

# **SWAMI VIVEKANAND UNIVERSITY, SIRONJA, SAGAR (M.P.)**



## **SYLLABUS**

**For**

**B.Tech Petrochemical Engineering  
Course Code: BTPCE**

Department of Petrochemical Engineering  
Faculty of Engineering

Duration of Course : Four Year

Examination Mode : Semester

Examination System : Grading

Swami Vivekanand University, Sironja Sagar (M.P.)  
2013-2014



**Mathematics - I (BTPCE-0101)**

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		Max	Min	Max	Min	(h) = (e+f)									
BTPCE-0101	Mathematics - I	3	1	-	4	80	25	20	100	-	-	-	-	100	03 Hrs

**UNIT – I**

**Marks :16**

MATRICES Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties of eigen values – Caley – Hamilton theorem – Orthogonal reduction of a symmetric matrix to diagonal form – Orthogonal matrices – Reduction of quadratic form to canonical form by orthogonal transformations.

**UNIT – II**

**Marks :16**

DIFFERENTIAL CALCULUS Curvature – Cartesian and polar coordinates – Circle of curvature – Involutives and Evolutes – Envelopes – Properties of envelopes.

**UNIT – III**

**Marks :16**

FUNCTIONS OF SEVERAL VARIABLES Function of two variables – Partial derivatives – Total differential – Taylor’s expansion – Maxima and Minima – Constrained Maxima and Minima by Lagrangean Multiplier method – Jacobians

**UNIT – IV**

**Marks :16**

ORDINARY DIFFERENTIAL EQUATIONS Simultaneous first order linear equations with constant coefficients – Linear equations of second order with constant and variable coefficients – Homogeneous equation of Euler type – Equations reducible to homogeneous form

**UNIT – V**

**Marks :16**

THREE DIMENSIONAL ANALYTICAL GEOMETRY Direction cosines and ratios – Angle between two lines – Equation of a plane – Equation of a straight line – Coplanar lines – Shortest distance between skew lines – Sphere – Tangent plane – Plane section of a sphere – Orthogonal spheres.

**Text Books**

1. Grewal B.S, Higher Engg Maths, Khanna Publications, 38th Edition.,
2. Dr.V.Ramamurthy & Dr. Sundarammal Kesavan,” Engineering Mathematics” – Vol I & II Anuradha Publications, Revised Edition 2006.
3. Veerajan, T., Engineering Mathematics, Tata McGraw Hill Publishing Co., New Delhi,2000.

**Reference Books**

1. Kreyszig E, “Advanced Engineering Mathematics”, 8th edition, John Wiley & Sons. Singapore,2001.
2. Kandasamy P etal. “Engineering Mathematics”, Vol.I (4th revised edition), S.Chand &Co., New Delhi,2000.
3. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., “Advanced Mathematics for Engineering students”, Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.



**Fundamentals of Physics (BTPCE-0102)**

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		Max	Min	(d) = (a+c)	Max	Min	(h) = (e+f)			(i) = (d+h)					
		(a)	(b)		(c)	(e)		(f)	(g)						
BTPCE-0102	Fundamentals of Physics	3	1	2	6	80	25	20	100	50	15	50	100	200	03 Hrs

**UNIT – I**

**Marks :16**

WAVE OPTICS-I Interference- definition, types, explanation of interference, Interference by division of wave front: Fresnel's biprism, fringe width, Interference in thin films Wedge shaped films, Interference by division of amplitude: Newton's rings, Michelson's Interferometer and its applications.

**UNIT – II**

**Marks :16**

WAVE OPTICS-II Diffraction :- Introduction - Differences between Fresnel and Fraunhofer diffractions Single slit diffraction ( Qualitative and quantitative treatment) – Differences between interference and diffraction, resolving power of optical instruments (prism and grating). Polarization:- Introduction – double refraction –Negative crystals & Positive crystals - Nicol's prism – Quarter wave plate and half wave plate – Production and detection of circularly and elliptically polarised light.

**UNIT – III**

**Marks :16**

QUANTUM PHYSICS De Broglie's hypothesis, De Broglie's wave length, Davisson and Germer's experiment, Compton Effect, concept of wave packet & their properties, wave function & probability interpretation, Heisenberg's Uncertainty Principle, its elementary proof and applications, energy and momentum operators, time dependent and time independent Schrödinger wave equation. Application of time independent Schrödinger wave equation to particle trapped in a one dimensional square potential well.

**UNIT – IV**

**Marks :16**

**NUCLEAR PHYSICS**

General properties of nucleus, Nuclear model (liquid drop model and shell model), accelerator, linear particle accelerator, cyclotron, general betatron, Counters and particle detectors Geiger-Muller Counter, nuclear fission, nuclear fusion, nuclear reaction, nuclear reactors.

