

# B.Tech. (CE/BT/EI) (V Sem.)

305 Paper 5.1

## B.Tech. (CE/BT/EI) (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

### PAPER 5.1—Economics for Engineers

TIME ALLOWED : THREE HOURS

Maximum Marks—30

*Attempt five questions in all, selecting not more than two questions from each Section.*

*All questions carry equal marks.*

#### SECTION A

1. Define economics. What are the fundamental differences between micro and macro economics?
2. Explain any *three* of the following:—
  - (a) Role of economics in engineering
  - (b) Law of demand
  - (c) Demand function
  - (d) Determinants of demand.
3. What do you understand by the concept of elasticity of demand? Critically examine the various methods employed for measuring the price elasticity of demand.

*Turn over*

## SECTION B

4. How are equilibrium price and output determined under perfect condition? Explain.
5. Explain diagrammatically the concepts of Average Fixed Cost (AFC), Average Variable Cost (AVC), Average Total Cost (ATC), and Marginal Cost (MC).
6. Write short notes on the following:—
  - (a) Increasing returns to scale
  - (b) Constant returns to scale
  - (c) Decreasing returns to scale.

## SECTION C

7. A company is trying to diversify its business in a new product line. The life of the project is 10 years with no salvage value at the end of its life. The initial outlay of the project is Rs. 20,00,000. The annual net profit is Rs. 3,50,000. Find the rate of return for the new business.
8. Explain the concept of capital budgeting. How does it help in investment decisions?
9. Explain any *three* of the following:—
  - (a) Interest formulas
  - (b) Principle of economic equivalence
  - (c) Present value method
  - (d) Declining balance method of depreciation.

# **B.Tech. (CS/IT/EC/EE) (V Sem.)**

**306**

**Paper 5.1**

## **B.Tech. (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017**

**(CS/IT/EC/EE)**

**PAPER 5.1— Principles of Management**

**TIME ALLOWED : THREE HOURS**

**Maximum Marks— 30**

*Attempt five questions in all, selecting not more than two questions from each Section.*

*All questions carry equal marks.*

### **SECTION A**

1. “Principles of administrative management are the backbone of organising.” What are those principles? Are these principles relevant in today’s era of Virtual Organisation?
2. What do you mean by ‘Taylorism’? Explain Taylor’s contribution in Industrial Engineering.
3. “Fail to Plan and Plan to Fail.” Elaborate this statement by giving your own experience. Do Plans guarantee success?

*Turn over*

## **SECTION B**

4. "Delegation of responsibility without delegation of authority is vain." Explain the statement mentioning essential condition for decentralization.
5. "Self motivation is extinct phenomenon, instead materialistic tendency is replacing it." Suggest how self motivation can be inculcated again.
6. Explain Maslow's theory of motivation. Is this theory relevant for professionals of the twenty first century?

## **SECTION C**

7. How is 'head by front' different from 'head by example'? Comment on these styles by giving suitable examples of leaders who adopted these leadership styles.
8. "Controlling is complementary to planning." Explain the statement discussing the role of each on other.
9. "Role of communication in organisation is like role of blood in human body." Discuss the role of communication explaining the above statement.

- (c) Show that a tree with  $n$  vertices has  $n - 1$  edges. 3+3+2

### SECTION C

7. (a) A chess player wants to prepare for championship match by playing some practice games in 77 days. She wants to play at least one game a day but not more than 132 games altogether. Show that no matter how she schedules the game, there is a period of consecutive days within which she plays exactly 21 games.

(b) Describe Tower of Hanoi problem and solve it using recurrence relation. 4+4

8. (a) State and prove the Inclusion-Exclusion principle for three sets.

(b) Evaluate the sum  $1^2 + 2^2 + 3^2 + \dots + r^2$  using generating function technique. 3+5

9. (a) Solve the recurrence relation:—

$$a_n - 4a_{n-1} + 4a_{n-2} = (n+1)2^n$$

(b) Find the numeric function for the generating function:—

$$A(z) = \frac{25}{(1-5z)}$$

(c) Find the generating function of the sequence:—

$a, a, 0, a, a, 0, a, a, 0, \dots$

4+2+2

## B.Tech. (CS) (V Sem.)

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Paper 5.2

### B.Tech.(COMPUTER SCIENCE AND ENGINEERING)(FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

#### PAPER 5.2— Discrete Mathematics

TIME ALLOWED : THREE HOURS

Maximum Marks— 40

The question paper is divided into three Sections. Students are required to attempt five questions in all, selecting not more than two questions from each Section.

### SECTION A

1. (a) Given a finite set  $A$  with  $n$  elements. Find how many relations are on  $A$  and how many of these are reflexive and symmetric.  
(b) Write a note on generation of Permutation.  
(c) How many binary strings of the length eight are possible?

4+2+2

2. (a) Let  $A = \{1, 2, 3, 4, 5, 6\}$  and let  $R$  be the equivalence relation on  $A$  defined by  $R = \{(1, 1), (1, 5), (2, 2), (2, 3), (2,$

6), (3, 2), (3, 3), (3, 6), (4, 4), (5, 1), (5, 5), (6, 2), (6, 3), (6, 6)}. Find the partition of  $A$  induced by  $R$ . Find the equivalence classes also.

(b) Let  $X = \{2, 4, 6, 9, 12, 18, 27, 36, 48, 60, 72\}$  and  $R$  be the relation ' $/$ ' (divides) on the set  $X$ . If  $(X, /)$  is a POSET:—

- Draw the Hasse diagram of the POSET
- Find the length of the longest chain.
- Find the width of the POSET
- Determine the maximal and minimal elements.

(c) Find the total number of five digit code numbers having one or more repetition digits. 2+4+2

3. (a) Define Boolean Algebra. State and prove the absorption property in Boolean Algebra.

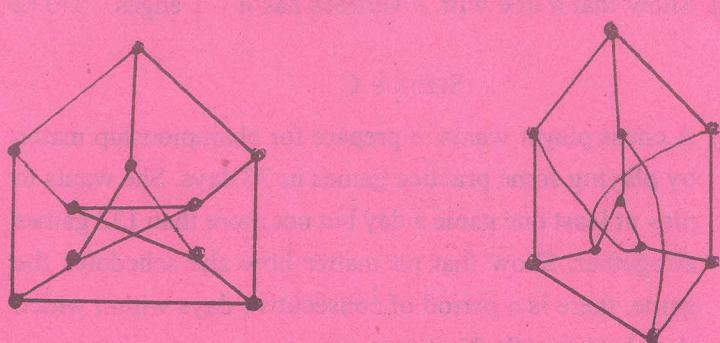
(b) Let  $E(x_1, x_2, x_3) = (x_1 \wedge x_2) \vee (x_1 \wedge x_3) \vee (\bar{x}_2 \wedge x_3)$  be a Boolean expression over the two valued Boolean Algebra. Write  $E(x_1, x_2, x_3)$  both in disjunctive normal form (DNF) and conjunctive normal form (CNF). 4+4

## SECTION B

4. (a) Define following with appropriate examples:—

- Complete bipartite graph
- Planar graph
- Eulerian path
- Cut set

(b) Define isomorphic graphs. Verify that following graphs are isomorphic or not. 4+4



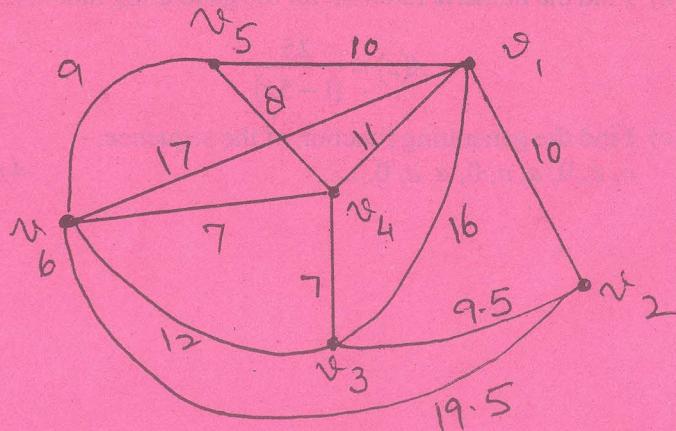
5. (a) State Kuratowski's theorem for the planar graphs. Using this theorem prove that Peterson graph is a non-planar graph.

(b) Prove that in a simple graph with  $n$  vertices and  $k$  components can have at most  $\frac{(n-k)(n-k+1)}{2}$  edges.

(c) Construct 2 graphs which are Euler but not Hamiltonian. 3+3+2

6. (a) A regular graph of degree two has fourteen vertices. How many edges does it contain? Give reasons for your answer.

(b) Find the shortest spanning tree of the following graph:



same using Timer 0 Mode 1. Assume crystal frequency is 12 MHz of 8051.

4

9. (a) Explain interrupts of 8051 in detail. Also explain IE and IP of 8051. 4

(b) Explain ADC interfacing with 8051 with suitable diagram. Also mention some applications of ADCs. 4

## B.Tech. (CSE/EC/IT/EI) (V Sem.)

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Paper 5.3

## B.Tech. (CSE/EC/IT/EI) (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

(CSE/EC/IT/EI)

### PAPER 5.3— Microprocessors and Microcontrollers

TIME ALLOWED : THREE HOURS

Maximum Marks— 40

The question paper is divided into three Sections. Students are required to attempt five questions in all, selecting not more than two questions from each Section.

All questions carry equal marks.

#### SECTION A

1. (a) What is meant by multiplexed address and data bus? Explain the concept of demultiplexing of address and data bus of 8086 in minimum mode using diagram. 4

(b) What do you mean by pipelined architecture? How is it implemented in 8086? 4

2. (a) Explain the functions of following signals:  
 (i) TEST                          (ii) LOCK  
 (iii) ALE                          (iv) Ready                          4
- (b) Draw and discuss the read and write cycle timing diagrams of 8086 in maximum mode.                  4
3. (a) Write the addressing mode of the following instructions:  
 (i) MOV [4560H], AX              (ii) ADD BL, 89H  
 (iii) ADD BX, [DI]                (iv) MOV 6[BP] [DI], AL  
 (v) MOV CX, [BP+9]              (vi) ADD CL, BL  
 (vii) MOV [SI] [56H], BL           (viii) STC.                  4
- (b) Write an assembly language program in 8086 to check whether a given string is palindrome or not.                  4

#### SECTION B

4. (a) Differentiate between memory mapped I/O and I/O mapped I/O.                  2
- (b) Interface two  $8K \times 8$  RAM chips and four  $16K \times 8$  EPROM chips with 8086, such that the memory address range assigned to the EPROM chips is  $90000H - 9FFFFH$ .                  6
5. (a) What is key debounce? Explain hardware and software key debounce.                  4
- (b) Show how you would interface a  $3 \times 3$  matrix keyboard having keys 1-9 with an 8086 processor using the 8255. Write an 8086 ALP to find the pressed key and store it in DL register.                  4

6. (a) Design the hardware interface circuit for interfacing 8251 with 8086. Write an 8086 assembly language program to initialize 8251 USART and receive 10 bytes of data and store them in memory from address  $3000H : 1000H$  with the following parameters : baud rate factor = 64, character length = 8 bits, no parity check and 1 stop bit. Assume port address  $50H$  for data and  $52H$  for control/status.                  6
- (b) Discuss the roles of the following registers in handling multiple interrupt requests by 8259:  
 (i) IRR                              (ii) IMR  
 (iii) ISR.                          2

#### SECTION C

7. (a) Discuss the following signal descriptions of 8051:  
 (i) ALE/PROG                      (ii)  $\overline{EA}/V_{PP}$   
 (iii) PSEN                        (iv)  $T_0$  and  $T_1$                   4
- (b) Draw and discuss the formats and bit definitions of the following SFRs of 8051:  
 (i) PCON                        (ii) TCON  
 (iii) SCON                       (iv) PSW                          4
8. (a) Explain the following instructions of 8051 with suitable example:  
 (i) ACALL                        (ii) DJNZ  
 (iii) SJMP                       (iv) DIV                          4
- (b) Find the count to be loaded into timer registers to generate a time delay of  $500 \mu s$  and also write a program for the

8. Differentiate the following:-  
 (a) Adapter class and Anonymous class  
 (b) Applet and swing  
 (c) Java (Servlet) and JSP  
 (d) Flow Layout and Border Layout. 4x2
9. (a) Write down all steps to create a servlet and execute it without using any IDE (NetBeans). 4  
 (b) Describe all implicit objects of JSP. 4

## B.Tech. (V Sem.)

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Paper 5.4

## B.Tech. (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

(CS / IT)

PAPER 5.4—Java Programming

TIME ALLOWED : THREE HOURS

Maximum Marks—40

The question paper is divided into three Sections. Students are required to attempt five questions in all, selecting not more than two questions from each Section.

All questions carry equal marks.

### SECTION A

1. (a) Describe the history of Java. Can Java run on any machine? What is needed to run Java on a computer? 3
- (b) Assume that x and y are int type. Which of the following are legal Java expressions?  
 (i)  $x > y > 0$   
 (ii)  $x = y \& \& y$   
 (iii)  $x /= y$

- (iv)  $x \text{ or } y$   
 (v)  $x \text{ and } y$   
 (vi)  $(x \neq 0) :: (x = 0)$

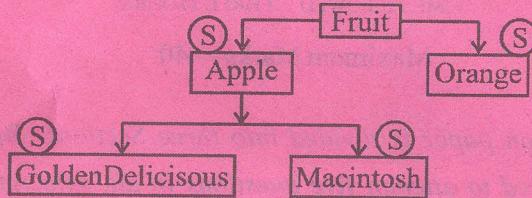
2

- (c) Convert the following for loop statement to a while loop and to a do-while loop:-

```
long sum = 0;
for (int i = 0; i <= 1000; i++)
    sum = sum + i;
```

3

2. (a) Suppose that fruit, Apple, Orange, Golden Delicious Apple and Macintosh Apple are declared as shown in figure:-



Golden Delicious and Macintosh are subclasses of Apple, Apple and Orange are subclasses of fruit.

Fruit.fruit = new Golden Delicious (); Orange org = new  
orange ();

- (i) Suppose the method makeApple is defined in the Apple class. Can fruit invoke this method? Can org invoke this method? Explain.
- (ii) Suppose the method makeOrangeJuice is defined in orange class. Can org invoke this method? Can fruit invoke this method?

- (iii) Is the statement Orange p = new Apple () legal?
- (iv) Is the statement Apple p = new Macintosh () legal? 6
- (b) How do you invoke an overridden method from the subclass? Explain with example. 2

3. (a) Is memory allocated for an array when it is declared? When is the memory allocated for an array? What is the printout of the following code?

```
int x = 30;
int [ ] numbers = new int[x];
x = 60; system.out.println("x is " + x);
system.out.println ("The size of numbers is ="
+ numbers.length);
```

2

- (b) The MyPoint class was created to model a point in a two-dimensional space. The MyPoint class has the properties x and y that represents x and y coordinates to get methods for x and y, and the method for returning the distance between two points.

Create a class named ThreeDPoint to model a point in a three dimensional space. Let ThreeDPoint be derived from MyPoint with the following additional features:-

- \* A data field named z that represents z-coordinate
- \* A no-arg constructor that constructs a point with coordinates (0, 0, 0)
- \* A constructor that constructs a point with three specified coordinates

- \* A get method that returns the z value.
- \* Override the distance method to return the distance between two points in the three dimensional space.

Write a test program that creates two points (0, 0, 0) and (10, 30, 25.5) and displays the distance between the two points.

6

### SECTION B

4. (a) Describe the Java Throwable class, its subclasses and the types of exceptions.

2

(b) How do following exceptions raise and handle:-

- ArithmaticException
- ArrayIndexOutOfBoundsException
- ClassCastException
- NullPointerException

6

5. (a) Describe the Java collection framework. List the interfaces convenience abstract classes and concrete class.

2

(b) Suppose the list 1 is a list that contains the strings red, yellow, green and that list 2 is another list that contains the strings red, yellow, blue. Answer the following questions:-

- \* What are list 1 and list 2 after executing

list1.addAll(list 2);

- \* What are list 1 and list 2 after executing

list1.add(list 2);

- \* What are list 1 and list 2 after executing  
list1.removeAll(list 2);
- \* What are list 1 and list 2 after executing  
list1.remove(list 2);
- \* What are list 1 and list 2 after executing  
list1.retainAll(list 2);
- \* What is list 1 after executing list1.clear ()

6

- (a) How do you set a priority for a thread? What is default priority?
- What is the possible cause for IllegalMonitorStateException?
- What is deadlock? How can you avoid deadlock?

