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ii. All questions are equal values.

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Section A

1. (a) Define frequency distribution. For the following data, construct a frequency table using suitable class interval.   6.67

11	20	16	10	22	7	13	14	23	11
15	5	10	12	14	18	15	13	11	6
26	16	14	18	27	29	23	33	17	24
17	18	21	11	10	12	12	18	15	16
22	14	14	8	9	17	15	14	10	11

   (b) How do you distinguish variable from attributes?   2

   (c) Construct a Pie Chart with the following frequency table.   3

Size of the Shirt	S	M	L	XL
Frequency (Number of Shirts)	15	26	12	7

2. (a) What is central tendency? Describe any three measures of central tendency with their advantages and disadvantages.   6

   (b) Prove that $AM \geq GM \geq HM$ where the notations have their usual meanings. When does equality hold?   5.67

3. (a) What is dispersion? What are the measures of dispersion? Describe the relative measures of dispersion. Why do need measures of dispersion? Explain.   5

   (b) The following data are the monthly household incomes (in Tk.) of ten families   4

10648	17416	6517	13555	14821
9226	52923	11800	18527	12222

Calculate Variance of the household incomes and comment.

   (c) What do β_1 and β_2 measure? The notations have their usual meanings. Comment on the shape of the frequency distribution when it is characterized with the following measures. $\beta_1 = 0, \beta_1 < 0, \beta_1 > 0$ and $\beta_2 = 3$ 2.67

4. (a) Define correlation. How do you interpret the values of correlation coefficient r ? What are the properties of correlation coefficient?   6

   (b) Show that the simple correlation coefficient r lies between -1 to $+1$.   5.67

Section B

5. (a) What is regression analysis? How does it differ from correlation analysis?   3

   (b) How do you estimate the parameters of a simple linear regression model using OLS method?   6

   (c) Consider a two variable regression model   2.67

$$Y_i = \alpha + \beta X_i + u_i \ , \qquad i = 1,2, \dots, n.$$

For a particular data set you estimate the parameters and obtain the following results. $\hat{\alpha} = 20$ and $\hat{\beta} = 3$. Interpret the result.

6. (a) Define random experiment, sample space and mutually exclusive events.   3

   (b) Define classical probability. Suppose two balanced dice are thrown. Find the probability that

      i.   The sum of the outcomes of two dice is 3.   5

      ii.   The sum of the outcomes of two dice is greater than 4.

   (c) If two events A and B are independent then their complements are also independent.   3.67

7. (a) Define Random variable with examples. When a function is said to be a probability mass function?   3

   (b) Suppose a fair coin is tossed times. Define a random variable X as the number of tails. Find the probability function of the random variable. Also find   5

      (i) $P(x \geq 2)$ (ii) $P(x < 1)$ (iii) $P (0 < x < 3)$

   (c) Let X be a continuous random variable with probability density function   3.67

$$f(x) = kx (1 - x); 0 \leq x \leq 1.$$

Find the value of k

8. (a) Define mathematical expectation and variance of random variable.   3

   (b) Lex X be a random variable with the following probablity function.   4

$X : x$	0	1	2
$P(x)$	1/4	1/2	1/4

Find   (i) $E(X), E(3X + 2)$ (ii) $V(X), V(5X + 1)$

   (c) What is stochastic process? What are the various types of stochastic process? How will you relate   4.67

SECTION-A

1. (a) Define conductor, semiconductor and insulator with energy band diagram. $2^{2/3}$

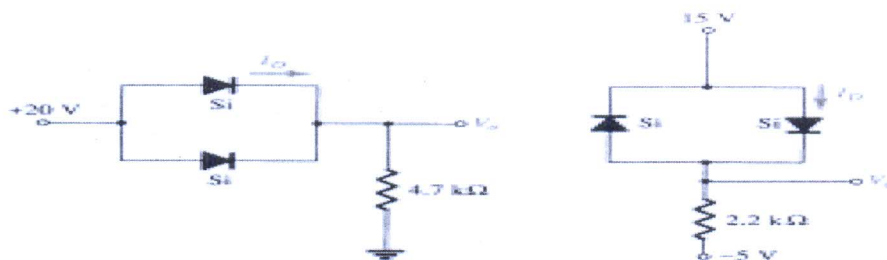   (b) Determine V_o and I for the network of figure-1   4

Figure-1

   (c) What is load line? Briefly explain how you can find point of operation of a diode using load line.   3

   (d) What is the basic difference between electrical circuit and electronic circuit?   2

