BE III Semester (Common for All Branch)						
COURSE CONTENTS						
MA-3001	**Mathematics – III**	**L**	**T**	**P**	**C**	**Max. Marks**	**Min. Marks**
Duration	**3 Hours**	**3**	**1**	**0**	**4**	**70**	**22**

Unit I

Functions of Complex Variables: Analytic functions, Harmonic Conjugate, Cauchy-Riemann Equations, Line integral, Cauchy's theorem, Cauchy's Integral Theorem, Tailors & Laurent's series expansions Singular points, Poles and Residues, Residue theorem, Evaluation of Real Integral, Elementary transformation, Bilinear Transformation.

Unit II

Numerical Analysis: Difference operators, Errors and Approximations, Interpolation, Inverse interpolation, Numerical differentiation, Numerical Integration Newton-cotes formula, Simpson's and Weddel's rule and Gauss Legendre open quadrature formula.

Unit III

Algebraic and Transcendental Equations: Solutions of algebraic and transcendental equations(Regula Falsi, Newton-Rephson, Iterative, Graffe's root squaring methods), Solutions of simultaneous algebraic equations, Solutions of ordinary differential equations (Taylor's Series, Picard's Method, Euler's method, Modified Euler's method, Runge-Kutta Method, Predictor-Corrector Method), Solution of Partial differential equation, Difference scheme, Solution of parabolic, hyperbolic and elliptic equations.

Unit IV

Introduction of Optimization: Introduction of optimization by linear programming (only two variables problem), Solution by graphical and simplex method, Concepts of degeneracy and duality, Simple three variables transport and assignment problems and modeling into LPP.

Unit V

Sampling distributions: The central limit theorem, Distributions of the sample mean and the sample variance for a normal population, Chi-Square test, t and F distribution, **Estimation:** The method of movements and method of maximum likelihood estimation, Confidence intervals for the mean(s) and variance(s) of normal population

Suggested Readings:

1. Adv. Engineering Mathematics by E. Kreyszig.
2. Adv. Engineering Mathematics by R.K. Jain & S.R.K. Iyenger.
3. Higher Engineering Mathematics by B.S. Grewal.
4. Mathematical Statistics by J.N. Kapoor.
5. Probability and Statistics in Engineering by W.W. Hines et al.
6. Numerical Methods of Scientific and Engineering Computation by M.K. Jain et al.
7. Operation Research : An Introduction by H.A. Taha.
8. Introduction to Operation Research by F.S. Hiller and G.J. Liberman.
9. Numerical Solutions of Differential Equations by M.K. Jain.

BE III Semester Chemical engineering							
COURSE CONTENTS							
CM-3001	**Fluid Flow Operations**	**L**	**T**	**P**	**C**	**Max. Marks**	**Min. Marks**
Duration	**3 Hours**	**3**	**1**	**2**	**6**	**70**	**22**

Unit I
Properties of fluid: Forces on fluid, stresses, the concept of constitution relations, fluid statics, Normal forces in fluid, Pressure Measurement, forces on submerged bodies, buoyancy, Stability.

Unit II
Newtonian and Non-Newtonian fluid: Viscosity measurement, Equations of changes: Equation of Continuity & Equation of motion. Navier stokes equation, concept of Reynolds number and friction factor: Friction factor for rough and smooth pipes, loss of head due to friction in pipes and fittings.

Unit III
Boundary Layer Theory: Bernoulli's equation, Fluid machinery; pumps, fans, blowers, compressor & vacuum pumps. Power and head requirement for pumps.

Unit IV
Flow of Fluids: Flow of incompressible fluid in conduits and thin layers, flow past immersed bodies. Dimensional analysis, Buckingham π-theorem, Dimensionless numbers and their significances, similitude criteria.

Unit V
Fluid flow Measurement: Constant area and constant head meters, Nozzles, Pitot tube, Weirs and Notches.

List of Experiments:
1. To determine the local pint pressure with the help of pitot tube.
2. To find out the terminal velocity of a spherical body in water.
3. To determine the viscosity of a given viscous liquid by capillary tube flow method
4. To find the pressure drop in a packed bed.
5. To study the flow behavior of a non-Newtonian fluid and to determine to flow constants.
6. To determine to power-number-Reynolds number curve for an agitated vessel.
7. To differentiate between laminar and turbulent flow using Reynolds experiment.
8. To study the characteristics of an air compressor.
9. To study the characteristics of a centrifugal pump.
10. To study the flow of a fluid in a pipeline and to prepare the friction factor – Re plot.
11. To determine the friction losses, expansion losses, and reduction losses in bends and pipes and verify the Bernoulli equation.
12. To prepare the calibration curve for an orifice meter and Rotameter.
13. To prepare the calibration curve for venturimeter.

