

University of Mumbai

Examination 2020 under cluster __ (Lead College: _____)

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: Computer Engineering

Curriculum Scheme: Rev 2019

Examination: Second Year Semester III

Course Code: CSC301 and Course Name: Engineering Mathematics-3

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Laplace transform of $\cos(\sqrt{3}t)$ is
Option A:	$\frac{s}{s^2 + 9}$
Option B:	$\frac{s}{s^2 - 9}$
Option C:	$\frac{s}{s^2 + 3}$
Option D:	$\frac{s}{s^2 - 3}$
2.	The value of $\int_0^\infty e^{-3t} \left(\frac{\sinh t}{t}\right) dt$ is
Option A:	$\frac{1}{3} \ln 3$
Option B:	$\frac{1}{3} \ln\left(\frac{1}{3}\right)$
Option C:	$\frac{1}{2} \ln 2$
Option D:	$\frac{1}{2} \ln\left(\frac{1}{2}\right)$
3.	Laplace transform of $f(t) = t^2 e^{-t}$ is
Option A:	$\frac{2}{(s-1)^3}$
Option B:	$\frac{2}{(s+1)^3}$

Option C:	$\frac{\Gamma(2)}{(s-1)^3}$
Option D:	$\frac{\Gamma(2)}{(s+1)^3}$
4.	Laplace transform of $\int_0^t \sin 2t \cosh 2t dt$ is
Option A:	$\frac{1}{s} \left[\frac{1}{(s-2)^2 - 4} - \frac{1}{(s+2)^2 - 4} \right]$
Option B:	$\frac{1}{s} \left[\frac{1}{(s-2)^2 - 4} + \frac{1}{(s+2)^2 - 4} \right]$
Option C:	$\frac{1}{s} \left[\frac{1}{(s-2)^2 + 4} - \frac{1}{(s+2)^2 + 4} \right]$
Option D:	$\frac{1}{s} \left[\frac{1}{(s-2)^2 + 4} + \frac{1}{(s+2)^2 + 4} \right]$
5.	Inverse Laplace transform of $\frac{s-1}{s^2}$ is
Option A:	$-1 - t$
Option B:	$-1 + t$
Option C:	$1 + t$
Option D:	$1 - t$
6.	$L^{-1} \left[\frac{s+2}{s^2+4s+5} \right]$ is
Option A:	$e^{-2t} \cos t$
Option B:	$e^{-2t} \sin t$
Option C:	$e^{2t} \cos t$
Option D:	$e^{2t} \sin t$
7.	$L^{-1}(\tan^{-1}s)$ is
Option A:	$\frac{\sin t}{t}$
Option B:	$\frac{\cos t}{t}$
Option C:	$-\frac{\sin t}{t}$
Option D:	$-\frac{\cos t}{t}$

8.	$L^{-1} \left[\frac{s(2s^2-3)}{(s^2+1)(s^2-4)} \right]$ is
Option A:	$\cosh t + \cosh 2t$
Option B:	$\cos t + \cosh 2t$
Option C:	$\cos t + \cos 2t$
Option D:	$\cosh t + \cos 2t$
9.	Fourier coefficient a_2 for $f(x)=x$, x belongs to $(-1, 1)$ is
Option A:	-1
Option B:	1
Option C:	0
Option D:	2
10.	Fourier coefficient b_1 for $f(x) = x \cdot \sin x$, where $x \in (0, 2\pi)$ is
Option A:	0
Option B:	π
Option C:	$-\pi$
Option D:	$\frac{\pi}{\sqrt{2}} - \frac{\pi}{\sqrt{3}}$
11.	Fourier coefficient a_0 in half range cosine series for $f(x) = e^x, x \in (0,1)$ is
Option A:	$e+1$
Option B:	$-e-1$
Option C:	$-e+1$
Option D:	$e-1$
12.	Value of constant real number m such that $f(z) = f(x + iy) = e^{3mx+2iy}$ is analytic function is
Option A:	$2/3$
Option B:	$-2/3$
Option C:	$3/2$
Option D:	$-3/2$

13.	For real variables x, y function $u(x, y) = 2xy$												
Option A:	does not satisfy Laplacian equation.												
Option B:	is not continuous.												
Option C:	is harmonic.												
Option D:	is continuous but not partially differentiable.												
14.	For $f(z) = \sin x \cosh(y) + i \cos x \sinh(y)$, where $z = x + iy$, $f'(z)$ is												
Option A:	$-\sin z$												
Option B:	$\sinh z$												
Option C:	$\cos z$												
Option D:	$\cosh z$												
15.	If coefficients of correlation between variables x, y is 0.5 and coefficient of regression b_{xy} is 0.2 then coefficient of correlation b_{yx} is												
Option A:	1.25												
Option B:	-1.25												
Option C:	2.5												
Option D:	-2.5												
16.	If a straight line is $y=ax+b$ is fitted to following data <table border="1" style="margin-left: 20px;"> <tbody> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>y</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> </tbody> </table> Then values of a & b are	x	0	1	2	3	4	y	1	2	3	4	5
x	0	1	2	3	4								
y	1	2	3	4	5								
Option A:	$a=1, b=0$												
Option B:	$a=1, b=1$												
Option C:	$a=0, b=1$												
Option D:	$a=-1, b=1$												
17.	The coefficient of rank correlation between two variables with unequal ranks is -0.9 . If the number of pairs is 5, then the sum of squares of differences in ranks is												
Option A:	37												
Option B:	36												
Option C:	39												
Option D:	38												

18.	If random variable X has the probability distribution as					
	X	-2	-1	0	1	2
	P(X=x)	3k	2k	2k	k	0.2
	Then $P(-2 < X \leq 2)$ is					
Option A:	1					
Option B:	0.7					
Option C:	0.8					
Option D:	0.5					
19.	A random variable X has probability distribution with $E(X) = 1.5$, $E(X^2) = 3$ then then variance is					
Option A:	0.75					
Option B:	1.5					
Option C:	3					
Option D:	5.25					
20.	A continuous random variable X has the probability law $f(x) = k^2 x^3$, $0 \leq x \leq 3$, $k > 0$ then value of k is					
Option A:	2/81					
Option B:	4/81					
Option C:	4/9					
Option D:	2/9					

