Heaven's Light Is Our Guide

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
4th Year ODD Semester Examination 2022

COURSE NO: **CSE 4103** COURSE TITLE: **Digital Signal Processing**
FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

			CO	Marks
Q.1.	(a)	Define the term aliasing.	CO1	2
	(b)	Review the multichannel and multidimensional signal received by color-TV	CO1	2
	(c)	If a band limited signal is sampled at a rate less than Nyquist rate then it corresponds to under-sampling. This approach is strongly discouraged in signal processing. Clarify the net effect of lowering the simple frequency with suitable figure.	CO1	3
	(d)	A digital communication link carries binary-coded words representing samples of an input signal. x_a(t) = 3cos60πt + 2cos100πt. The link is operated at 10000 bits/sec and each input sample is quantized into 1024 different voltage levels. i. Find out the discrete time signal when the sampling rate is 100Hz. ii. Reconstruct the analog signal y_a(t) considering ideal cases.	CO1	5
Q.2.	(a)	A signal can be classified as a power signal or an energy signal for extracting some interesting properties to analyze the signal. Prove that an energy signal has zero power while a power signal has infinite energy by considering the signal is continuous time signal.	CO1	4
	(b)	Sketch the block diagram representation of the discrete time system described by the following input output relation: $$y(n) = \frac{1}{3}y(n-2) + \frac{1}{2}y(n-1) - \frac{2}{5}x(n-1)$$	CO1	3
	(c)	Write the condition for being a system called BIBO(Bounded Input and Bounded Output) stable: Determine the range of the values a and b for which the liner time invariant system with impulse response $$h(n) = \begin{cases} a^n, n \geq 0 \\ b^n, n < 0 \end{cases}$$ is BIBO stable.	CO1	5
Q.3.	(a)	Consider the following signal, x(n) which is defined as $$x(n) = \begin{cases} n, & n \geq 0 \\ 0, otherwise \end{cases}$$ Now answer the following questions i. Determine the behavior of the signal in complex z-domain ii. Find the region of convergence (ROC) of the input signal in complex z-domain	CO2	3
	(b)	Z-transformation is another tool that is used to analyze a discrete time signal more easily, compared to another transform and it behaves as the Laplacian/Fourier transform. Prove that, the convolution of two independent sequences in time domain acts as a multiplication of their independent z-transform in z-domain	CO2	3
	(c)	Determine the pole-zero pattern for the signal, x(n): $$x(n) = \begin{cases} a^n, 0 \leq n \leq k-1 \\ 0, \quad otherwise \end{cases}$$ where a>0	CO2	3
	(d)	Evaluate the response of the system $$y(n) = \frac{7}{12}y(n-1) - \frac{1}{12}y(n-2) + x(n)$$ where the input signal x(n) is defined as, $$x(n) = \delta(n) - \frac{1}{4}\delta(n-1)$$	CO2	3
Q.4.	(a)	Determine the z-transformation of the following signals and also specify the region of convergence. i. $x(n) = (-3)^n sin(\pi n)u(n+1)$ ii. $x(n) = \frac{1}{F}(n+1)(\frac{1}{2})^n u(n-2)$	CO2	6
	(b)	State the theory of pole-zero cancellations.	CO2	3
	(c)	Describe the rules for pole-zero placements while designing real filters.	CO2	3

SECTION : B

Q.5. (a) Determine the causal signal, x(n) having z-transformation: CO2 4

$$x(z) = \frac{1}{1 - 0.5Z^{-1} + 0.25Z^{-2}}$$

(b) Is it possible to measure the amount of overlap between two discrete-time signals utilizing Fourier analysis? Justify your answer with proper examples. CO3 4

(c) Find out the spectra of the following signal(a portion) CO3 4

$$x(n) = \begin{cases} 2; & if\ n\%3 = 0 \\ -2; & if\ n\%3 = 1 \\ 0;\ if\ n\%3 = 2\ \&\ otherwise \end{cases}$$

