

**Bodoland University**  
**Curriculum Structures for UG syllabus for Computer Science (Honours),**  
**No. of papers=14+12=26, Total Credits= 140**  
**Total Marks = 2400**

<b>SEM-I</b>						
<b>Paper Code</b>	<b>Course</b>	<b>L+T+P</b>	<b>Credit</b>	<b>End Sem</b>	<b>Int</b>	<b>Total</b>
CS-101H	C-1	4+0+2 5+1+0	6	60(L)+20(P) 60(L)+20(T)	20 20	100
CS-102H	C-2	4+0+2 5+1+0	6	60(L)+20(P) 60(L)+20(T)	20 20	100
MATH- GE-103H	GE-1	4+0+2 5+1+0	6	60(L)+20(P) 60(L)+20(T)	20 20	100
COMM- 104HR	AECC- 1:English/Hindi/MIL.(Communication)	2	2	50(L)		50
<b>Total-</b>			<b>20</b>	<b>290</b>	<b>60</b>	<b>350</b>

## 1<sup>ST</sup> SEMESTER

### **C-I: Programming Fundamentals using C/C++**

**Theory: 60 Lectures**

**1. Introduction to C and C++ (3 Lectures)**

Overview of Procedural Programming and Object-Orientation Programming, Using main() function, Compiling and Executing Simple Programs in C++.

**2. Data Types, Variables, Constants, Operators and Basic I/O (5 Lectures)**

Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Data Types, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise), Basic Header Files (stdio.h, iostream.h, conio.hetc).

**3. Expressions, Conditional Statements and Iterative Statements (5 Lectures)**

Simple Expressions in C++, Understanding Operators Precedence in Expressions, Conditional Statements, Understanding syntax and utility of Iterative Statements, Use of break and continue in Loops, Using Nested Statements

**4. Functions and Arrays (10 Lectures)**

Utility of functions, Functions returning value, Void functions, Inline Functions, Return data type of functions, Functions parameters, Differentiating between Declaration and Definition of Functions, Command Line Arguments/Parameters in Functions

Creating and Using One Dimensional Arrays, Use various types of arrays

**5. Derived Data Types (Structures and Unions) (3 Lectures)**

Declaring, initializing and using simple structures and unions, Manipulating individual members of structures and unions, Array of Structures, Individual data members as structures, Passing and returning structures from functions

**6. Pointers and References in C++ (7 Lectures)**

Understanding a Pointer Variable, Pointers to Pointers, Pointers to structures, Passing pointers as function arguments, Returning a pointer from a function, using arrays as pointers, Passing arrays to functions. Pointers vs. References

**7. Memory Allocation in C++ (3 Lectures)**

Differentiating between static and dynamic memory allocation, use of malloc, calloc and free functions, use of new and delete operators

**8. File I/O, Pre-processor Directives (4 Lectures)**

Opening and closing a file, Reading and writing Text Files, Using put(), get(), read() and write() functions, Random access in files, Understanding the Pre-processor Directives, Macros

**9. Using Classes in C++ (7 Lectures)**

Defining & Using Classes, Class Constructors, Constructor Overloading, Function overloading in classes, Class Variables & Functions, Objects as parameters, Overview of Template classes

### **10. Overview of Function Overloading and Operator Overloading (5 Lectures)**

Overloading functions by number and type of arguments, Looking at an operator as a function call, Overloading Operators

### **11. Inheritance, Polymorphism and Exception Handling (8 Lectures)**

Introduction to Inheritance, Polymorphism, Basics Exceptional Handling

#### **Reference Books**

1. HerbtzSchildt, "C++: The Complete Reference", Fourth Edition, McGraw Hill.2003
2. BjarneStroustrup, "The C++ Programming Language", 4<sup>th</sup> Edition, Addison-Wesley , 2013.
3. BjarneStroustrup, "Programming -- Principles and Practice using C++", 2nd Edition, Addison-Wesley 2014.
4. E Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw-Hill Education, 2008.
5. Paul Deitel, Harvey Deitel, "C++ How to Program", 8th Edition, Prentice Hall, 2011. 5. John R. Hubbard, "Programming with C++", Schaum's Series, 2nd Edition, 2000.
6. Andrew Koeni, Barbara, E. Moo, "Accelerated C++", Published by Addison-Wesley , 2000. 7. Scott Meyers, "Effective C++", 3rd Edition, Published by Addison-Wesley, 2005.
8. Harry, H. Chaudhary, "Head First C++ Programming: The Definitive Beginner's Guide", First Create space Inc, O-D Publishing, LLC USA.2014
9. Walter Savitch, "Problem Solving with C++", Pearson Education, 2007.
10. Stanley B. Lippman, JoseeLajoie, Barbara E. Moo, "C++ Primer", Published by Addison-Wesley, 5th Edition, 2012