**UNIT – V**

**Marks :16**

**LASER AND FIBER OPTICS**

Laser: Stimulated and spontaneous processes, main part of laser, laser action population inversion, pumping, Optical resonators, characteristics of laser beam, Principles and working of Ruby, Nd:YAG, He-Ne & with energy level diagram and Applications of lasers Fiber Optics - Fundamental idea about optical fiber, types of fibers, acceptance angle & cone, numerical aperture, V-number, propagation of light through step index fiber (Ray theory) pulse dispersion, attenuation, losses, various uses, and application of optical fibers.



**Text Books**

1. Gaur and Gupta "Engineering Physics"
2. Tiwari and Navneet Gupta "Engineering Physics"
3. Vikram Yadav "Engineering Physics"

**Reference Books**

1. Beiser, "Modern Physics", McGraw-Hill Inc., New Delhi.
2. Avadhanulu and Kshirsagar "Engineering Physics".
3. Jenkins and White: "Optics", McGraw-Hill Book Company.
4. Sanjeev Puri: Modern Physics, Narosa Pub.Co. 2004.
5. Kaplan: Nuclear Physics, Narosa Publishing, 1987.
6. Tyagrajan and Ghatak: Lasers, Macmillan, 2001.

**List of Experiments**

1. Keiser: G Optical fiber Communication, McGraw-Hill, 2000.
2. Fresnel Biprism,
3. Newton's Rings,
4. Michelson's Interferometer.
5. Resolving Powers –Telescope,
6. Spectrometers-R.I., Wavelength, using prism and grating
7. Optical polarization based experiments: Brewster's angle, polarimeter etc.
8. Measurements of wavelength of LASER
9. To study the CRO.
10. Charging and discharging of capacitor
11. Other conceptual experiments related to theory syllabus



**Chemistry (BTPCE-0103)**

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		Max	Min	Max	Min										
		(a)	(b)	(c)	(d) = (a+c)	(e)	(f)	(g)	(h) = (e+f)	(i) = (d+h)					
BTPCE-0103	Chemistry	3	1	2	6	80	25	20	100	50	15	50	100	200	03 Hrs

**UNIT – I**

**Marks :16**

**TECHNOLOGY OF WATER**

Source of water, Impurities in water, Analysis of water- Hardness of water, Estimation of Hardness, Alkalinity of water, Determination of alkalinity, Disadvantages of using hard water in boiler- sludge and scale formation, Boiler corrosion, Water softening techniques (Internal and External treatment), treatment of water for domestic purposes.

**UNIT – II**

**Marks :16**

**CORROSION AND ITS CONTROL**

Corrosion: Basic concept- Principles, Mechanism of Dry or Chemical Corrosion and Wet or Electrochemical Corrosion, Pilling Bedworth rule, Types of corrosion- Galvanic corrosion, Concentration cell corrosion, Pitting corrosion, Stress corrosion, Microbiological corrosion, Factors influencing corrosion, Corrosion control.

**UNIT – III**

**Marks :16**

**A. FUELS**

Definition & Classification of fuels, Calorific values, Analysis of coal, Carbonization of coal, Manufacturing of coke & recovery of by products. Cracking, Knocking, Anti-knocking, Octane & Cetane number, Gaseous fuels.

**B. LUBRICANTS**

Introduction, functions & classification of lubricants, Mechanism of lubrication, Properties and Testing of lubricants.

**UNIT – IV**

**Marks :16**

**POLYMERS**

Introduction and classification of polymers, Types of polymerization: addition or chain polymerization, condensation polymerization, Mechanism of addition polymerization -Free radical and Ionic polymerization, Ziegler Natta polymerization, Vulcanization of rubbers, Preparation, Properties and Applications of important polymers- Polyethylene, PVC, PMMA, Nylons, Terylene, Glyptal, Bakelite, Urea-formaldehyde, Silicone resin, Neoprene, Buna S, Buna N.

**UNIT – V**

**Marks :16**

**INSTRUMENTATIONAL METHODS OF CHEMICAL ANALYSIS**

Introduction to Spectroscopy, Electromagnetic spectrum, Introduction, Principle, Instrumentation and Application of IR, UV- Visible, NMR, Basic Principle and Instrumentation of Potentiometry, Flame photometry and Chromatography.

**Text Books**

1. Jain.P.C and Monika Jain, Engineering Chemistry, Danpat Raj publishing company (P) Ltd, New Delhi – 2002.
2. Dara.S.S, Text book of Engineering Chemistry, S. Chand & Company Ltd, New Delhi
3. Sharma B.K., “Instrumental methods of chemical analysis” 24th Edition Krishna Prakashan Media Pvt. Ltd, Meerut, 2005.