Q2 (20 Marks)	Solve any Four out of Six	5 marks each
A	Find Laplace transform of $f(t) = \sin^2 t \cos^3 t$.	
B	Using convolution theorem find the inverse Laplace transform of $\phi(s) = \frac{s}{s^4 - 1}$	
C	Find Fourier series of $f(x) = x \sin x$ in $(-\pi, \pi)$.	
D	Find an analytic function $\omega = f(z) = u + iv$, where $z = x + iy$, whose real part is $u(x, y) = x^2 - y^2 + 2y - \sin(x) \cdot \sinh(y)$	
E	Calculate Spearman's coefficient of rank correlation and Pearson's coefficient of correlation from the following data on height and weights of 5 students.	
	Height(in inches)	61 63 65 67 69
	Weight(In kgs)	64 62 65 70 72

F	<p>The warranty of electronic device in thousand of days has the density function $f(x) = \begin{cases} 4e^{-4x}, & x > 0 \\ 0, & \text{otherwise} \end{cases}$</p> <p>Find the expected warranty of the device.</p>
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Q3 (20 Marks)	Solve any Four out of Six	5 marks each																
A	<p>Given $f(t) = \begin{cases} 4, & 0 \leq x < 3 \\ 0, & x > 3 \end{cases}$.</p> <p>Find $L[f(t)]$, $L[f'(t)]$.</p>																	
B	<p>Find inverse Laplace transform of $\phi(s) = \frac{3s^2+11s+11}{s^3+6s^2+11s+6}$</p>																	
C	<p>Find half range sine series for $f(x) = e^{-x}, 0 < x < 1$.</p>																	
D	<p>In the polar coordinates, let $\omega = u + iv$, $u(r, \theta) = r^2 \sin 2\theta$. Show that u satisfies Laplace's equation and find $v(r, \theta)$.</p>																	
E	<p>Fit a second degree parabolic curve to the following data.</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 10%;">x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td>y</td> <td>1</td> <td>1</td> <td>3</td> <td>7</td> <td>13</td> <td>21</td> <td>31</td> </tr> </table>		x	0	1	2	3	4	5	6	y	1	1	3	7	13	21	31
x	0	1	2	3	4	5	6											
y	1	1	3	7	13	21	31											
F	<p>A random variable X has the probability distribution $P(X = x) = \frac{1}{16} ({}^4C_x)$, $x = 0,1,2,3,4$. Write Probability distribution and find standard deviation.</p>																	

University of Mumbai

Examination 2020 under cluster 4 (Lead College: PCE, New Panel)

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: Computer Engineering

Curriculum Scheme: Rev2019

Examination: SE Semester III

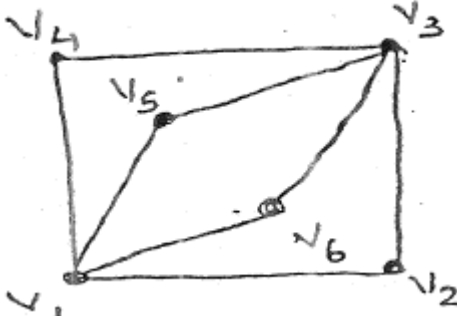
Course Code: CSC302 and Course Name: Discrete Structures and Graph Theory

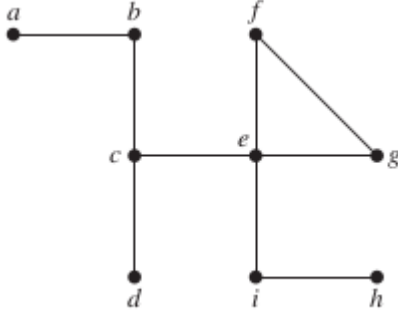
Time: 2 hour

Max. Marks: 80

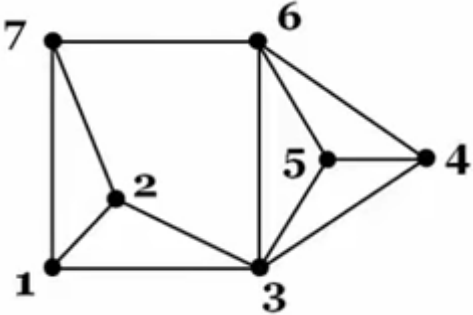
Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Let $A = \{2,3,4,5,6\}$ and let R_1, R_2 be relations on A such that $R_1 = \{(a,b) \mid a-b=2\}$ and $R_2 = \{(a,b) \mid a+1=b \text{ or } a=2b\}$ Find the composite relation $R_2.R_1$?
Option A:	$\{(4,3),(5,4),(6,2),(6,5)\}$
Option B:	$\{(3,2),(5,4),(4,3)\}$
Option C:	$\{(5,2),(6,3)\}$
Option D:	$\{(2,3),(3,4),(4,5),(5,6)\}$
2.	Which of the following is the correct representation of the sentence "Someone is liked by everyone"?
Option A:	$(\exists x)(\exists y) \text{ likes}(x,y)$
Option B:	$(\forall x)(\forall y) \text{ likes}(x,y)$
Option C:	$(\exists y)(\forall x) \text{ likes}(x,y)$
Option D:	$(\forall x)(\exists y) \text{ likes}(x,y)$
3.	Draw the Hasse diagram of D_{30} . i) It is Complemented Lattice ii) It is Distributive Lattice Which of the above statement is True?
Option A:	Only i
Option B:	Only ii
Option C:	Both i and ii
Option D:	Neither i nor ii
4.	Consider the set N of positive integers, and let $*$ denote the operation of least common multiple(lcm) on N . Which of the following sentence is True?
Option A:	$(N,*)$ is not a Semi group.
Option B:	$(N,*)$ is commutative Semi group
Option C:	$(N,*)$ is not commutative Semi group.
Option D:	None of the Above.
5.	How many two digits or three digits numbers can be formed using the digits