## COMPUTER SCIENCE LAB (C-I): Programming Fundamentals using C/C++ Lab Practical: 60 Lectures

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1. WAP to print the sum and product of digits of an integer.
2. WAP to reverse a number.
3. WAP to compute the sum of the first n terms of the following series  $S = 1 + 1/2 + 1/3 + 1/4 + \dots$
4. WAP to compute the sum of the first n terms of the following series  $S = 1 - 2 + 3 - 4 + 5 - \dots$
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. WAP to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it.
9. WAP to print a triangle of stars as follows (take number of lines from user):

```

*
***
*****
*****
*****

```

10. WAP to perform following actions on an array entered by the user:
  - i) Print the even-valued elements
  - ii) Print the odd-valued elements
  - iii) Calculate and print the sum and average of the elements of array
  - iv) Print the maximum and minimum element of array
  - v) Remove the duplicates from the array
  - vi) Print the array in reverse order

The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.

11. WAP that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
12. Write a program that swaps two numbers using pointers.
13. Write a program in which a function is passed address of two variables and then alter its contents.
14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.
15. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc() functions or new operator.
16. Write a menu driven program to perform following operations on strings:

- a) Show address of each character in string
  - b) Concatenate two strings without using strcat function.
  - c) Concatenate two strings using strcat function.
  - d) Compare two strings
  - e) Calculate length of the string (use pointers)
  - f) Convert all lowercase characters to uppercase
  - g) Convert all uppercase characters to lowercase
  - h) Calculate number of vowels
  - i) Reverse the string
17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.
  18. WAP to display Fibonacci series (i)using recursion, (ii) using iteration
  19. WAP to calculate Factorial of a number (i)using recursion, (ii) using iteration
  20. WAP to calculate GCD of two numbers (i) with recursion (ii) without recursion.
  21. Create Matrix class using templates. Write a menu-driven program to perform following Matrix operations (2-D array implementation):  
a) Sum b) Difference c) Product d) Transpose
  22. Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respective information in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism).
  23. Create a class Triangle. Include overloaded functions for calculating area. Overload assignment operator and equality operator.
  24. Create a class Box containing length, breath and height. Include following methods in it:  
a) Calculate surface Area  
b) Calculate Volume  
c) Increment, Overload ++ operator (both prefix & postfix)  
d) Decrement, Overload -- operator (both prefix & postfix)  
e) Overload operator == (to check equality of two boxes), as a friend function  
f) Overload Assignment operator  
g) Check if it is a Cube or cuboid  
Write a program which takes input from the user for length, breath and height to test the above class.
  25. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
  26. Write a program to retrieve the student information from file created in previous question and print it in following format: Roll No. Name Marks
  27. Copy the contents of one text file to another file, after removing all whitespaces.
  28. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.
  29. Write a program that will read 10 integers from user and store them in an array. Implement array using pointers. The program will print the array elements in ascending and descending order.

## C-2: Computer System Architecture

### Theory: 60 Lectures

#### 1. Introduction

(8 lectures)

Logic gates, Boolean Algebra, combinational circuits, and sequential circuits, memory units.

#### 2. Data Representation and Basic Computer Arithmetic

(10 lectures)

Number systems, fixed and floating point representation, character representation, addition, subtraction

#### 3. Basic Computer Organization and Design

(13 lectures)

Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input -output and interrupt, Interconnection Structures

#### 4. Central Processing Unit

(15 lectures)

Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, input output programming, RISC, CISC architectures, pipelining and parallel architecture.

#### 5. Memory Organization

(6 lectures)

Cache memory, mapping.