### **Reference Books**

1. Kuriacose J.C. and Rajaram J. Chemistry in Engineering and Technology, Volume II, Tata McGraw Hill p.b. Co., 1988.
2. Jeyalakshmi.R & Ramar. P, Engineering Chemistry, 1st Edition, Devi Publications, Chennai 2006.
3. Rattan S., Text book of Engineering Chemistry, S.K. Kataria and Sons, Publication, 1st Edition, New Delhi, 2012

### **List of Experiments**

1. Preparation of standard solutions.
2. Conductometric titration-determination of strength of an acid.
3. Determination of alkalinity, hydroxyl, carbonate and bicarbonate in water.
4. Determination of total hardness in water using EDTA titrations.
5. Estimation of iron by potentiometer.
6. Estimation of Copper in Ore
7. Determination of viscosity of lubricating oil with change of temperature by
  - a. Red Wood Viscometer Number 1
  - b. Red Wood Viscometer Number 2
8. Determination of Flash and Fire point of liquid fuel and lubricants by
  - a. Cleaveland's Open Cup Method
  - b. Abel's Flash Point Apparatus
  - c. Pensky Martin's Flash Point Apparatus.
9. Determination of Cloud and Pour point of lubricants by Cloud and Pour point Apparatus.
10. Determination of carbon residue of lubricants by Conradson's Apparatus.

### **REFERENCE BOOKS FOR PRACTICAL**

1. Chemistry department manual, Edition, 2008.
2. Chawla S., Theory and Practicals of Engineering Chemistry, Dhanpat Rai & Co. (Pvt.) Ltd. 6th Edition, New Delhi – 2011.



**Basic Engg.- I (BTPCE-0104)**

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		Max	Min	Max	Min	(h) = (e+f)	(i) = (d+h)								
		(a)	(b)					(c)	(d) = (a+c)	(e)	(f)	(g)			
BTPCE-0104	Basic Engg.- I	3	1	2	6	80	25	20	100	50	15	50	100	200	03 Hrs

**UNIT – I**

**Marks :16**

**AC & DC CIRCUITS**

Circuit parameters, Ohms law, Kirchhoff’s law. Average and RMS values, concept of phasor representation, RLC series circuits and series resonance, RLC parallel circuits (includes simple problems in DC & AC circuits) Introduction to three phase systems – types of connections, relationship between line and phase values.

**UNIT – II**

**Marks :16**

**MAGNETIC CIRCUITS**

Definition of mmf, flux and reluctance, leakage flux, fringing, magnetic materials and B-H relationship. Problems involving simple magnetic circuits. Faraday’s laws, induced emfs and inductances, brief idea on Hysteresis and eddy currents.

**UNIT – III**

**Marks :16**

**ELECTRICAL MACHINES**

Working principle, construction and applications of DC machines and AC machines (single phase transformers, single phase induction motors – split phase, capacitor start and capacitor start & run motors).

**UNIT – IV**

**Marks :16**

**DIGITAL ELECTRONICS**

– Number system, Boolean Theorems, DeMorgan’s Theorem, Logic gates, Implementation of Boolean expression using logic gates, Half adder, Full adder. Electronic Components – Resistors, Inductors and Capacitors and their types. CRO.

**UNIT – V**

**Marks :16**

**SEMICONDUCTOR** – Energy band diagram, Intrinsic and Extrinsic semi conductors, PN Junction diode, Zener diode and their V-I characteristics , Zener diode used as a Voltage regulator, Light emitting diode and Photo diode. Rectifier – Half wave and full wave Rectifier and their efficiency and ripple factor, Filters.

**Text Books**

1. Vincent Del Toro, Electrical Engineering Fundamentals, PHI Learning, II Edition
2. S.Ghosh, Fundamentals of Electrical and Electronics Engineering, PHI, II Edition.
3. Millman, Halkias & Parikh, Integrated Electronics, Mc Graw Hill, II Edition
4. Nagrath & Kothari, Basic Electrical Engineering, III Edition TMH.
5. Mehta V.K., Principals of Electronics, S. Chand & Co.
6. Moris Mano, Digital Electronics, PHI Pub.
7. Kalsi H.s. , Electronics Instrumentation, ISTE Pub.



### **Reference Books**

1. Kothari D. P and Nagrath IJ, Basic Electrical Engineering, Tata McGraw- Hill, 1991.
2. Thomas L.Floyd Electronic devices, Addison Wesley Longman (Singapore) Pvt . Ltd., 5th Edition.
3. Nagrath & Kothari, Basic Electrical Engineering, III Edition TMH.
4. Mehta V.K., Principals of Electronics, S. Chand & Co.

### **List of Experiments**

1. Study of KVL and KCL.
2. Study of Transformer, name plate rating, determination of rayio and polarity.
3. Determination of equivalent circuit parameters of a single phase transformer by O.C. and S.C. tests and estimation of voltage regulation and efficiency at various loading conditions and verification by load test.
4. Identification and testing of different Electronics components.
5. Observing input and output waveforms of rectifiers.
6. Verification of truth table for various gates.
7. To study the V-I characteristics of PN diode and Zener Diode.
8. To implement basic logic gate by using universal gate(NAND & NOR).
9. Measurement of frequency and time period of a signal using CRO.