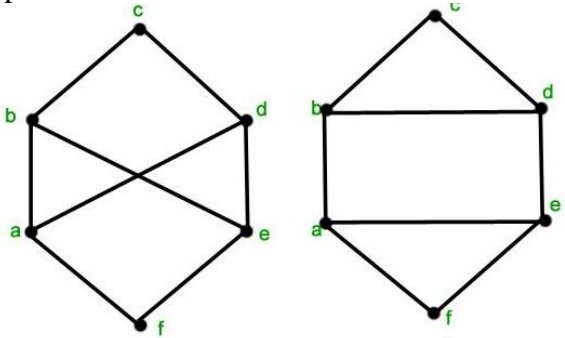
	1,2,3,4,5,6,7,8 and 9 , if no digits are repeated ?
Option A:	210
Option B:	24
Option C:	212
Option D:	252
6.	Consider the following subsets of the positive integers N. Which of the following is not closed under multiplication operation?
Option A:	$A=\{0,1\}$
Option B:	$E=\{1,3,5,\dots\}$
Option C:	$C=\{x: x \text{ is prime}\}$
Option D:	$F=\{0,1,2\}$
7.	If every vertex of simple graph has same degree it is called as _____.
Option A:	Bipartite Graph
Option B:	Regular Graph
Option C:	Planner Graph
Option D:	Sub graph
8.	The less than relation, $<$, on real is
Option A:	A Partial ordering since it is asymmetric and reflexive.
Option B:	A partial ordering since it is anti-symmetric and reflexive.
Option C:	Not a partial ordering because it is not asymmetric and not reflexive.
Option D:	Not a partial ordering because it is not anti-symmetric and not reflexive.
9.	Consider set of integers from 1 to 250. Find how many of these numbers are divisible by 5 or 6 but not by 8?
Option A:	83
Option B:	69
Option C:	100
Option D:	31
10.	Consider $G=\{1,5,7,11,17\}$ under multiplication modulo 18. Find inverse of 5, 7 and 17 ?
Option A:	11,17 and 13
Option B:	11,13 and 17
Option C:	11 , 17 and 7
Option D:	13,11 and 7
11.	The following graph is _____.
Option A:	Bipartite Graph
Option B:	Complete Bipartite Graph
Option C:	Eulerian Graph
Option D:	Eulerian but not Bipartite Graph

12.	The set of integers Z with binary operation $*$ defined as $a*b=a+b+1$ for $a,b \in Z$, is a group. The identity element of this group is_____.
Option A:	0
Option B:	1
Option C:	-1
Option D:	12
13.	How many persons must be chosen in order that at least five of them will have birthdays in the same calendar month?
Option A:	28
Option B:	69
Option C:	49
Option D:	52
14.	 <p>Which of the following is true for above graph?</p> <p>i) It is Eulerian Graph</p> <p>ii) It is Hamiltonian Graph</p>
Option A:	Only i
Option B:	Only ii
Option C:	Both i and ii
Option D:	Neither i nor ii
15.	A Poset in which every pair of elements has both a least upper bound and a greatest lower bound is termed as _____
Option A:	Walk
Option B:	Trail
Option C:	Sub lattice
Option D:	Lattice
16.	State the type of function for following example “ To each country assign the number of people living in the country”
Option A:	Many-One
Option B:	One-Many
Option C:	One-One
Option D:	Many-Many
17.	Let P: We should be trustworthy. Q: We should be committed. R: We should be overconfident. Then ‘We should be trustworthy or committed but not overconfident.’ is best represented by?

Option A:	$P \vee Q \wedge R$
Option B:	$\sim P \vee \sim Q \vee R$
Option C:	$P \vee Q \wedge \sim R$
Option D:	$P \wedge \sim Q \wedge R$
18.	Total how many Cut Vertex exists in the following graph? 
Option A:	2
Option B:	4
Option C:	3
Option D:	1
19.	The binary relation $\{(a,a), (b,a), (b,b), (b,c), (b,d), (c,a), (c,b)\}$ on the set $\{a,b,c\}$ is _____
Option A:	irreflexive, symmetric and transitive
Option B:	reflexive, symmetric and transitive
Option C:	irreflexive and antisymmetric
Option D:	neither reflexive, nor irreflexive but transitive
20.	Which rule of inference is used in this argument? "No humans can fly. John is human. Therefore John can not fly."
Option A:	Universal instantiation
Option B:	Existential instantiation
Option C:	Universal generalization
Option D:	Existential generalization

Q2	
A	Solve any Two 5 marks each
i.	Let $A=\{1,2,3,4,5\}$, $R=\{(a,b) \mid (a+b) \text{ is even}\}$. R is a relation on set A. Check whether R is an equivalence relation?
ii.	$X=\{2,3,6,1,24,36\}$ R on X = $\{(x,y) \in R, x \text{ divides } y\}$ a) Construct Hasse diagram b) Maximum and Minimal elements? c) Give Chain and Ant chains. d) Maximum length of chain? e) Is a poset lattice?
iii.	Define the following with suitable example a) Ring b) Cyclic Group c) Monoid d) Normal Subgroup e) Planner Graph

B	Solve any One	10 marks each
i.	<p>Define with example Euler path, Euler circuit, Hamiltonian path and Hamiltonian circuit. Determine if following diagram has Euler path, Euler circuit, Hamiltonian path and Hamiltonian circuit and state the path/circuit.</p> 	
ii.	<p>Find the number of code word generated by the parity check matrix H given below. Find all the code words generated.</p> $H = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 \end{pmatrix}$	

Q3.		
A	Solve any Two	5 marks each
i.	<p>Define Isomorphic Graph. Determine if following graphs G1 and G2 are isomorphic or not.</p> 	
ii.	Convert into CNF: $((P \rightarrow Q) \rightarrow R)$	
iii.	<p>Functions f,g,h are defined on a set $X = \{a,b,c\}$ as $f = \{(a,b), (b,c), (c,a)\}$ $g = \{(a,b), (b,a), (b,b)\}$ $h = \{(a,a), (b,b), (c,a)\}$</p> <p>i) Find fog, gof. Are they equal? ii) Find fogoh and fohog?</p>	
B	Solve any One	10 marks each
i.	Prove that $(\mathbb{Z}_5, +_5)$ is a Abelian group.	
ii.	Solve the recurrence relation for Fibonacci sequence 1,1,2,3,5,8,13.	