#### 6. Input-Output Organization

(8 lectures)

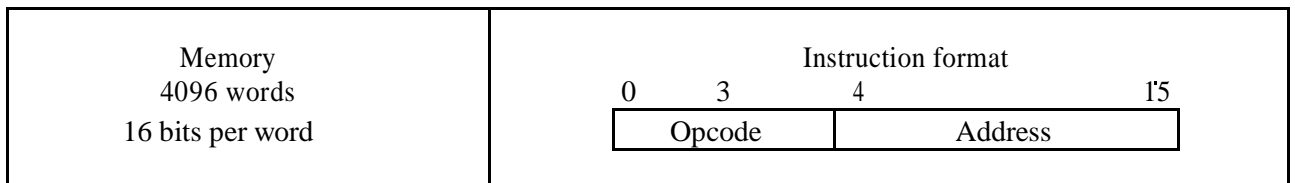
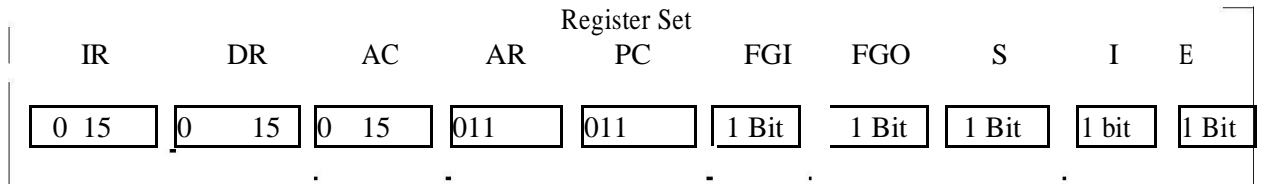
I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.

### Recommended Books:

1. M. Mano, Computer System Architecture, Pearson Education 1992
2. A. J. Dos Reis, Assembly Language and Computer Architecture using C++ and JAVA, Course Technology, 2004<sup>th</sup>
3. W. Stallings, Computer Organization and Architecture Designing for Performance, 8 Edition, Prentice Hall of India, 2009
4. M.M. Mano , Digital Design, Pearson Education Asia, 2013
5. Carl Hamacher, Computer Organization, Fifth edition, McGrawHill, 2012.

**COMPUTER SCIENCE LAB (C-2): Computer System Architecture**  
**Lab Practical: 60 Lectures**

I. Create a machine based on the following architecture:



Basic Computer Instructions

Memory Reference		Register Reference		Input-Output	
Symbol	Hex	Symbol	Hex	Symbol	Hex
AND	0xxx	CLA	E800	INP	F800
ADD	2xxx	CLE	E400	OUT	F400
LDA	4xxx	CMA	E200	SKI	F200
STA	6xxx	CME	E100	SKO	F100
BUN	8xxx	CIR	E080	ION	F080
BSA	Axxx	CIL	E040	IOF	F040
ISZ	Cxxx	INC	E020		
AND_I	1xxx	SPA	E010		
ADD_I	3xxx	SNA	E008		
LDA_I	5xxx	SZA	E004		
STA_I	7xxx	SZE	E002		
BUN_I	9xxx	HLT	E001		
BSA_I	Bxxx				
ISZ_I	Dxxx				

2. Create the micro operations and associate with instructions as given in the chapter(except interrupts). Design the register set, memory and the instruction set. Use this machine for the

assignments of this section.

3. Create a Fetch routine of the instruction cycle.
4. Simulate the machine to determine the contents of AC, E, PC, AR and IR registers in hexadecimal after the execution of each of following register reference instructions:
 

a. CLA	e. CIR	i. SNA
b. CLE	f. CIL	j. SZA
c. CMA	g. INC	k. SZE
d. CME	h. SPA	l. HLT

Initialize the contents of AC to  $(A937)_{16}$ , that of PC to  $(022)_{16}$  and E to 1.
5. Simulate the machine for the following memory-reference instructions with I= 0 and address part = 082. The instruction to be stored at address 022 in RAM. Initialize the memory word at address 082 with the operand B8F2 and AC with A937. Determine the contents of AC, DR, PC, AR and IR in hexadecimal after the execution.
 