**Computer Lab (BTPCE-0105)**

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		L	T	P	C	Max	Min	(c)	(d) =	Max	Min	(g)	(h) =	(i) =	
		(a)	(b)	(e)	(f)	(e+f)	(d+h)								
BTPCE-0105	Computer Lab	-	-	2	2	-	-	-	-	-	-	50	50	50	

**PURPOSE**

This Lab Course will enable the students to understand the basics of computer and to know the basics of MSOffice.

**INSTRUCTIONAL OBJECTIVES**

1. To learn the basics of computer, Computer Peripherals and its application in real world.
2. Demonstration on Ms-Word, Ms-Excel, Ms-Power Point and Ms-Access

**Text Books**

1. Introduction to Information Technology IITL Education Solutions Ltd., Pearson 2nd Edition, 2006.

**List of Experiments**

1. Study experiment on evolution of computer programming languages.
2. Suggest some of the Network Topologies that can be incorporated in your campus. Justify your choice.
3. Experiments to demonstrate directory creation and file creation.
4. Create a document with all formatting effects.
5. Create a document with tables.
6. Create labels in MS word.
7. Create a document to send mails using mail merge option.
8. Create an Excel File to analyze the student’s performance. Create a chart for the above data to depict it diagrammatically.
9. Create Excel sheet to use built-in-function like sum, count, countif ,if, etc.
10. Create Excel sheet to maintain employee information and use this data to send mails using mail merge.
11. Create a Power Point presentation for your personal profile with varying animation effects with timer.
12. Consider student information system which stores student personal data, mark information and non-academic details.
  - \* Use MS Access to create Tables and execute SQL queries to do this following
  - \* Display all student records.
  - \* Display student details with respect to his identity.
  - \* Delete some records from the table.
  - \* Find total marks obtained by student in each list.



## Workshop Practice (BTPCE-0106)

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		Max	Min	Max	Min	(d) =	(h) =			(i) =					
		(a)	(b)	(c)	(a+c)	(e)	(f)	(g)	(e+f)	(d+h)					
BTPCE-0106	Workshop Practice	-	-	2	2	-	-	-	-	50	15	50	100	100	

### PURPOSE

To provide the students with hands on experience on different trades of engineering like fitting, carpentry, smithy, welding and sheet metal.

### INSTRUCTIONAL OBJECTIVES

To familiarize with

1. The basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy.
2. The production of simple models in the above trades.

### Text Books

1. Gopal, T.V., Kumar, T., and Murali, G., A first course on workshop practice – Theory, practice and work book, Suma Publications, 2005.

### Reference Books

1. Kannaiah, P. & Narayanan, K.C. Manual on Workshop Practice, Scitech Publications, Chennai, 1999.
2. Venkatachalapathy, V.S. , First year Engineering Workshop Practice, Ramalinga Publications, Madurai, 1999.

### List of Experiments

1. EMPHASIS TO BE LAID ON REAL LIFE APPLICATIONS WHEN FRAMING THE EXERCISES.
2. FITTING  
Tools & Equipments – Practice in Filing and Drilling.  
Making Vee Joints, Square, dovetail joints, Key Making.
3. CARPENTRY  
Tools and Equipments- Planning practice. Making Half Lap, dovetail, Mortise & Tenon joints, a mini model of a single door window frame.
4. SHEET METAL  
Tools and equipments - Fabrication of a small cabinet, Rectangular Hopper, etc.
5. WELDING  
Tools and equipments - Arc welding of butt joint, Lap Joint, Tee Fillet.  
Demonstration of Gas welding, TIG & MIG.
6. SMITHY  
Tools and Equipments –Making simple parts like hexagonal headed bolt, chisel.



**English (BTPCE-0107)**

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		Max	Min	(d) = (a+c)	Max	Min	(h) = (e+f)			(i) = (d+h)					
		(a)	(b)		(c)	(e)		(f)	(g)						
BTPCE-0107	English	3	1	-	4	80	25	20	100	-	-	-	-	100	03 Hrs

**UNIT – I**

**Marks :16**

**LANGUAGES AND SKILLS OF COMMUNICATION**

Linguistic Techniques, Reading Comprehension, Phonetic symbols/signs, Oral Presentation, Process of communication, Verbal and non-verbal Communication, Barriers of communication

**UNIT – II**

**Marks :16**

**APPLICATION OF LINGUISTIC ABILITY**

Definitions of Engineering terms, objects, processes & principles ,Paragraph Writing on topics of General Interest, Importance of Listening Skills, Unseen Passage, Conversational Dialogues

**UNIT – III**

**Marks :16**

**LETTER WRITING**

Applications, Enquiry & Complaint letters, Calling & Sending quotations, Placing orders, Tenders.