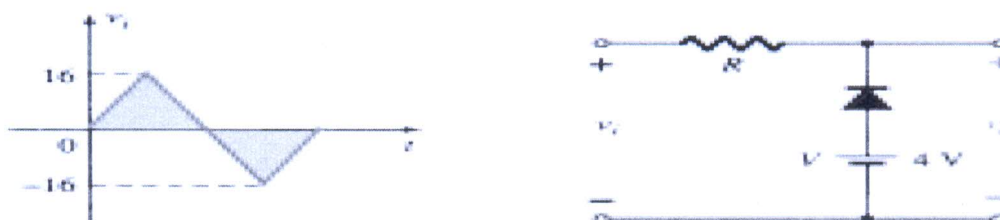2. (a) Determine V_0 for the network of figure-2   3

Figure-2

   (b) What is Zener diode? How a Zener diode can be used as a voltage regulator? $3^{2/3}$

   (c) (a)For the Zener diode network of figure-3, determine V_L, V_R, I_Z and P_Z .   4
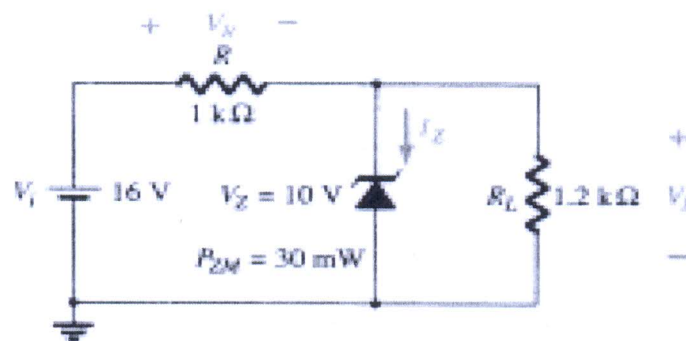   (b)Repeat part (a) with $R_L=3K\Omega$

Figure-3

   (d) What is PIV?   1

3. (a) Draw and explain input and output characteristics of common base configuration of Bipolar Junction Transistor. $4^{2/3}$

   (b) Discuss BJT amplifying action. Why it is called transistor?   3

   (c) From the emitter bias network, detrmine   4
   (i) I_B
   (ii) V_{CE}
   (iii) V_B
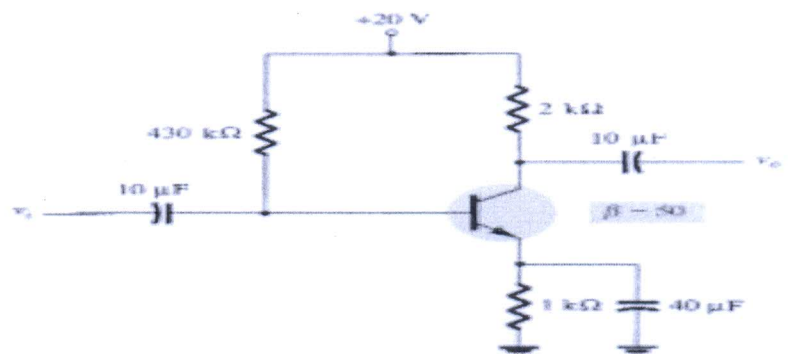   (iv) V_{BC}

Figure-4

4. (a) Briefly explain transistor operation with neat sketch $3^{2/3}$

(b) Determine Input impedance Z_{IN}, Output impedance Z_O, Voltage gain A_V, and Current gain A_i for the common-emitter fixed biased configuration of figure-5
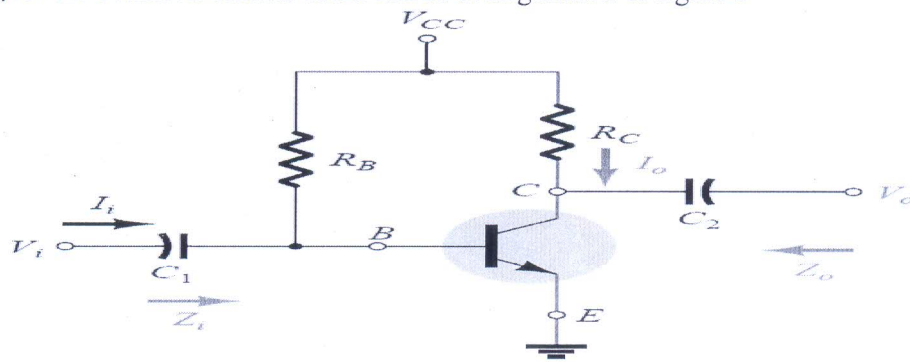

Figure-5

(c) Is transistor a bipolar device? Why so? 1.5

(d) Write short notes on reverse recovery time and transition capacitance 1.5

SECTION-B

5. (a) What is buffer amplifier? Why we use buffer amplifier in spite of unity gain noninverting amplifier? $4^{2/3}$

(b) Design an amplifier circuit using OP-AMP whose input is +1V and required output is +20 volt 3

(C) Derive an expression of output voltage of an noninverting operational amplifier 3