Q.6. (a) State the following theorems: CO3 3

i. Parseval's relation
ii. Wiener-Khintchine

(b) Summarize the symmetry property of Fourier Transforms. CO3 3

(c) Calculate the energy density spectrum of the signal utilizing "Wiener-Khintchine" theorem. CO3 6

$$x(n) = a^n u(n);\ -1 < a < 1$$

Q.7. (a) Consider the following figure fig. 7(a) and answer the following questions: CO3 3

i. Determine the x(n) using the information in the figure fig 7(a).
ii. Find the magnitude and phase information of X(ω)

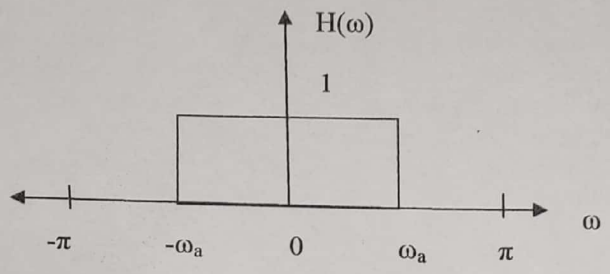

fig. 7(a): the function of H(ω).

(b) Consider the signals $x_1(n) = x_2(n) = \{1, 0, -1\}$. Determine the convolution in time domain using the Fourier transforms. CO3 3

(c) Prove that the total time complexity for finding N-point DFT is $O(N^2)$. Also compare the DFT of 5-point sequence $x(n) = \{0, 3, 2, 1, 0\}$ CO3 4

(d) Briefly discuss about: i) Comb Filter, ii) Digital Resonator, iii) Notch Filter CO4 2

Q.8. (a) Design an ideal low pass filter (LPF) following the figure number fig. 7(a). CO4 3

(b) Perform the circular convolution of the following two sequences: CO4 3
$x_1(n) = \{1, 2, 0\}$ and $x_2(n) = \{2, -1, 3\}$

(c) Establish a relation between the z-transform and the Fourier transform. CO3 3

(d) Prove that the discrete Fourier transform (DFT) follows the linearity and the symmetry property. CO4 3

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4th Year odd Semester Examination 2022

COURSE NO:CSE 4117 COURSE TITLE: **Parallel and Distributed Processing**
FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

			CO	Marks
Q.1.	(a)	Suppose you are leading the development of a new mobile note taking app called NoteAI that will have advanced handwriting recognition and AI-based text generation features. The app needs to work well on phones with limited resources while providing a seamless user experience. (i) Describe the application layering of your software. (ii) Distribute logical levels of your application into a physical two-tiered architecture. Provide reasons behind your choice.	CO3	5
	(b)	Analyze what happens when two processes simultaneously detect the demise of the coordinator and initiate elections using the Bully algorithm.	CO1	4
	(c)	Discuss the disadvantages of non-blocking send in communication between client and server.	CO1	3
Q.2.	(a)	Evaluate the capability of triple modular redundancy and primary Backuy systems in handling Bazantine faults.	CO1	8
	(b)	Explain how the use of caching and load balancing in a distributed system affects its ability to scale efficiently.	CO1	4
Q.3.	(a)	Define: (i) logical clock (ii) system architecture	CO1	3
	(b)	Process P_0, P_1 and P_2 are started at timestamps 30, 20 and 10 respectively. P_0 wants a resource that P_1 holds, P_1 wants a resource that P_2 holds and P_2 wants a resource that P_0 holds. (i) Draw a simplified wait-for graph and check if there is any deadlock. (ii) Use wait-die and wound-wait algorithms to make deadlock structurally impossible. (iii) Conclude which algorithm is superior in this scenario.	CO3	5
	(c)	2048 CPUs are connected to 2048 RAMs using an Omega network. Each CPU is a RISC chip capable of executing 2300 million instructions per second. Calculate the maximum allowable switching time.	CO1	4
Q.4.	(a)	You are developing a news feed app that generates real time news updates from many different sources and recommends news to users according to their topic preference. Recommend a suitable software architecture for implementing the core features of the app.	CO3	5
	(b)	Write down the properties of distributed algorithms.	CO1	3
	(c)	Discuss a distributed system that uses remote procedure calls to enable communication between different programming languages.	CO1	4