Note: Each student should perform at least eight experiments out the above list.

Suggested Readings:
1. W.L. Mc Cabe & I.C. Smith–UNIT OPERATIONS IN CHEMICAL ENGG.–3ed. Mc Graw Hill & Kogakusha 1976
2. J.M. Coulson & J.F. Richardson – CHEMICAL Engineering – Vol I & II
3. B.S. Maney, zel (SI) Van Nostand & Reinhold – MECHANICS OF FLUID – ELBS, 1970
4. I. Grannet – FLUID MECHANICS FOR ENGG. AND TECHNOLOGY – Prentice Hall, 1971
5. Maurice G. Larian – FUNDAMENTALS OF CHEMICAL ENGG. OPERATION – Constable and Company Ltd. Landon.
6. S.K. Gupta – MOMENTUM TRANSFER – Newage Publication.

BE III Semester Chemical Engineering						
COURSE CONTENTS						
CM-3002	**Chemical Process Instrumentation**	**L**	*T*	*P*	*C*	*Max. Marks*	*Min. Marks*
Duration	**3 Hours**	**3**	**0**	**2**	**5**	**70**	**22**

Unit I
Introduction: Chemical process instrumentation, Choice of Instruments for a Specific Application Process variables, static and dynamic characteristics of instruments & their general classification , Elements of Measuring systems & their functions, True value ,Measured Value, Errors, Classification Of Errors and Methods of Reducing errors.

Unit II
Temperature of Humidity Measurement: Principle, construction and operation of instruments for the measurement of Temperature: Liquid filled thermometers, Vapour Pressure Thermometers, Thermometers based on solid expansion like bimetallic type, Thermocouples, Resistance thermometers, Radiation Pyrometers, Optical Pyrometers, Photo electric Pyrometers. Principle, construction and operation of instruments for the measurement of Humidity and moisture

Unit III
Pressure Measurement: Principle, construction and operation of instruments for the measurement of pressure and Vacuum: Mechanical Pressure sensors e.g. Bourdon Tube, Diaphragm Pressure Elements, Bellows, Electrical Pressure Measuring Devices e.g. capacitance Manometer, Strain Gauge Pressure Transducers, Piezo Resistive Pressure Transducers, Resistive Pressure Transducers, LVDT Pressure Transducer. Measurement Of vacuum e.g Mcleod Gauge , Pirani gauge, Ionization gauge.

Unit IV
Flow Measurement: Principle, construction and operation of instruments for the measurement of Flow e.g. Variable Head flow meters, Variable Area flow meters, Hot Wire Anemometer, Principle, construction and operation of instruments for the measurement of Level e.g. Float and Displacer type Devices, Hydrostatic Methods, Capacitance type Devices , Radiation type Devices. Principle, construction and operation of instruments for the measurement of Density and Viscosity.

Unit V
Composition Measurement: Principle, construction and operation of instruments for the measurement of Composition e.g. Thermal conductivity analyzers, Paramagnetic Analyzers, Spectroscopic Methods, Gas Chromatograph, Process instrumentation diagrams and symbols, process instrumentation for process equipments such as Distillation column Absorption column, Heat Exchanger, Reactors, Evaporators, fluid storage vessels

List of Experiments:
1. Measurement of weight of pressure using strain gauge.
2. Measurement & calibration of temperature using thermister, RTD and thermocouple.
3. Measurement of water level using capacitance probe.
4. Measurement of water level using differential pressure meter
5. Measurement of flow using electromagnetic flow meter
6. Measurement of flow using differential pressure cell across orifice/ venturimeter
7. Study of Gas Chromatograph

Suggested Readings:

1. Albert D. Cooper- Modern Electronic Instrumentation, PHI
2. Eckman-Industrial Instrumentation
3. H.S. Kalsi- Electronic Instrumentation
4. Curties Johnson- Process Control Instrumentation Technique, IV Edn, PHI
5. Jaggi, Mathur; Engineering Mathematics; Khanna Publisher.
6. B.G. Liptak- Instrument Engineering 'Handbook, Volume 1 : Process Measurement
7. Austin E. Fribance- Industrial Instrumentation Fundamentals, new York: Mcgraw-Hill 1962
8. Ernest Doebelin- Measurement Systems: Application and Design, McGraw-Hill

BE III Semester Chemical engineering							
COURSE CONTENTS							
CM-3003	**Chemical Process Calculations**	**L**	**T**	**P**	**C**	**Max. Marks**	**Min. Marks**
Duration	**3 Hours**	**4**	**2**	**0**	**6**	**70**	**22**

Unit I
Mathematical and Engineering Calculations: Units and dimensions, conversions units, expression and equations, Dimensional groups and constants, stoichiometric and composition relationships conservation of mass, mass and volumetric relationships in volumetric chemical reactions. Basis of calculation. Excess reactants, degree of completion

Unit II
Ideal Gases & Vapors Pressure: Behavior of ideal gases, Gaseous mixtures, Vapour pressure, Clausius Clapeyron equation. Coxchart, Duhrings plot, Raoult's Law. Humidity & saturation, relative humidity, humid heat, humid volume, dew point, Humidity chart and its use.

Unit III
Material Balance: Crystallization, dissolution, solving material balance problems with and without chemical reactions. Recycle, bypass and purge calculations. Aid of computer in solving material balance problem.

Unit IV
Energy Balance: Heat capacity, calculation of enthalpy changes. Energy balances with chemical reactions. Heat of vaporization, heat of formation, Laws of thermo chemistry, heat of combustion, heat of reaction, solution of set of equations.

Unit V
Combustion Case Study: Heating value of solid, liquid & gaseous fuels, characterization of petroleum. Thermal efficiency, complete and incomplete combustion of fuels. Actual & Theoretical flame temperature Case study of selected problems.

List of Experiments
1. To determine the boiling point relation with respect to concentration of caustic soda and verify Duhring's rule.
2. Application of dry and wet bulb thermometer to find out atmospheric humidity.
3. Use of humidity chart to find enthalpy, dew point, humid heat and saturation.
4. Solubility at room temperature & at boiling point to urea in water and verify the material balance.
5. Crystallization of copper sulfate in saturated solution by cooling and finding out the crystal yield.
6. To find out the heating value of coal using a calorimeter.
7. Combustion of coal & performing the material balance.
8. Proximate analysis of coal sample.
9. Measurement of flame temp. and compare actual & theoretical temp. (Business- Burner, Sprit- lamp, Kerosene lamp)
10. To find the heat of reaction using calcium oxide and water.

Suggested Readings:
1. O. A Hougen, K.M Watson, R.A. Ragatz – Chemical Process Principles Part I – CBS publications, New Delhi 1995 edition.
2. David M. Himmelblau – Basic Principles and calculations in chemical Engineering – Prentice Hall India, Sixth Edition Feb, 1999
3. B. I Bhatt, S. M. Vora – Stoichiometry – Tata Mc- Graw Hill, 1996
4. Narayanan K.V. and Lakshmikutty B., "Stoichiometry and Process Calculations", Prentice Hall of India.

BE III Semester Chemical engineering							
COURSE CONTENTS							
CM-3004	**Fuel Technology**	**L**	**T**	**P**	**C**	*Max. Marks*	*Min. Marks*
Duration	**3 Hours**	**3**	**1**	**2**	**6**	**70**	**22**

Unit I
Solid Fuel: Coal & lignite reserves in India, Classifications of coal, Recent advances in coal preparation methods including fine coal treatment, Washing of Coal, Analysis of Coal, proximate and ultimate analysis.

Unit II
Coal carbonization: Mechanism of Low temperature carbonization and high temperature carbonization, by product recovery from coke oven; properties of coke coal; grinding, pulverization, briquetting of solid fuels.

Unit III
Liquid Fuel: Origin of petroleum production, Indian Petroleum resources and their nature, Petroleum processing, distillation, cracking thermal & catalytic, coking, reforming, Isomerization, Crude oil classification, Reserves of Hydrocarbon in INDIA, introduction to Petroleum refining & processing.