(d) What is open loop gain? 1

6. (a) Derive the expression of integrator by using 741 op-amp. $4^{2/3}$

(b) Suppose that you have three battery say 1V, 2V, and 3V. How do you add these three voltage using operational amplifier? 4

(c) What is feedback circuit? Write down the advantages of feedback circuit. 3

7. (a) Draw the circuit diagram of four basic feedback tropology. 4

(b) What is oscillator? Write short notes on feedback oscillator and relaxation oscillator. $4^{2/3}$

(c) Briefly discuss Wien-Bridge oscillator circuit with neat sketch. 3

8. (a) What is LED? Today why we use LED bulb as an alternative of incandescent bulb? Write down the application of LED. $3^{2/3}$

(b) What is photo conductive cell? Draw and explain illumination characteristics of photoconductive cell. 3

(c) What is optocoupler? How it works? 2

(d) Suppose that your teacher give you a red LED and told you to check it. Design a circuit to check that LED. Assume any value as you want. 3

1st Year 2nd Semester B.Sc. Engineering Examination-2015

Course No: MAT156   Course Title: Differential and Integral Calculus

Marks: 70   Time: 4 hours

N.B.

i) Answer **SIX** questions, taking any **THREE** from each section.

ii) All questions are of equal values.

iii) Use separate answer script for each section.

Section-A

1. (a) Define domain and range of a real function   2

   (b) Drawing the graph find the domain and range of the following function.   3

$$f(x) = \begin{cases} x^2 + 1 \ when \ x < 0 \\ x \ when \ 0 \leq x \leq 1 \\ \dfrac{1}{x} \ when \ 1 < x \end{cases}$$

   (c) Define limit of a function. Using the (ε,δ) definition of limit show that   3.67

$$\lim_{x \to a} \left(\frac{x^2 - a^2}{x - a} \right) = 2a$$

   (d) Define continuous function. A function f(x) is defined as follows: 3

   f(x)=-x When x $\leq$0

   =x when 0 < x<1

   =2-x when x$\geq$1

   Test the continuity at x=1

2. (a) Show that the function f(x) = |x-1|+|x-2| is not differentiable at x =2.   4

   (b) If $y = \left(\frac{n}{x}\right)^{nx} \left(1 + \ln\frac{x}{n}\right) find \ \frac{dy}{dx}$ 3

   (c) If $f(x) == \left(\frac{a+x}{b+x}\right)^{a+b+2x}$, then show that $f'(0) = \left(\frac{a}{b}\right)^{a+b}\left[\frac{b^2-a^2}{ab} + 2\ln\frac{a}{b}\right]$ 4.67

3. (a) Find the nth derivatives of the function $y = \frac{1}{x^2+a^2}$.   4

   (b) Verify mean value theorem for the following function and find C if possible $f(x) = (x-1)(x-2)(x-3) in \ [0,4]$ 4

   (c) State and prove Leibnitz theorem.   3.67

4. (a) State and prove mean value theorem.   4

   (b) If V $=\sin^{-1}\frac{x^2+y^2}{x+y}$, then prove that $xV_x + yV_y = \tan V$ 4

   (c) State and prove Euler's theorem.   3.67

Section-B

5. (a) Evaluate the following integrals (i) $\int \frac{dx}{\sqrt{x+a}+\sqrt{x+b}}$ (ii) $\int sec^{2n+2} dx$ 11.67

   (iii) $\int \frac{1}{(1+x^2)\sqrt{1-x^2}} dx$ (iv) $\int \frac{dx}{\sqrt{(x-a)(b-x)_-}}$

6. (a) Sate and prove fundamental theorem of integral calculus.   5

   (b) Integrate (i) $\int \frac{dx}{x^3+1}$ (ii) $\int \frac{dx}{1+tanx}$ 6.67

7. (a) Evaluate $\int_\alpha^\beta \sqrt{(x-\alpha)(x-\beta)}dx$ 3.67

   (b) Find the reduction formula for $\int sin^m x \ cos^n x \ dx$ and hence find the value of $\int_0^{\frac{\pi}{6}} sin^4 3xdx$ 4

   (c) If $U_{(m,n)} = \int_0^{\frac{\pi}{2}} sin^m x cos^n x dx$ then prove that $U_{(m,n)} = \frac{n-1}{m+n} U_{(m,n-2)}$ 4

8. (a) Find the area of the region bounded by the curve $a^2 y^2 = a^2 x^2 - x^4$ 3.67

   (b) Find the area enclosed by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ 4

   (c) Find the volume of the solid formed by the revolution of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ 4

