SEMESTER – III

FLUID MECHANICS ME – 3005

Course Code	**ME – 3005**	Credits : 5	L-4, T-1, P-0
Name of the Course	**Fluid Mechanics**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 40% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

Introduction

Fluid and flow-definition and types, properties of ideal and real fluids, continuum concept, Lagrangian & Eulerian approach.

Fluid Statics

General differential equation, manometry, Force on plane and curved surfaces, stability of floating and submerged bodies, Relative equilibrium.

SECTION – B

Kinematics of fluid

Steady flow, uniform flow, stream, streak and path lines, continuity equation, stream function, irrotational flow, velocity potential, flow nets, circulation, simple flows, flow around circular cylinder with and without rotation, lift and drag.

Dynamics of fluids

Concept of system and control volume, Reynold's transportation theorem, Euler's equation, Bernoulli's equation, Navier Stoke's equation and their application to nozzle, venturimeter, orifices and mouth pieces, time taken in emptying a vessel. Pitot - Prandtl tube.

SECTION-C

Flow in pipes

Laminar flow through pipe, total and hydraulic gradient lines, series and parallel connection of pipes, transmission of power through pipes.

Laminar flow of viscous fluids

Boundary layer concept, boundary layer thickness, displacement, momentum and energy thickness, integral method, drag on flat plate, flow around an airfoil, boundary layer separation.

SECTION-D

Turbulent flow

Fluid friction and Reynolds number, Prandtl mixing length hypothesis velocity distribution in pipes, Cole brook formula.

Dimensional analysis

Buckingham's Pi theorem, Non – dimensional numbers and their application, similitude.

Suggested Text Books & References

1. Agarwal, "Fluid Mechanics and Machinery", Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
2. Som, S.K. and Biswas, G. "Introduction To Fluid Mechanics and Fluid Machines", Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
3. Bansal, Dr. R.K. "A Text Book of Fluid Mechanics and Hydraulic Machines", Luxmi Publications (P) Ltd., New Delhi.
4. Rajput, R.K. "A Text Book of Hydraulics", Sultan Chand and Sons, New Delhi.

SEMESTER – III

Advanced Maths and Computer Programming **AS(ID) - 3004**

Course Code	**AS(ID) – 3004**	Credits : 4	L-3, T-1, P-0
Name of the Course	**Advanced Math and Computer Programming**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 40% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section – A

Definition of tensor, transformation of coordinates (rotation, translation and orthogonal) contravarient and covariant tensors. Addition and multiplication of tensors, contraction of tensors. Inner product, fundamental tensors, symmetric and anti - symmetric tensors, kronecker delta.

Section – B

Inertia tensor : Definition and application of inertia tensor in Kinetic energy, moment of inertia and radius of gyration. Cartesian tensor: definition and application of Cartesian tensor in stress, strain and Hookes law.

Section – C

Introduction to Object-oriented concepts: Overview, Abstract data types: object, Modularization, classes, creating and destroying objects, Garbage collection strategies, overloading, dynamic binding, polymorphism, constants.

Inheritance: Class inheritance, Inheriting instance variable, inheriting methods, meta classes, object inheritance, multiple and multilevel inheritance.

Section – D

C++ Programming Language: Overview: Programming paradigm, support for data abstraction and object-oriented programming, declaration and constants, expression and statements, functions and files.

Classes and Objects: Definition of class declaration, data numbers class function definition, member function definition scope resolution operator, private and public member function, nesting of member functions, creating objects, accessing class data members functions, array of objects, objects as function arguments.

Operator overloading: Operator function, user-defined typed conversion large object, assignments and initialization and subscripting and function call, referencing, increment and decrement, a string class, friends and members.

Books:

1. Vectors and Tensors: Fred A.Hinchey, Wiley Eastern Ltd.
2. Cartesian Tensor: Harold Jeffreys, Cambridge University Press.
3. Cartesian Tensors: A.M.Goodbody, Ellis Horwood Ltd.
4. Matrices and Tensors in Physics, A.W.Joshi, New Age International Publishers Ltd., willey Eastern Ltd.
5. The C++ Progamming Language, Bjarne Stroustrup, Addison Wesley.
6. Objecting Modeling and Design, James, Rumbaugh, Michael Blaha, William Premerlani, Frederick Eddy and William Lorensen, PHI.
7. Object Oriented Programming with C++, Balagurusamy, Tata Mc. Graw Hill Publishing Co. Ltd.
8. Programming with C++, D. Ravichandran, Tata McGraw Hill.
9. Object Oriented Programming in TURBO C++, Robert Lafore, Galgotia Publications Pvt. Ltd.