**UNIT – IV**

**Marks :16**

**PRECISE WRITING**

Slogan – Writing, Technical Description of Simple engineering objects & processes, Note – making.

**UNIT – V**

**Marks :16**

**REPORT WRITING**

Observation Report, Survey Report, Report of Trouble, Laboratory Report, Project Report, Telephonic Etiquettes, Debate, Speech.

**Text Books**

1. Abraham Benjamin Samuel Practical Communication Communicative English LSRW2000 – SRMEC –June 2006 Revised Edition.
2. Staff of the Department of Humanities and Social Science, Anna University, “English for Engineers /Technologist Vol.-I”. Orient Longman, 1990.

**Reference Books**

1. Herbert. A. J. The structure of Technical English Orient Longman 1995.
2. Pickett and Laster, ‘Technical English, Writing, Reading and Speaking’, New York Harper and Row Publications, 1997.
3. Interactive course in phonetics and spoken English published by Acoustics Engineers (ACEN) 2002.



## Project - I (BTPCE-0108)

Course Code	Title of the paper	Period Per Week				Distribution of Marks							Grand Total	Duration of Exam	
						Theory		MST	Total	Practical		TW			Total
		Max	Min	(d) = (a+c)	Max	Min	(h) = (e+f)			(i) = (d+h)					
		(a)	(b)		(c)	(e)		(f)	(g)						
BTPCE-0108	Project - I	-	-	4	4	-	-	-	-	-	-	50	50	50	

The objectives of the course 'Project work' are

1. To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses.
2. To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems.
3. To give students an opportunity to do some thing creative and to assimilate real life work situation in institution.
4. To adapt students for latest developments and to handle independently new situations.
5. To develop good expressions power and presentation abilities in students.

The faculty and student should work according to following schedule:

- i) Each student undertakes substantial and individual project in an approved area of the subject and supervised by a member of staff.
- ii) The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty
- iii) At all the steps of the project, students must submit a written report of the same.



**Mathematics - II (BTPCE-0201)**

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		Max	Min	Max	Min	(h) =	(i) =								
		(a)	(b)	(c)	(d) = (a+c)	(e)	(f)	(g)	(e+f)	(d+h)					
BTPCE-0201	Mathematics - II	3	1	-	4	80	25	20	100	-	-	-	-	100	03 Hrs

**UNIT – I**

**Marks :16**

Laplace Transform: Introduction of Laplace Transform, Laplace Transform of elementary functions, properties of Laplace Transform, Change of scale property, second shifting property, Laplace transform of the derivative, Inverse Laplace transform & its properties, Convolution theorem, Applications of L.T. to solve the ordinary differential equations

**UNIT – II**

**Marks :16**

Fourier Series: Introduction of Fourier series , Fourier series for Discontinuous functions, Fourier series for even and odd function, Half range series Fourier Transform: Definition and properties of Fourier transform.

**UNIT – III**

**Marks :16**

Second Order linear differential equation with variable coefficients : Methods one integral is known, removal of first derivative, changing of independent variable and variation of parameter, Solution by Series Method.

**UNIT – IV**

**Marks :16**

Linear and Non Linear partial differential equation of first order: Formulation of partial differential equations, solution of equation by direct integration, Lagrange’s Linear equation, charpit’s method. Linear partial differential equation of second and higher order: Linear homogeneous and Non homogeneous partial diff. equation. Separation of variable method for the solution of wave and heat equations.

**UNIT – V**

**Marks :16**

Vector Calculus: Differentiation of vectors, scalar and vector point function, geometrical meaning of Gradient, unit normal vector and directional derivative, physical interpretation of divergence and Curl. Line integral, surface integral and volume integral, Green’s, Stoke’s and Gauss divergence theorem.

**Text Books**

1. Grewal B.S, Higher Engg Maths, Khanna Publications, 38th Edition., Veerajan, T., Engineering

**Reference Books**

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India
2. Higher Engineering Mathematics by BS Grewal, Khanna Publication
3. Advance Engineering Mathematics by D.G.Guffy



**Material Physics (BTPCE-0202)**

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		L	T	P	C	Max	Min	(c)	(d) =	Max	Min	(g)	(h) =	(i) =	
		(a)		(b)		(a+c)	(e)		(f)		(e+f)		(d+h)		
BTPCE-0202	Material Physics	3	1	2	6	80	25	20	100	50	15	50	100	200	03 Hrs

**UNIT – I**

**Marks :16**

**STRUCTURE OF MATERIALS**

Type of solids, Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – Bragg's law X-ray diffraction for crystal structure.

**UNIT – II**

**Marks :16**

**SEMICONDUCTING MATERIALS**

Introduction, intrinsic and extrinsic semiconductors, carrier concentration in intrinsic semiconductors, carrier concentration in n type semiconductors, carrier concentration in p-type semiconductors, Hall effect and its applications - variation of carrier concentration with temperature, conductivity of extrinsic semiconductor, P-N junction – forward bias – reverse bias –V-I characteristics of a p-n junction. Basic introduction of transistors.