4

2

2

### SECTION C

7. (a) What is an applet? How does it differ from an application? Describe its life cycle.

4

(b) Why does the applet in (i) display nothing? Why does the applet in (ii) have a runtime NullPointerException on the highlighted line? Explain.

2x2

(A)

```
import javax.swing.*;
public class welcomeApplet extends JApplet
{
    public void welcomeApplet (){
        JLabel jl = new JLabel("Java");
    }
}
```

(B)

```
import java.awt.*;
public class welApplet extends JApplet
{
    private JLabel jl;
    public welApplet ()
    {
        JLabel jl = new JLabel ("Java");
    }
    public void init( )
    {
        add(jl);
    }
}
```

# B.Tech. (CS/IT) (V Sem.)

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Paper 5.5

## B.Tech. (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

(CS / IT)

### PAPER 5.5— Systems Programming

TIME ALLOWED : THREE HOURS

Maximum Marks— 40

*Attempt five questions in all, selecting not more than two questions from each Section.*

*All questions carry equal marks.*

#### SECTION A

1. (a) Draw a block diagram of General Machine Structure and explain each of them. 4  
(b) Describe the complete process of a two-pass assembler. 4
  
2. (a) Draw a block diagram of the phases of a compiler and indicate the main function of each phase. 6  
(b) What are the essential differences between an Interpreter and a Compiler. 2

*Turn over*

3. Differentiate between the following:—

- (a) Pure and impure interpreter
- (b) Subroutines and macros
- (c) USING and BALR statements
- (d) Two Pass and Single Pass Macro Processor.

$2 \times 4 = 8$

### SECTION B

4. (a) What is the function of Loader? List various types of loader. 3
- (b) Explain the data structures required by two pass loader. Also explain how it works. 5

5. (a) Briefly explain the following terms:—

- (i) Linkage editor
- (ii) Overlays.

$2 \times 2 = 4$

- (b) What do you understand by operating system? What are its basic functions? 4

6. (a) Describe different types of text editors in brief. 4

- (b) What are the software tools for program development? 4

### SECTION C

7. (a) What are the major functions of ROM BIOS? 3

- (b) Describe in detail the structure and processing of DOS Device Drivers. 5

8. (a) What are the different types of Interrupt? How do systems differentiate between them? 4
- (b) Explain how system processes the various types of interrupts. 4

9. Write short notes on:—

- (a) Terminal Emulator 3
- (b) Screen Management 2
- (c) Expanded Memory Specifications. 3

**B.Tech. (CS/IT) (FIFTH SEMESTER) EXAMINATION, DEC. 2017**

**COMPUTER SCIENCE / INFORMATION AND TECHNOLOGY**

**PAPER 5.6— Data Communications and Networks**

**TIME ALLOWED : THREE HOURS**

**Maximum Marks— 40**

*Attempt five questions in all, selecting not more than two questions from each Section. All questions carry equal marks.*

**Section A**

**Q.1 (a). For the bit stream- 1011000101, sketch the waveforms for the following codes:-**

- i) NRZ-L, NRZ-I,
- ii) Bipolar-AMI, RZ,
- iii) Manchester
- iv) Differential Manchester

**(b). Explain model and components of a data communication system. What are the advantages & applications of networking?** 4

**Q.2.(a). Explain analog signal for digital transmission. How does PCM differ from delta modulation? Explain sampling rate and Quantization Noise.** 4

**(b). Suppose the spectrum of the channel between 3MHz and 4MHz and SNR<sub>dB</sub> is 24dB. What is the channel capacity for this and how many signaling levels are required?** 4

**Q.3.(a). Why is multiplexing and demultiplexing needed in network? Explain FDM and TDM and their usage. What are the drawbacks of Synchronous TDM?** 4

**(b). Why does impulse noise have more effect on digital signals rather than on analog signals?** 2

**(c). What is the purpose of cladding in an optical fiber? Discuss its density with respect to the core.** 2

## Section B

Q.4.(a). Explain the reasons for layered approach of communication protocol. Describe the layers of TCP/IP protocol suite with their data names, addresses, devices and protocols by giving neat and labeled table? 4

(b). Calculate the maximum link utilization efficiency for Stop & Wait Flow Control mechanism if Bit rate is 4800 bps, frame size is 2400bits, distance between the devices is 2000km. Speed of propagation over the transmission media can be taken as 200,000 km./sec.? 4

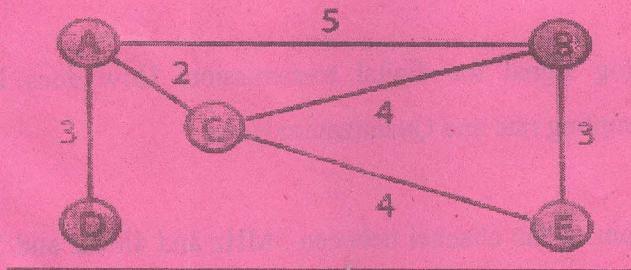
Q.5.(a). Generate CRC code for the data words 110101010 using the divisor 10101. The code word is received as a polynomial of  $x^{12}+x^{11}+x^8+x^5+x^3+x^1+1$ . Check if there are errors present in the code word. 4

(b). Differentiate between the following:-

a. Datagram and Virtual Circuit Switching

b. Selective Repeat ARQ and Go-Back-N ARQ 4

Q.6. (a). Using Dijkstra's algorithms find the shortest path of following network. Determine the least cost path also.



4

(b). Write short note on:- (Any Two)

a. ATM

b. Frame Relay

c. Congestion Control 4

## Section C

Q.7.(a). Explain TCP Connection in Brief? Give significance of flags SYN, ACK, PSH, RST and FIN. In TCP, How do we define the sequence number of a segment? Show with the example.

4

(b). Explain use of HTTP & FTP protocol. What are the codes and messages available for HTTP? Explain request and response message for HTTP?

4

Q.8. (a). What is IP datagram? Explain frame format of IPv4 datagram. Define significance of flags & fragmentation offset in IPv4?

4

(b). What is Network security. Explain symmetric and asymmetric cryptography. Explain RSA algorithm with example.

4

Q.9. (a). What is ISDN interface, What are the channels available for ISDN? Explain reference point available for ISDN?

4

(b). Write a short note on the following:- (any four)

- (i). DNS.
- (ii). SMTP.
- (iii). RPC.
- (iv). SNMP.
- (v). URL.

4

# B.Tech. (IT) (V Sem.)

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Paper 5.2

## B.Tech. (IT) (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

### PAPER 5.2— Information Systems and Security

TIME ALLOWED : THREE HOURS

Maximum Marks— 40

*Attempt five questions in all, selecting not more than two questions from each Section.*

*All questions carry equal marks.*

#### SECTION A

1. (a) Define attack. Explain four general types of cryptanalytic attacks. 4  
(b) Give Euclidean algorithm for determining the greatest common divisor of two positive integers. Also give steps for finding GCD of 18 and 12 using the Euclidean algorithm. 4
  
2. (a) Explain the working of a single round of Data Encryption Standard (DES) algorithm for encryption. 4  
(b) Explain Cipher Block Chaining (CBC) and Cipher Feedback (CF) modes of operations. 4

*Turn over*

3. (a) What are stream ciphers? Explain working of any one stream cipher. 4

(b) Explain One-Time Pad with suitable example. Also give problems associated with One-Time Pads. 4

~~QUESTION ANSWER SHEET~~  
~~Y103 SUBJECT: COMPUTER SECURITY~~

**SECTION B**

4. (a) Give Miller-Rabin algorithm to test a large number for primality. 4

(b) Explain RSA algorithm for public-key encryption. 4

~~QUESTION ANSWER SHEET~~  
~~Y103 SUBJECT: COMPUTER SECURITY~~

5. (a) Give Diffie-Hellman Key Exchange algorithm. 4

(b) Explain HMAC algorithm for developing Message Authentication Code. 4

6. (a) Explain message digest generation using SHA. 4

(b) Explain DSS approach for generating digital signatures. Also give Digital Signature Algorithm (DSA). 4

~~QUESTION ANSWER SHEET~~  
~~Y103 SUBJECT: COMPUTER SECURITY~~

**SECTION C**

7. (a) Explain the working of Kerberos Version 4. 4

(b) Explain Pretty Good Privacy (PGP) services for e-mail security. 4

8. (a) Explain IPSec Documents and IPSec Services. 4

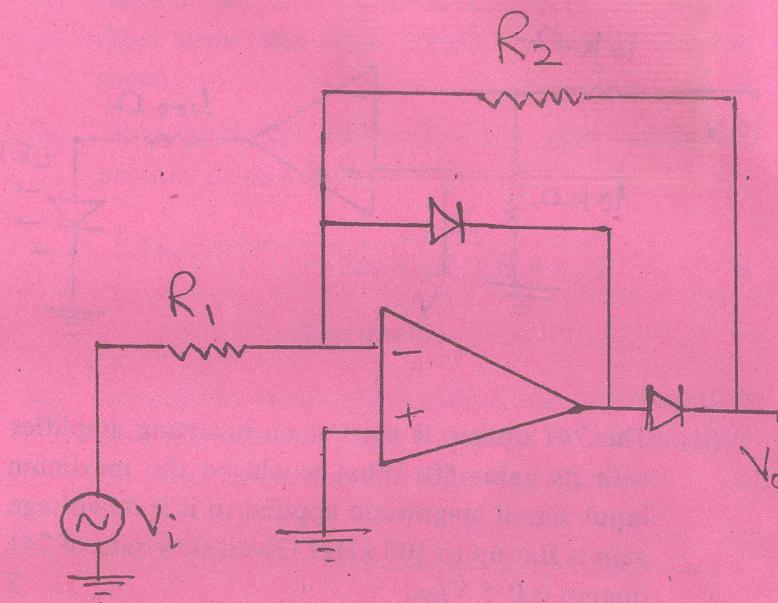
(b) Explain Secure Socket Layer (SSL) architecture. 4

9. Write short notes on:—

(a) Digital Watermarking

(b) Steganography. 4+4

- (b) Obtain the output voltage of following circuit in the range of  $0 < V_o > 0$ . What is the name of this circuit? 3+1



9. (a) Derive the expression of voltage gain  $\frac{V_o}{V_i}(s)$  for a second order high pass active filter. 4

- (b) Prove that frequency,  $f$  of astable multivibrator using 555 timer is given by:-

$$f = \frac{1.45}{(R_A + 2R_B)C} \quad 2$$

- (c) Draw the circuit diagram of dual-input unbalanced output differential amplifier. Sketch its transfer characteristics. 1+1

## B.Tech. (EC/EI/EE) (V Sem.)

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5.2/5.3

### B.Tech. (EC/EI/EE) (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

PAPER 5.2/5.3—Analog Integrated Circuits

TIME ALLOWED : THREE HOURS

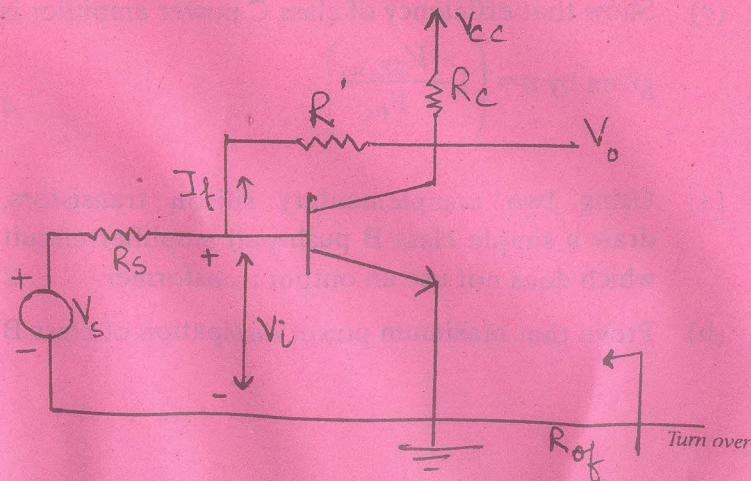
Maximum Marks—40

Attempt five questions in all, selecting not more than two questions from each Section. Assume missing data, if any, suitably. Illustrate your answers with neat sketches wherever necessary.

All questions carry equal marks.

#### SECTION A

1. (a) Consider the circuit given in figure:-



Given that:  $R_c=4$  K,  $R'=40$  K,  $R_s=10$  K,  $h_{ie}=1.1$  K,  $h_{fe}=50$  and  $h_{re}=h_{oe}=0$ . Find:—

- (i)  $R_{Mf}$
- (ii)  $A_{Vf}$
- (iii)  $R_f$
- (iv)  $R_o$

6

- (b) Explain why even harmonics are not present in a push-pull class B amplifier. 2

2. (a) The voltage gain without negative feedback is 40 dB. What is the new voltage gain if 3% negative feedback is introduced? 2

- (b) A single-stage amplifier has lower and upper cutoff frequencies 1 and 50 kHz, respectively, having midband gain=500. What should be the feedback factor to achieve higher cutoff of 300 kHz? What is the corresponding value of the lower cutoff frequency with feedback? 1+1

- (c) Show that efficiency of class C power amplifier is given by  $\eta = \left(1 - \frac{V_{CE, \text{sat}}}{V_{CC}}\right)$ . 4

3. (a) Using two complementary silicon transistors, draw a simple class B push-pull amplifier circuit which does not use an output transformer. 2

- (b) Prove that maximum power dissipation of class B

power amplifier is given by;  $P_{D, \text{max}} = \frac{2V_{CC}^2}{\pi^2 R'_L}$ , where

$R'_L$  is effective load resistance. 3

- (c) For a class B amplifier providing a 20 V peak signal to a  $16\ \Omega$  load (speaker) and a power supply of  $V_{CC}= 30$  V, determine the input power, output power and circuit efficiency. 1+1+1

## SECTION B

4. (a) Derive the expression of hybrid- $\pi$  diffusion capacitance as given by expression:—

$$C_{DE} = \frac{W^2}{2D_B} \cdot \frac{1}{r_e}$$

where  $W$  is base width,  $r_e$  is the emitter-junction incremental resistance and  $D_B$  is the diffusion constant of minority carriers in base region. 5

- (b) The low frequency parameters for a given transistor at room temperature are given as:—

$$I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, h_{ie} = 500 \Omega, h_{oe} = 10^{-5} \text{ U}, h_{fe} = 100, h_{re} = 10^{-4}$$

Determine  $r_{b'c}$ ,  $r_{bb'}$  and  $r_{b'e}$ . 1+1+1

5. (a) Three identical cascaded stages have an overall upper 3-dB frequency of 20 kHz and a lower 3-dB frequency of 20 Hz. What are  $f_L$  and  $F_H$  of each stage? Assume non interacting stages. 1+1

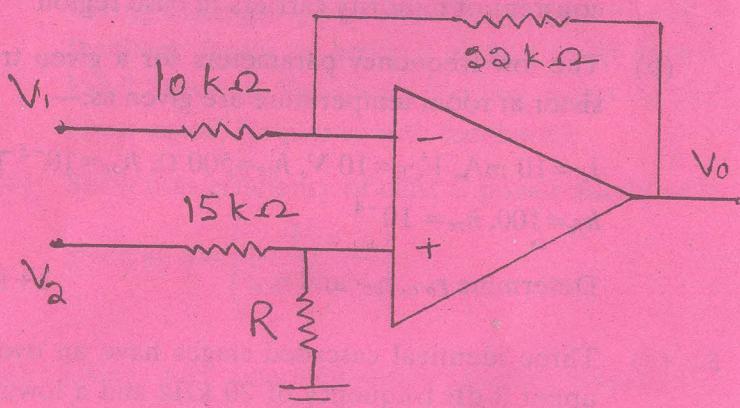
- (b) With  $g_m = 50 \text{ mA/V}$ ,  $r_{b'e} = 1 \text{ k}$ ,  $C_e = 1 \text{ pF}$  and  $C_c = 0.2 \text{ pF}$ , determine the values of  $f_B$  and  $f_T$ . 1+1

- (c) Derive the expression for the CE short-circuit current gain ( $A_i$ ) as a function of frequency. 4
6. (a) Sketch two  $R-C$  coupled CE transistor stages. Also draw the high frequency model for the same. 2+2
- (b) Show that the expression for gain bandwidth product of current gain is given by:—

$$|A_{ISO} \cdot f_H| = \frac{f_T \cdot R_s}{(1 + 2\pi f_T C_c R_L)(R_s + r_{bb'})} \quad 4$$