SEMESTER – III

Principles of Engineering Economics and Management **AS(ID)- 3002**

Course Code	AS(ID)- 3002	Credits : 4	L-3, T-1, P-0
Name of the Course	**Principles of Engineering Economics and Management**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 40% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION - A

ECONOMICS

Definitions, Nature & scope of Economics, Economics Systems-meaning of Capitalism, Socialism & mixed economy.

DEMAND AND SUPPLIES ANALYSIS

Law of demand and supply, exception to the law of demand, Elasticity of demand and supply and their types, Methods of measuring elasticity of demand and supply.

SECTION - B

THEORY OF PRODUCTION

Scales of production, Law of returns, Break even analysis.

MONETARY SYSTEM

Monetary policy – Meaning, objectives, methods, Fiscal policy – Meaning & objectives of fiscal policy in a developing country like India, Functions of Reserve Bank of India and commercial banks.

ECONOMICS & BUSINESS ENVIRONMENT

Privatization –Growth of private capitalism in India, Business/Trade Cycles – Meaning, Characteristics & classification, Foreign capital & economic development.

SECTION - C

MANAGEMENT PRINCIPLES

Meaning & types of Management, Concept of Scientific Management, Management By Objectives, System Approach to Management.

FINANCIAL MANAGEMENT

Meaning, functional areas of financial management, Sources of Finance, Meaning of financial accounting, accounting principles-concepts & conventions, Importance of final accounts – profit & loss a/c and balance sheet, Need and importance of capital budgeting.

MARKETING MANAGEMENT

Introduction to marketing management, Market segmentation, Developing & managing advertising programs, Deciding on media & measuring effectiveness.

SECTION - D

PRODUCTION MANAGEMENT

Procedure for production planning & Control, Plant Location & Lay-out, Routing, Scheduling, CPM & PERT,

QUALITY MANAGEMENT

Statistical Quality Control,

Introduction

Control Charts, X Charts, R Charts, Control Charts for C (N. of defects per unit), Control chart for P(Fraction Defective), Advantages & Limitations of SQC

Quality Circles:- Structure, functions & Limitations.

Text Books :-

1. Business Organisation & Management – B.P.Singh – T.N.Chabra – Dhanpat Rai & Sons.
2. Modern Economic Theory – K .K. Dewett – S.Chand & Co.

Reference Books :-

1. Marketing Management – Philip Kotler – Prentice Hall of India Pvt. Ltd.
2. Financial Management - I.M. Pandey - Vikas Publishing House Pvt. Ltd.
3. Indian Economic – Ruddar Dutt, K.P.M.Sundaram – S.Chand & Co.
4. Advanced Economic Theory – H.L.Ahuja – S.Chand & Co.
5. Production Operation Management.- Dr. B.S. Goel – Pragati Prakashan.
6. Statistical Quality Control – Grant, Leaven worth – Tata Mc. Graw Hill.
7. Personnel Management – Edwin B.Flippo – Tata Mc. Graw Hill.
8. Management – A Global Perespective – Harold Krontz – Tata Mc. Graw Hill.

SEMESTER – III

APPLIED THERMODYNAMICS ME - 3002

Course Code	**ME - 3002**	Credits : 5	L-4, T-1, P-0
Name of the Course	**Applied Thermodynamics**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 40% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

Introduction to Thermodynamic Systems

Definition, Familiarity with common examples of thermodynamic systems such as steam power plant, vapour-compression refrigerator, automobile engines, air compressor, rocket engine.

Review of basic concepts

Working fluids (air, steam, refrigerants) and calculation of their properties for various thermodynamic processes, Thermodynamic processes and cycles, Psychrometry, use of psychrometric chart for calculation of properties of air-water vapour mixture.

SECTION – B

First Law of Thermodynamics

Quantity of energy and its measurements, First law energy equations for closed and open systems under SSSF and USUF conditions, Application of First Law energy equations to thermodynamic system components such as boiler, turbine, compressor, nozzle, expander, pump, condenser, First law efficiency, First law analysis of combustion processes.

Second Law of Thermodynamics
Quality of energy and its measurement, Reversible and irreversible processes, Entropy and its significance, Principle of increase of entropy of the universe, Carnot cycle, Second law entropy relations for closed and open systems under SSSF and USUF conditions, Clausius inequality, Applications of Second law to various thermodynamic systems, Availability and irreversibility, Second law analysis of combustion processes.