**UNIT – III**

**Marks :16**

**DIELECTRIC MATERIALS**

Introduction, Fundamental definitions, Local field, Clausius- Mossotti relation, different types of electric polarization (dipolar, ionic and electronic polarizations), frequency and temperature effects on polarization, dielectric loss, dielectric breakdown, determination of dielectric constant, properties and different types of insulating materials, ferroelectric materials, spontaneous polarization in BaTiO<sub>3</sub>, electrets.

**UNIT – IV**

**Marks :16**

**MAGNETIC & SUPERCONDUCTING MATERIALS**

**MAGNETIC MATERIALS** Concept of magnetism- Dia, para, ferro magnetic materials · Hysteresis loop· Soft and hard magnetic material· magnetic Storages application of magnetic materials

**SUPERCONDUCTING MATERIALS** Introduction – basic theories for superconductivity Meissner effect - Properties of superconductors - Type-I and Type-II superconductors – High T<sub>c</sub> superconductors – application.

**UNIT – V**

**Marks :16**

**NANO MATERIALS**

Introduction to nano science, nano materials synthesis of nano materials (using different routes) properties of nano materials, carbon nano tubes, application of nano materials.



**Text Books**

1. Gaur and Gupta "Engineering Physics"
2. Tiwari and Navneet Gupta "Engineering Physics"
3. Vikram Yadav "Engineering Physics"
4. Materials Science'. By Dr. M. Arumugam.

**Reference Books**

1. Beiser, "Modern Physics", McGraw-Hill Inc., New Delhi.
2. Avadhanulu and Kshirsagar "Engineering Physics".
3. Azroff: Solid State Physics, Tata McGraw-Hill, 2004.
4. Materials Science'. By Dr. M. Arumugam.
5. Science of Engg. Materials and Carbon Nano tubes- C. M. Shrivastava and C. Srinivasan

**List of Experiments**

1. Uses of Potentiometers and Bridges (Electrical)
2. Experiments connected with diodes
3. Experiments connected with transistor.
4. Measurement of energy band gap of semiconductor.
5. To study Hall effect.
6. To study Solar cell.
7. To study the LED
8. Other conceptual experiments related to theory syllabus.



**Energy & Environment Science (BTPCE-0203)**

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		Max	Min	(d) = (a+c)	Max	Min	(h) = (e+f)			(i) = (d+h)					
		(a)	(b)		(c)	(e)		(f)	(g)						
BTPCE-0203	Energy & Environment Science	3	1	-	4	80	25	20	100	-	-	-	-	100	03 Hrs

**UNIT – I**

**Marks :16**

**ENERGY**

Energy, Energy scenario in world and India, Sources of energy, Renewable and nonrenewable sources of energy, Advantages and disadvantages of different sources of energy- Fossil fuel, Coal, Oil, Gas, Nuclear, Solar, Wind, Geothermal, Hydel, Hydrogen and Ocean energy.

**UNIT – II**

**Marks :16**

**ENVIRONMENT AND ECOSYSTEM**

Ecology and ecosystem, Structure and types of an ecosystem, Food chain and food web, segment of Environment-Atmosphere, Hydrosphere, Lithosphere, Biosphere, Cycles in ecosystem- Gaseous, Sedimentary and Water.

**UNIT – III**

**Marks :16**

**ENVIRONMENTAL POLLUTION-I**

Introduction, Air Pollution, Lapse Rate and Inversion Temperature, Air Pollutants, Classification of Air Pollutants, Causes of air pollution, Adverse effect of air pollution, Acid rain, Global warming, Chemical & photochemical smog and Ozone layer depletion, Control of Air Pollution.

**UNIT – IV**

**Marks :16**

**ENVIRONMENTAL POLLUTION-II**

Water Pollution, Classification of water pollutants, Characteristics of waste water, Waste water treatment- Primary, Secondary and Tertiary, Eutrophication, Soil or and Pollution, Radioactive Pollution, Noise Pollution

**UNIT – V**

**Marks :16**

**ENVIRONMENTAL PROTECTION AND WASTE MANAGEMENT**

Solid waste management, Treatment and disposal methods, important environmental protection act in India- water, air (prevention and control of pollution) act, Wild life conservation and forest act, Functions of central and state pollution control boards, Environmental impact assessment.

**Text Books**

1. Sharma.B.K. and Kaur, Environmental Chemistry, Goel Publishing House, Meerut, 1994.
2. De A.K., Environmental Chemistry, New Age International Pvt. Ltd., New Delhi, 1996.
3. Kurian Joseph & R. Nagendran, Essential of Environmental Studies, Pearson Education, 2004.

