

Ujjain Engineering College, Ujjain (MP) 456010

SYLLABUS FOR FOUR YEARS Bachelor of Technology DEGREE COURSE as per AICTE Model Curriculum

(CE/CM/ME Branches :: July 2019)

Subject Code	Subject Name	Semester	Periods per Week			Scheme of Examination			Total Marks	Credits
			L	T	P	ESE	MST	QAR		
MA 3002	Mathematics – III	III	3	1	0	70	20	10	100	4

Prerequisite: Mathematics – I, Mathematics – II

Course Objective: Introduce students to Laplace transforms, inverse Laplace transforms of different type of functions and principles and use them to solve ordinary and partial differential equations. Also, introduce students to how linear and non linear Partial Differential are formed and solve them by different methods. This course also aims to provide an understanding of the basic concepts in probability, conditional probability and independent events. It will also focus on the random variable, mathematical expectation, and different types of distributions, sampling theory. Another objective of the course is to design a statistical hypothesis about the real world problem and to conduct appropriate test for drawing valid inference about the population characteristics. It is inevitable to have the knowledge of hypothesis testing for any research work. The course will provide an opportunity to learn R programming to substantial extent.

Detailed Course Contents

[Total contact hours required: 60 hours]

Module 1: Laplace Transform (9 lectures, 3 tutorials) [Weightage 14 marks]

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.

Module 2: Partial Differential Equations (9 lectures, 3 tutorials) [Weightage 14 marks]

First order partial differential equations, Solutions of first order linear and non-linear PDEs. Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method. Second-order linear PDE equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems), Separation of variable method, Wave and Heat conduction equations.

Module 3: Basic probability and distributions (9 lectures, 3 tutorials) [Weightage 14 marks]

Probability spaces, conditional probability, independence; Total probability, Baye's theorem, Discrete random variables, Binomial distribution, Poisson distribution, Continuous random variables and their properties, Normal distribution, Evaluation of statistical parameters for these three distributions.

Module 4: Basic Statistics (9 lectures, 3 tutorials) [Weightage 14 marks]

Measures of Central tendency: Moments, Skewness and Kurtosis, Curve fitting by the method of least squares-fitting of straight lines, second degree parabolas and more general curves. Correlation and Regression, Rank correlation.

Module 5: Applied Statistics (9 lectures, 3 tutorials) [Weightage 14 marks]

Tests of significance: Introduction, Sampling and standard error. Test of significance for large samples: Null and alternate hypothesis, critical region, critical value, and level of significance, confidence interval, Errors in testing of hypothesis. Tests of significance for small samples: Student's t -distribution, Snedecor's F -distribution. Chi-Square distribution: Properties, applications, test for goodness of fit, independence of attributes, test for population variance.

Suggested Text/Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. R. K. Jain, S. R. K. Iyenger, Advanced Engineering Mathematics, Narosa Publications.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
6. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
7. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

Yash
Akash
Anurag

Table 01: Course Outcomes (COs)

On successful completion of this course students will be able to:

Course Outcome #	Course Outcome
CO1	Find Laplace transform and Inverse Laplace transforms of functions using different methods and able to apply them to solve initial and boundary value problems.
CO2	Classify PDE, solve linear PDEs of both first and second orders, solve nonlinear PDEs of first order and identify real phenomena as models of partial derivative equations (wave and heat equations)
CO3	Understand the concepts of probability, random variables and be familiar with some common probability distribution like Binomial, Poisson and Normal distributions and their properties.
CO4	Understand and apply the concepts of Moments, Skewness and Kurtosis, fit different curves by least square method, understand and apply the concepts of correlation and regressions.
CO5	Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.