SECTION – C

Third Law of Thermodynamics
Measurement of entropy, Zero value of entropy, Absolute zero temperature.

Thermodynamic (PVT) relations of Working Fluids
Equation of state for ideal gas, Behaviour of real gases and compressibility factor, Generalized, empirical and theoretical equations of state for real gases, Law of corresponding states and use of generalized compressibility chart. Helmoltz and Gibbs functions, Maxwell's relations, Enthalpy, entropy, internal energy, and specific heat relations, Clausius – Clapeyron's equation, Applications to ideal and real gases. Joule Thompson coefficient.

SECTION – D

Gas Power Cycles
Carnot, Diesel, Otto, Dual combustion, Brayton, Sterling, Atkinson, and Ericssion cycles, Air standard thermal efficiency and conditions for maximum work output and efficiency, Concepts of mean effective pressure, indicated power and brake power for reciprocating engines.

Refrigeration Cycles/Processes
Brayton air refrigeration cycle, Vapour compression cycle, Vapour absorption cycle, Water refrigeration, Vortex tube and pulse tube refrigeration, thermoelectric refrigeration.

Text Books :-

1. C.P.Arora, "Engineering Thermodynamics", Tata McGraw – Hill.
2. Nag, P.K., "Engineering Thermodynamics", Tata McGraw – Hill 2nd edition.

References Books :-

1. Cengel, Y.A.,& Boles, M.A.., "Thermodynamics – An Engineering Approach", McGraw – Hill Inc.
2. Spalding, D.B. and Cole, E.H., "Engineering Thermodynamics", Edward Arnold.
3. Hawkins, G.A., "Engineering Thermodynamics", John Wiley and Sons.
4. Wylen Van, G.J. and Sonntag, R.E., "Fundamentals of Classical Thermodynamics", John Wiley and Sons, 4th edition, 1997.

SEMESTER – III

STRENGTH OF MATERIALS-I ME-3003

Course Code	**ME-3003**	Credits : 4	L-3, T-1, P-0
Name of the Course	**Strength of Materials-I**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 15% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 40% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section- A

Compound stresses & strains: Concept of surface and volumetric strains, two - dimensional stress system, complementary shear stresses at a point on a plane. Principal stresses & strains and principal planes. Mohr's circle of stresses, Numerical problems.

Theories of Elastic Failure: Various theories of elastic failure with derivations and graphical representations, applications to problems of two-dimensional stress systems with (i) Combined direct loading and bending and (ii) combined torsional and direct loading. Numerical problems.

Section- B

Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact. Strain energy of beams in bending, beam deflections. Strain energy of shafts in twisting. Energy methods in determining spring deflection, Castigliano's & Maxwell's theorems, Numerical problems.

Section - C

Shear and combined stresses in beams: Shear stresses in beams with derivation of shear stress in rectangular I, T, circular and hollow circular sections. Combined bending, torsion & axial loading of beams. Numerical problems.

Columns & Struts: Columns under axial load, concept of instability and buckling, slenderness ratio. Derivation of Euler's formulae for the elastic buckling load. Euler's, Rankine Gordon's formulae ,Johnson's empirical formula for axial loading of columns and their applications, eccentric compression of a short strut of rectangular & circular sections, Numerical problems.

Section –D

Slope & Deflection : Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method. Calculations for slope &deflection of (1) cantilevers and (2) simply supported beams with or without overhang, under concentrated loads, uniformly distributed loads or combination of concentrated and uniformly distributed loads. Numerical problems.

Fixed Beams: Deflections, reactions and fixing moments. Calculations of deflection and S.F. & B.M. diagrams for fixed beams under (1) concentrated loads, (2) uniformly Distributed loads and (3) a combination of concentrated loads and uniformly distributed load.

Text Books:

1. Strengths of Materials – G.H. Ryder- Third Edition in S.I. units 1969 Macmillan India.
2. Mechanics of Materials- Dr. Kirpal Singh, Standard Publishers Distributors, New Delhi.