**Reference Books**

1. Dara S.S., A Text Book of Environmental Chemistry and pollution contro, S.Chand & Company Ltd., New Delhi, 2004.
2. Jeyalakshmi.R, Principles of Environmental Science, 1st Edition, Devi Publications, Chennai 2006.
3. Kamaraj.P & Arthanareeswari.M, Environmental Science – Challenges and Changes, 1st Edition,Sudhandhira Publications, 2007.





**Basic Engg.- II (BTPCE-0204)**

Course Code	Title of the paper	Period Per Week				Distribution of Marks								Grand Total	Duration of Exam
						Theory		MST	Total	Practical		TW	Total		
		Max	Min	Max	Min	(d) =	(h) =			(i) =					
BTPCE-0204	Basic Engg.- II	3	1	2	6	80	25	20	100	50	15	50	100	200	03 Hrs

**UNIT – I**

**Marks :16**

Building Materials & Construction Stones, bricks, cement, lime, timber-types, properties, test & uses, laboratory tests concrete and mortar Materials: Workability, Strength properties of Concrete, Nominal proportion of Concrete preparation of concrete, compaction, curing. Elements of Building Construction, Foundations conventional spread footings, RCC footings, brick masonry walls, plastering and pointing, floors, roofs, Doors, windows, lintels, staircases – types and their suitability

**UNIT – II**

**Marks :16**

Surveying & Positioning:  
Introduction to surveying Instruments – levels, theodolites, plane tables and related devices. Electronic surveying instruments etc. Measurement of distances – conventional and EDM methods, measurement of directions by different methods, measurement of elevations by different methods. Reciprocal leveling.

**UNIT – III**

**Marks :16**

Engineering Mechanics  
Forces and Equilibrium: Graphical and Analytical Treatment of Concurrent and non concurrent Co- planner forces, free Diagram, Force Diagram and Bow’s notations, Application of Equilibrium Concepts: Analysis of plane Trusses: Method of joints, Method of Sections. Frictional force in equilibrium problems. Centre of Gravity and moment of Inertia: Centroid and Centre of Gravity, Moment Inertia of Area and Mass, Radius of Gyration, Introduction to product of Inertia.

**UNIT – IV**

**Marks :16**

Measurement  
Temperature, pressure, velocity, flow, strain, force and torque measurement, concept of measurement error & uncertainty analysis, measurement by Vernier caliper, micrometer, dial gauges, slip gauges, sine-bar and combination set; introduction to lath, drilling, milling and shaping machines.

**UNIT – V**

**Marks :16**

Reciprocating Machines  
Thermodynamics: First and second law of thermodynamics; steam properties, steam processes at constant pressure, volume, enthalpy & entropy, Steam engines, hypothetical and actual indicator diagram; Carnot cycle and ideal efficiency; Otto and diesel cycles; working of two stroke & four stroke petrol & diesel IC engines.



**Text Books**

1. Raju K.V.B., Ravichandran P.T., Basics of Civil Engineering, Ayyappa Publications, Chennai, 2000.
2. Ramesh Babu, Civil Engineering, VRB Publishers, Chennai, 2000.
3. Kumar, T., Leenus Jesu Martin., and Murali, G., Basic Mechanical Engineering, Suma Publications, Chennai, 2007.
4. Prabhu, T. J., Jai Ganesh, V., Jebaraj, S., Basic Mechanical Engineering, Scitech Publications, Chennai, 2000.

**Reference Books**

1. Rangwala,S.C., Engineering Materials, Charotar Publishing House, Anand,
2. National Building Code of India, Part V, Building Materials, 2005
3. Surendra Singh, Building Materials, Vikas Publishing Company, New Delhi
4. Prabhu, T. J., Jai Ganesh, V., Jebaraj, S., Basic Mechanical Engineering, Scitech Publications, Chennai, 2000.
5. Palanichamy, M.S., Basic Civil & Mechanical Engineering, Tata McGraw-Hill , New Delhi 1991.
6. Nagpal G. R., Power Plant Engineering, Khanna Publisher, Delhi,2004













**Mathematics III (BTPCE-0301)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E-0301	Mathematics-III	3	1	-	4	80	25	20	100	-	-	-	-	100	3 hrs

**UNIT- I**

**Marks : 16**

**FOURIER SERIES**

Fourier Series : Introduction of Fourier series, Fourier series for Discontinuous functions, Fourier series for even and odd function, Half range series Fourier Transform: Definition and properties of Fourier transform, Sine and Cosine transform.

**UNIT- II**

**Marks : 16**

**SECOND ORDER DIFFERENTIAL EQUATIONS**

Second Order linear differential equation with variable coefficients : Methods one integral is known, removal of first derivative, changing of independent variable and variation of parameter, Solution by Series Method

**UNIT- III**

**Marks : 16**

**PARTIAL DIFFERENTIAL EQUATIONS**

Linear and Non Linear partial differential equation of first order: Formulation of partial differential equations, solution of equation by direct integration, Lagrange's Linear equation, charpit's method. Linear partial differential equation of second and higher order: Linear homogeneous and non homogeneous partial diff. equation of nth order with constant coefficients. Separation of variable method for the solution of wave and heat equations.