a. ADD	f. BSA
b. AND	g. ISZ
c. LDA	
d. STA	
e. BUN	
6. Simulate the machine for the memory-reference instructions referred in above question with I= 1 and address part = 082. The instruction to be stored at address 026 in RAM. Initialize the memory word at address 082 with the value 298. Initialize the memory word at address 298 with operand B8F2 and AC with A937. Determine the contents of AC, DR, PC, AR and IR in hexadecimal after the execution.
7. Modify the machine created in Practical 1 according to the following instruction format:

**Instruction format**

0	2	3	4	15
Opcode	I	Address		

- a. The instruction format contains a 3-bit opcode, a 1-bit addressing mode and a 12-bit address. There are only two addressing modes, I = 0 (direct addressing) and I = 1 (indirect addressing).
- b. Create a new register I of 1 bit.
- c. Create two new microinstructions as follows :
  - i. Check the opcode of instruction to determine type of instruction (Memory Reference/Register Reference/Input-Output) and then jump accordingly.
  - ii. Check the I bit to determine the addressing mode and then jump accordingly.



**GE-1: Computer Fundamentals****Theory: 60 lectures**

- |   |            |
|---|------------|
| 1. <b>Introduction:</b> Introduction to computer system   | <b>6L</b>  |
| 2. <b>Data Representation:</b> Number systems and character representation  | <b>12L</b> |
| 3. <b>Human Computer Interface:</b> Types of software, Operating system as user interface,  | <b>6L</b>  |
| 4. <b>Devices:</b> Input and output devices (with connections and practical demo)   | <b>10L</b> |
| 5. <b>Memory:</b> Primary, secondary, auxiliary memory  | <b>6L</b>  |
| 6. <b>Computer Organisation and Architecture:</b> C.P.U., registers, system bus, main memory unit, cache memory, Motherboard, processors. | <b>12L</b> |
| 7. <b>Overview of Emerging Technologies:</b> Cloud computing, big data, mobile computing and embedded systems.                            | <b>8L</b>  |

**Reference Books:**

1. A. Goel, Computer Fundamentals, Pearson Education, 2010.
2. P. Aksoy, L. DeNardis, Introduction to Information Technology, Cengage Learning, 2006
3. P. K.Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers, 2007

**Computer Fundamentals Lab****Practical: 60 lectures**

Practical exercises based on MS Office/ Open Office tools using document preparation and spreadsheet handling packages.

**MS Word**

1. Prepare a **grocery list** having four columns (Serial number, The name of the product, quantity and price) for the month of April, 06.
  - Font specifications for Title (Grocery List): 14-point Arial font in bold and italics.
  - The headings of the columns should be in 12-point and bold.
  - The rest of the document should be in 10-point Times New Roman.
  - Leave a gap of 12-points after the title.
2. Create a **telephone directory**.
  - The heading should be 16-point Arial Font in bold
  - The rest of the document should use 10-point font size
  - Other headings should use 10-point Courier New Font.
  - The footer should show the page number as well as the date last updated.
3. Design a **time-table form** for your college.
  - The first line should mention the name of the college in 16-point Arial Font and should be bold.
  - The second line should give the course name/teacher's name and the department in 14-point Arial.
  - Leave a gap of 12-points.

- The rest of the document should use 10-point Times New Roman font.
  - The footer should contain your specifications as the designer and date of creation.
4. BPB Publications plans to release a new book designed as per your syllabus. Design the **first page of the book** as per the given specifications.
- The title of the book should appear in bold using 20-point Arial font.
  - The name of the author and his qualifications should be in the center of the page in 16-point Arial font.
  - At the bottom of the document should be the name of the publisher and address in 16-point Times New Roman.
  - The details of the offices of the publisher (only location) should appear in the footer.
5. Create the following one page documents.
- a. Compose a note inviting friends to a get-together at your house, Including a list of things to bring with them.
  - b. Design a certificate in landscape orientation with a border around the document.
  - c. Design a Garage Sale sign.
  - d. Make a sign outlining your rules for your bedroom at home, using a numbered list.
6. Create the following documents:
- (a) A newsletter with a headline and 2 columns in portrait orientation, including at least one image surrounded by text.
  - (b) Use a newsletter format to promote upcoming projects or events in your classroom or college.
7. Convert following text to a table, using comma as delimiter  
Type the following as shown (do not bold).
- Color, Style, Item**  
**Blue, A980, Van**  
**Red, X023, Car**  
**Green, YL724, Truck**  
**Name, Age, Sex**  
**Bob, 23, M**  
**Linda, 46, F**  
**Tom, 29, M**
9. Enter the following data into a table given on the next page.