SECTION : B

			CO	Marks
Q.5.	(a)	State parallel processing. List the advantages of it.	CO1	4
	(b)	Explain the reason why main memory has highest bandwidth. Suppose, the IBM 3033 uniprocessor has a processor cycle, t_p=57 ns. Four words can be requested from a four-way interleaved memory system per each memory cycle, t_m=456 ns. Calculate the utilized bandwidth of the memory.	CO2	4
	(c)	Explain the advantages and disadvantages of using a shared memory model compared to a distributed memory model.	CO3	4

Q.6.	(a)	Explain what types of applications or tasks are MISD and SIMD effective.	CO1	4
	(b)	Identify the level of parallelism possible in the below program. Give a proper explanation to your answer. program.c .... for (i=1; i<n; i++) { B[i+1]=C[i-1]+D[i-1]; A[i]=A[i]+B[i]; }	CO3	4
	(c)	Suppose a company has built a server system with high availability along with high network and server overhead. Will this system work all the time? If not, design an improved version of that system. Justify your answer.	CO3	4
Q.7.	(a)	Discuss different approaches to explicit multi-threading.	CO1	4
	(b)	If TI 6487 can execute eight 32-bit instructions per cycle and the clock speed is 1.2 GHz per core. Compute the values of MIPS.	CO2	4
	(c)	A multinational e-commerce company wants to provide reliable service and localized shopping experiences to its customers. Design a system which would be better in this situation. Justify your answer.	CO2	4
Q.8.	(a)	Design a $2^2 \times 2^2$ Omega network.	CO2	3
	(b)	Explain the main architectural differences between CPU and GPU.	CO1	4
	(c)	Draw a single SM architecture. Briefly explain its basic components.	CO1	5

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4th Year Odd Semester Examination 2022

COURSE NO:**CSE 4101** COURSE TITLE: **Compiler Design**
FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

CO Marks

SECTION : A

Q.1. (a) Explain the role of compiler. Show output of each phase of a compiler of following statement: CO1 4

$z=x+y$

Where x and y are of integer types and z is of float type.

(b) Show first sets, follow sets and predictive parsing table for the following code snippet: CO2 4

```
S→int*ID
ID→p|q
```

Show whether predictive parser accepts following input string: `int*q`

(c) Construct SDT which can perform type checking and type casting on expression: a-b*c based on the following table: CO3 4

Types of a	Types of b	Types of a op b	Type cast
int	int	int	-
int	double	int	convert b to int
double	int	error	-
double	double	double	-

Implement all relevant functions.

Q.2. (a) Explain the phases of the compiler in detail. Write down the output of each phase for the expression: CO1 4

```
a=b*c/(d-e)
```

Where, b, d and e are all real values and c is an integer value.

(b) Consider the context free grammar: CO2 4

```
S→ABC,
A→ aAb | ε
B→cBd | ε
C→eC | ε
```

Show first sets, follow sets and predictive parsing table for the grammar and show that predictive parser can parse the input string cde.

(c) Define inherited attribute. Write syntax directed definition with inherited attribute for type declaration for list of identifiers. Show annotated parse tree for the sentence: CO3 4

```
real id1, id2, id3
```

Q.3. (a) Show a transition diagram that can tokenize C comment (A string surrounded by /* and */) CO1 4

(b) Explain importance of parsing. Show CFG which can parse following code snippet: CO2 4

```
struct salary
{ int amount;
};
salary person1;
```

(c) Consider following grammar and its SDD: CO3 4

Production	Rules
Declare →Type Id	Id.type=Type.name
Type→int	Type.name=int
Id→a	Id.name=a

Build attributed parse tree to determine value of "type" attribute of Id for input:

```
int a
```

Q.4. (a) Find errors and identify the phase of compiler detecting them for following C program segment: CO1 4

```
int fi(int);
char a[10], *cptr;
int k=1; int j=2;
float f;
cptr=a;
if(k);
fi(k);
fi(j);
++k;
*(cptr+1)=0;
++a;
n+*k;
```

