	Discuss the classification of Directive Principles of State Policy in detail.	KTU Dec 2021 (2019 Scheme)	5
7	State the Directive Principles of State Policy and explain its significance.	KTU Dec 2021 (2019 Scheme)	6
8	What are the fundamental duties of an Indian citizen?	KTU June 2022 (2019scheme)	4
9	Explain the various writs issued by High court of Kerala.	KTU July 2022 (2019scheme)	4
10	Explain the needs and importance of fundamental duties of Indian Citizen.	KTU July 2022 (2019scheme)	4

MODULE 3

1	Explain how Union Executive is elected and formed.	KTU April 2021 (2019 Scheme)	7
2	Explain the procedure for impeachment of the President of India.	KTU April 2022 (2019 Scheme)	5

3	Explain the Powers and Functions of the Attorney General for India.	KTU April 2021 (2019 Scheme)	5
4	Explain the functions and the powers of President of India.	KTU April 2021 (2019 Scheme)	8
5	Explain the constitutional position and essential qualifications of Vice-president of India.	KTU April 2021 (2019 Scheme)	4
6	Explain the qualification and disqualification for membership in the house of the people.	KTU April 2021 (2019 Scheme)	4
7	Explain various kinds of jurisdiction of Supreme Court.	KTU Dec 2022 (2019 Scheme)	6
8	Explain the constitutional duties and powers of the Prime Minister.	KTU Dec 2022 (2019 Scheme)	6
9	Write five specialties of Supreme court?	KTU Dec 2022 (2019 Scheme)	4
10	Describe the duties and role of Comptroller and Auditor General of Indian (CAG).	KTU Dec 2022 (2019 Scheme)	5

MODULE 4

1	Explain the functions of the State Legislature.	KTU April 2021 (2019 Scheme)	7
2	Explain State Legislative Assembly in detail.	KTU April 2022 (2019 Scheme)	6
3	Explain the qualification a disqualification for membership of the state legislature.	KTU April 2021 (2019 Scheme)	5
4	Explain the procedure for the appointment of chief minister.	KTU April 2021 (2019 Scheme)	4
5	Explain the responsibilities and functions of Council of Ministers to State Legislative Assembly.	KTU April 2021 (2019 Scheme)	4
6	Explain the duties of advocate general of the state.	KTU April 2021 (2019 Scheme)	7
7	Explain the powers and functions of the Governor of Kerala state.	KTU Dec 2022 (2019 Scheme)	8
8	Explain the constitution of High court. What are the essential qualifications required for the appointment of High court Judge?	KTU Dec 2022 (2019 Scheme)	6
9	Examine the administrative and financial relation between the Union and the State.	KTU Dec 2022 (2019 Scheme)	4
10	Discuss about Jurisdiction of High court.	KTU Dec 2022 (2019 Scheme)	3

MODULE 5

1	Explain the distribution of tax revenue with respect to centre-state financial relation.	KTU April 2021 (2019 Scheme)	7
2	How is Central and State Government related on economic basis?	KTU April 2022 (2019 Scheme)	5

3	Explain parliamentary legislation in the state field.	KTU April 2021 (2019 Scheme)	5
4	Discuss the effects of national and financial emergencies.	KTU April 2021 (2019 Scheme)	4
5	What is the need for administrative tribunals? Explain the functions of state administrative tribunals.	KTU April 2021 (2019 Scheme)	4
6	Distinguish between an „ Ordinary Bill“ and „Money Bill“	KTU April 2021 (2019 Scheme)	6
7	Enumerate the powers and functions of Public Service Commission.	KTU Dec 2022 (2019 Scheme)	6
8	List out the three types of emergencies under Indian Constitution.	KTU Dec 2022 (2019 Scheme)	6
9	Explain the characteristics of Administrative Tribunals.	KTU Dec 2022 (2019 Scheme)	4
10	What are the reasons for the growth of Administrative Tribunals in India.	KTU Dec 2022 (2019 Scheme)	5