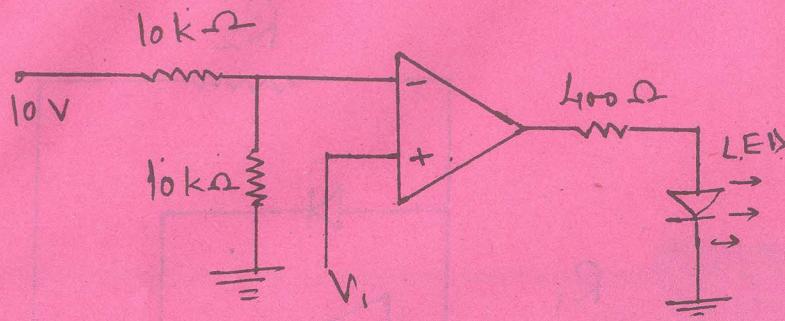
### SECTION C

7. (a) Obtain the value of resistor  $R$  for the condition that both inputs  $V_1$  and  $V_2$  should be amplified by the same amount in the following figure:— 2



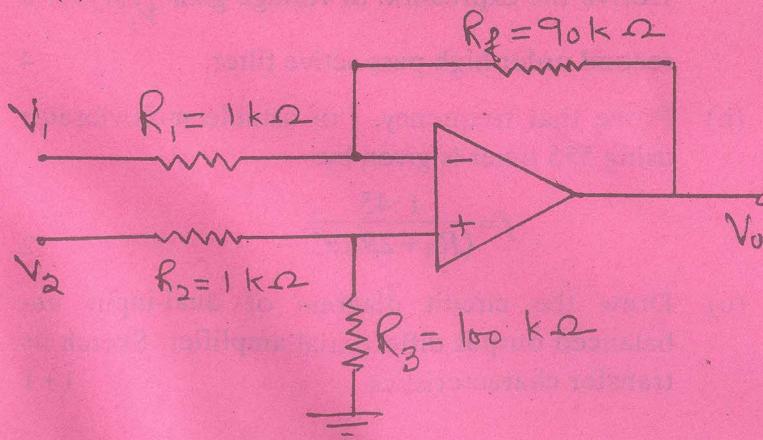
- (b) Find out the value of two resistors used in a non-inverting op-amp to result in the voltage gain of 21 dB. 2

- (c) Find the condition of input voltage for making the LED ON in the following figure:— 2



- (d) The 741 opamp is used as an inverting amplifier with its gain=50. What would be the maximum input signal magnitude applied to it if its voltage gain is flat up to 100 kHz? Given slew rate of 741 opamp is 0.5 V/μs. 2

8. (a) Obtain CMRR for the circuit given below:— 4



**B.Tech. (EC) (V Sem.)**

**314**

**Paper 5.4**

**B. Tech. (EC) (FIFTH SEMESTER)  
EXAMINATION, 2017**

**PAPER 5.4 : Communication Network**

**Time Allowed : 3 HOURS**

**Maximum Marks : 40**

*This question paper is divided into three Sections. Students are required to attempt five questions in all, selecting not more than two questions from each section.*

*All questions carry equal marks.*

**SECTION-A**

1. What is OSI ISO model. Give the structure of the model and briefly explain the functions of the layers in it. 8
2. a) What is the difference between FDM and TDM. 2  
b) What is the difference between synchronous communication and asynchronous communication. Also state the difference between serial and parallel data transmission. 6
3. How are dual ring system used to maintain a link when a station fails? Explain this with the help of a diagram. For 'n' device in a network, what is the number of cable links required for a mesh, ring

and star topology respectively? 8

### **SECTION-B**

4. a) Bring out the difference between circuit switching and Packet switching. 4
- b) Explain the different states of CSMA/CD protocol. 4
5. Explain the different IP address formats and their uses. What is subnet? How is subnetting implemented. 8
6. Explain the various extension headers used in IPV6 along with their formats. 8

### **SECTION-C**

7. What are the general principles of congestion control? How is it done in virtual circuit subnet. 8

**OR**

- Write short note on (a) 4+4
- a) ARP and RARP protocols
  - b) UDP
  8. a) What is piggy backing? Discuss the working of back by 'n' protocol of Data link layer. 6
  - b) What is the meaning of HTTP. 2
  9. What is error detection? Explain CRC in detail with the help of example. 8

- (ii) the image frequency and its rejection ratio at 25 MHz. 2+4+2

9. (a) Write short notes on:—

- (i) Carrier shareholding  
(ii) Capture effect.

(b) Discuss the principle of Foster-Seeley discriminator and also show with the help of vector diagram, how it cancels one part of the signal.

4+4

## B.Tech. (V Sem.)

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Paper 5.5

### B.Tech. (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

(EC)

#### PAPER 5.5—Analog Communication

TIME ALLOWED : THREE HOURS

Maximum Marks— 40

Attempt five questions in all, selecting not more than two questions from each Section.

All questions carry equal marks.

#### SECTION A

1. (a) What is the need of modulation in transmission of audio signal? 3+3+2

(b) Compare analogue and digital communication. Which one is preferred and why?

(c) Mention the elements of a communication system. 3+3+2

2. (a) Define signal-to-noise ratio and noise figure of receiver.

(b) Give the procedure for the calculation of noise figure.

- (c) The first stage of a two-stage amplifier has a voltage gain of 10, a  $600\ \Omega$  input resistor, a  $1600\ \Omega$  equivalent noise resistance and a  $27\ k\Omega$  output resistor. For the second stage, these values are  $25$ ,  $81\ k\Omega$ ,  $10\ k\Omega$  and  $1\ M\Omega$ , respectively. Calculate the equivalent input noise resistance of this two-stage amplifier. Also calculate the noise figure of the amplifier, if it is driven by a generator whose output impedance is  $50\ \Omega$ . 2+3+3
3. (a) Represent a frequency spectra of non-sinusoidal signal.  
 (b) Discuss in detail:—  
 (i) Base band and pass band signals  
 (ii) Continuous and discrete spectra. 2+6
- SECTION B**
4. (a) Why is SSB preferred over DSBSC and how can it be extracted from DSBSC with the help of balanced modulator?  
 (b) Why is VSB used for transmission?  
 (c) Calculate the power saving when the carrier and one of the sidebands are suppressed in an AM wave modulated to a depth of  
 (i) 100%  
 (ii) 50%. 4+2+2
5. (a) Compare amplitude modulation and angle modulation techniques.

- (b) In an FM system, when the audio frequency (AF) is  $500\ Hz$  and the AF voltage is  $2.4\ V$ , the deviation is  $4.8\ kHz$ . If the AF voltage is now increased to  $7.2\ V$ , what is the new deviation? If the AF voltage is further raised to  $10\ V$  while the AF is dropped to  $200\ Hz$ , what is the deviation? Find the modulation index in each case. 4+4
6. (a) With the aid of vector diagrams, explain what happens when a carrier is modulated by a single noise frequency.  
 (b) What is the significance of pre-emphasis and de-emphasis in modulation? 5+3
- SECTION C**
7. (a) Why is superheterodyne receiver preferred over tuned radio-frequency receiver?  
 (b) What should be the characteristics of receiver system? Discuss in detail. 4+4
8. (a) What considerations should we take to choose intermediate frequency?  
 (b) Discuss the methodology adopted for automatic gain control and amplitude limiting.  
 (c) In a broadcast superheterodyne receiver having no RF amplifier, the loaded  $Q$  of the antenna coupling circuit is 100. If the intermediate frequency is  $455\ kHz$ , calculate:—  
 (i) the image frequency and its rejection ratio at  $1000\ kHz$  3

# B.Tech. (V Sem.)

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EC 5.6

## B.Tech. (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

(EC)

### PAPER EC 5.6— Microwave Electronics

TIME ALLOWED : THREE HOURS

Maximum Marks— 40

*Attempt five questions in all, selecting not more than two questions from each Section.*

*All questions carry equal marks.*

#### SECTION A

1. What are resonant and antiresonant lines? At what conditions do open and short circuited lines behave as resonant and antiresonant lines? Explain. 2+3+3
  
2. Explain construction and applications of Smith chart. 4+4
  
3. Write short notes on the following:—
  - (a) Strip lines 4
  - (b) Microstrip lines 4

### SECTION B

4. Write propagation of dominant mode in rectangular waveguide and find:— 2

(a) Electric and magnetic field intensity components 2+2

(b) Cutoff frequency. 2

5. Write *s*-parameter representation for following microwave components:—

(a) E-plane tee 2

(b) H-plane tee 2

(c) Circulator 2

(d) Two hole directional coupler. 2

6. (a) Explain working of phase shifter. 4

(b) Find Q-factor of a cavity resonator. 4

### SECTION C

7. (a) What are differences between D-type and M-type devices? 2

(b) Calculate efficiency of two cavity klystron. 6

8. Explain working of Helix Travelling Tube and find its gain. 4+4

9. (a) Explain working of linear magnetron and find Hull cutoff magnetic field. 4

(b) A linear magnetron has the following operating parameters:—

Anode voltage  $V_0 = 10$  kV

Cathode current  $I_0 = 1$  A

Magnetic flux density  $B_0 = 0.01$  Wb/m<sup>2</sup>

Distance between cathode and anode  $d = 5$  cm

Compute:—

(i) The Hull cutoff voltage for a fixed  $B_0$

(ii) The Hull cutoff magnetic flux density for a fixed  $V_0$ . 4

$$P(x_1) = \frac{1}{2}, P(x_2) = \frac{1}{4}, P(x_3) = \frac{1}{8}, P(x_4) = P(x_5) = \frac{1}{16}.$$

Determine the entropy and information rate if there are 16 outcomes per second. 4

8. (a) Consider a discrete memoryless source with source alphabet =  $\{S_0, S_1, S_2\}$  and source statistics {0.7, 0.15, 0.15}. 4

(i) Calculate the entropy of the source.

- (ii) Calculate the entropy of second order extension of the source. 4

- (b) Determine the Huffman code for the following messages with their probabilities given:

$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$x_7$	
0.05	0.15	0.2	0.05	0.15	0.3	0.1	4

9. Write short notes on (any four):

- (a) Channel capacity
- (b) Electronic commutator
- (c) T1 carrier system
- (d) Shannon Fano coding
- (e) Entropy
- (f) Bit/Byte Interleaving.

$$2 \times 4 = 8$$

## B.Tech. (V Sem.)

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Paper EI 5.4

## B.Tech. (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

(EI)

### PAPER EI 5.4—Communication Engineering

TIME ALLOWED : THREE HOURS

Maximum Marks—40

*The question paper is divided into three Sections. Students are required to attempt five questions in all, selecting not more than two questions from each Section.*

*All questions carry equal marks.*

### SECTION A

1. (a) The baseband signal is a voice signal which extends over a frequency range from 300 Hz to 3400 Hz. It is transmitted by amplified modulation process using 1 MHz carrier frequency signal. Compare the signal transmission B.W. by DSB-SC AM and SSB AM techniques. Draw the DSB-SC, SSB (USB), SSB (LSB) spectrum. 4

- (b) A carrier wave of frequency 20 KHz is amplified modulated by a modulating signal:

$$m(t) = \cos 2\pi \times 10^3 t + \cos 4\pi \times 10^3 t.$$

Find the corresponding DSB-SC signal.

4

2. (a) Explain the phase-shift method of SSB generation. List its advantages and disadvantages with respect to the other methods.

4

- (b) Explain in detail principle, generation and application of vestigial side band modulation. Why is VSB modulation used in TV transmission?

4

3. (a) A single-tone FM signal is given by

$$v(t) = 10 \sin(16\pi \times 10^6 t + 20 \sin 2\pi \times 10^3 t) \text{ volts}$$

Determine the modulation index, modulating frequency, frequency deviation, carrier frequency and the power of the FM signal.

4

- (b) Draw the block diagram of balance frequency discriminator and explain it for demodulation of FM signal.

4

### SECTION B

4. (a) Compare natural and flat top sampling. Why is flat-top sampling preferred over natural sampling?

4

- (b) The signal  $X(t) = \cos 5\pi t + \cos 10\pi t$  is instantaneously sampled. The interval between the samples is  $T_s$ .

(i) Find the maximum allowable value of  $T_s$ .

- (ii) To reconstruct, the signal is passed through a low-pass filter. Find the minimum filter B.W. to reconstruct the signal without distortion.

4

5. Compare PAM, PWM and PPM. Draw the circuit diagram of PAM modulation and demodulation and explain it with the help of detailed waveforms.

8

6. (a) Explain the quantization error and derive an expression for maximum signal to noise ratio in PCM system that uses linear quantization.

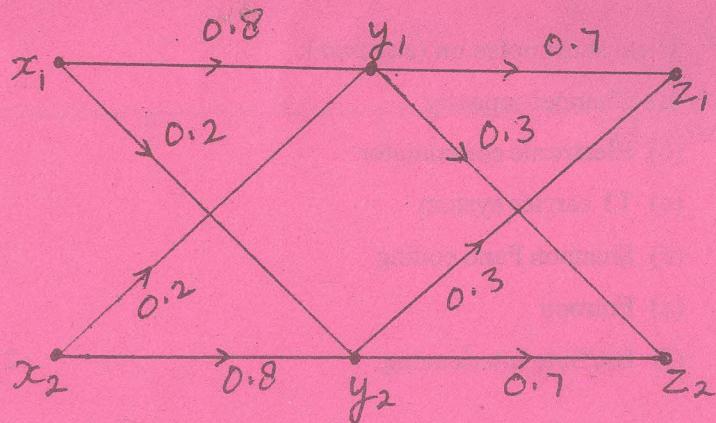
4

- (b) What is BFSK technique? Explain in detail with the help of waveforms, modulation and demodulation along with signal space diagram.

4

### SECTION C

7. (a) Two BSCs are connected in cascade, as shown in the figure:



(i) Find the channel matrix of the resultant channel.

(ii) Find  $P(z_1)$  and  $P(z_2)$  if  $P(x_1) = 0.6$  and  $P(x_2) = 0.4$ .

4

- (b) The probabilities of the five possible outcomes of an expression are given as:

**B.Tech. (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017**

(EI)

**PAPER EI 5.5— Transducers****TIME ALLOWED : THREE HOURS****Maximum Marks— 40**

*Attempt five questions in all, selecting not more than two questions from each Section. All questions carry equal marks.*

**SECTION A**

1. (a) Explain the role of transducers in industrial instrumentation. How they have been categorized, explain with suitable examples? 2
- (b) Discuss the method of calibration of strain gauges. What are the different factors on which the strain gauge sensitivity depends? 3
- (c) Explain the function of Rosettes. Also explain the working of rectangular strain gauge rosettes. 3
2. (a) Describe the construction and working of a resistance type thermometer. What are the advantages of 3-wire and 4-wire construction? 4
- (b) Explain the construction and principle of working of bimetallic thermometer. Derive the expression for radius of curvature when the bimetallic element is used as a cantilever. Also explain their advantages, disadvantage, temperature range and applications. 4
3. (a) Discuss the following methods for the measurement of pressure by using:
  - (i) McLeod gauge
  - (ii) Knudsen gauge
  - (iii) Hot cathode ionization gauge
  - (iv) Elastic diaphragm4

- (b) Discuss various methods used for the measurement of very low pressure.  
Explain any one method in detail. 4

### SECTIONB

4. (a) Describe the construction and working of an electromagnetic type flow meter. Compare the operation of this meter when it is excited by d. c. and a. c. 4

- (b) Explain the working of an ultrasonic flow meter. List its advantages and disadvantages. 4

5. (a) Discuss various methods used for the measurement of thickness. Describe ultrasonic vibration method for the measurement of thickness in detail. Write their merits and demerits. 4

- (b) Write short notes on the following:  
(i) flow nozzle  
(ii) dall tube  
(iii) turbine flow meter  
(iv)hot wire anemometer 4

6. (a) Describe the construction and working of Doppler flow meter for the measurement of open channel flow. Also mention its limitations and advantages. 4

- (b) Explain solid flow measurement by correlation method, also enumerate the advantages and disadvantages. 4

### SECTIONC

7. (a) Describe different electrical methods used for the measurement of liquid level. Explain variable permeability method in detail along with its merits and demerits. 4

- (b) Write short notes on the following:  
(i) torque tube-bubbler system  
(ii) Glass level gauge

(iii) Differential pressure meter

4

8. (a) What are the different methods used for the level measurement of corrosive fluids. Explain one of the method in detail with its advantages and disadvantages.

4

- (b) Explain the working of a  $5 \times 7$  LED matrix display with the help of suitable diagram. Also explain the difference between  $3\frac{1}{2}$  digit and 4 digit digital displays.

