GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-IV (New) EXAMINATION – WINTER 2015

Subject Code:2141703						Date:	Date:19/12/2015		
Su Ti Ins	bject me: 2 tructio	t Name: Ni 2:30pm to ons:	imerical Te 5:30pm	echniques 8	z Statistica	l Methods	Total	l Marks:	: 70
	1. 2. 3.	Make suitaFigures to	able assump	tions wherev dicate full m	ver necessar arks.	у.			
Q.1	(a)	 (i) A civil engineer has measured the height of a 10 floor building as 2950 cm and the working height of each beam as 35 cm while the true values are 2945 cm and 30 cm, respectively. Compare their absolute and relative errors. 							03
		(ii) Find th upto fo	ne positive r our decimal	boot of $x - c$ places.	$\cos x = 0$, u	ising bisect	ion method co	orrect	04
	(b)	(i) A car ro four of probab	ental agency the cars are ility of getti	y has 18 con randomly s ng two of ea	npact cars a elected for ach kind ?	nd 12 inter a safety che	mediate-size eck, what is th	cars. If e	03
		(ii) The pr the pr 0.24 a a) W b) W	obability the obability the nd the probe 'hat is the pr 'hat is the pr	at a new airp at it will get ability that in robability th robability th	oort will get an award fo t will get bo at it will ge at it will ge	t an award f or the effici oth awards i t atleast one t only one c	For its design i ent use of mar s 0.11. e of the two av of two awards	is 0.16, terials is wards ? ?	04
Q.2	(a)	(i) If $f(x) =$ f(a,b,c)	$=\frac{1}{x^2}, \text{ find } t$	he divided d	lifferences	f(a,b), f(a,b)	<i>a,b,c</i>) and		03
		(ii) Use Lag	grange's for	mula to fit a	polynomia	l to the data	l		04
			X	-1	0	2	3		
			у	-8	3	1	12		
		and her	the find $y($.	x = 1).					
	(b)	(i) Compute the integral $\int_{0}^{\pi/2} \sqrt{\sin x} dx$ by applying Simpson's $\frac{1}{3}$ rule for							03
	n=4 and $n=6$ with an accuracy to five decimal places.								
	(ii) Using Milne's predictor-corrector method, find $y(2)$ for							04	
		$y' = \frac{1}{2}$	(x+y) wh	ere $y(0) = 2$,	y(0.5)=2.0	636, y(1)=	3.595, y(1.5)	=4.968.	

- (b) Use Gauss-Seidel iterative method to solve the following system of simultaneous 07 equations:
 - 9x + 4y + z = -17 x - 2y - 6z = 14x + 6y = 4
- Q.3 (a) Solve the equation y' = x + y with initial condition y(0) = 1 by using Runge 07 Kutta method of fourth order from x=0 to x=0.4 with h=0.1.
 - (b) (i) Apply modified Euler's method to solve $\frac{d y}{d x} = e^x + x y$, y(0)=0 to 03
 - compute y(0.1) and y(0.2) taking step size h = 0.1.
 - (ii) Using Romberg's method, evaluate $I = \int_{0}^{1} \frac{dx}{1+x}$ correct to three decimal places by taking h=0.5, 0.25, 0.125. Hence evaluate $\log_{e} 2$.
- OR 0.3 (a) Obtain cubic spline for each subintervals from the following data 07 2 3 0 1 Х 2 1 33 244 V (b) (i) Using Gauss- Jordan method, find the inverse of the matrix 03 $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}.$
 - (ii) Apply Taylor's series method to find the value of y(1.1) and y(1.2), **04** given that $\frac{dy}{dx} = x y^{\frac{1}{3}}$, y(1) = 1.
- Q.4 (a) (i) Human error is given as the reason for 75% of all accidents in a plant. Use 03 the formula for the binomial distribution to find the probability that human error will be given as the reason for two of the next four accidents.
 - (ii) At a checkout counter customers arrive at an average of 1.5 per minute. Find 04 the probabilities that
 - a) at most 4 will arrive in any given minute
 - b) at least 3 will arrive during an interval of 2 minutes
 - (b) (i) The time required to assemble a piece of machinery is a random variable having approximately a normal distribution with μ=12.9 minutes and σ=2.0 minutes. What are the probabilities that the assembly of a piece of machinery of this kind will take
 - a) at least 11.5 minutes
 - b) anywhere from 11.0 to 14.8 minutes ?

(ii) A random sample of size n=100 is taken from a population with $\sigma=5.1$. 04 Given that the sample mean is $\bar{x} = 21.6$, construct a 95% confidence interval for the population mean μ .

OR

- Q.4 (a) (i) During one stage in the manufacture of integrated circuit chips, a coating must be applied. If 70% of chips receive a thick enough coating, use the binomial distribution to find the probabilities that, among 15 chips :
 - a) exactly 10 will have thick enough coatings
 - b) at most 6 will have thick enough coatings
 - (ii) A heavy machinery manufacturer has 3,840 large generators in the field that **04** are under warranty. If the probability is $\frac{1}{1,200}$ that any one will fail during the given year, find the probabilities that 0 and 2 of the generators will fail during the given year.
 - (b) (i) A stamping machine produces can tops whose diameters are normally distributed with a standard deviation of 0.01 inch. At what normal mean diameter should the machine be set so that no more than 5% of the can tops produced have diameters exceeding 3 inches ?
 - (ii) The mean weight loss of n=16 grinding balls after a certain length of time 04 in mill slurry is 3.42 grams with a standard deviation of 0.68 gram. Construct a 99% confidence interval for the true mean weight loss of such grinding balls under the stated conditions.
- Q.5 (a) A manufacturer claims that the average tar content of a certain kind of cigarette 07 is $\mu = 14.0$. In an attempt to show that it differs from this value, five measurements are made of the tar content(mg per cigarette):

14.4

14.5

14.2

Show that the difference between the mean of this sample, $\bar{x} = 14.4$, and the average tar claimed by the manufacturer, $\mu = 14.0$, is significant at $\alpha = 0.05$. Assume normality.

14.3

14.6

project. The job consists of the following activities and their estimated times :						
Activity	Description	Immediate	Time			
		Predecessors	(days)			
Α	Prepare preliminary sketches	-	2			
В	Outline specifications	-	1			
С	Prepare drawings	Α	3			
D	Write specifications	A, B	2			
E	Run off prints	C, D	1			
F	Have specification	B, D	3			
G	Assemble bid packages	E,F	1			

(b) An architect has been awarded a contract to prepare plans for an urban renewal 07 project. The job consists of the following activities and their estimated times :

- a) Draw the network diagram of activities for the project.
- b) Indicate the critical path and calculate the total float and free float for each activity.

- Q.5 (a) A trucking firm is suspicious of the claim that the average lifetime of certain tires is at least 28,000 miles. To check the claim, the firm puts 40 of these tires on its trucks and gets a mean lifetime of 27,463 miles with a standard deviation of 1,348 miles. What can it conclude if the probability of a Type *I* error is to be at most 0.01 ?
 - (b) A small project is composed of 7 activities, whose time estimates are listed in the table below. Activities are identified by their beginning *i* and ending *j* node numbers.

Activity	Estimated Duration (weeks)					
(i - j)	Optimistic	Most Likely	Pessimistic			
1 – 2	1	1	7			
1 – 3	1	4	7			
1-4	2	2	8			
2-5	1	1	1			
3 - 5	2	5	14			
4 - 6	2	5	8			
5 - 6	3	6	15			

(a) Find the critical path.

- (b) What is the expected project length?
- (c) Calculate the variance and standard deviation of the project length.