University of Mumbai

Examination 2020 under cluster 4 (Lead College: PCE, New Panvel)

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: **Computer Engineering**

Curriculum Scheme: Rev2019

Examination: SE Semester III

Course Code: CSC302 and Course Name: Discrete Structures and Graph Theory

Time: 2 hour

Max. Marks: 80

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Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	B
Q2.	C
Q3.	C
Q4	B
Q5	D
Q6	C
Q7	B
Q8.	D
Q9.	B
Q10.	B
Q11.	A
Q12.	C
Q13.	C
Q14.	A
Q15.	D
Q16.	C
Q17.	C
Q18.	B
Q19.	D
Q20.	A

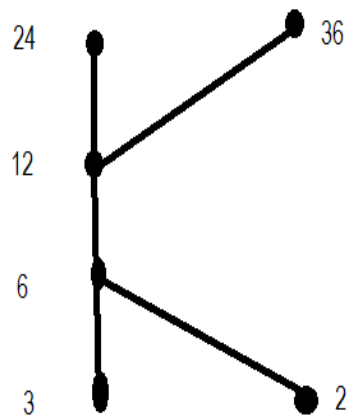
Q2. A

i) Definition of Equivalence relation
– 1 marks

Prove that relation is equivalence
relation – 4 marks

ii)

a. Construct Hasse diagram



b. Maximum elements
= $\{24,36\}$ and Minimal
elements= $\{3,2\}$

c. Chain =
 $\{3,6,12,24\}$, $\{3,6,12,36\}$, $\{2,6,$
 $12,24\}$ and $\{2,6,12,36\}$ and
Ant chains= $\{2,3\}$ and $\{24,36\}$

d. Maximum length of chain? 4

e. Is a poset lattice? No
As $(2$ and $3)$ has no lower
bound and $(24,36)$ has no
upper bound

iii) Definition $\frac{1}{2}$ marks and example
 $\frac{1}{2}$ mark each

B) Solve any one

i) definition $\frac{1}{2}$ mark example 1 mark
 $11/2 * 4 = 6$ marks for correct path/
circuit finding 4 marks.

ii) Ans :

$C = \{(000000), (001011), (010101), (01111$
 $0), (100111), (101100), (110010), (111001)$

Q3. I) Defintion with example 2 marks

These are not isomorphic graphs ,
steps 3 marks.

ii) Convert to CNF , apply logic rules,

and get equivalent form

Ans: $(P \vee R) \wedge (\sim Q \vee R)$

iii) Gof = $\{(1,3),(3,1),(2,2)\}$
 , gof = $\{(1,1),(2,3),(3,2)\}$
 Fog not equal to gof
 Fogoh = $\{(1,3),(2,2),(3,3)\}$
 Fohog = $\{((1,3),(2,2),(3,2))\}$

B solve any one

i) To prove $(\mathbb{Z}_5, +_5)$ is Abelian group

Definition of Abelian Group – 2
 marks, stepwise explanation – 8
 marks

ii) Recurrence relation Fibonacci
 sequence

Sol: Gr: Fibonacci sequence: $F_n = F_{n-1} + F_{n-2}$, $F_1=1, F_2=1$
 is a homogeneous equation of order 2
 characteristic eqn: $y^2 - y - 1 = 0$ $a=1, b=-1, c=-1$

$$y = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-1)}}{2(1)} = \frac{1 \pm \sqrt{5}}{2}$$

$$r_1 = \frac{1 + \sqrt{5}}{2}, r_2 = \frac{1 - \sqrt{5}}{2} \rightarrow \text{Real \& distinct}$$

General Solution: Real & distinct: $F(n) = A r_1^n + B r_2^n$

$$F(n) = A \left[\frac{1 + \sqrt{5}}{2} \right]^n + B \left[\frac{1 - \sqrt{5}}{2} \right]^n$$

To find constant: $F_1=1, F_2=1$

$n=1$, $F(1) = A \left[\frac{1 + \sqrt{5}}{2} \right]^1 + \left[\frac{1 - \sqrt{5}}{2} \right]$

$$1 = \frac{1}{2} [A+B] + \frac{\sqrt{5}}{2} [A-B] \Rightarrow \textcircled{1}$$

$n=2$, $F(2) = A \left[\frac{1 + \sqrt{5}}{2} \right]^2 + B \left[\frac{1 - \sqrt{5}}{2} \right]^2$

$$= A \left[\frac{1 + 2\sqrt{5} + 5}{4} \right] + B \left[\frac{1 - 2\sqrt{5} + 5}{4} \right]$$

$$= A \left[\frac{3 + \sqrt{5}}{2} \right] + B \left[\frac{3 - \sqrt{5}}{2} \right]$$

$$1 = \frac{3}{2} [A+B] + \frac{\sqrt{5}}{2} [A-B] \Rightarrow \textcircled{2}$$

$\textcircled{2} - \textcircled{1} \Rightarrow 0 = A+B \Rightarrow B = -A$

Sub B in $\textcircled{1}$; $1 = \frac{1}{2} [A-A] + \frac{\sqrt{5}}{2} [A - (-A)] \Rightarrow \boxed{A = \frac{1}{\sqrt{5}}}$

$\therefore \boxed{B = -\frac{1}{\sqrt{5}}}$

Solution: $F(n) = \frac{1}{\sqrt{5}} \left[\frac{1 + \sqrt{5}}{2} \right]^n + \left(-\frac{1}{\sqrt{5}} \right) \left[\frac{1 - \sqrt{5}}{2} \right]^n, n \geq 1$

University of Mumbai

Examination 2020 under cluster 4 (Lead College: PCE, Panvel)

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021
to 20th January 2021

Program: COMPUTER ENGINEERING

Curriculum Scheme: Rev2019

Examination: SE Semester: III

Course Code: CSC303 and Course Name: DATA STRUCTURE

Time: 2 hour

Max. Marks: 80

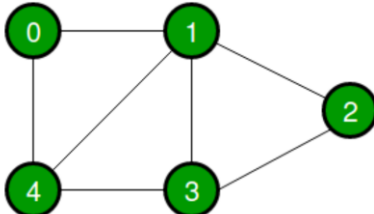
Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which data structure has fixed size?
Option A:	Array
Option B:	Linked List
Option C:	Graph
Option D:	Tree
2.	The result of evaluating the postfix expression 59+84-*8/
Option A:	6
Option B:	7
Option C:	5
Option D:	4
3.	What will be the output of the following program? <pre>void main () { char str [] ="STRUCTURE"; int len = strlen(str); int i; for (i=0; i<len; i++) push(str[i]); // pushes an element into stack for (i=0; i<len; i++) pop (); //pops an element from the stack }</pre>
Option A:	ERUTCURTS
Option B:	CTURESTRU
Option C:	EUCRSTUTR
Option D:	STRUCTURE
4.	Which data structure is also known as a head tail linked list because elements can be added to or removed from the front (head) or back (tail)? However, no element can be added or deleted from the middle.
Option A:	Circular queue