4

9. (a) Compare the advantages and disadvantages of a flat panel CRT and LCD. Explain the working of flat panel CRT in detail.

4

- (b) Which of the display technology is better between CRT, plasma, LCD and LED. Make an exhaustive comparison among them and justify your answer.

4

Determine the filter coefficients  $h(n)$  for  $M = 7$ , using type I frequency sampling technique. 2

- (c) A low pass filter is to be designed with the following desired frequency response:-

$$H_d(e^{j\omega}) = \begin{cases} e^{-j2\omega}, & -\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4} \\ 0, & \frac{\pi}{4} < |\omega| \leq \pi \end{cases} \quad 4$$

9. (a) Determine  $H(z)$  using the impulse invariant technique for the analog system function:-

$$H(s) = \frac{1}{(s + 0.5)(s^2 + 0.5s + 2)} \quad 4$$

- (b) Design a digital Chebyshev filter to satisfy the constraints:-

$$0.717 \leq |H(e^{j\omega})| \leq 1 \quad 0 \leq \omega \leq 0.2\pi$$

$$|H(e^{j\omega})| \leq 0.1 \quad 0.5\pi \leq \omega \leq \pi$$

using bilinear transformation and assuming  $T = 1$  s. 4

## B.Tech. (V Sem.)

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Paper 5.6

## B.Tech. (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

### PAPER EI 5.6— DIGITAL SIGNAL PROCESSING

TIME ALLOWED : THREE HOURS

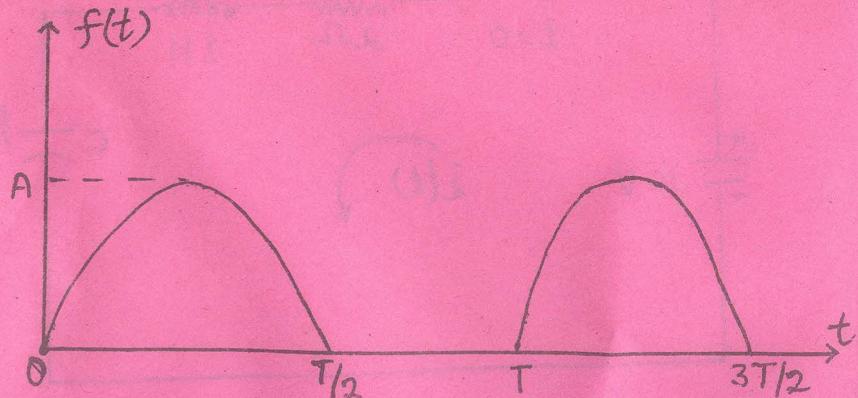
Maximum Marks— 40

The question paper is divided into three Sections.  
Students are required to attempt five questions in all,  
selecting not more than two questions from each Section.

All questions carry equal marks.

#### SECTION A

1. (a) Obtain the trigonometric Fourier series for the half wave rectified sine wave shown in figure. 4



Turn over

- (b) Determine the signal energy and signal power for given functions:-

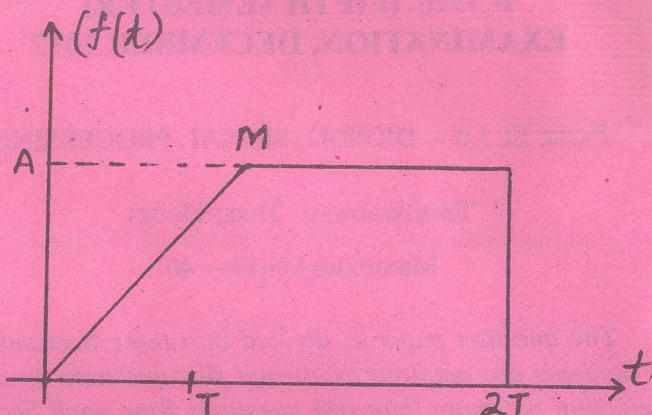
2

(i)  $f(t) = e^{-3|t|}$

(ii)  $f(t) = e^{-3t}$

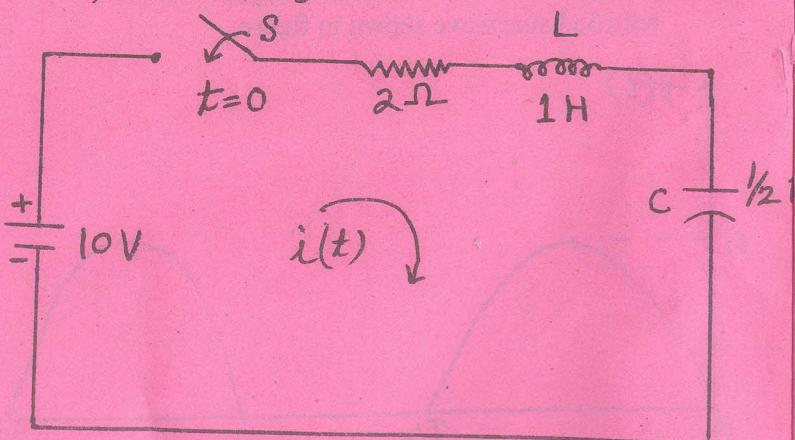
- (c) Find the Fourier transform of the signal  $f(t)$  shown in figure.

2



2. (a) In a series RLC circuit shown in figure below, there is no initial charge on the capacitor. If the switch is closed at  $t=0$ , find the resulting current.

2



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2

- (b) A system has a transfer function given by:-

$$H(s) = \frac{1}{(s+1)(s^2+s+1)}.$$

Find the response of the system when the excitation is:

$$x(t) = (1 + e^{-3t} - e^{-t}) \mu(t).$$

4

- (c) Determine the convolution integral when  $f_1(t) = e^{-2t}$  and  $f_2(t) = 2t$ .

2

3. (a) The discrete time systems are represented by the following difference equations in which  $x(n)$  is input and  $y(n)$  is output. Determine their linearity and causality.

(i)  $y(n) = 3y^2(n-1) - nx(n) + 4x(n-1) - 2x(n+1)$

(ii)  $y(n) = x(n+1) - 3x(n) + x(n-1)$

4

- (b) Determine the impulse response for the systems given by the following difference equations:-

(i)  $y(n) + 3y(n-1) + 2y(n-2) = 2x(n) - x(n-1)$

(ii)  $y(n) = x(n) + 3x(n-1) - 4x(n-2) + 2x(n-3)$

2

- (c) Determine the frequency response, magnitude response of the system given by:-

$$y(n) + \frac{1}{2}y(n-1) = x(n) - x(n-1)$$

2

## SECTION B

4. (a) Determine the inverse z-transform of the following  $X(z)$  by the partial expansion method:-

$$X(z) = \frac{z+2}{2z^2 - 7z + 3}$$

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3

Turn over

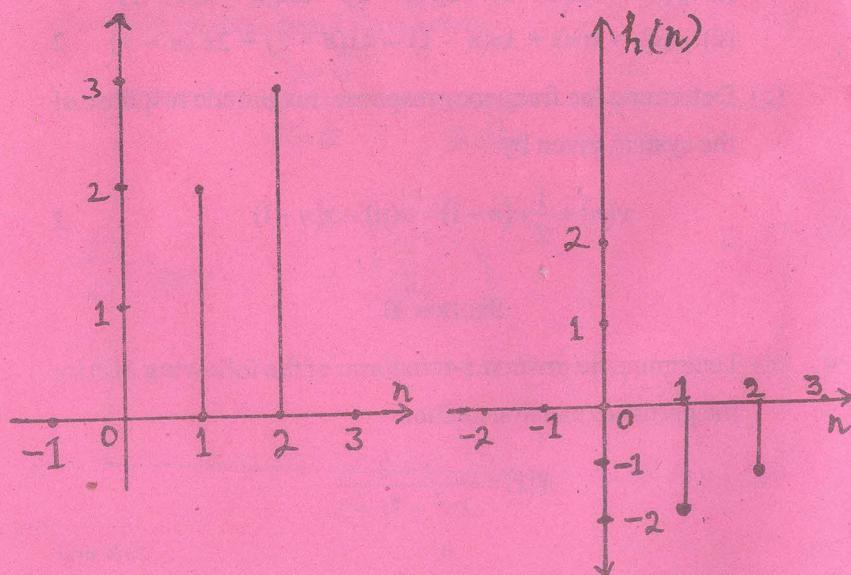
if the ROCs are (i)  $|z| > 3$   
(ii)  $|z| < \frac{1}{2}$   
(iii)  $\frac{1}{2} < |z| < 3$ . 4

(b) Using the residue method, find the inverse z-transform of:-

$$X(z) = \frac{1}{(z - 0.25)(z - 0.5)}, \text{ ROC: } |z| > 0.5 \quad 4$$

5. (a) Determine the IDFT of  $X(R) = \{3, (2+j), 1, (2-j)\}$ . 2  
(b) Given  $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ , find  $X(R)$  using DIF FFT algorithm. 4  
(c) Explain the following properties of DFT:-  
(i) circular correlation  
(ii) circular time shift. 2

6. (a) Find the response of an FIR filter with impulse response  $h(n) = \{1, 2, 4\}$  to the input sequence  $x(n) = \{1, 2\}$ . 4  
(b) Find the convolution of the two signals shown in figure. 4



### SECTION C

7. (a) Determine the parallel realisation of the IIR digital filter transfer function:-

$$H(z) = \frac{3(2z^2 + 5z + 4)}{(2z+1)(z+2)} \quad 2$$

- (b) Draw the structures of cascade and parallel realisation of:-

$$H(z) = \frac{(1-z^{-1})^3}{(1-\frac{1}{2}z^{-1})(1-\frac{1}{8}z^{-1})} \quad 4$$

- (c) Obtain direct form and cascade form realisations for the transfer function of an FIR system given by:-

$$H(z) = \left(1 - \frac{1}{4}z^{-1} + \frac{3}{8}z^{-2}\right) \left(1 - \frac{1}{8}z^{-1} - \frac{1}{2}z^{-2}\right) \quad 2$$

8. (a) A digital filter with a 3 dB bandwidth of  $0.25\pi$  is to be designed from the analog filter whose system response is:-

$$H(s) = \frac{\Omega_c}{s + \Omega_c}$$

Use bilinear transformation and obtain  $H(z)$ . 2

- (b) A low-pass filter has the desired response as given below:-

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega} & 0 \leq \omega < \frac{\pi}{2} \\ 0 & \frac{\pi}{2} \leq \omega < \pi \end{cases}$$

- b) Why parallel operation of transformers required? Calculate the circulating current in two parallel single-phase transformers with leakage impedance 5% each and no-load voltage difference of 1%. Express in percentage of full load current.

B.Tech. EE (V Sem.)

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Paper 5.2

**B. Tech. (FIFTH SEMESTER)  
EXAMINATION, 2017**

PAPER 5.2: Electrical Machine - 1

Time Allowed : 3 HOU

Maximum Marks : 40

*This paper is divided into THREE sections. Attempt FIVE questions in all. Selecting not more than two questions from each Section.*

**All questions carry equal marks.**

SECTION-A

1. a) What is leakage flux? Why flux fringing occurs in an Electromechanical devices? 3

b) The coils of the magnetic circuit shown below are connected in series so that the mmf's of path A and B both tend to setup flux in the centre leg C in the same direction. The coils one wound with equal turns,  $N_1 = N_2 = 100$ . The dimensions are: -

Cross-section area of A and B legs =  $7\text{cm}^2$

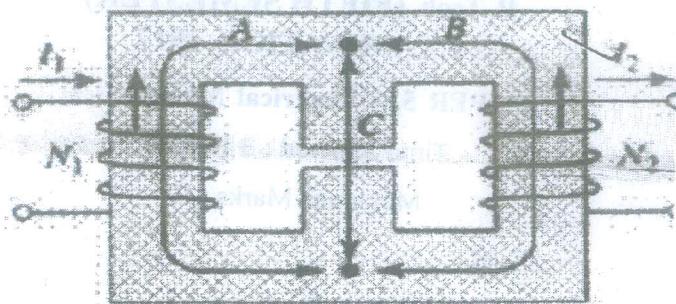
Cross – section area of C legs =  $14\text{cm}^2$

Length of A path =  $17\text{cm}$

Length of B path =  $17\text{cm}$

Length of C path = 5.5cm

Air gap = 0.4cm



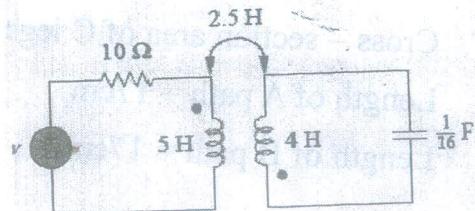
The material is M-5 grade, 0.012in steel, with a stacking factor of 0.94. Neglect fringing and leakage.

i) How many amperes are required to produce a flux density of 1.2T in the air gap?

ii) Under the condition of path how many joules of energy are stored in the magnetic field in the air gap?

iii) Calculate the inductance? 5

a) Consider the circuit shown here. Determine the coupling coefficient? Determine the energy stored in the coupled inductor at times  $t=1S$ , if  $V=60 \cos(4t+30)$  Fig: 2(a) 5



b) What happens to current, if a pure inductor is attached with fixed dc supply? What if capacitor replaces inductor? 3

3. a) Explain the following with respect to rotating electrical machines:-

i) Pole pitch

ii) Channing angle

iii) Flux density waves in sinusoidally distributed in space.

iv) Pulsating-stationary flux

v) Co-energy density and magnetic flux density. 6

b) The eddy current loss in a magnetic circuit is found to be 100w. when the exciting coil is energized by 200v, 50Hz source. If the coil is supplied with 180v, 54Hz instead, calculate the eddy current loss? 2

## SECTION-B

4. a) How does armature reaction influence the performance of a DC machine? Discuss with wave form? 5

b) A 200KW, eight-pole DC generator operating at 850 rev/mnt has a generated voltage of 200V; Determine: a) frequency of the induced emf; b) The voltage and frequency if the speed is increased by 20 percent and the flux is decreased by 5 percent. 3

5. a) What is critical resistance? What is the significance of it in self excited shunt generator? Draw the curve of magnetic characteristics of a separately excited generator? 3

b) Discuss Wand-Leonard method for speed control of DC motor? 5

6. a) A 230V DC shunt motor, takes an armature current of 3.3A at related voltage and no-load speed of 1000 rpm. The resistance of the armature circuit and field circuit are respectively  $0.3\Omega$  and  $160\Omega$ . The line current of FL and rated voltage is 40A. Calculate at FL, speed and developed torque incase the armature reaction weakens the no local flux by 4%. 4

b) The results of the Hopkinson's test conducted on a pair of DC shunt machines at full load are as follow. Line voltage-200V, Line current 50A, Motor Armature current = 195A, field current = 6A and 5A, Armature resistance =  $0.08\Omega$  calculate the efficiency of each machine? 4

### SECTION-C

7. a) The 0.C and 5C test data are given below for a single phase, 5KVA, 200V/400V, 50Hz transformer:

0.C test from LV side: 200V 1.25A 150W

5.C test from HV side: 20V 12.5A 175W

Draw the equivalent circuit of the transformer  
i) referred to HV side ii) Referred to LV side  
inserting all the parameter values. 5

b) A 5KVA, 200V/100V, 50Hz, Single phase ideal two winding transformer is used to step up a voltage of 200V to 300V by connecting it like an auto transformer. Show the connection diagram to achieve this? 3

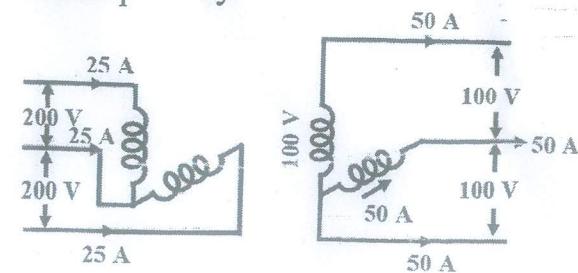
8. a) Define Zero voltage Regulation? 3

b) If a 250/125V, 5KVA single phase transformer has primary resistance of  $0.2\Omega$  and reactance of  $0.75\Omega$ . The secondary Resistance is  $0.05\Omega$  and reactance of  $0.2\Omega$

i) Determine its regulation while supplying full load on 0.8 leading p.f.

ii) The secondary terminal voltage on full load 0.8 and leading p.f. 5

9. a) Two identical transformers each of rating 5KVA, 200V / 100V, 50Hz transformers are connected in open delta. Calculate the KVA rating of the open delta bank when HV side is used as primary. 4



**B.Tech. (V Sem.)**

**321**

**Paper 5.4**

**B.Tech. (FIFTH SEMESTER)  
EXAMINATION, 2017**

**(EE)**

**PAPER EE 5.4: Power Electronics**

**Time Allowed : 3 HOURS**

**Maximum Marks : 40**

*Attempt FIVE questions in all, selecting not more than TWO questions from each section.*

*All questions carry equal marks.*

**SECTION-A**

1. a) Draw the V-I characteristics of Triac and explain its working principle.  
b) Explain the safe operation of an IGBT.  
c) Give the merits and demerits of GTO as compared to conventional SCR.
2. a) Draw the power diagram for protection of SCR against over voltage.  
b) Draw the dynamic characteristics of Thyristor.  
c) Draw the power diagram for gate protection of SCR.  
d) Snubber circuit for an SCR should be primarily consist of capacitor only. But, in actual practice, a resistor is used in series with the

- capacitor, why?
3. a) Draw the power diagram and waveforms of R firing scheme.
  - b) Draw the power diagram and waveforms of RC firing scheme.
  - c) Draw the power diagram and waverforms of UJT firing scheme.
  - d) Draw the power diagram of pulse transformer trigger circuit and optical isolator based trigger circuit. Why pulse train triggering is preferred over pulse triggering.