Table 02: Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	1	-	-	-	-	-	-	-
CO2	3	3	1	2	1	-	-	-	-	-	-	-
CO3	3	3	1	2	1	-	-	-	-	-	-	-
CO4	3	3	1	2	1	-	-	-	-	-	-	-
CO5	3	3	1	2	1	-	-	-	-	-	-	-
MA 3002	3	3	1	2	1	-	-	-	-	-	-	-

Policy for Attendance:

Attendance in lectures and tutorials is compulsory. Please ensure that your attendance is marked on the attendance sheet, and that this is done no later than the first five minutes of the class. There will be maximum 5% marks for attendance which will be awarded as follows:

Attendance	Marks	Attendance	Marks
$\leq 40\%$	1.0	$61\% \leq 80\%$	3.5
$41\% \leq 60\%$	2.5	$81\% \leq 100\%$	5.0

Evaluation Plan:

1. There will be two assignments. Each assignment will carry 1% weightage. Dates, timings and syllabus for Assignment 1 and Assignment 2 will be announced later in the class.
2. There will be two quizzes. Quizzes will be conducted in the tutorial class. Each quiz will be of 30 minutes duration and will carry 1.5% weightage. Dates, timings and syllabus for Quiz 1 and Quiz 2 will be announced later in the class. Questions in Quiz 1 and Quiz 2 will be asked from the tutorial sheets. Missed quizzes cannot be made up.
3. The Mid-Semester examination, will be of 20% weightage. The syllabus for Mid-Sem examination will be announced later in the class. Questions in MSTs may be asked from the tutorial sheets. The End Semester Examination will be of 70% weightage, and will cover all the topics.

BE III SEMESTER CHEMICAL ENGINEERING							
COURSE CONTENTS							
CM3301	Chemical Engineering Thermodynamics	L	T	P	C	Max. Marks	Min. Marks
Duration	3 Hours	3	1	0	4	70	22

Unit 1**Introduction**

Scope of thermodynamics, Temperature, Pressure, Work, Heat, Energy, Equilibrium, Phase rule, Joule's Experiment, Internal energy, Enthalpy, Heat capacities, Processes- Reversible & Irreversible, System & Surroundings.

Unit 2**Phase Transitions**

PVT behavior; description of materials – Ideal gas law, van der Waals, virial and cubic equations of state; Reduced conditions & corresponding states theories, Heat engines, Carnot's theorem; Thermodynamic Temperature Scales; Entropy; Entropy changes of an ideal gas; Clausius inequality, Entropy balance for open systems.

Unit 3**Laws of Thermodynamics**

First Law and second law of thermodynamics, Thermodynamic properties of fluids, property relations for homogenous phases, Maxwell relations, various equations of enthalpy, entropy and internal energy, Residual properties, two phase systems: Clapeyron equation, Estimation of thermodynamic properties by using graphs and tables. Third law of thermodynamics.

Unit 4**Refrigeration and Phase Equilibria**

Compression of real gas, Refrigeration – Ideal reversed Carnot Cycle. Vapor compression refrigeration, Binary fluid cycle & Cascade system. Dry ice. Fundamental property relation, Chemical potential and phase equilibria, Partial properties, Ideal gas mixture model, fugacity and fugacity coefficient for pure species and in solution, Ideal solution model and excess properties.

Unit 5**Chemical Equilibria**

Solution thermodynamics Application, Liquid phase properties of VLE data, The reaction coordinates, Application of the criteria for equilibrium to chemical reactions, the standard Gibbs free energy change and the equilibrium constant, effect temperature on equilibrium constant, evaluation of the equilibrium constants, Relation of equilibrium constants to composition, equilibrium conversions for reactions, phase rule for reacting systems.

[Handwritten signature]

[Handwritten signature]
Dr. Anjani K. Dwivedi
HEAD
 Deptt. of Chemical Engg.
 Rajan Engg. College, Jaipur (M.P.)

Suggested Text Books

1. Smith J. M. & Van Ness – Introduction to Chemical Engineering Thermodynamics – 2nd Edition.
2. Dodge B. F. Chemical Engineering Thermodynamics – McGraw Hill
3. Balzhiser, Samuels and Eliassen – Chemical Engineering Thermodynamics – Prentice Hall
4. Sandler, S.I. – Chemical Engineering Thermodynamics – John Wiley & Sons.
5. Rastogi and Mishra – Chemical Engineering Thermodynamics.