<b>Salesperson</b>	<b>Dolls</b>	<b>Trucks</b>	<b>Puzzles</b>
Kennedy, Sally	1327	1423	1193
White, Pete	1421	3863	2934
Pillar, James	5214	3247	5467
York, George	2190	1278	1928
Banks, Jennifer	1201	2528	1203
Atwater, Kelly	4098	3079	2067
Pillar, James	5214	3247	5467
York, George	2190	1278	1928

Banks, Jennifer	1201	2528	1203
Atwater, Kelly	4098	3079	2067

Add a column Region (values: S, N, N,S,S,S) between the Salesperson and Dolls columns to the given table Sort your table data by Region and within Region by Salesperson in ascending order:

In this exercise, you will add a new row to your table, place the word "Total" at the bottom of the Salesperson column, and sum the Dolls, Trucks, and Puzzles columns.

10. Wrapping of text around the image.

11. Following features of menu option must be covered

FILE	Complete menu
EDIT	Complete menu
VIEW	Complete menu
INSERT	Complete menu
FORMAT	Complete menu
TABLE	Complete menu
WINDOW	Complete menu
HELP	Complete menu
TOOLS	All options except Online collaboration, Tools on Macro, Templates

### MS Excel

1. Enter the Following data in Excel Sheet

<b>REGIONAL SALES PROJECTION</b>						
<b>State</b>	<b>Qtr1</b>	<b>Qtr2</b>	<b>Qtr3</b>	<b>QTR4</b>	<b>Qtr Total</b>	<b>Rate Amount</b>
Delhi	2020	2400	2100	3000	15	
Punjab	1100	1300	1500	1400	20	
U.P.	3000	3200	2600	2800	17	
Haryana	1800	2000	2200	2700	15	
Rajasthan	2100	2000	1800	2200	20	

### TOTAL AVERAGE

(a) Apply Formatting as follow: I.Title in

TIMES NEW ROMAN

- ii. Font Size - 14
- iii. Remaining text - ARIAL, Font Size -10
- iv. State names and Qtr. Heading Bold, Italic with Gray Fill Color.
- v. Numbers in two decimal places.
- vi. Qtr. Heading in center Alignment.
- vii. Apply Border to whole data.

(b) Calculate State and Qtr. Total

(c) Calculate Average for each quarter

(d) Calculate Amount = Rate \* Total.

2. Given the following worksheet

	A	B	C	D
1	Roll No.	Name	Marks	Grade
2	1001	Sachin	99	
3	1002	Sehwag	65	
4	1003	Rahul	41	
5	1004	Sourav	89	
6	1005	HarBhajan	56	

Calculate the grade of these students on the basis of following guidelines:

If Marks	Then Grade
$\geq 80$	A+
$\geq 60 < 80$	A
$\geq 50 < 60$	B
$< 50$	F

3. Given the following worksheet

	A	B	C	D	E	F	G
1	<b>Salesman</b>		<b>Sales in (Rs.)</b>				
2	No.	Qtr1	Qtr2	Qtr3	Qtr4	Total	Commission
3	S001	5000	8500	12000	9000		
4	S002	7000	4000	7500	11000		
5	S003	4000	9000	6500	8200		
6	S004	5500	6900	4500	10500		
7	S005	7400	8500	9200	8300		
8	S006	5300	7600	9800	6100		

Calculate the commission earned by the salesmen on the basis of following Candidates:

If Total Sales	Commission
$< 20000$	0% of sales
$> 20000$ and $< 25000$	4% of sales
$> 25000$ and $< 30000$	5.5% of sales
$> 30000$ and $< 35000$	8% of sales
$\geq 35000$	11% of sales

The total sales is sum of sales of all the four quarters.