### SECTION-B

4. a) Draw the power diagram and waveforms for single phase asymmetrical converter for R, RL and RLE load. Assume  $L \ll R$  and  $L \gg R$ . Write output voltage equation.
- b) Draw the power diagram and waveforms for single phase fully controlled bridge converter for R, RL and RLE load. Assume  $L \ll R$  and  $L \gg R$ . Write output voltage equation.
5. a) For single phase bridge rectifiers explain the effect of source inductance effect.
- b) A 3-phase fully controlled bridge converter is connected to three phase a.c. supply of 400V, 50Hz and operates with a firing angle  $\alpha = \pi / 4$ . The load voltage is 360V. Compute: Source inductance  $LS$ , Load resistance  $R$  and overlap angle ' $\mu$ '

6. Draw the power diagram of Type A, Type B, Type C, Type D and Type E Chopper. For each types write switching sequence and draw quadrant operation diagram.

### SECTION-C

7. Explain the principle of operation of single phase half bridge and full bridge inverters considering following points: -
  - a) What are feedback diodes and their use?
  - b) Draw the output voltage and current waveforms for over damped and under damped loads.
  - c) Mark the conduction period of thyristor and feedback diode on waveforms.
8. What do you mean by  $180^\circ$  and  $120^\circ$  conduction mode of three phase inverters? Explain  $180^\circ$  mode three-phase VSI for star connected load with suitable waveforms.
9. Explain the operation of three phase to single cycloconverter with the help of schematic diagram and waveform.

### SECTION C

7. Write short notes on any two:-

- (a) Neutral grounding
- (b) Bundled conductor
- (c) Grounding transformer
- (d) EHV AC system.

2×4=8

8. (a) Explain the detailed structure of HVDC transmission system. 4

(b) A transformer secondary line voltage to a 3-φ bridge converter rectifier is 38 kV. Calculate the gross voltage output, when the overlap and commutation angle is  $15^\circ$  of delay angle in:

- (i)  $0^\circ$
- (ii)  $15^\circ$

4

9. (a) A 230 kV, 3-phase, 50 Hz, 200 km transmission line has a capacitance to earth of  $0.02 \mu\text{F}/\text{km}$  per phase. Calculate the inductance and KVA rating of the Peterson coil used for earthing the above system. 4

(b) Explain the solid or effective grounding with the help of neat diagram and also discuss its advantages. 4

### B.Tech. (EE) (V Sem.)

322

Paper EE 5.5

### B.Tech. (EE) (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

#### PAPER EE 5.5— ELEMENTS OF POWER SYSTEM

TIME ALLOWED : THREE HOURS

Maximum Marks— 40

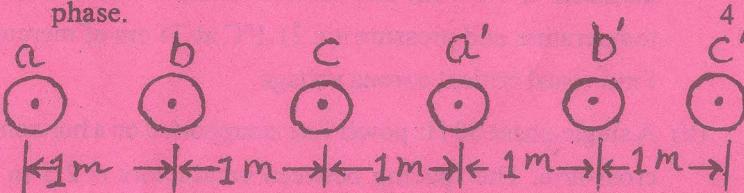
*The question paper is divided into three Sections.*

*Attempt five questions in all, selecting not more than two questions from each Section. All questions carry equal marks.*

#### SECTION A

1. (a) Explain single line diagram of the power system network and also discuss the role of reactive power in voltage control. 4

(b) A double-circuit three-phase line is shown in fig. The conductors  $a, a'$ ;  $b, b'$ ; and  $c, c'$  belong to the same phase respectively. The radius of each conductor is 1.5 cm. Find the inductance of the double-circuit line in mH/km/phase.



2. (a) Derive an expression for the capacitance per meter length between two long parallel conductors, each of radius  $r$ , with axes separated by a distance  $D$ , where  $D \gg r$ , the insulating medium being air. 4

- (b) A three phase, 50 Hz overhead line has regular transposed conductors equilaterally spaced 4 m apart. The capacitance of such a line is  $0.01 \mu\text{F}/\text{km}$ . Recalculate the capacitance per kilometer to neutral when the conductors are in the same horizontal plane with successive spacing of 4 m and are regularly transposed. 4

3. (a) A single-phase 50 Hz generator supplies an inductive load of 5,000 kW at a power factor of 0.707 lagging by means of an overhead transmission line 20 km long. The line resistance and inductance are  $0.0195 \Omega$  and  $0.63 \text{ mH}$  per km. The voltage at the receiving-end is required to be kept constant at 10 kV. Find the sending-end voltage and voltage regulation of the line. 4

- (b) Using first principle determine the A, B, C, D parameters of the long transmission line. 4

## SECTION B

4. (a) A 3-phase overhead line consists of 3 conductors in equilateral formation with 2.44 m spacing. The conductor diameter is 1.04 cm and surface factor is 0.85. The air temperature and pressure are  $21.1^\circ\text{C}$  at 74 cm of mercury. Find visual critical corona voltage. 4

- (b) A single-phase 50 Hz power line is supported on a horizontal cross-arm. The spacing between conductors is 2.5 m. A

telephone line is also supported on a horizontal cross arm in the same horizontal plane as the power line. The conductors of the telephone line are of solid copper spaced 0.6 m between centres. The distance between the nearest conductors of the two lines is 20 m. Find the voltage per kilometre induced in the telephone line for 150 A current flowing over the power line. 4

5. (a) Explain the methods of improving string efficiency. 4

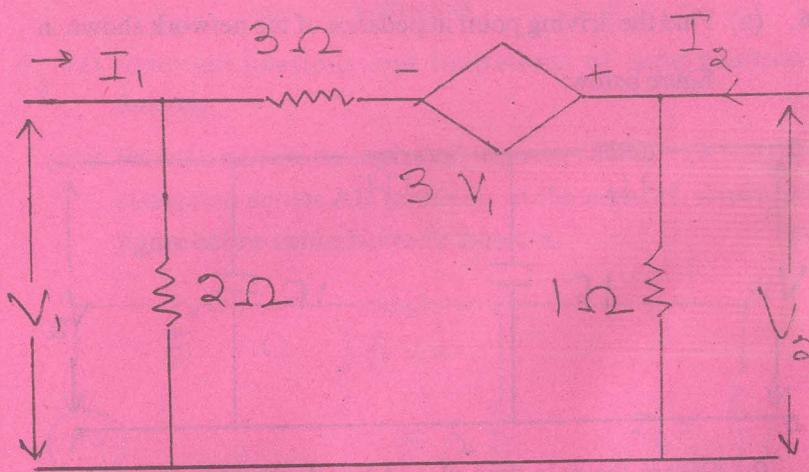
- (b) A 3-phase line is supported by suspension string having three units. The voltage across the unit nearest to the line is 20 kV and that across the adjacent unit is 15 kV. Find:

- Ratio of the capacitance of joint to capacitance of disc
- System line voltage
- String efficiency. 4

6. (a) Explain the effect of ice and wind loading on the transmission line and also discuss the sag template. 4

- (b) A single-core cable 1.0 km long has a core diameter of 0.5 cm and diameter under sheath 2.0 cm. The relative permittivity of insulating material is 3.5. The power factor on open circuit is 0.05 and the supply voltage is 11 kV, 50 Hz. Determine:

- The capacitance of the cable
- The charging current
- The dielectric loss
- Equivalent insulation resistance. 4



8. (a) Obtain  $Y$ -parameters in terms of  $Z$  parameters. 4

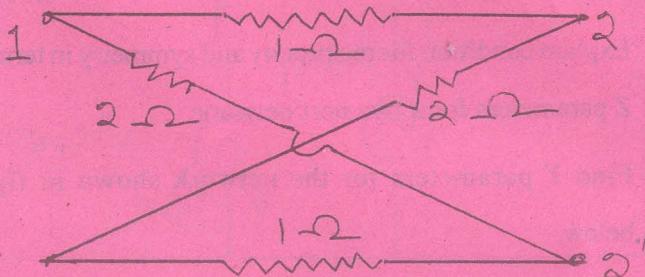
(b) A two port network has the following parameters:

$Z_{22} = 40 \Omega$ ,  $Z_{11} = 30 \Omega$  and  $Y_{12} = 0.05 \text{ mhos}$ . Calculate the

ABCD parameters of the network. 4

9. (a) For a given network, if  $Z$  parameters are given then how can the equivalent T-network values be found? 2

(b) Obtain  $h$  parameters of the network shown in figure below: 6



### B.Tech. (EE) (V Sem.)

23

EE 5.6

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### B.Tech. (EE) (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

PAPER EE 5.6— Network Analysis

TIME ALLOWED : THREE HOURS

Maximum Marks—40

Attempt five questions in all, selecting not more than two questions from each Section.

All questions carry equal marks.

#### SECTION A

(a) Explain the following terms:

- (i) node
- (ii) tree
- (iii) link
- (iv) loop
- (v) degree of node
- (vi) directed graph

(b) The reduced incidence matrix of a graph is shown below.

Draw the graph corresponding to it.

5

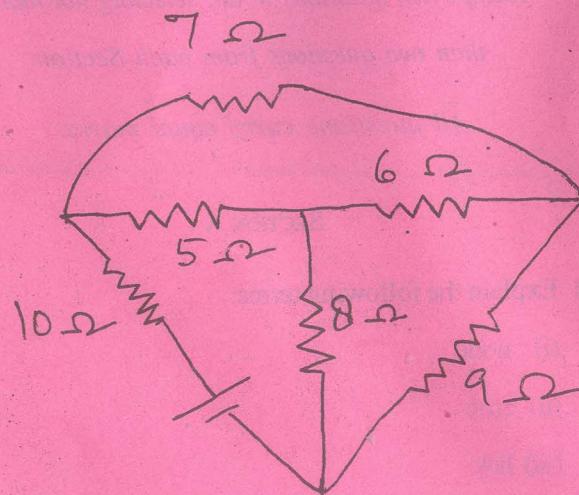
$$\begin{bmatrix} -1 & +1 & 0 & 0 & 0 & -1 \\ 0 & -1 & -1 & +1 & 0 & 0 \\ 0 & 0 & +1 & 0 & -1 & +1 \end{bmatrix}$$

2. (a) Explain the procedure for obtaining fundamental tie-set matrix of a given network.

3

(b) Find the branch current in the circuit shown below by using the concept of tie-set matrix:

5



3. (a) Write cut-set matrix of the graph shown in figure below:

What is the rank of the cut-set matrix? (a)

What is the number of loops in the graph?

What is the number of trees in the graph?

What is the number of edges in the graph?

What is the number of vertices in the graph?

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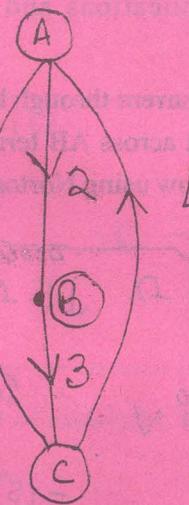
What is the number of vertices in the graph?

What is the number of edges in the graph?

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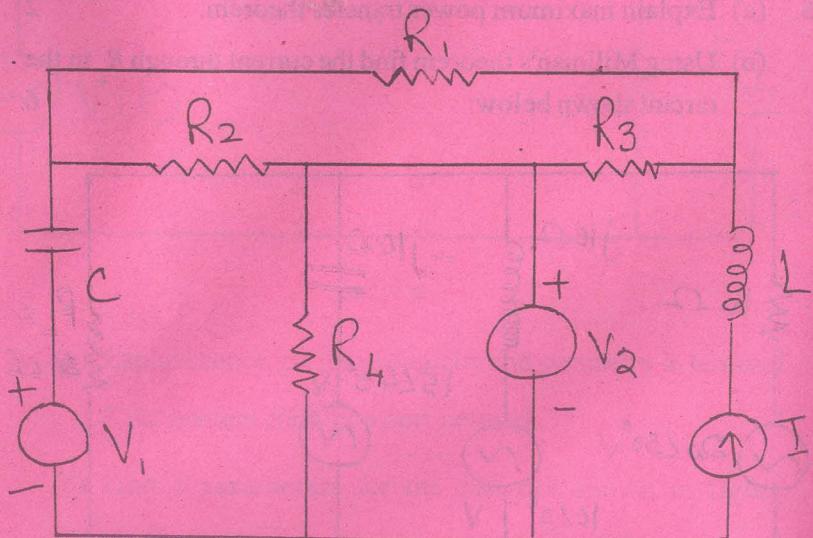
What is the number of edges in the graph?

What is the number of vertices in the graph?



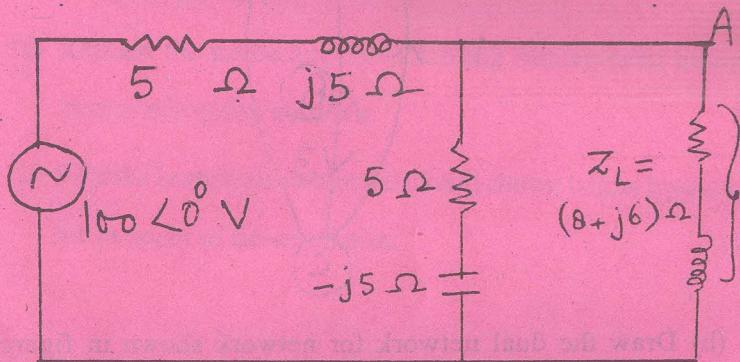
(b) Draw the dual network for network shown in figure below:

5

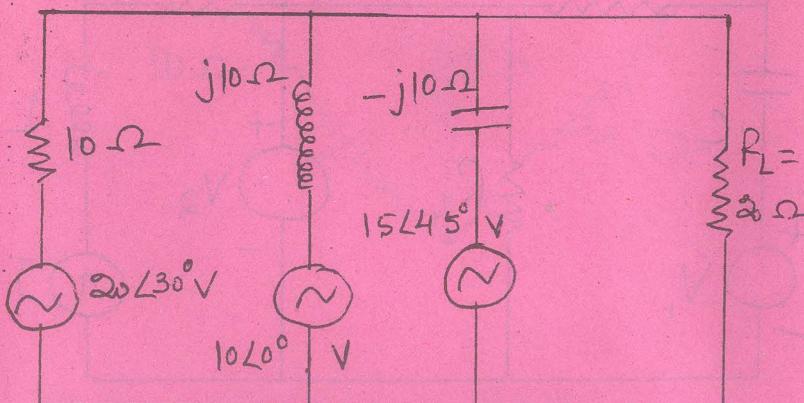


### SECTION B

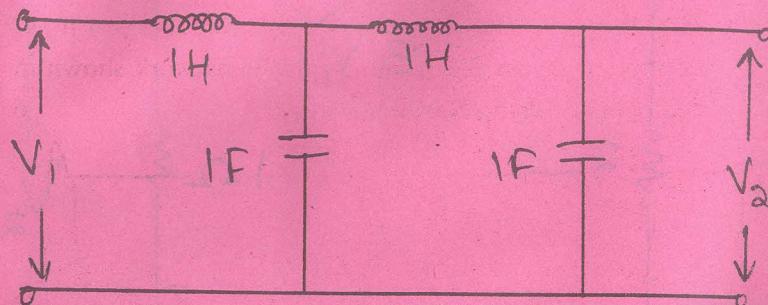
4. (a) State applications and limitations of superposition theorem. 2
- (b) Find the current through load impedance  $Z_L = (8+j6)\Omega$  connected across AB terminals in the network shown in figure below using Norton's theorem. 6



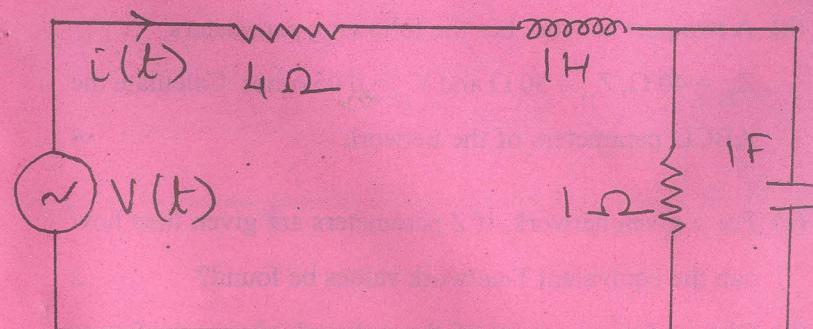
5. (a) Explain maximum power transfer theorem. 2
- (b) Using Millman's theorem find the current through  $R_L$  in the circuit shown below: 6



6. (a) Find the driving point impedance of the network shown in figure below: 4



- (b) Obtain the pole zero plot of transform impedance of the network shown in fig below: 4



### SECTION C

7. (a) Explain condition for reciprocity and symmetry in terms of Z parameters for a two port network. 4
- (b) Find Y parameters for the network shown in figure below. 4

एम०एच०सी० अणुओं के बारे में समझाइए। पूरक प्रणाली का सचित्र वर्णन कीजिये।

### प्रश्न अधिकारी का टिप्पणी

प्रश्न अधिकारी को एक अलग चैप्टर में लिखा गया है। उसका अवलोकन करने के बाद उत्तर दिया जाएगा।

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### प्रश्न अधिकारी

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## B.Tech. (B.T.) (V Sem.)