Option B:	Stack
Option C:	Deque
Option D:	Priority queue
5.	A circular queue is implemented using an array of size 15. The array index starts with 0, front is 10, and rear is 14. The insertion of next element takes place at which array index?
Option A:	15
Option B:	1
Option C:	0
Option D:	11
6.	<p>What will the output of the following function if nodes present in linked list are 6→5→2→8→9→NULL and START points the first node.</p> <pre>void fun (struct node* START) { if (START == NULL) return; fun (START→next); printf ("%d ", START→data); }</pre>
Option A:	6,5,2,8,9
Option B:	9,8,2,5,6
Option C:	9,6,5,2,8
Option D:	9,8,2,6,5
7.	<p>What is the output of following function if start pointing to first node of following linked list? 1→2→3→4→5→6→NULL</p> <pre>void fun (struct node* start) { if (start == NULL) return; printf ("%d ", start→data); if (start→next! = NULL) fun(start→next); printf ("%d ", start→data); }</pre>
Option A:	6,5,4,3,2,1,6,5,4,3,2,1
Option B:	1,3,5,5,3,1,1,3,5,5,3,1
Option C:	1,3,5,2,4,6,1,3,5,2,4,6
Option D:	1,2,3,4,5,6,6,5,4,3,2,1
8.	Which type of linked list has no beginning and no ending.
Option A:	Circular Linked List
Option B:	Doubly Linked List
Option C:	Singly Linked List
Option D:	Multi Linked List

9.	In a doubly linked list, the number of pointers affected for an insertion operation in middle will be_____.
Option A:	1
Option B:	4
Option C:	0
Option D:	2
10.	struct node *ptr = start->next; what "ptr" will contain if it is variable of type struct node? (start points to first node)
Option A:	Address of second node
Option B:	Address field of second node
Option C:	Data of second node
Option D:	Data fields of second field
11.	What are the number of nodes in left and right sub-tree of the root node if the data is inserted in the following order in binary search tree 45, 15, 8, 56, 64, 65, 47, 12, 59, 10, 73, 50, 16, 61?
Option A:	6,7
Option B:	7,6
Option C:	8,5
Option D:	5,8
12.	Consider the following code segment in C to traverse a binary tree using the preorder void preorder (node *tree) { if (t) { Statement1 Statement2 Statement3 } }
	The above Statements should be,
Option A:	printf("%d", tree->info); preorder(tree->right); preorder(tree->left);
Option B:	preorder(tree->left); preorder(tree->right); printf("%d", tree->info);
Option C:	preorder(tree->left); printf("%d", tree->info); preorder(tree->right);
Option D:	printf ("%d", tree->info); preorder(tree->left); preorder(tree->right);

13.	A BST is traversed in the following order recursively: Right, root, left The output sequence will be in,
Option A:	Ascending order
Option B:	Descending order
Option C:	No specific sequence
Option D:	Random sequence
14.	What is the maximum possible number of nodes in a binary tree at level 6?
Option A:	64
Option B:	32
Option C:	48
Option D:	80
15.	Assume that a structure for a Binary Search Tree exists. What does the following function do? <pre>int function(root) { ptr = root; while (ptr->left!= NULL) { ptr = ptr->left; } return(ptr->data); }</pre>
Option A:	Leftmost child of BST
Option B:	Rightmost child of BST
Option C:	It gives error
Option D:	Root of BST
16.	When in-order and post-order traversing a tree resulted D, B, E, A, C, G, F and D, E, B, G, F, C, A respectively. the pre-order traversal would return:
Option A:	A, B, C, F, G, D, E
Option B:	A, D, E, B, C, F, G
Option C:	A, B, D, E, C, F, G
Option D:	A, B, G, F, D, E, C
17.	What is the number of edges present in a complete graph having n vertices?
Option A:	$(n*(n+1))/2$
Option B:	n
Option C:	$(n-1)/2$
Option D:	$(n*(n-1))/2$
18.	What is the maximum possible number of edges in a directed graph with no self-loops having 7 vertices?
Option A:	28
Option B:	35
Option C:	42
Option D:	56

19.	Using division method, in a given hash table of size 153, the key of value 172 be placed at position.
Option A:	19
Option B:	72
Option C:	17
Option D:	15
20.	What are the values of $h_1(k)$ and $h_2(k)$ in the double hashing?
Option A:	$h_1(k) = (m \bmod k)$ and $h_2(k) = 1 + (m' \bmod k)$
Option B:	$h_1(k) = (1 + (m \bmod k))$ and $h_2(k) = m' \bmod k$
Option C:	$h_1(k) = (k \bmod m)$ and $h_2(k) = k \bmod m'$
Option D:	$h_1(k) = (k \bmod m)$ and $h_2(k) = 1 + (k \bmod m')$

Q2 (20 Marks Each)	Solve any Four out of Six	5 marks each
A	Write a C program to test if a string is a palindrome or not using a stack data structure (Note: palindromes ignore spacing, punctuation, and capitalization)	
B	Write a C program that compresses a string by deleting all space characters in the string using queue data structure	
C	Give the breadth-first traversal of the graph for following graph, starting from vertex 0. Show all the steps. 	
D	Consider a hash table with size = 10. Using quadratic probing, insert the keys 27, 72, 63, 42, 36, 18, 29, 101 into the table. Take $c_1 = 1$ and $c_2 = 3$.	
E	Explain types of data structure with example	
F	Write an algorithm to convert infix expression to postfix expression. Show stepwise execution of algorithm for converting infix expression to postfix expression for following expression $A * B + C * D$	

Q3. (20 Marks Each)	Solve any Two Questions out of Three	10 marks each
A	Create an AVL tree using the following data entered as a sequential set. Show all the steps. 15, 20, 24, 10, 13, 7, 30, 36, 25. Show which rotations are used while constructing AVL tree.	
B	Write a C program for Singly Linked list for performing following operations i. Create SLL ii. Display SLL iii. Delete a node from SLL iv. Append two SLLs	
C	Draw the B-tree of order 3 created by inserting the following data arriving in sequence: 92 24 6 7 11 8 22 4 5 16 19 20 78	

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Examination 2020 under cluster __ (Lead College: _____)