After completion of course student will be able to

CO1: Explain basic concepts of thermodynamics to engineering applications.

CO2: Evaluate the properties of non-ideal gases and liquids using cubic equations of state.

Apply entropy balance for open and closed systems.

CO3: Calculate thermodynamic properties using residual properties. Explain laws of thermodynamics.

CO4: Understand the concepts of various Refrigeration cycles. Explain ideal solution model and excess properties.

CO5: Analyze the effect of change in temperature, pressure and composition on equilibrium conversions for chemical reactions.

[Handwritten signature]

[Handwritten signature]
Dr Anjani K. Dwivedi
HEAD
Deptt. of Chemical Engg.
Ujjain Engg. College, Ujjain (M.P.)

BE III SEMESTER CHEMICAL ENGINEERING							
COURSE CONTENTS							
CM3302	Material and Energy Balance Computations	L	T	P	C	Max. Marks	Min. Marks
Duration	3 Hours	3	1	0	4	70	22

Course Objective: To understand and apply the basics of calculations related to material and energy

flow in the processes. Upon completion of this course, the students will be able to:

1. perform material balance for problems without chemical reactions.
2. perform material balance for problems involving chemical reactions.
3. perform energy balance for problems without chemical reactions.
4. perform energy balance for problems involving chemical reactions.

Unit I

Mathematical and Engineering Calculations: Units and dimensions, conversions units, expression and equations, Dimensional groups and constants, stoichiometry mole concept and composition relationships, conservation of mass, mass and volumetric relationships in volumetric chemical reactions. Basis of calculation, Concept of limiting and excess reactants, percentage conversion and yield.

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, Humidification operation and calculation of properties of air-water system.

Unit III

Material Balance: Simple material balances problems solving with and without chemical reactions. Material balance for unit operations like absorption, distillation, extraction, drying, evaporation and Crystallization. Recycle, bypass, purge, and the industrial application of material balances. Aid of computer in solving material balance problem.

Unit IV

Energy Balance: Heat capacity of gases, liquids, and solids, Latent heats, Heats of formation, combustion, reaction and dissolution, calculation of enthalpy changes, Laws of thermo chemistry, solution of set of equations, Energy balance calculations in unit operations and systems with and without chemical reaction.

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.

[Signature]

[Signature]
Dr. Anjan K. Dwivedi
HEAD
 Deptt. of Chemical Engg.
 Jijain Engg. College, Jijain (M.P.)

Suggested Readings:**Text Books:**

1. David M. Himmelblau – Basic Principles and calculations in chemical Engineering – Prentice Hall India, Sixth Edition Feb, 1999
2. B. I Bhatt, S. M. Vora – Stoichiometry – Tata Mc- Graw Hill, 1996
3. Narayanan K.V. and Lakshmikutty B., “Stoichiometry and Process Calculations”, Prentice Hall of India.

Reference Books:

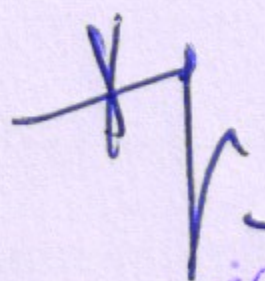
4. O. A Hougen, K.M Watson, R.A. Ragatz – Chemical Process Principles Part I – CBS publications, New Delhi 1995 edition.
5. Richard M. Felder, Ronald W. Rousseau, Lisa G. Bullard, Elementary Principles of Chemical Processes, 4th edition, 2011, John Wiley & Sons

Course Outcomes:

After completion of course student will be able to

CO1: Apply the fundamental concepts of First law of thermodynamics to engineering applications.
CO2: Understand, analyze and apply the Second law of thermodynamics, concept of Entropy to engineering applications.
CO3: Derive the fundamental equations govern the estimation of solution properties.
CO4: Understand the concepts of various Refrigeration cycles.
CO5: Understand the principle of equilibrium conversion in reversible reactions at given pressure and temperature following rigorous thermodynamic method and Vant's Hoeff method.