324

Paper 5.2

## B.Tech. (B.T.) (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

### PAPER 5.2—Microbiology and Immunology

TIME ALLOWED : THREE HOURS

Maximum Marks— 40

Attempt five questions in all, selecting not more than two questions from each Section.  
All questions carry equal marks.

कुल पाँच प्रश्न करने हैं। प्रत्येक खण्ड में से दो से अधिक प्रश्न नहीं किये जा सकते हैं।  
सभी प्रश्नों के अंक समान हैं।

#### SECTION A (खण्ड अ)

1. Write short notes on the following:

- Bacterial Capsule— Structure
  - Structure and functions of plasma membrane.
- निम्नलिखित पर संक्षिप्त टिप्पणी लिखिये:
- जीवाण संपुट की संरचना
  - कोशिका द्विल्ली की संरचना एवं कार्य।

Turn over

2. Write short notes on the following:—

- (a) Asexual reproduction in fungi
- (b) Structure of bacteriophage.

निम्नलिखित पर संक्षिप्त टिप्पणी लिखिये:—

- (a) कवकों में अतैंगिक जनन
- (b) जीवाणुभोजी की संरचना।

3. Write down the structure and composition of bacterial cell wall. Explain the cell wall of gram positive bacteria with the help of suitable diagrams.

जीवाणुओं की कोशिका भित्ति की संरचना के बारे में लिखिये।  
ग्राम पोजीटिव जीवाणुओं की कोशिका भित्ति का सचित्र वर्णन कीजिये।

#### SECTION B (खण्ड ब)

4. Write short notes on the following:—

- (a) Chemical methods of sterilization
- (b) Properties of antigens.

निम्नलिखित पर संक्षिप्त टिप्पणी लिखिये:—

- (a) रासायनिक क्रिया द्वारा बंध्याकरण
- (b) प्रतिजन की विशेषताएँ।

5. Write short notes on the following:—

- (a) Techniques of culture preservation
- (b) Industrially important microorganisms.

निम्नलिखित पर संक्षिप्त टिप्पणी लिखिये:—

- (a) सूक्ष्म जीवों के कल्चर संरक्षण की विभिन्न विधियाँ
- (b) सूक्ष्मजीवों का औद्योगिक महत्व।

6. Define Immunity. Explain different cells and organs of immune system.

प्रतिरोधक क्षमता के बारे में समझाइए। प्रतिरोधक क्षमता में प्रयोग होने वाली कोशिकाओं एवं अंगों के बारे में विस्तार से समझाइये।

#### SECTION C (खण्ड स)

7. What are immunoglobulins? Explain the molecular structure, properties and classification of immunoglobulins with the help of suitable diagrams.

इम्यूनोग्लोब्युलिन के बारे में बताइये। इम्यूनोग्लोब्यूलिन की संरचना, कार्य एवं वर्गीकरण का सचित्र वर्णन कीजिये।

8. Write short notes on the following:—

- (a) Applications of monoclonal antibodies
- (b) Difference between humoral and cell mediated immunity.

निम्नलिखित पर संक्षिप्त टिप्पणी लिखिये:—

- (a) मोनोक्लोनल एण्टीबाडी उपयोगिताएँ
- (b) ह्यूमोरल एवं सेल मिडिएटेड प्रतिरक्षा क्रियाओं में अन्तर।

9. What are MHC molecules? Define complement system with the help of suitable diagrams.

## B.Tech. (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

### BIOTECHNOLOGY PAPER 5.3—Metabolic Engineering

TIME ALLOWED : THREE HOURS

Maximum Marks— 40

*Attempt five questions in all, selecting not more than two questions from each Section.  
All questions carry equal marks.*

#### SECTION A

1. (a) Distinguish between primary and secondary metabolites. Explain the phase during which secondary metabolites are synthesized. 3  
(b) Give an overview of cellular metabolism for substrate serving as both carbon and energy source. 5
  
2. (a) What is facilitated diffusion? How does facilitated transport rate of compounds follow Michaelis-Menten saturation type kinetics? 4

- (b) Growth energetics describe the relationship between generation and consumption of Gibb's free energy. Explain this statement. 4
3. (a) What is stoichiometry of cellular reaction? Give a generalized equation for different components (substrate, metabolic product, intracellular metabolites and biomass) of cellular reaction. 4
- (b) Explain different mechanisms involved in metabolic regulation network at whole cell level. 4
- SECTION B**
4. What is Metabolic Flux Analysis (MFA)? Explain flux determination in an overdetermined system with an example. 8
5. (a) Explain briefly how radiolabelled materials are utilized in experimental determination of metabolic flux. 4
- (b) What do you understand by stereo-chemistry of regulatory molecules? 4
6. Give the metabolic pathway synthesis algorithm comprising following reactions:—
- $A \rightarrow B$
  - $B \leftrightarrow C$
  - $C \leftrightarrow D$
  - $C + D \leftrightarrow F + K$
- (e)  $F + K \leftrightarrow H + E$
- (f)  $H + D \leftrightarrow E + F$
- (g)  $A \leftrightarrow E$
- (h)  $E \rightarrow F + G$
- (i)  $F \leftrightarrow G$
- (j)  $G \rightarrow L$
- SECTION C**
7. Discuss the role of molecular biology and recombinant DNA technology for metabolic pathway improvement. 8
8. Differentiate between feedback inhibition and feedback repression. Explain with proper example. 8
9. Write short notes on the following:—
- Free energy is the most useful thermodynamic function in metabolic engineering.
  - Description of cellular growth by non-equilibrium thermodynamics. 2x4

**B.Tech. (FIFTH SEMESTER) EXAMINATION, DEC. 2017**

**BIO-TECHNOLOGY**

**PAPER 5.4— Genetics and Genetic Engineering**

**TIME ALLOWED : THREE HOURS**

**Maximum Marks— 40**

*Attempt five questions in all, selecting not more than two questions from each Section. All questions carry equal marks.*

**Section A**

Q.1. Explain Mendel's laws of inheritance with examples

Q.2 Write notes on the following

- a) Linkage maps                    b) Multiple alleles

Q.3. Give an account of various types of chromosomal aberrations.

**Section B**

Q.4 What are plasmids and how they are classified? Describe incompatibility groups of plasmids.

Q.5. What is cDNA library? Describe a method to prepare cDNA library.

Q.6 Describe importance of the following enzymes in molecular cloning

- a) DNA polymerase I                b) DNA ligase                c) Terminal deoxynucleotidyl transferase  
d) Polynucleotide kinase

**Section C**

Q.7 Write notes on the following

- a) Inborn errors of metabolism                b) Identical and fraternal twins

Q.8 Give an overview of recombinant clone identification methods

Q.9 Write notes on the following

- a) Genetic diseases in humans    b) FISH

**B.Tech. (FIFTH SEMESTER) EXAMINATION, DEC. 2017****CHEMICAL ENGINEERING****PAPER CE 5.2— Computational Methods in Engineering****TIME ALLOWED : THREE HOURS****Maximum Marks— 40****SECTION A**

- Q.1. Convert the following set of equations in *Diagonally Dominant* form and then apply [8] *Successive Displacement* method to solve the equations. Take zero as initial guess. Carryout at least six iterations.

$$\begin{bmatrix} 4 & 2 & 3 \\ 3 & -5 & 2 \\ -2 & 3 & 8 \end{bmatrix} \begin{bmatrix} x \\ x^2y \\ x^2z \end{bmatrix} = \begin{bmatrix} 8 \\ -14 \\ 27 \end{bmatrix}$$

- Q.2. Use the power method with *scaling* to approximate a dominant eigenvector of the given [8] matrix. Use  $x_0 = (1,1,1)$  as the initial approximation and calculate upto five iterations.

$$A = \begin{bmatrix} 1 & 2 & 0 \\ -2 & 1 & 2 \\ 1 & 3 & 1 \end{bmatrix}$$

- Q.3. Solve the following set of equations using Newton-Raphson Technique. [8]  
Use  $[x_0, y_0] = [0, 0]$ .

$$f_1(x, y) = x^2 - 10x + y^2 + 8$$

$$f_2(x, y) = xy^2 + x - 10y + 8$$

**SECTION B**

- Q.4. The upward velocity of a rocket is given as a function of time: [8]

$t$ (s)	$v(t)$ , m/s
0	0
10	227.04
15	362.78
20	517.35
22.5	602.97
30	901.67

- a) Determine the value of the velocity at  $t = 16$  s with third order polynomial interpolation using Newton's divided difference polynomial method.  
 b) Find the distance covered by the rocket from  $t = 11$  s to  $t = 16$  s.

- Q.5. Using Simpson's rule compute the integral  $\int_0^1 e^{x^2} dx$ , where the table for the values of [8]  
 $y = e^{x^2}$  is given below:

x	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
y	1.000	1.010	1.041	1.094	1.173	1.284	1.433	1.632	1.896	2.248	2.718

Also, use the true value of integral to find the error for Simpson's rule approximation.

- Q.6. Generate Pade' approximation of  $f(x) = \sin(x)$  as: [8]

$$y(x) = \frac{a_0 + a_1 x + a_2 x^2}{1 + b_1 x}$$

## SECTION C

- Q.7. Solve the given boundary-value problem using finite-difference method to determine  $y(0.5)$ ; [8]

$$\frac{d^2y}{dx^2} + y + 1 = 0, \quad 0 \leq x \leq 1$$

where  $y(0) = 0$ ,  $y(1) = 0$  with  $h = 0.25$ . Also, compute the absolute error by comparing the answer with true solution.

- Q.8. The steady state heat transfer in a rod of length 5 meters with heat transfer coefficient [8]  
 $k = 0.01 m^{-2}$  is given by the equation,

$$\frac{d^2T}{dx^2} + k(5 - T) = 0; \quad T(0) = 10, T(5) = 100$$

The two ends of the rod are maintained at fixed temperature  $10^\circ\text{C}$  and  $100^\circ\text{C}$ . The rod is not insulated and heat transfer is allowed from (to) the surface to (from) the surrounding air at a temperature  $20^\circ\text{C}$  by convection. Find  $T(3)$  using *Shooting Technique* along with *Heun's* method.

- Q.9. Solve the heat equation [8]

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

Subject to the conditions:

$$u(x, 0) = 0; u(0, t) = 0; u(1, t) = t$$

Take  $k = 1/16$  and  $h = 1/4$

**B.Tech. (FIFTH SEMESTER) EXAMINATION, DEC. 2017**

**CHEMICAL ENGINEERING**

**PAPER CE 5.3— Process Instrumentation and Control**

**TIME ALLOWED : THREE HOURS**

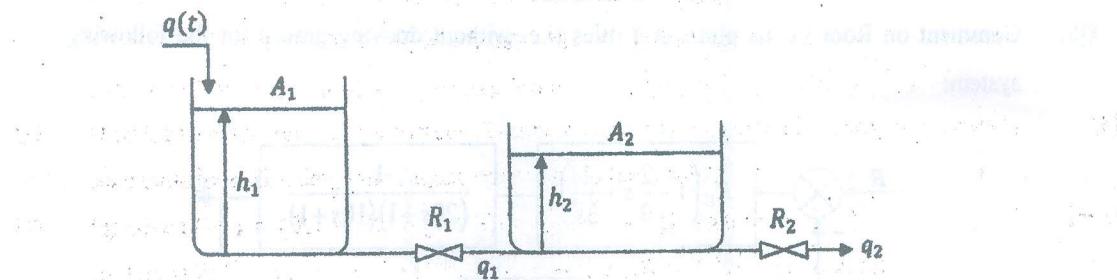
**Maximum Marks— 40**

**Section A**

- Q1.** Develop transfer function for mercury U-tube manometer. Develop all steady and unsteady state equations. Use developed equations to obtain the results. [8]
- Q2.** (a) Given  $G(s) = (86s - 78)/[(s + 3)(s - 4)(5s - 1)]$ . Determine  $G(t)$ . [5+3]  
 (b) Given  $2y'' + 3y' - 2y = te^{-2t}$ ,  $y(0) = -1$ ,  $y'(0) = 2$ . Determine  $y(s)$ .
- Q3.** A mercury thermometer having time constant 0.1 minute is placed in temperature bath at 100 °F and allowed to come in equilibrium with the bath. At time  $t = 0$ , the temperature of the bath begins to vary in sinusoidal manner about its average temperature 100 °F with an amplitude of 2 °F. If the frequency of oscillation is  $10/\pi$  cycles/minute, plot the ultimate response of the thermometer reading as a function of time. What is the phase lag? [8]

**Section B**

- Q4.** For a interacting system (as shown in the figure) derive the expression  $H_2(s)/Q(s)$ . Develop all steady and unsteady state equations. Use developed equations to obtain the results. [8]



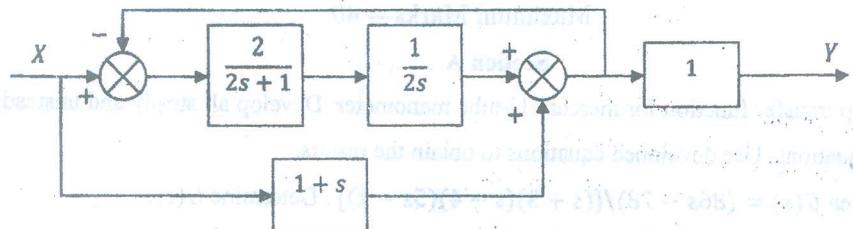
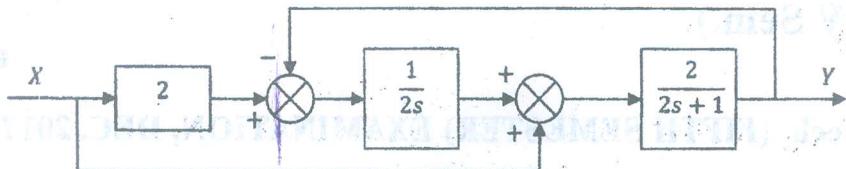
- Q5.** Open loop transfer function for a control system is given as: [8]

$$G = \frac{K_c}{(\tau_1 s + 1)(\tau_2 s + 1)(\tau_3 s + 1)}$$

where  $\tau_1$ ,  $\tau_2$  and  $\tau_3$  are 1, 1/3 and 1/5 respectively. Determine (i) range of  $K_c$  for which system will become unstable (ii) values of all roots when system will be on the verge of instability.