(b) Write unambiguous production rules for producing arithmetic expression consisting of symbols id,*,-,() and ∧, where ∧ represents exponent. Parse following string using shift-reduce parser. CO2 5

```
id-id*(id∧id)∧id
```

(c) Explain how type checking and error reporting is performed in a compiler. CO3 3

SECTION : B

Q.5. (a) Build three address code IR that can be generated from following code snippet: CO4 4

```
if(a>b)
  if(b>c)
     largest=c;
```

(b) Determine garbages created from heap allocation from following code snippet using reference counting algorithm. Show reference count of all objects. CO5 4

```
int *p=new int;
int *q=new int;
int *r=new int;
int *m=p, *n=m;
m=q; p=r; q=r; r=n;
```

(c) Construct flow graph using basic blocks by translating following program into three address code: CO6 4

```
int num=17, num_is_prime=1;
for(int i=2; i<=num/2; i++)
   if (num%i==0){num_is_prime=0; break;}
```

Q.6. (a) Consider the following code segment: CO4 4

```
if (a>b)
   x=a+b;
else
   x=a-b;
```

Generate an abstract syntax tree, a control flow graph and quadruples from the above code segment and discuss the advantages of each representation.

(b) Consider the following code: CO6 4

```
int fib(int n){
    if(n==0) return1;
    if(n==1) return1;
    return fib(n-1)+fib(n-2);}
    int main(){
    int c, n;
    n=5;
    c=fib(n);
    return 0;}
```

Show how stack of activation records grow and shrink during execution based on the code snippet.

(c) Explain the main issues in code generation. Generate assembly code for the following three address code: CO6 4

```
L: b= a[i]
a[j] = b
if b<10 goto L
```

Q.7. (a) Generate three address code for the following code fragment: CO4 4

```
while (a>b)
    {
       if (c<d)
          x=y+z;
        else
         x=y-z;}
```

(b) Explain various storage allocation strategies with its merits and demerits. CO5 4

(c) Consider the following code snippet: CO6 4

```
void main(){
      int x=10;
      int c;
      if(x>0){
      c=func(x);}
else
   {x++;}   }
   int func(int p)
   {
    return p+1;}
```

Write assembly code using stack allocation and activation record based on the code snippet. Assume main function starts at address 100.

Q.8. (a) Build stack machine code IR that can be generated from the following snippet: CO4 4

```
i=0;
do{i=i+1;} while(i<10);
```

(b) Determine activation record with their values and stack grow and shrink during execution of following program: CO5 4

`void main()` `{` `int i=5;` `int j=3;` `int k=sub1(i,j+1)}`	`int sub1(int a, int b)` `{` `int x=a;` `int y=sub2(&x,b);` `return y;` `}`	`int sub2(int *var1, int var2)` `{` `int temp=*var1-var2;` `return temp;` `}`

(c) Construct assembly code from following three address code using simple code generation algorithm: CO6 4

```
t=a-b
u=a-c
v=t+u
a=d
d=v+u
```

Where t, u, v & a are live on exit variables and b, c & d are temporaries. General Purpose registers are AX and BX.

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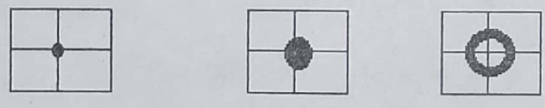
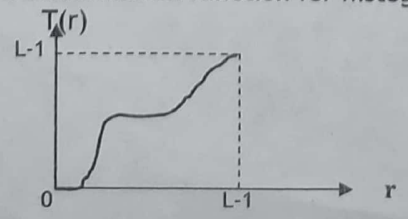
DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING
4th Year Odd Semester Examination 2022