Reference Books:

1. Strengths of Materials-Popov , PHI, New Delhi
2. Strengths of Materials-Sadhu Singh, Khanna Publications
3. Strengths of Materials- A Rudimentary Apprach-M.A. Jayaram, Revised Ed. 2001, Sapna Book house, Bangalore.
4. Strengths of Materials- U.C. Jindal

SEMESTER – III

MACHINE –DRAWING ME-3004

Course Code	**ME – 3004**	Credits : 4	**L-1, T-0, P-6**
Name of the Course	**Machine –Drawing**		
Lectures to be delivered	**91 (1 Hr Each) (L = 13, T = 0, P=78 for each semester)**		
Semester End Examination	**Max. Time = 4 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. In the semester examination, the examiner will set two questions from each unit. The students have to attempt three questions taking one from each unit.

2. The questions from unit I and unit II will carry 20 Marks each. Questions from unit III will carry 60 Marks.

Unit I

Introduction to BIS Specification sp: 46- 1988 Code of engineering drawing – Limits. Fits and Tolerance (dimensional and Geometrical tolerance), Surface finish representation. Gear: Gear terminology. I.S convention of assembly of spur gears, helical gear, bevel gears, worm and worm wheel.

Unit II

Orthographic view from isometric views of machine parts / components. Dimensioning- Sectioning. Exercises on coupling, crankshaft, pulley, piston and connecting rod, cotter and knuckle joints. Riveted joints and Welded joints.

UNIT III

Assembly drawing with sectioning and and bill of materials from given detail drawings of assemblies : Lathe tail stock , machine vice , pedestal bearing , Steam stop valve , drill jigs and milling fixture .

Text Books:

1. Machine Drawing : By N D Bhat and V M Panchal Pub Charotar Publishing House.
2. A text book of machine drawing : PS Gill Pub. S.K.Kataria & SONS.

Reference books:

1. A text books of machine Drawing: Laxmi narayana and Mathur pub. M/s Jain Brother. New Delhi.
2. Machine Drawing : N Sidheshwar, P Kannaieh, V V S Sastry, Pub. Tata Mc Graw Hill Publishing Ltd.

SEMESTER – III

FLUID MECHANICS LAB ME – 3006

Course Code	**ME – 3006**	Credits : 2	L-0, T-0, P-2
Name of the Course	**FLUID MECHANICS LAB**		
Lectures to be delivered	**26 hours of Lab sessions**		
Semester End Examination		**Max. Marks: 50**	**Min. Pass Marks: 20**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (25 marks).
ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments:

1. To determine the coefficient of impact for vanes.
2. To determine the coefficient of discharge of Notch (V and Rectangular types)
3. To determine the friction factor for the pipes.
4. To determine the coefficient of discharge of venturimeter.
5. To determine the coefficient of discharge, contraction & velocity of an orifice.
6. To find critical Reynolds number for a pipe flow.
7. To determine the meta-centric height of a floating body.
8. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
9. To show the velocity and pressure variation with radius in a forced vertex flow.

SEMESTER – III

STRENGTH OF MATERIALS – LAB ME - 3007

Course Code	**ME – 3007**	Credits : 2	L-0, T-0, P-2
Name of the Course	**STRENGTH OF MATERIALS – LAB**		
Lectures to be delivered	**26 hours of Lab sessions**		
Semester End Examination		**Max. Marks: 50**	**Min. Pass Marks: 20**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (25 marks).
ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments:

1. To study the Brinell hardness testing machine & perform Brinell hardness test
2. To study the Rockwell hardness testing machine & perform the Rockwell hardness test.
3. To study the Vickers hardness testing machine & perform Vickers hardness test
4. To study Erichsen sheet metal testing machine & perform the Erichsen sheet metal test
5. To study the Impact machine and perform the Impact tests (Izod & Charpy)
6. To study the Universal testing machine and perform the tensile test.
7. To perform compression test on UTM.
8. To perform bending test on UTM.
9. To perform the shear test on UTM.
10. To study the torsion testing machine and perform the torsion test .

SEMESTER – III

COMPUTER PROGRAMMING LAB AS(ID) - 3005

Course Code	**AS(ID) - 3005**	Credits : 2	L-0, T-0, P-2
Name of the Course	**COMPUTER PROGRAMMING LAB**		
Lectures to be delivered	**26 hours of Lab sessions**		
Semester End Examination		**Max. Marks: 50**	**Min. Pass Marks: 20**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (25 marks).
ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of exercises:

1. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power () that takes a double value for an int value for p, and returns the result as double values. Use a default argument of 2 of p, so that if this argument is omitted, the number will be squared. Write a main () function that gets values from the user to test this function.

2. A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4, 5) represents point 4 units to the right of the origin along the X-axis and 5 units up the Y-axis. The sum of two points can be defined as new point with X and Y coordinates.