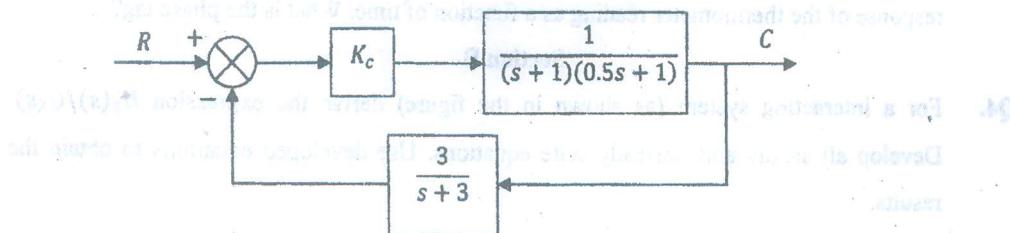
- Q6.** Determine the transfer function  $Y(s)/X(s)$  for the following block diagrams. [4+4]

**P.T.O**

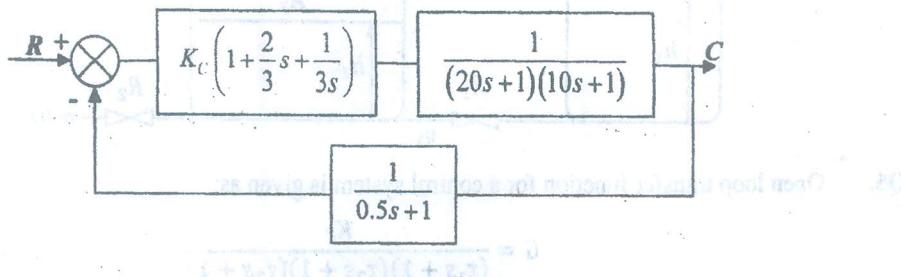


### Section C

- Q7. Write the characteristic equation and construct the Routh array for the control system shown in the figure. Write your conclusion. Is the system stable for (a)  $K_c = 9.5$ , (b)  $K_c = 11$  and (c)  $K_c = 12$ ? [8]



- Q8. Comment on Root Locus plot using rules (i.e. without drawing graph) for the following system: [8]



- Q9. Two tanks having transfer functions  $\frac{1}{2s+1}$  and  $\frac{1}{s+10}$  are connected in series. Determine expressions for overall amplitude ratio ( $AR_{overall}$ ) and overall phase angle ( $\phi_{overall}$ ). Draw plots for  $AR_{overall}$  and  $\phi_{overall}$  on same abscissa using log-log graph paper. [8]

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## B.Tech. (BT) (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

BT

PAPER 5.5—Enzyme Engineering and Technology

TIME ALLOWED : THREE HOURS

Maximum Marks—40

*Attempt five questions in all, selecting not more than two questions from each Section.*

*All questions carry equal marks.*

### SECTION A

1. What are different types of reversible inhibitor?  
Explain the kinetics of competitive inhibitor. 6+2
  
2. Explain specificity of enzyme and different types of methodologies for investigation of kinetics of enzyme catalyzed reaction. 4+4
  
3. Explain briefly the following:—
  - (a) Hofstee's plot
  - (b) Transition state stabilisation hypothesis

- (c) Michaelis-Menten Law  
(d) Mechanism of carboxypeptidase A. 2×4

### SECTION B

4. Explain the impact of genetic engineering approach on modification of catalytic properties of enzymes. 8

5. Explain different types of allosteric inhibitor and their kinetics. 4+4

6. Explain the following:—

- (a) Extraction of membrane bound enzyme  
(b) Salt precipitation  
(c) Mechanism of enzyme reaction catalysis using FADH<sub>2</sub>  
(d) Industrial importance of enzymes secreted from Extremophiles. 2×4

### SECTION C

7. What are different methods of immobilization? Describe the effect of solute partition on kinetics of immobilized enzymes. 4+4

8. Explain the role of enzymes in molecular biology and clinical diagnostics. 4+4

9. Explain the industrial role of the following enzymes:—

- (a) Cyclodextrin glycosyl transferase  
(b) Penicillin acylase  
(c) Protease  
(d) Oxidoreductase. 2×4

dispersed plug flow. At point A in the pipe the spread of tracer is 16m. At point B, 1 kilometer downstream A, its spread is 32m. What do you estimate its spread to be at point C, which is 2 kilometers downstream from point A? 5

**Discuss "molecular mixing into distribution". If you consider the following ways of mixing the reactants:**

- a) 1. S + 2. 2. 3. 0 (mixing)
- b) Add A slowly to B
- c) Add B slowly to A
- d) Both (a) & (b) are instantaneous

**Q. 10) Ethanol (boiling point 78.3°C) has to be heated to 90°C. If equilibrium constant for the reaction**

**Q. 11) In a first order reaction, the time taken to reduce the concentration of reactant by 50% is 10.0 min. Present the result in the form of a plot of temperature versus conversion.**

**Q. 12) What temperature should be placed on the reactor plate if 90% of conversion of 75% or higher is desired?**

**Q. 13) What is the effect of rate of shear on the rate of polymerization?**

### B.Tech. (CE) (V Sem.)

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### B.Tech. (FIFTH SEMESTER) EXAMINATION, 2017

#### CHEMICAL ENGINEERING

#### PAPER 5.4: Chemical Reaction Engineering - I

Time Allowed : 3 HOURS

Maximum Marks : 40

*This question paper is divided into three sections.*

*Students are required to attempt FIVE questions in all, selecting not more than two questions from each section. All questions carry equal marks.*

*In case of missing data or incorrect information make appropriate assumption(s) and mention them clearly in answer sheet. Write the answers in sequential order.*

*Graph paper is to be provided*  
**SECTION-A**

1. a) Define order of reaction.  
Milk is pasteurized if it is heated to 63°C for 36 min, but if it is heated 74°C it only needs 18s for the same result. Find the activation energy of this sterilization process. 3
- b) On doubling the concentration of reactant, the rate triples. Find the reaction order. 3
- c) Define rate of reaction and list variable

affecting rate of reaction.

2. a) If a first order reversible reaction carried out in a batch reactor, prove that

$$-\ln \left( 1 - \frac{X_A}{X_{Ae}} \right) = \frac{M+1}{M+X_{Ae}} k_t t$$

All symbols have their usual meanings. 5

- b) Aqueous A at the concentration  $C_{A0} = 1 \text{ mol/liter}$  is introduced into a batch reactor where it reacts away to form product R according to stoichiometry  $A \rightarrow R$ . The concentration of A in the reactor is monitored at various times, as shown below: -

t, min	0	100	200	300	400
$C_A, \text{ mol/m}^3$	1000	500	333	250	200

For  $C_{A0} = 500 \text{ mol/m}^3$ , find the conversion of reactant after 200 minutes in the reactor. 3

3. a) The irreversible isomerization



was carried out in a batch reactor and the following concentration time data were obtained:-

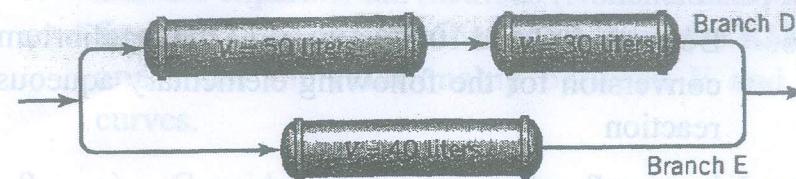
t(min)	0	3	5	8	10	12	15	17.5
$C_A (\text{mol/dm}^3)$	4.0	2.89	2.25	1.45	1.0	0.65	0.25	0.07

Determine the reaction order and the specific reaction rate. 4

- b) In an isothermal batch reactor 70% of a liquid reactant is converted in 13 min. What space-time and space-velocity are needed to effect this conversion in a plug flow reactor and in a mixed flow reactor? 4

## SECTION-B

14. a) The reactor setup shown in Figure consists of three plug flow reactors in two parallel branches. Branch D has a reactor of volume 50 liters followed by a reactor of volume 30 liters. Branch E has a reactor of volume 40 liters. What fraction of the feed should go to branch D? 4



- b) Develop the performance equation for recycle reactor. 4

5. a) Write the relation between instantaneous fractional yield and overall fractional yield. And also show that

$$\phi_P = \frac{1}{\Delta C_A} \int_{C_{A0}}^{C_A} \phi_m dC_A$$

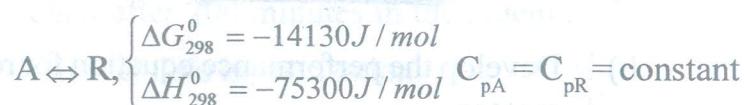
- b) All symbols have their usual meanings. 4
- b) Two step irreversible series-parallel reaction

is carried out



Imagine that we have two beakers, one containing A and the other containing B. Discuss about the product distribution, if consider the following ways of mixing the reactants: -

- i) Add A slowly to B
  - ii) Add B slowly to A
  - iii) Mix A and B together rapidly
- 4
6. Between 0°C and 100°C determine the equilibrium conversion for the following elementary aqueous reaction



- i) Present the result in the form of a plot of temperature versus conversion.
  - ii) What restriction should be placed on the reactor operating isothermally if conversion of 75% or higher is desire?
- 8

### SECTION-C

7. a) Explain the role of RTD, state of aggregation

and earliness and lateness of mixing in determining the non-ideal behavior of reactor.

4

- b) The concentration readings in Table represent a continuous response to a pulse input into a closed vessel which is to be used as a chemical reactor. Calculate the mean residence time  $t$  of fluid in the vessel, and tabulate and plot the exit age distribution "E".

$t(\text{min})$	0	5	10	15	20	25	30	35
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$C(\text{g/liter})$	0	3	5	5	4	2	1	0
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Here: time  $t(\text{min})$  and Tracer output concentration  $C(\text{g/liter})$  fluid.

8. Discuss experimental methods (Nonchemical) for finding E (the age distribution of fluid, the RTD) and show the relationship between E and F curves.
- 4
9. a) Consider the dispersed plug flow model with a pulse input into a closed vessel (or closed-closed vessel boundary condition with  $(D/uL) > 0.01$ ) and derive the expression to show dimensionless variance as

$$\sigma_\theta^2 = \frac{\sigma_1^2}{t^{-2}} = 2\left(\frac{D}{uL}\right) - 2\left(\frac{D}{uL}\right)^2 [1 - e^{-uL/D}]$$

All symbols have their usual meanings.

5

- b) An injected slug of tracer material flows with its carrier fluid down a long, straight pipe in

## B.Tech. (C.E.) (FIFTH SEMESTER) EXAMINATION, DECEMBER 2017

PAPER 5.5— TRANSPORT PHENOMENON

TIME ALLOWED : THREE HOURS

Maximum Marks— 40

*The question paper is divided into three Sections.*

*Students are required to attempt five questions in all,  
selecting not more than two questions from each  
Section. All questions carry equal marks.*

*All additional data required to solve the questions  
are provided with the question paper only.*

### SECTION A

1. Write all seven assumptions that were used in obtaining the Hagen-Poiseuille equation for flow in a circular tube and also derive an expression for velocity distribution ( $V_z$ ) and average velocity  $\langle V_z \rangle$  in circular tube. Laminar flow of liquid occurs downward under influence of a pressure difference and gravity.

$$2+3+3=8$$

Turn over

2. Rederive the velocity profile and the average velocity in "Flow of a falling film of a liquid down an inclined flat plate" by replacing  $x$  by a coordinate  $\bar{x}$  measure away from the wall; that is,  $\bar{x} = 0$  is the wall surface, and  $\bar{x} = \delta$  is the liquid-gas interface. Show that the velocity distribution is then given by:-

$$V_z = \frac{\rho g \delta^2}{\mu} \left[ \left( \frac{\bar{x}}{\delta} \right) - \frac{1}{2} \left( \frac{\bar{x}}{\delta} \right)^2 \right] \cos \beta$$

and then use this to get average velocity, where:-

$\rho$  = density of liquid

$\mu$  = viscosity of liquid

$\delta$  = film thickness

$\beta$  = angle of inclination of flat plate.

4+4=8

3. Calculate the required torque in lb<sub>f</sub>. ft and power consumption in horsepower to turn the shaft in the friction bearing shown in figure 1. The length of the bearing surface on the shaft is 2 inch, and shaft is rotating at 200 rpm. The viscosity of the lubricant is 200 cp, and its density is 50 lb/in<sup>3</sup>. Neglect the effect of eccentricity.

4+4=8

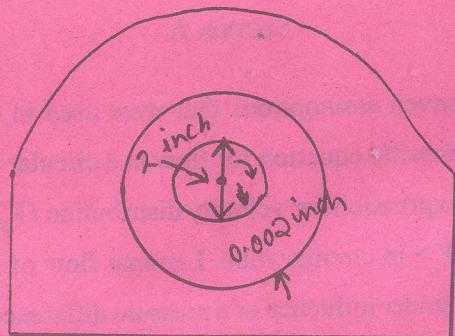


Fig. 1 (Friction Bearing)

## SECTION B

4. Derive an expression of radial temperature distribution for a system having electric wire of circular cross-section with radius ( $R$ ) and electric conductivity  $k_e$  ohm<sup>-1</sup> cm<sup>-1</sup>. Through this wire there is an electric current  $I$  amp/cm<sup>2</sup> flow. The transmission of an electric current is irreversible process and some electrical energy is converted into heat. The rate of heat production per unit volume is given by the expression-

$$S_e = \frac{I^2}{k_e}$$

Assume that the thermal conductivity and electrical conductivity are independent of the temperature. The surface of wire is maintained at temperature  $T_0$ . And also calculate "average temperature rise" in wire. 8

5. (a) A solid material occupying the space from  $y = 0$  to  $y = \infty$  is initially at temperature  $T_0$ . At time  $t = 0$ , the surface at  $y = 0$  is suddenly raised to temperature  $T_1$  and maintained at that temperature for  $t > 0$ . Find the time dependent temperature profile  $T(y, t)$  and wall heat flux.
- (b) Develop equations for the relationship of local pressure to density or temperature in a stream of ideal gas in which the momentum flux  $z$  and heat flux  $q$  are negligible. 4+4=8

6. (a) Derive an expression for concentration profile for the diffusion with homogeneous chemical reaction of absorption rate of gas A by liquid B as:-

$$\frac{C_A}{C_{A0}} = \frac{\cosh \left[ \sqrt{\left( K_1''' \frac{L^2}{D_{AB}} \right)} \left( 1 - \frac{z}{L} \right) \right]}{\cosh \left( \sqrt{K_1''' \frac{L^2}{D_{AB}}} \right)} = \frac{\cosh (QU - \epsilon)}{\cosh \phi}$$

where  $Q$  = dimensionless group, known as Thiele Modulus

$\epsilon$  = dimensionless length  $\frac{z}{L}$

$K_1'''$  = 1<sup>st</sup> order rate constant.

- (b) The diffusivity of the gas pair  $O_2 - CCl_4$  is being determined by observing the steady state evaporation of  $CCl_4$  into a tube containing oxygen ( $O_2$ ). The distance between the  $CCl_4$  liquid level and the top of the tube is  $z_2 - z_1 = 17.1$  cm. The total pressure on the system is 755 mm Hg, and the temperature is 0°C. The vapour pressure of  $CCl_4$  at that temperature is 33 mm Hg. The cross-section area of diffusion tube is  $0.82 \text{ cm}^2$ . It is found that  $0.0208 \text{ cm}^3 CCl_4$  evaporate in a 10 hour period after steady state has been attained. What is the diffusivity of the gas pair  $O_2 - CCl_4$ ?

4+4=8

## SECTION C

7. (a) Derive an expression for Von-Karman Prandtl universal logarithmic velocity distribution for time smoothed turbulent momentum flux. Also compare it with an empirical expression given by Barenblott-Chorin. 4

- (b) Explain the following terms:-

- (i) Eddy mass diffusivity  
(ii) Eddy thermal diffusivity. 4

8. Determine the ratio  $\frac{\mu^{(+)}}{\mu}$  at  $y = \frac{R}{2}$  for water flowing at steady rate in a long, smooth, round tube under the following conditions:-

$R$  = tube radius = 3 inch = 7.62 cm

$\zeta_0$  = Wall shear stress =  $2.36 \times 10^{-5}$  lbs/inch<sup>2</sup> = 0.163 Pa

$\rho$  = density of water = 62.4 lbm/ft<sup>3</sup> = 1000 kg/m<sup>3</sup>

$\gamma$  = kinematic viscosity =  $1.1 \times 10^{-5}$  ft<sup>2</sup>/sec =  $1.02 \times 10^{-7}$  m<sup>2</sup>/sec. 8

9. Write short notes on:-

- (a) Reynold stresses

- (b) Logarithmic turbulent temperature profile in inertial sublayer.