COURSE NO:**CSE 4105** COURSE TITLE: **Digital Image Processing**

FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

			CO	Marks
Q.1.	(a)	In the process of analog to digital conversion of an image, explain the effect of quantization.	CO1	3
	(b)	Describe and explain the functionality of the basic intensity transformation function given below: (i) S=L-1-r (ii) S=clog(1+r) (iii) $S=cr^2$ Where the symbols have usual meanings.	CO1	4
	(c)	Define histogram of an image. Draw general shaped histogram of the following images: (i) Bright image (ii) Dark image (iii) Low contrast image (iv) High contrast image.	CO1	5
Q.2.	(a)	Suppose, we have an image of 32×32. We want to zoom this image, which interpolation technique should we use and why?	CO1	3
	(b)	Define contour of an image. Identify the contour of the following binary image. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	CO1	3
	(c)	Consider the following 2×2 image: 20 30 30 20 Now, find the values of pixel locations (1,1) and (2,2) if we want to change the height and width of the input image by 6×6 using Bi-linear interpolation. Consider the unit distance value as 1.	CO1	6
Q.3.	(a)	Distinguish the use of spatial filter and frequency domain filter in image enhancement. Write down the general form of H(u,v) in frequency domain for- (i) Ideal low pass filter (ii) Butterworth low pass filter (iii) Ideal band pass filter.	CO2	5
	(b)	Draw the histogram of the corresponding spatial image of the following Fourier image- 	CO2	3
	(c)	Find out the cause of ringing blurring in frequency domain filtering and explain the way of removing it.	CO2	4
Q.4.	(a)	Identify the shortest 8-adjancent and m-adjacent path between P and Q for the following image, where, V={1,2}. (Q) 5 4 3 1 1 5 4 0 2 0 3 2 0 2 4 2 1 1 3 5 1 3 5 1 3 (P)	CO2	5
	(b)	Is it possible to perform histogram equalization using the following transformation function? Write down the conditions of choosing transformation function for histogram equalization. 	CO3	3

(c) Let us assume that, the continuous intensity values in an image have the probability density function (PDF), CO3 4

$$P_r(r)=\begin{cases}\dfrac{2r}{(L-1)^2}, & 0\le r\le L-1\\ 0, & otherwise\end{cases}$$

Find the $P_s(S)$, where the transformation function T(r) is given as,

$$(L-1)\int_0^r P_r(\omega)d\omega$$

SECTION : B

Q.5. (a) Describe the following process with examples: CO2 4

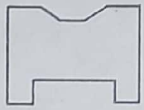
(i) $\hat{B}=\{\omega\,|\,\omega=-b, \quad for \quad b\in B\}$

(ii) $(B)_z=\{C\,|\,C=b+z, \quad for \quad b\in B\}$

(iii) $A\Theta B=\{z\,|\,(B)_z\subseteq A\}$

(iv) $A\oplus B=\{z\,|\,(\hat{B})_z\cap A\neq\phi\}$

(b) Write down the properties of opening and closing. Below are the two objects and a structuring element. Explain opening and closing on both of the objects with the structuring element. CO3 4


Objects Structuring element

(c) Explain how the following operations are performed by morphological processing: CO3 4

(i) Boundary extraction

(ii) Hole filling.

Q.6. (a) Write down your opinion about exploiting spatial, spectral and temporal correlation for compressing images. CO3 4

(b) Following is a sequence of text that we want to transmit. Compare the compression model interms of the different measurement criteria, i.e., redundancy or compression ratio: CO3 6

A	A	A	B	B	B
A	A	A	A	B	B
A	A	A	A	B	B
A	C	C	B	B	C
A	C	C	B	D	D

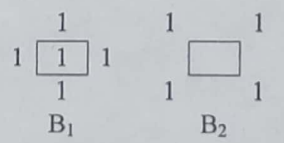
(c) Explain the different kind of fidelity criteria for comparing images. CO3 2

Q.7. (a) Dilation and erosion are dual of each other-Justify the statement using suitable examples. CO5 5

(b) Identify the particular patterns in foreground and background pixels for the following image. CO5 5

0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0
0	0	1	0	0	1	1	1	1	0	0
0	1	(1)	1	0	0	0	0	0	0	0
0	0	1	0	0	0	0	1	1	0	0
0	0	0	0	1	0	0	1	(1)	1	0
0	0	0	1	(1)	1	0	0	1	0	0
0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0

image (A)



(c) Define hole filling. Write down the condition of stopping iteration during hole filling in a binary image. CO5 2