4. A company XYZ Ltd. pays a monthly salary to its employees which consists of basic salary, allowances & deductions. The details of allowances and deductions are as follows:

#### Allowances

- HRA Dependent on Basic

30% of Basic if Basic  $\leq 1000$

25% of Basic if Basic  $> 1000$  & Basic  $\leq 3000$

20% of Basic if Basic >3000

- DA Fixed for all employees, 30% of Basic
- Conveyance Allowance Rs. 50/- if Basic is  $\leq 1000$  Rs.  
75/- if Basic >1000 & Basic  $\leq 2000$   
Rs. 100 if Basic >2000
- Entertainment Allowance NIL if Basic  
is  $\leq 1000$  Rs. 100/- if Basic > 1000

#### Deductions

- Provident Fund 6% of Basic
- Group Insurance Premium Rs. 40/- if Basic is  $\leq 1500$   
Rs. 60/- if Basic > 1500 & Basic  $\leq 3000$   
Rs. 80/- if Basic >3000

Calculate the following:

Gross Salary = Basic + HRA + DA + Conveyance + Entertainment

Total deduction = Provident Fund + Group Insurance Premium

Net Salary = Gross Salary – Total Deduction

5. Create Payment Table for a fixed Principal amount, variable rate of interests and time in the format below:

No. of Instalments	5%	6%	7%	8%	9%
3	XX	XX	XX	XX	XX
4	XX	XX	XX	XX	XX
5	XX	XX	XX	XX	XX
6	XX	XX	XX	XX	XX

6. Use an array formula to calculate Simple Interest for given principal amounts given the rate of Interest and time

Rate of Interest	8%
Time	5 Years
Principal	Simple Interest
1000	?
18000	?
5200	?

7. The following table gives year wise sale figure of five salesmen in Rs.

Salesman	2000	2001	2002	2003
S1	10000	12000	20000	50000
S2	15000	18000	50000	60000
S3	20000	22000	70000	70000
S4	30000	30000	100000	80000
S5	40000	45000	125000	90000

- (a) Calculate total sale year wise.
- (b) Calculate the net sale made by each salesman
- (c) Calculate the maximum sale made by the salesman

- (d) Calculate the commission for each salesman under the condition.  
 (i) If total sales >4,00,000 give 5% commission on total sale made by the salesman.  
 (ii) Otherwise give 2% commission.  
 (e) Draw a bar graph representing the sale made by each salesman. (f) Draw a pie graph representing the sale made by salesman in 2000.

8. Enter the following data in Excel Sheet

### PERSONAL BUDGET FOR FIRST QUARTER

Monthly Income (Net): 1,475

EXPENSES	JAN	FEB	MARCH QUARTER TOTAL	QUARTER AVERAGE
Rent	600.00	600.00		
Telephone	48.25	43.50	60.00	
Utilities	67.27	110.00	70.00	
Credit Card	200.00	110.00	70.00	
Oil	100.00	150.00	90.00	
AV to Insurance	150.00			
Cable TV	40.75	40.75	40.75	

#### Monthly Total

Calculate Quarter total and Quarter average.

- (a) Calculate Monthly total.  
 (b) Surplus = Monthly income - Monthly total.  
 (c) What would be total surplus if monthly income is 1500?  
 (d) How much does telephone expense for March differ from quarter average?  
 (e) Create a 3D column graph for telephone and utilities.  
 (f) Create a pie chart for monthly expenses.

9. Enter the following data in Excel Sheet

### TOTAL REVENUE EARNED FOR SAM'S BOOKSTALL

Publisher name	1997	1998	1999	2000	total
A	Rs. 1,000.00	Rs. 1100.00	Rs. 1,300.00	Rs. 800.00	
B	Rs. 1,500.00	Rs. 700.00	Rs. 1,000.00	Rs. 2,000.00	
C	Rs. 700.00	Rs. 900.00	Rs. 1,500.00	Rs. 600.00	
D	Rs. 1,200.00	Rs. 500.00	Rs. 200.00	Rs. 1,100.00	
E	Rs. 800.00	Rs. 1,000.00	Rs. 3,000.00	Rs. 560.00	

- (a) Compute the total revenue earned.  
 (b) Plot the line chart to compare the revenue of all publishers for 4 years.  
 (b) Chart Title should be Total Revenue of sam's Bookstall (1997-2000)  
 (c) Give appropriate categories and value axis title.

10. Generate 25 random numbers between 0 & 100 and find their sum, average and count. How many no. are in range 50-60