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: COMPUTER ENGINEERING

Curriculum Scheme: Rev2019

Examination: SE Semester III

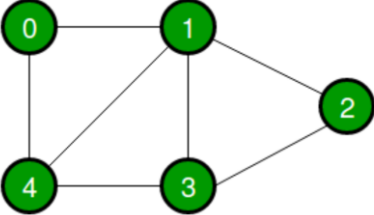
Course Code: CSC303 and Course Name: DATA STRUCTURE

Time: 2 hour

Max. Marks: 80

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Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	A
Q2.	B
Q3.	A
Q4	C
Q5	C
Q6	B
Q7	D
Q8.	A
Q9.	B
Q10.	A
Q11.	D
Q12.	D
Q13.	B
Q14.	A
Q15.	A
Q16.	C
Q17.	D
Q18.	C
Q19.	A
Q20.	C

Q2 (20 Marks Each)	Solve any Four out of Six	5 marks each
A	Write a C program to test if a string is a palindrome or not using a stack data structure (Note: palindromes ignore spacing, punctuation, and capitalization)	Palindrome logic/function (with main function): 3 Marks Push operation: 1 Mark Pop operation: 1 Mark
B	Write a C program that compresses a string by deleting all space characters in the string using queue data structure	Deleting-space character logic/function (with main function): 3 Marks Insert operation: 1 Mark Delete operation: 1 Mark
C	Give the breadth-first traversal of the graph for following graph, starting from vertex 0. Show all the steps. 	Adjacency Matrix: 1 Mark Writing all steps with queue data structure: 3 Marks Final BFS traversal order: 1 Mark
D	Consider a hash table with size = 10. Using quadratic probing, insert the keys 27, 72, 63, 42, 36, 18, 29, 101 into the table. Take $c_1 = 1$ and $c_2 = 3$.	Formula of quadratic probing: 1 Mark Writing all steps for calculating array index for given data: 3 Marks Final answer with number of collisions: 1 Mark
E	Explain types of data structure with example	Explanation of primitive and non-primitive types of data with example: 1 Mark Explanation of linear types of data structure with example: 2 Marks Explanation of non-linear types of data structure with example: 2 Marks
F	Write an algorithm to convert infix expression to postfix expression. Show stepwise execution of algorithm for converting infix expression to postfix expression for following expression $A * B + C * D$	Algorithm for Infix to Postfix conversion: 2 Marks Steps to convert infix to postfix expression using stack data structure: 3 Marks


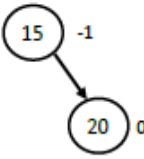
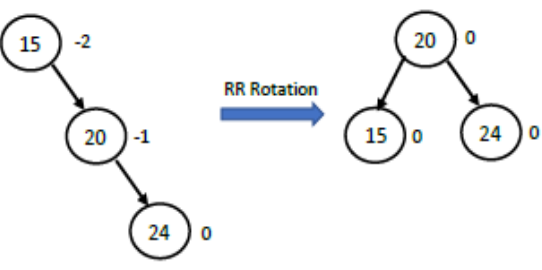
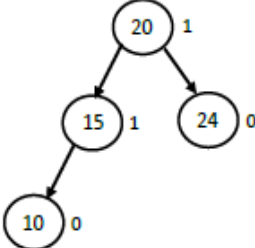
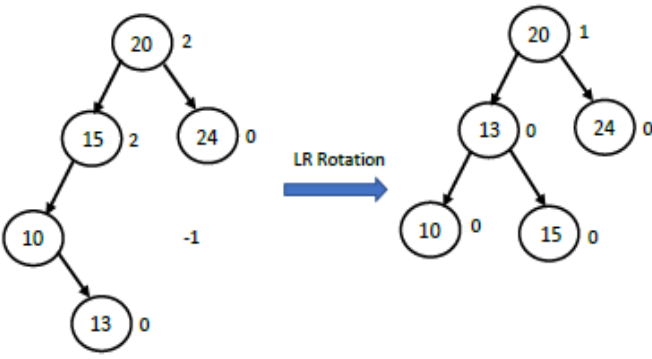
Q3.
(20 Marks Each)

Solve any Two Questions out of Three

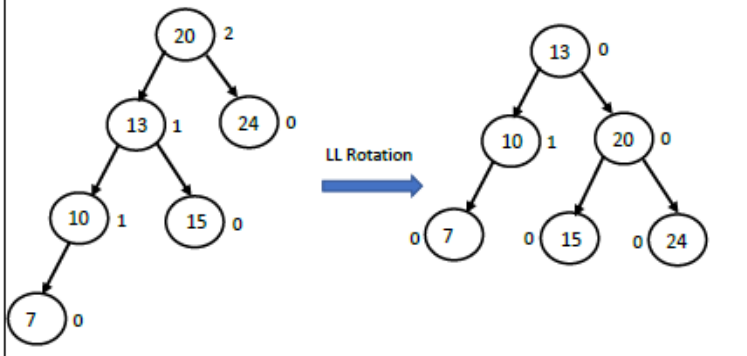
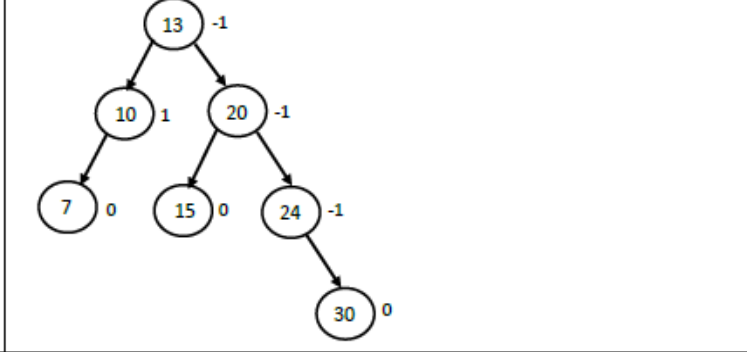
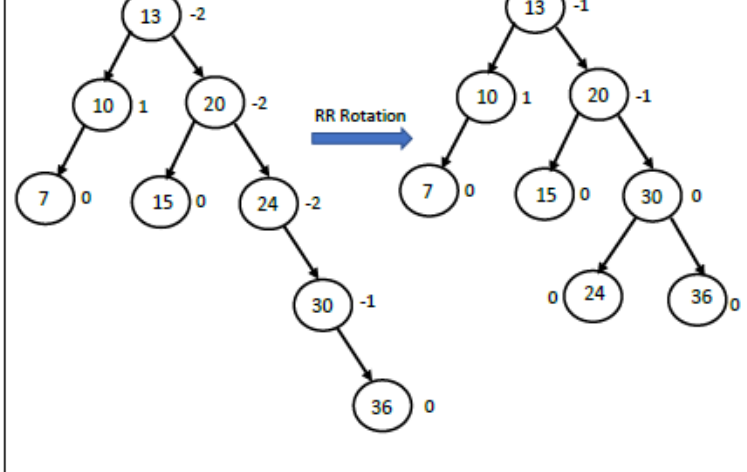
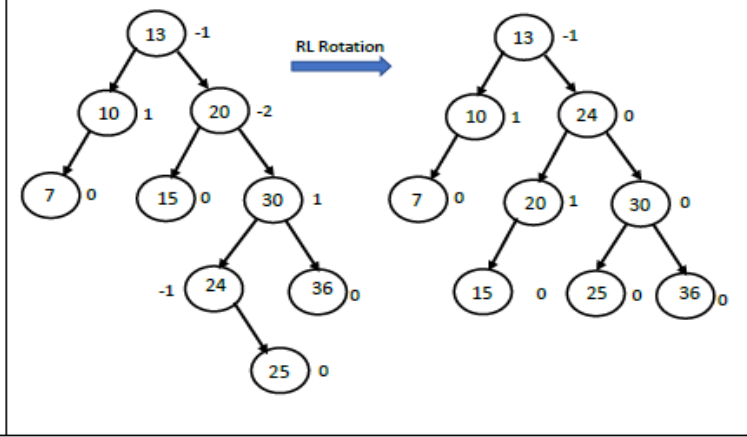
10 marks each