   Write a program that uses a structure called point to model a point. Define three points, and have the user input to two of them. Than set the third point equal to the sum of the other two. And display the value of the new point. Interaction with the program might look like this:

   Enter coordinates for PI : 3 4
   Enter coordinates for P2 : 5 7
   Coordinates of P1 + P2 are : 8 11

3. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator and another number. It should they carry out the specified arithmetical operation: adding, subtracting, multiplying or dividing the two numbers. (it should use a switch statement to select the operation). Finally, it should display the result.

   When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N' some sample interaction with the program might look like this.

   Enter first number, operator and second number 12 + 100

   Answer = 112
   Do another (Y/N) ? N

4. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure displaying both numbers. The interchange might look like this:

   Enter your area code, exchange and number : 415 555 1212
   My number is (415) 555 – 1212

5. Create two classes DM and DB, which store the value of distances. DM stores distances in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and one object of DM with another object of DB.

   Use a friend function to carry out the addition operation. The object that stores the results may be a DM object or DB object, depending on the units in which the results are required.

   The display should be in the format of feet and inches or meters and centimeters depending on the object on display.

6. Create a class rational which represents a numerical value by two double values – NUMERATOR & DENOMINATOR. Include the following public member Functions:
   - Constructor with no arguments (default).
   - Constructor with two arguments .
   - Void reduce () that reduces the rational number by eliminating the highest common factor between the numerator and the denominator.
   - Overload +operator to add two rational number.
   - Overload >>operator to enable input through cin.
   - Overload <<operator to enable input through count.

   Write a main () to test all the functions in the class.

7. Consider the following class definition class father {

```
        Protected : int age;
Public;
        Father (int x)  {age  =  x;}
        Virtual void iam ()
        {cout << " I AM THE FATHER, my age is : "<<age<<end 1:}
};
```

Derive the two classes son and daughter from the above class and for each, definite iam () to write our similar but appropriate messages. You should also define suitable constructors for these classes.

Now, write a main () that creates objects of the three classes and then call iam () them. Declare pointer to father, successively assign addresses of objects of the two derived classes to this pointer and in each case, call iam () through the pointer to demonstrate polymorphism in action.

8. Write a program that creates a binary file by reading the data from the students for the terminal. The data of each students consist of roll No., name (a string of 30 or lesser No. of Characters) and marks.

9. A hospital wants to create a database regarding its indoor patients. The information to store include

   a) Name of the patient.
   b) Date of admission.
   c) Disease.
   d) Date of discharge.

   Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age o the patients. List the information about all to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

10. Make a class Employee with name and salary. Make a class Manager inherit form Employee. Add an instance variable, named department, type string. Supply a method to String that prints the manager's name, department and salary. Make a class Executive inherit form information stored in the manager superclass object. Supply a test program that test these classes and methods.

11. Imagine a tollbooth with a class called Toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes to these to 0. A member function called paying Car () increments the car total and adds 0.50 to the cash total. Another function, called nopay Car (), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals.

    Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a non-paying car. Pushing the ESC key should cause the program to print out the total cars and total cash and then exit.

12. Write a function called reversit () that reverses a string (an array of Char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit (), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)"

13. Create some objects of string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the for Each () function and a user written display function. Then search the Deque for a particular string, using the first That () function and display any strings that match. Finally remove all the items form the Deque using the get left () function and display each item

14. Assume that a blank maintains two kinds of accounts for customers. One called as savings account and the other as current account. The saving account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

    Create a class account that stores customer name, account number and type of account. Form this derive the classes cur_acct and Sav_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

    a) Accept deposit from a customer and update the balance.
    b) Display the balance.
    c) Compute and deposit interest.
    d) Permit withdrawal and update the balance.
    e) Check for the minimum balance, impose penalty, necessary and update the balance.
    f) Do not use any constructor. Use member functions to initialize the class members.

15. Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figure. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get data () to initialize base class data members and another members function display area (), to compute and display the area of figures. Make display area () as a virtual function and redefine this function in the derived classes to suit their requirements.

Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.

Remember the two values given, as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:

Area of rectangle = x * y
Area of Triangle = 1/2 x * y

Programming of exercises in C++ in the form of projects (based on “Object Oriented Programming in TURBO C++, Robert Lafore, Galgotia Publications Pvt. Ltd., 1994, to be done in consultation with the faculty incharge for the course.)

Note :- *Record to be maintained both electronically and hard copy for evaluation.*