Q.8. (a) Why segmentation is necessary in medical image processing? In region-based segmentation, we segment an image into 'n' number of subregions, such that R_1, R_2, ------ R_n, We expect this subregion to satisfy some properties. What are they? CO4 6

(b) Write down the properties of edge detector. How non-maximum suppression is done in canny edge detection process? Explain it using suitable examples. CO4 6

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RAJSHAHIUNIVERSITY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING

4th Year Odd Semester Examination 2021

COURSE NO: CSE 4107 COURSE TITLE: Information System Analysis And Design

FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

		CO	Marks
Q.1.	(a) What is project? What are the key terms of a project management system? Explain briefly each of them.	CO1	3
	(b) Write the differences between adaptive and incremental project development life cycle. Draw the figure of each of the development cycle.	CO2	4
	(c) What are the roles of a project manager?	CO2	2
	(d) Explain the process of scrum project management framework with necessary diagram.	CO2	3
Q.2.	(a) Why is analyst/user interface a problem? Discuss the behavioral issues involved in understanding the analyst/user interface.	CO1	4
	(b) The political factor has been brought up in the literature for various issues. In what respect should the analyst be a politician? Can you give an example where political considerations are used in systems work?	CO2	4
	(c) Discuss and illustrate the key strategies for eliciting information about the user's requirements. Which strategy would you select and why?	CO1	4
Q.3.	(a) What is meant by the analyst/user interface? Why is it a problem?	CO1	2
	(b) Elaborate on the technical and interpersonal skills required of systems analysis. When is one skill favored over the other? Why? Write with figure.	CO4	6
	(c) Why is it important that the analyst learns about an organization's policies and objectives? Explain with suitable example.	CO3	4
Q.4.	(a) "A data dictionary is a structured repository if data about data". Discuss with example.	CO2	3
	(b) Describe the concept and procedure used in constructing DFD. Use an example of your own to illustrate.	CO2	4
	(c) An international airline initiated a frequent traveler program designed to encourage passengers to fly regularly and earn awards based on miles flown. The airline policy is specified as follows: Passengers who fly more than 1,00,000 miles per calendar year and, in addition, pay cash for tickets or have been flying the airline regularly for more than five years are to receive a free round-trip ticket around the world. Passengers who fly less than 1,00,000 miles per calendar year and have been flying the airline regularly for more than five years also get a free round-trip ticket around the world. Now, (i) Draw a decision tree based on the statement. (ii) Develop a decision table for passenger free ticket.	CO2	5

SECTION : B

Q.5.	(a) What do you mean by cover letter and economic justification in feasibility report?	CO2	2
	(b) How important is a project team in feasibility analysis? Is it mandatory in every study?	CO2	3
	(c) Explain why project manager should assign a planner in the feasibility study and detailed study phase?	CO2	3
	(d) How can you select the best candidate system using weighted evaluation matrix?	CO2	4
Q.6.	(a) Suppose you were asked to prepare a plan for training the user staff on a newly acquired microcomputer system. (i) What factors do you consider in preparing the plan? (ii) How would you design the plan? (iii) What objective(s) are considered as a basis for the plan?	CO4	5
	(b) If new system design is likely to meet user specifications, why do users resist change? How would one reduce resistance to change? Explain in detail.	CO4	4
	(c) Elaborate on the steps taken in system testing that lead to the user's acceptance of the system.	CO4	3
Q.7.	(a) How to calculate the candidate system performance/cost evaluation matrix in details feasibility analysis? Explain briefly with example.	CO2	4
	(b) Distinguish between the followings: (i) Opportunity and sunk costs/benefits. (ii) Direct and indirect costs/ benefits (iii) Tangible and intangible costs/ benefits (iv) Fixed and variable costs/benefit.	CO2	4
	(c) Explain the procedure of Break-even analysis technique with a numerical example and figure.	CO2	4
Q.8.	(a) How important is testing? Draw the activity network for system testing?	CO3	4
	(b) List and briefly describe the factors that affect the quality of a system.	CO3	4
	(c) What is a form? Summarize the characteristics of action, memory and report forms.	CO3	4

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