Create an AVL tree using the following data entered as a sequential set. Show all the steps. 15, 20, 24, 10, 13, 7, 30, 36, 25. Show which rotations are used.

AVL tree for the numbers 15, 20, 24, 10, 13, 7, 30, 36, 25

Step-1: Insert 15	
Step-2: Insert 20	
Step-3: Insert 24 (Critical Node: 15)	
Step-3: Insert 10	
Step-3: Insert 13 (Critical Node: 15)	

A

<p>Step-3: Insert 7 (Critical Node: 20)</p>	
<p>Step-3: Insert 30</p>	
<p>Step-3: Insert 36 (Critical Node: 24)</p>	
<p>Step-3: Insert 25 (Critical Node: 20)</p>	

B Write a C program for Singly Linked list for performing following operations

	<ul style="list-style-type: none"> i. Create SLL ii. Display SLL iii. Delete a node from SLL iv. Append two SLLs
	<p>Create SLL: 2 Marks</p> <p>Display SLL: 2 Marks</p> <p>Delete a node from SLL: 2 Marks</p> <p>Append two SLLs: 4 Marks</p>
C	<p>Draw the B-tree of order 3 created by inserting the following data arriving in sequence: 92 24 6 7 11 8 22 4 5 16 19 20 78</p> <p>Writing all steps while inserting numbers (with reason to split the node wherever required)</p> <pre> graph TD Root[7] --> Node5[5] Root --> Node16_24[16 24] Node5 --> Leaf4[4] Node5 --> Leaf6[6] Node16_24 --> Leaf11[11] Node16_24 --> Leaf19_20[19 20] Node16_24 --> Leaf52_53[52 53] </pre>

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Examination 2020 under cluster __ (Lead College: _____)

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: Computer Engineering

Curriculum Scheme: Rev2019

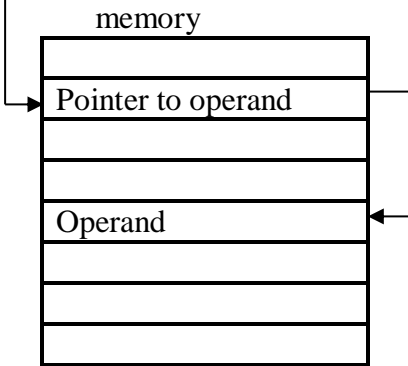
Examination: SE Semester III

Course Code: **CSC304** and Course Name: **Digital Logic and Computer Architecture**

Time: 2 hour

Max. Marks: 80

Q1. 40 Marks	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks (2 marks each)
1.	Convert number(723.17) ₈ into equivalent hexadecimal number
Option A:	(0D3.3C) ₁₆
Option B:	(1D3.3C) ₁₆
Option C:	(1E3.3C) ₁₆
Option D:	(1D3.4C) ₁₆
2.	What is the equivalent of (52) ₁₀ in Gray code
Option A:	110100
Option B:	1011101
Option C:	111000
Option D:	101110
3.	As per Boolean Laws which of the expressions results in 0 (i) A+A (ii) A.A (iii)A.0 (iv) A. 1
Option A:	ii only
Option B:	ii &iii
Option C:	iii only
Option D:	ii,iii,iv
4.	For 4 bit number what is the range of 2's complement representation? Also perform (5) ₁₀ -(7) ₁₀ using 2's complement method
Option A:	-7 to +7 , 1101
Option B:	-8 to +8 , 1110
Option C:	-8 to +7 , 1110
Option D:	-7 to +8 , 1101
5.	Arrange the steps for obtaining IEEE representation of floating point in proper

	format 1) calculate the biased exponent 2) convert to binary 3) convert to normalized form		
Option A:	1,2,3		
Option B:	3,2,1		
Option C:	2,3,1		
Option D:	2,1,3		
6.	In Restoring division Algorithm if $A < 0$ then which of the following is immediate step (Assume M as Dividend Q as Divisor and A as result)		
Option A:	$Q_0 = 0$		
Option B:	$A = A + M$		
Option C:	$Q_0 = 0$ & $A = A - M$		
Option D:	$Q_0 = 0$ & $A = A + M$		
7.	In full adder, Boolean expression of sum will be _____		
Option A:	$S = A \oplus B$		
Option B:	$S = \overline{A} \oplus B$		
Option C:	$S = A \oplus B \oplus C$		
Option D:	$S = A \oplus B \oplus \overline{C}$		
8.	Which of the following Twos Complement binary numbers is equivalent to decimal -75 ?		
Option A:	1001011		
Option B:	1001100		
Option C:	0001100		
Option D:	0110101		
9.	Identify the type of addressing mode Instruction <table border="1" style="margin-left: 20px;"> <tr> <td style="padding: 2px;">OPCODE</td> <td style="padding: 2px;">Address</td> </tr> </table> 	OPCODE	Address
OPCODE	Address		
Option A:	Register Addressing mode		
Option B:	Register Indirect Addressing mode		
Option C:	Direct Addressing mode		
Option D:	Indirect Addressing mode		