Unit IV
Petroleum Product: Petroleum product and their utilization, blending of petrol for octane number boosting, Transport fuels: Diesel, Petrol, AVL (Aviation Liquid Fuel), Kerosene, fuel & furnace oil, Testing of petroleum product: Flash Point, pore point, Fire point, Octane number, Cetane number, viscosity and viscosity index, API.

Unit V
Gaseous Fuel: Natural gas, Synthetic gases, their composition & properties, producer gas, Water gas, Coal Gas, LPG, CNG.

List of Experiments (Pl. expands it):
1. To carry on proximate analysis of the given coal sample.
2. To determine the calorific value of the coal by Bomb-Calorimeter method.
3. Crushing, grinding, Pulverizing and Screening of solid fuel.
4. To determine the viscosity of the given oil sample by Redwood Viscometer. No. 1 and No. 2
5. To determine the viscosity of a given oil sample by Say bolt viscometer.
6. To determine viscosity of a given coal tar with the help of tar viscometer.
7. To determine the flash and fire points of the given oil sample by Penskey Martin's apparatus.
8. To determine the flash and fire points of the given oil sample by Abel's apparatus.
9. To determine the flash and fire points of the given oil sample by Cleveland apparatus.
10. To determine the carbon residue of the given oil by Ramsbottom method.
11. To determine the carbon residue of the given oil by Conradson method.
12. To find out the calorific value of a gaseous fuel (LPG) by Boy's Gas calorimeter.
13. To determine cloud and pour point of given oil sample (coconut) by cloud and pour point apparatus.
14. To determine the composition of given gas by Orsat apparatus.
15. To determine the sulphur content of the given fuel oil sample by lamp method.
16. To determine the smoke point of the given kerosene sample.
Note: Each student should perform at least eight experiments out the above list.

Suggested Readings:
1. Sarkar S. – FUEL AND COMBUSTION – 2nd ed. Orient Long men Ltd., Mumbai, 1996
2. Gupta O. P. – FUEL & COMBUSTION – 3rd ed. Khanna Publishers, New Delhi, 1996.

BE III Semester Chemical engineering							
COURSE CONTENTS							
CM-3005	**Computer Programming**	**L**	**T**	**P**	**C**	**Max. Marks**	**Min. Marks**
Duration	**3 Hours**	**0**	**0**	**4**	**4**	**60**	**19**

SECTION A : VISUAL C++

Unit I

Visual C++ Basics : Introduction, Building a Basic Application, Using Microsoft Foundation Class (MFC) Library, Visual C++ resources: Application Wizard, Accelerators and Menus, Toolbars.

Unit II

Visual C++ and Database Management: Data Access Objects (DAO) versus Open Database Connectivity (ODBC), Database Building Overview, Building a Database Application Using ODBC, Building a Database Application Using DAO.

Unit III

Visual C++ and the Internet: Designing a Web Page. An Overview of JavaScript, Creating and ActiveX Control, Creating an ActiveX Document Application, Using URLs and Monikers, Working with Internet Information Server (IIS), Designing with Security in Mind, Building a Help File, Packaging Your Application.

SECTION B: VISUAL BASIC

Unit IV

Introduction : Creating First VB Application, Adding Controls, Activation Controls, Creating Menus, VB Program Structure, Handling Data, Fundamental Expressions, Working with Interactive Keyboard and Screen 110, Adding Loops, Using Arrays, Procedures.

Unit V

Intermediate VB Programming: VB Forms, Dialog Boxes, Additional Controls, Printing with VB, Understanding Objects and Using Object Browser, Accessing Files, Adding OLE to a Program.

Unit VI

Adding Power to VB Programs: Using Graphics and Multimedia, Using Form Template, Accessing Database, Using Keyboard and Mouse I/0, Building Help Subsystem, Using ActiveX, Adding Internet Access to the Applications.

Unit VII

Building a Professional Application: Developing and Designing Forms, Adding the Controls, Integrating Code, Debugging and Testing, Packaging Your Application.

Suggested List of Experiment:

Programs based on each unit in Section A (Visual C++) and Section B (Visual Basic). At least 8 programs in Visual C++ and Visual Basic each.

Reference Books:
1) Visual C++: John Paul Mueller 1997, Tata McGraw Hill Edition.
2) Visual Basic: Night School - Greg Perry, QUE Pub.
3) Visual Basic 5: The Comprehensive Guide - Mansfield, Galgotia Pub.