4x2=8

**B.Tech. (CE) (FIFTH SEMESTER) EXAMINATION, DEC. 2017****CHEMICAL ENGINEERING****PAPER 5.6— Environmental Pollution Control****TIME ALLOWED : THREE HOURS****Maximum Marks— 40**

*Attempt five questions in all, selecting not more than two questions from each Section. All questions carry equal marks.*

**Section-A**

**Q.1 A)** For 200 mL  $\text{CaCO}_3$  solution, initial pH is 10. A 30 ml 0.02 N  $\text{H}_2\text{SO}_4$  is required to reach at 4.5 pH and 11 mL is required to reach at 8.3 pH. Determine the species responsible for alkalinity and their quantity. (4)

**B)** An effluent of  $18925 \text{ m}^3/\text{d}$  having  $\text{BOD}_{5^{20}}$  30 mg/L, DO 2 mg/L, temperature  $27^\circ\text{C}$  and  $k_{20} 0.23 \text{ d}^{-1}$  is discharged into river. The river is found to have flow  $0.65 \text{ m}^3/\text{s}$ ,  $\text{BOD}_{5^{20}}$  5 mg/L, DO 8 mg/L and temperature  $23^\circ\text{C}$ . After mixing, flow velocity is 0.5 m/s and reaeration constant (at  $20^\circ\text{C}$ ) is  $0.45 \text{ d}^{-1}$ . Find dissolve oxygen level after 2 days. (4)

**Q.2 A)** State the theories to explain coagulation process. (4)

**B)** Find the dimensions and power requirements of flocculators to treat  $50000 \text{ m}^3/\text{d}$  effluent at  $Gt$  value of  $4*10^4$ . The reactor should be a maximum of 12 m wide and 5 m deep. Flocculation must have a set of 3 cross flow paddles and 4 boards. Effluent viscosity is  $1.139*10^{-3} \text{ N.s/m}^2$ , density 999.1 kg/m<sup>3</sup> and  $C_D$  is 1.8. (4)

**Q.3 A)** Find number of stages and expected BOD at outlet of a 3 trains Rotating Biological Contactor to treat effluent  $4000 \text{ m}^3/\text{d}$ . BOD at inlet is 90 mg/L and required to be 10 mg/L at outlet. BOD loading should be  $15 \text{ g/m}^2.\text{d}$  and area per shaft to be  $9300 \text{ m}^2$ . (4)

**B)** Calculate area of tertiary pond to treat effluent flow of  $3000 \text{ m}^3/\text{d}$  of  $\text{BOD}_{5^{20}}$  200 mg/L at  $8^\circ\text{C}$ . BOD removal efficiency is expected to be 90%. Data given as: (4)

$$k_{20}: 0.23 \text{ d}^{-1}$$

$$\Phi: 1.06$$

$$k\theta: 4$$

$$\text{Depth: } 1.5 \text{ m}$$

**Section-B**

**Q.4 A)** It was observed that burning coal mines of Jharia emits  $23.34 \text{ kg SO}_2/\text{hr}$  at velocity of 18.3 m/s and temperature  $140^\circ\text{C}$  from a hole of diameter 8 m at ground level. Find the downwind ground level concentration at the distance of 1.5 km. Data given: (4)

Air temperature:  $8^\circ\text{C}$ ,

Wind speed: 4.5 m/s

Dispersion coefficient crosswind: 210 m

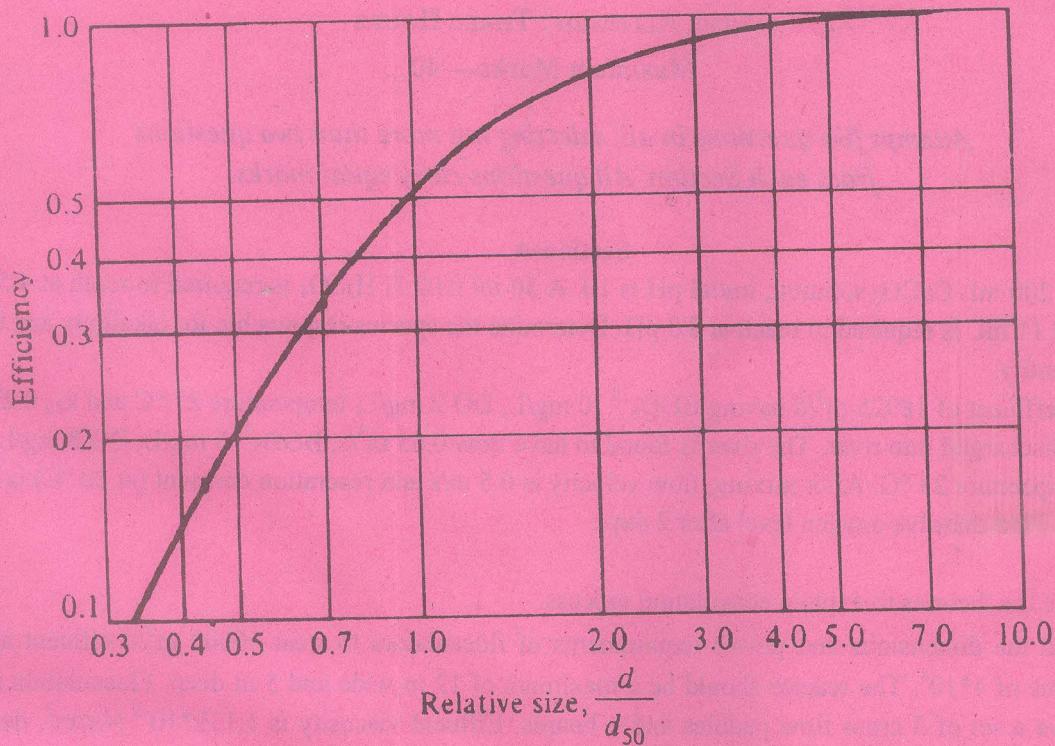
Dispersion coefficient vertical: 160 m

**B)** Classify movement of air for scale of motion. (4)

- Q.5 A)** What are the major contributors of automobile emission? How emission can be controlled? (4)  
**B)** Show the major forces and their mathematical expressions working on a particle in cyclone separators. Draw schematic diagram of cyclone w.r.t. major diameter. (4)

- Q.6 A)** Find overall efficiency of cyclone if 7  $\mu\text{m}$  particles are separated with 50% efficiency. Data given:

Particle range ( $\mu\text{m}$ )	0-10	10-20	20-30	30-50	>50
Average size ( $\mu\text{m}$ )	5	15	25	40	60
% mass	18	32	24	16	10



- B)** Find the number of bags in each section of an 8 sectioned filter bag-house to treat 15  $\text{m}^3/\text{s}$  air. Air to cloth ratio  $9 \text{ m}^3/\text{min.m}^2$  is to be maintained for proper functioning. The bags are 0.25 m diameter and 7 m long. (4)

### Section-C

- Q.7 A)** Write about combustion methods to control gaseous pollutant emission. (4)  
**B)** Write solid waste generation pattern in India w.r.t. zones, states, geo-political etc. (4)

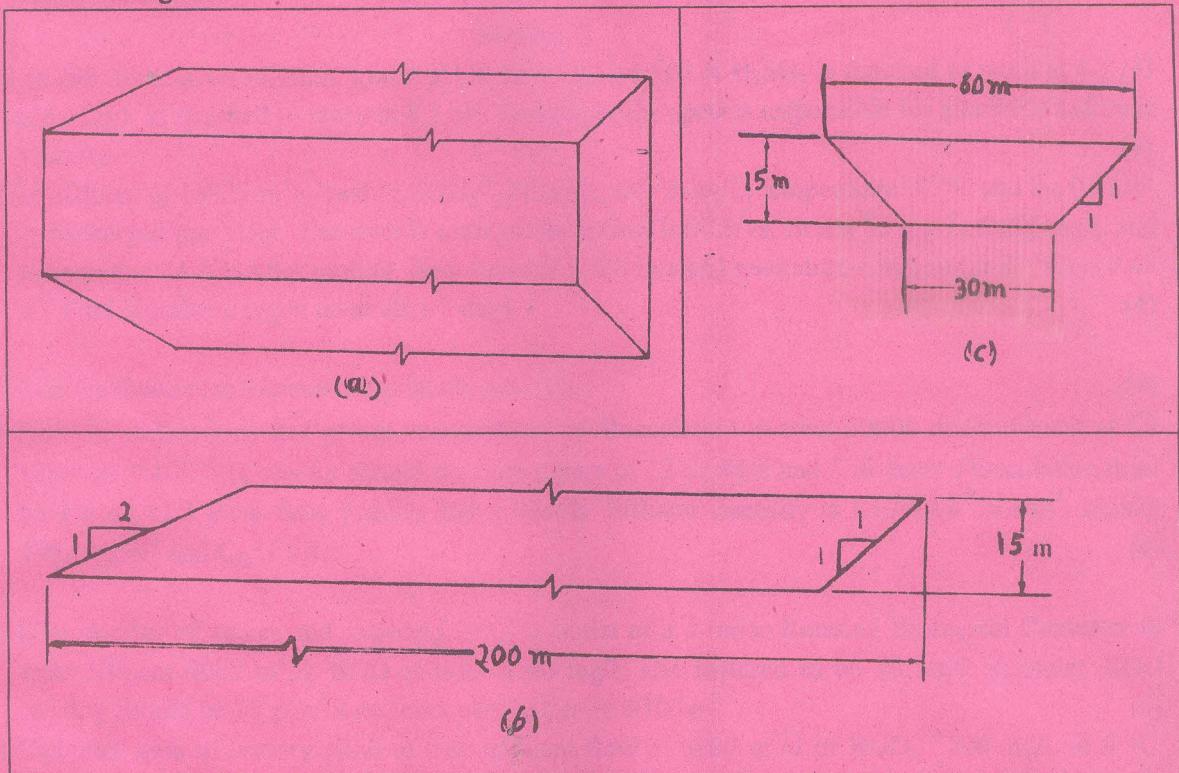
- Q.8 A)** Classify solid waste and name various physical and chemical properties. (4)

B) Analysis of solid waste is given below. Calculate overall moisture and density of sample. (4)

Component	% Mass	% Moisture	Density ( $\text{kg/m}^3$ )
Food waste	15	70	290
Paper	45	6	85
Card board	10	5	50
Plastic	10	2	65
Garden waste	10	60	105
Wood	5	20	240
Tin can	5	3	90

Q.9 A) Determine the amount of methane produced from anaerobic digestion of 1 ton solid waste having chemical equation  $\text{C}_{60}\text{H}_{120}\text{O}_{30}\text{N}_3$ .

B) Calculate volume of solid waste to be dumped in land-filling site of dimensions and layout given below in diagram. (4)



9. Write short notes on following:—(Any two)

- (a) Drying
- (b) Liquid-Liquid Extraction
- (c) Azeotropic distillation.

$$4 \times 2 = 8$$

## B.Tech. (V Sem.)

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Paper CE 5.7

Chemical Engineering

Turn over

## B.Tech. (FIFTH SEMESTER)

### EXAMINATION, DECEMBER 2017

#### CHEMICAL ENGINEERING

#### PAPER CE 5.7—Mass Transfer

TIME ALLOWED : THREE HOURS

Maximum Marks—40

The question paper is divided into three Sections.  
Students are required to attempt five questions in all,  
selecting not more than two questions from each Section.

All questions carry equal marks.

#### SECTION A

1. (a) What is molecular diffusion and how does it differ from eddy diffusion?  
(b) What are the applications of molecular diffusion?  
(c) Explain the significance of the Fick's law of diffusion with respect to stationary coordinate.  
(d) How does molecular diffusivity in gas and liquid depend upon conditions like pressure and temperature?

2+2+2+2=8

2. (a) Explain the surface renewal theory. What are the important results of this theory? 4

- (b) An open cylindrical tank is filled with pure  $\text{CH}_3\text{OH}$  (methanol), 2 m below from the top of the tank. The tank is tapered as shown in figure 1. The air within the tank is stationary but circulation of air immediately above the tank is adequate to assume negligible concentration of  $\text{CH}_3\text{OH}$  (methanol) at this point. The tank and air space are at  $77^\circ\text{C}$  and 1 atm. The diffusivity of methanol in air at  $77^\circ\text{C}$  and 1 atm pressure is  $0.6 \text{ m}^2/\text{sec}$ . Calculate the rate of methanol loss from tank at steady state. 4

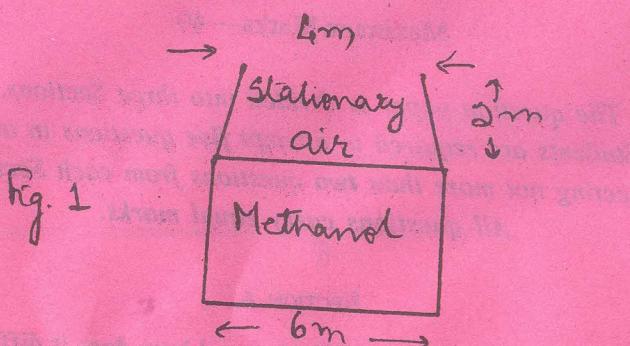


Fig. 1

3. (a) What do you mean by interphase mass transfer? 2  
 (b) Explain two film theory of mass transfer and also show the relationship between individual phase mass transfer coefficient and overall mass transfer coefficient as:-

$$\frac{1}{k_y} = \frac{1}{k_y} + \frac{m'}{k_x}$$

where

$k_y$  — overall mass transfer coefficient  
 $k_x$  — liquid phase mass transfer coefficient  
 $k_y$  — gas phase mass transfer coefficient  
 $m'$  — slope

## SECTION B

4. (a) Define relative volatility ( $\alpha$ ). What is role of relative volatility in distillation? 2  
 (b) Explain differential distillation with diagram. 3  
 (c) Derive the Rayleigh's equation and also prove:-

$$\log_e\left(\frac{F}{W}\right) = \frac{1}{(\alpha - 1)} \log_e \frac{x_F(1 - x_W)}{x_W(1 - x_F)} + \log_e \frac{(1 - x_W)}{(1 - x_F)}$$

where  $\alpha$  is relative volatility,  $F$  and  $W$  are mole flow rate of feed and residue respectively;  $x_F$  and  $x_W$  are mole fraction of more volatile component in feed and in residue respectively. 3

5. Solutions of methanol and ethanol are substantially ideal. Compute the vapour-liquid equilibrium data for this system at 1 atmosphere pressure and plot  $x-y$  and  $t-x-y$  diagrams. Compute also relative volatilities and determine an average value. The vapour pressure and temperature relationships are:-

$$\log p_{\text{methanol}} (\text{mm Hg}) = 7.84863 - \frac{1473.11}{(230 + t^\circ\text{C})}$$

$$\log \rho_{\text{methanol}} (\text{mm Hg}) = 8.04494 - \frac{1554.3}{(222.65 + t^{\circ}\text{C})}$$

where  $t$  = temperature in  $^{\circ}\text{C}$

$\rho$  = vapour pressure in mm Hg

8

6. (a) Derive the relation,  $Z = (\text{HTU}) \times (\text{NTU})$  in case of a packed absorption column where:-

HTU  $\rightarrow$  height of transfer unit

NTU  $\rightarrow$  No. of transfer unit

Z  $\rightarrow$  height of column.

3

- (b) Define a theoretical stage. What is the difference between HETP and HTU? Define overall column efficiency, Murphree plate efficiency and point efficiency. Explain why sometimes Murphree efficiencies are greater than 100.

$$\frac{1}{2} + 2 + 1\frac{1}{2} + 1 = 5$$

### SECTION C

7. (a) What do you mean by adsorption isotherm? Explain any two adsorption isotherms.

4

- (b) A waste stream of alcohol vapour in air from a process was absorbed by activated carbon particles in packed bed having diameter of 4 cm and length of 14 cm containing 79.2 gm of carbon. The inlet gas stream having a concentration  $C_0$  of 600 ppm and density of 0.00115 gm/cm<sup>3</sup> entered the bed at a flow rate of 754 cm<sup>3</sup>/sec. The break point concentration is set at  $\frac{C}{C_0} = 0.01$ . Determine

4

the break-point time, the fraction of total capacity used upto the break-point and length of unused bed.

### Break through concentration data

S. No.	Time (hr)	$\frac{C}{C_0}$
1	0	0
2	3	0
3	3.5	0.002
4	4	0.030
5	4.5	0.155
6	5	0.396
7	5.5	0.658
8	6.0	0.903
9	6.2	0.933
10	6.5	0.975
11	6.8	0.993

4

8. (a) What do you understand by the term "Crystallization"? 2
- (b) What is the difference between precipitation and crystallization? 2
- (c) What do you mean by nucleation? What are the different types of nucleation? What are the important factors that influence the rate of nucleation? 4