10.	Choose appropriate sequence of instruction cycle
Option A:	Instruction fetch, Instruction address calculation, Instruction decode, operand address calculation , fetch operand, data operation, operand address calculation, operand store
Option B:	Instruction address calculation , Instruction fetch, operand address calculation fetch operand, Instruction decode, data operation, operand address calculation and operand store
Option C:	Instruction address calculation , Instruction fetch, Instruction decode, operand address calculation , fetch operand, data operation , operand address calculation, operand store
Option D:	Instruction address calculation, Instruction fetch, Instruction decode, operand address calculation , fetch operand, operand address calculation , operand store, data operation
11.	Basic task for control unit is
Option A:	To perform logical operations
Option B:	Execution
Option C:	To initiate the resources
Option D:	To decode instructions and generate control signal
12.	A micro instruction has _____
Option A:	Control field
Option B:	Address field
Option C:	Status field
Option D:	Both control and address field
13.	Microprogram consisting of _____ is stored in control memory of control unit
Option A:	instructions
Option B:	micro instructions
Option C:	micro program
Option D:	macro program
14.	In memory Hierarchy which is the fastest memory
Option A:	SRAM
Option B:	DRAM
Option C:	Register
Option D:	Cache
15.	The correspondence between the main memory blocks and those in the cache is given by _____.
Option A:	Mapping function
Option B:	Hash function
Option C:	Locale function
Option D:	Assign function
16.	Consider a direct mapped cache of size 64 KB with block size 16 bytes. The CPU generates 28-bit addresses. The number of bits needed for cache indexing are

	respectively are:
Option A:	13
Option B:	10
Option C:	12
Option D:	11
17.	In Instruction Pipelining Structural Hazard means
Option A:	any condition in which either the source or the destination operands of an instruction are not available at the time expected in the pipeline
Option B:	a delay in the availability of an instruction causes the pipeline to stall
Option C:	the situation when two instructions require the use of a given hardware resource at the same time.
Option D:	When a data gets overwritten by branching
18.	Identify the Type of Flynn's Classification of Parallel Processing
Option A:	SISD
Option B:	SIMD
Option C:	MISD
Option D:	MIMD
19.	To resolve the clash over the access of the System Bus we use
Option A:	BUS arbitrator
Option B:	Multiple BUS
Option C:	Priority access
Option D:	virtual access
20.	SIMD represents an organization that _____.
Option A:	refers to a computer system capable of processing several programs at the same time.
Option B:	represents organization of single computer containing a control unit, processor unit and a memory unit.
Option C:	includes many processing units under the supervision of a common control unit
Option D:	includes many processing units with many control unit.

Q2 20 Marks	Solve any Four out of Six (5 marks each)
A	Show the mathematical step for the following conversion

	i) Convert decimal (123.25) to its equivalent octal ii) Convert decimal (123.25) to its equivalent hexadecimal iii) Convert Hexadecimal (ABCD) to its equivalent binary iv) Convert binary (10111100) to equivalent gray code v) Convert decimal (1543) to Excess-3 code
B	Write short note on Von-Neumann Model
C	Explain the single and double precision format for representing floating point number using IEEE 754 standards
D	Define Instruction cycle. Explain it with a detailed state diagram.
E	Differentiate between static RAM and dynamic RAM.
F	What are the functions of following Register 1. IR 2. PC 3. MAR 4. MDR 5. SP

Q3. 20 marks	
A	Solve any Two Questions out of Three (5 marks each)
i)	Write micro program for the instruction ADD A, B (Register A and B are added and result is stored at Register A.)
ii)	Differentiate between Hardwired control unit and Micro programmed control unit
iii)	Explain memory Hierarchy
B	Solve any One Question out of two (10 marks each)
i)	A program having 10 instructions (without Branch and Call instructions) is executed on non-pipeline and pipeline processors. All instructions are of same length and having 4 pipeline stages and time required to each stage is 1nsec. (Assume the four stages as Fetch Instruction, Decode Instruction, Execute Instruction, Write Output) i. Calculate time required to execute the program on Non-pipeline and Pipeline processor. ii Show the pipeline processor with a diagram.
ii)	Draw the flowchart of Restoring Division Algorithm & perform $10/3$ using this Algorithm

University of Mumbai

Examination 2020 under cluster __ (Lead College: _____)

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Program: Computer Engineering

Curriculum Scheme: Rev2019

Examination: SE Semester III

Course Code: **CSC304** and Course Name: **Digital Logic and Computer Architecture**

Time: 2 hour

Max. Marks: 80

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Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	B
Q2.	D
Q3.	B
Q4	C
Q5	C
Q6	D
Q7	C
Q8.	D
Q9.	D
Q10.	C
Q11.	D
Q12.	D
Q13.	B
Q14.	C
Q15.	A
Q16.	B
Q17.	C
Q18.	D
Q19.	A
Q20.	C

Note: The distribution of marks for the descriptive questions is given below for your illustration. Examiners may vary with this and add additional criteria's for evaluation

Q2:

- A. For every conversion allot 1 mark
- B. Von-Neumann Model block diagram 2 marks and explanation 3 marks
- C. For single precision allot 2,5 marks for describing format , specifying various fields and their size similarly for double precision 2.5 marks for describing format , specifying various fields and their size
- D. Definition 1 mark , explanation of state diagram marks and for drawing state diagram 2 marks
- E. For every main difference allot 1 mark
- F. 1 mark each for every register function described

Q3.

A

- i) . For defining the Micro program 4 marks and for explanation 1 mark
- ii) For every main difference allot 1 mark
- iii) For diagram allot 2 marks and for explanation 3 marks

B

- i) for calculations of time required for Pipelined and non-Pipelined System allot 4 marks and for Drawing the timing diagram for Pipelined processor allot 6 marks
- ii) For flow chart allot 4 marks and for performing the mathematical task of $10/3$ allot 6 marks