Kurudy


Dr. Anjani K. Dwivedi
HEAD
Dept. of Chemical Engg.
Ujjain Engg. College, Ujjain (M.P.)

BE III SEMESTER CHEMICAL ENGINEERING							
COURSE CONTENTS							
LM3303	Fluid Mechanics	L	T	P	C	Max. Marks	Min. Marks
Duration	3 Hours	3	0	2	4	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, Laminar flow of incompressible fluids in pipes and conduits. Shear stress and velocity distribution – maximum and average velocity- Hagen Poiseuille and Darcy Wiesbach equation, Definition of Friction factor on Reynolds number in laminar flow. Turbulent flow of incompressible fluids in pipes and conduits.

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. Fluid machinery: pumps, fans, blowers, compressor & vacuum pumps. Power and head requirement for pumps.

Suggested Readings:

1. W.L. McCabe & I.C. Smith–Unit Operations in Chemical Engineering. 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.

Course Outcomes:

After completion of course student will be able to

CO1: Understand the fundamental properties of fluid and its characteristics under static condition
CO2: Analyze fluid (Newtonian and Non-Newtonian) system with general energy equations and to calculate change in fluid flow in circular and non-circular pipes.
CO3: Assess the validity of Bernoulli's equation for various fluid flow system.
CO4: Develop empirical correlation using dimensionless analysis.
CO5: Understand and select the flow measuring devices and other fluid machineries.

[Signature]

Dr. Anjani K. Dwivedi
HEAD
Dept. of Chemical Engg.
Munir Engg. College, Bilain (M.P.)

BE III SEMESTER CHEMICAL ENGINEERING							
COURSE CONTENTS							
CM3304	Inorganic Process Technology	L	T	P	C	Max. Marks	Min. Marks
Duration	3 Hours	3	0	2	4	70	22

Unit I

Chlor-Alkalies: Salts and Sodium compounds, Soda ash, Caustic Soda, Chlorine and potassium salts.

Unit II

Acids and Phosphates: Hydrochloric acid, Sulphur and sulfuric acid, Phosphoric acid and phosphates.

Unit III

Nitrogenous Fertilizers: Nitrogenous Industries, Ammonia and Nitric acid, Nitrogenous fertilizer, mixed fertilizers, N-P-K Fertilizers and micronutrients.

Unit IV

Cement and Ceramics: Types and manufacture of Portland cement, Manufacture of glasses and special glasses, Ceramics: Refractories and its classification. Industrial gases: Nitrogen, Oxygen, Hydrogen, Carbon dioxide and Acetylene.

Unit V

Inorganic chemicals and Paints: Inorganic chemicals namely Bromine, Iodine and Fluorine, Alumina and Aluminum chloride, Manufacture of paints - Pigments

Suggested Readings:

1. Austine G.T. – SHREEVES CHEMICALS PROCESS INDUSTRIES – 5th Ed., Mc GrawHill 1984
2. Dryden C.E., M. Gopala Rao – OUTLINES OF CHEMICAL TECHNOLOGY – 3rd Ed. Affiliated East – West Press, New Delhi.
3. Pandey G.N. – CHEMICAL TECHNOLOGY VOLUME – I – Lion Press, Kanpur.

Course Outcomes:

After completion of course student will be able to

CO1: Basic understanding of manufacturing of chlor alkali products as per industrial trends
CO2: Desirable exposure of making acids, phosphates and their applications.
CO3: Familiarity with commercial manufacture of nitrogenous fertilizers with capability to solve practical problems
CO4: Confidence in commercial process of making cement and ceramics with a possibility to reduce air pollution
CO5: Knowledge of raw materials and processing details of inorganic chemicals and paints with exposure to industrial challenges

[Signature]

[Signature]

Dr. Anjan K. Dwivedi
HEAD
Dept. of Chemical Engg.
Ujjain Engg. College, Ujjain (M.P.)