Full Marks: 70   **Times: 4 Hours**
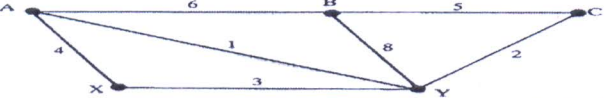
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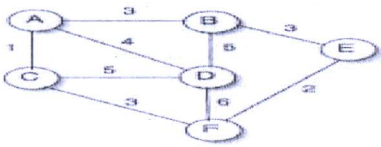ii. Use **separate answer script** for each section

<div align="center">

SECTION-A
</div>

1.	a)	What do you mean by data structure? Explain the basic operations those are normally performed on a particular data structure.	4
	b)	Describe how arrays stored in memory. How you dynamically allocate memory and used it as an array using pointer.	4
	c)	Describe a situation where storing items in array is clearly better than storing items on a linked list.	3.67
2.	a)	How you check for balanced parentheses in an expression?	4
	b)	What is Recursion? Write a program to generate Fibonacci series using recursion.	3.67
	c)	Describe the implementation of queue using link list.	4
3.	a)	What do you mean by binary search tree?	2
	b)	Build a heap from the following list of numbers: 40, 30, 70, 23, 54, 50, 21, 44, 55, 77.	6
	c)	Explain "For breath first search; it traverse a graph from lowest level to highest level with respect to start node".	3.67
4.	a)	What do you mean by topological sort and Minimum spanning tree?	3
	b)	Write down the algorithm of searching a linked list when the list is unsorted.	4
	c)	**The pre-order and in-order traversal sequences of nodes in a binary tree are given below:**	4.67

Pre-order — M A D H U S M I T A
In-order — M A D H U S M I T A
Construct the binary tree and state the logic to construct the tree.

<div align="center">

SECTION-B
</div>

5	a)	What is hashing? What is main advantage that open addressing hashing technique has over chaining?	3
	b)	Write down some hash functions with their limitation and advantages.	3
	c)	What are the advantages of linked list over array? Consider the following list of 11 numbers: 33 11 77 45 23 17 60 25 71 31 85. Use the Quick sort algorithm to find the final position of 33.	
6.	a)	What is graph? Give practical use of graph, DFS and BFS.	3.67
	b)	How do you determine all vertices of a graph are connected or not and write pseudo code for implementation.	4
	c)	How file are stored logically in computer disc.	4
7.	a)	Find a minimal spanning tree of the following weighted graph using Prims's algorithm.	4

	b)	Write the Huffman's Algorithm. Suppose A, B, C, D, E, F, G and H are 8 items and suppose they are assigned Weights as follows:	4

     Data Item : A B C D E F G H
     Weight   : 22 5 11 19 2 11 25 5
Construct a tree using Huffman's algorithm.

	c)	How you convert infix expression to postfix expression?	3.67
8	a)	How you represent this graph in computer.	3

	b)	Write the Huffman's Algorithm. Suppose A, B, C, D, E, F, G and H are 8 items and suppose they are assigned Weights as follows:	3

     Data Item : A B C D E F G H
     Weight   : 22 5 11 19 2 11 25 5
Construct a tree using Huffman's algorithm.

	c)	How you find maximum path between to vertices in graph.	5.67

Q.6. **a)** Distinguish between interference and diffraction process.   2

       b) Obtain the maxima and minima of interference from Fraunhoffer diffraction at double slit.   5

       c) Explain polarization of light on the basis of electromagnetic theory.   2.67

       d) What do you understand by optical activity of a material?   2

Q.7 **a)** Deduce the Coulombs law from Gauss's law.   2.67

       b) For a parallel capacitor, prove that, $\varepsilon_o \oint K\vec{E}.d\vec{S} \oint =Q$ where the symbols have their usual meaning.   5

       c) Mention some application of Biot - savart law.   2

       d) An electric dipole consists of two opposites charges of magnitude q= 2.0×10^{-6} Coul separated by 2.0cm. The dipole is placed in an external field of 2.0×10^{5}Newton/Coul. Calculate the maximum torque on the dipole.   2

Q.8 **a)** What is meant by Faraday effect? Give the physical interpretation of Faraday effect.   3

       b) Discuss the magnetic effect of current with the help of Biot –Savart law.   3

       c) Calculate the energy density of the electromagnetic field in empty space.   4

       d) Mention the Maxwell equations with their origin.   1.67

Department of Computer Science and Engineering
1st Year 2nd Semester BSc Engineering Examination-2015
Course No: STA154 / STA156   Course Title: Statistics for Engineers

Full Marks: 70   Times: 3 Hours

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Section B

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   (b) How do you estimate the parameters of a simple linear regression model using OLS method?   6

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   (c) Let X be a continuous random variable with probability density function   3.67

$$f(x) = kx (1 - x); 0 \leq x \leq 1.$$

Find the value of k

8. (a) Define mathematical expectation and variance of random variable.   3

   (b) Lex X be a random variable with the following probablity function.   4

$X : x$	0	1	2
	1/4	1/2	1/4