**UNIT- IV**

**Marks : 16**

**COMPLEX ANALYSIS**

Functions of complex variables : Analytic functions, Harmonic Conjugate, Cauchy-Riemann Equations, Line Integral, Cauchy's Theorem, Cauchy's Integral Formula, Singular Points, Poles & Residues, Residue Theorem , Application of Residues theorem for evaluation of real integrals

**UNIT- V**

**Marks : 16**

**PROBABILITY**

Concept of Probability: Probability Mass function, Probability density function. Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution ,Gamma Distribution ,Beta Distribution ,Testing of Hypothesis: Students t-test, Fisher's z-test, Chi-Square Method





**Text Books:**

1 Grewal B.S., “Higher Engineering Mathematics”, Fortieth Edition, Khanna Publishers, 2007.

**Reference Books**

1. Churchill R.V. and Brown J.W., “Fourier Series and Boundary Value Problems”, Fourth Edition, McGraw-Hill, 1987.
2. Veerarajan T., “Engineering Mathematics III”, Third Edition, Tata McGraw-Hill Education, 2007.
3. Kandasamy P., Thilagavathy K. and Gunavathy K., “Engineering Mathematics”, Vol-III, S. Chand & Company Ltd., 2007.



**Organic Chemistry (BTPCE-0302)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E-0302	Organic Chemistry	3	1	-	4	80	25	20	100	-	-	-	-	100	3 hrs

**UNIT- I**

**Marks : 16**

**ALIPHATIC HYDROCARBONS AND ALCOHOLS**

Alkanes – General methods of preparation – Physical and chemical properties – Alkenes – General methods of preparation – Physical and chemical properties – Markovnikov’s rule – Peroxide effect – Bayer’s test – Alkynes – General methods of preparation and properties monohydric alcohols – Saytzeff rule – Methods of distinguishing the three classes of alcohols – Lucas test – Dichromate test

**UNIT- II**

**Marks : 16**

**ALDEHYDES, KETONES AND ACIDS**

General methods of preparation – Physical and chemical properties – Aldol condensation – Clemmensen reduction – Wolf-Kishner reduction – Haloform reaction – Cannizzaro reaction – Reformatsky reaction – Wittig reaction – Saturated monocarboxylic acids – Methods of preparation – Physical and chemical properties – Hell-Volhard-Zelinsky reaction – Amino acids – Methods of preparation – Physical and chemical properties.

**UNIT- III**

**Marks : 16**

**CARBOHYDRATES**

Classification of carbohydrates – Monosaccharides – Reactions of glucose and fructose – Open chain and cyclic structures of glucose and fructose – Mutarotation – Epimerization – Killiani-Fisher synthesis – Ruff degradation – Conversion of aldoses to ketoses and ketoses to aldoses – Disaccharides – Properties and structure of sucrose – Polysaccharides – Properties and structure of starch and cellulose – Derivatives of cellulose – Carboxy methyl cellulose and gun cotton.

**UNIT- IV**

**Marks : 16**

**AROMATIC HYDROCARBON, AMINE AND DIAZONIUM SALT**

Benzene – Aromaticity – Huckel rule – General methods of preparation of benzene – Electrophilic substitution reactions – Directive effects of substituents – Aromatic amino compounds – General methods of preparation – Physical and chemical properties – Carbylamines reaction – Aryldiazonium salts – Preparation and synthetic applications.



**UNIT- V**

**Marks : 16**

**DYES AND DYEING**

Colour and constitution – Synthesis – Azodyes – Methyl orange – Methyl red and Congo red – Triphenylmethane dyes – Malachite green – Para-rosaniline – Alizarin – Eosin – Introduction to natural and reactive dyes.

**Text Books**

1. Morrison R.T. and Boyd R.N., “Organic chemistry”, Sixth Edition, Prentice Hall of India (P) Ltd., 2003.
2. Arun Bahl and Bahl B.S., “Advanced Organic Chemistry”, Sixteenth Edition, S.Chand & Company Ltd., 2002

**Reference Books**

1. Churchill R.V. and Brown J.W., “Fourier Series and Boundary Value Problems”, Fourth Edition, McGraw-Hill, 1987.
2. Veerarajan T., “Engineering Mathematics III”, Third Edition, Tata McGraw-Hill Education, 2007.
3. Kandasamy P., Thilagavathy K. and Gunavathy K., “Engineering Mathematics”, Vol-III, S. Chand & Company Ltd., 2007.



**Material Technology (BTPCE-0303)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E-0303	Material Technology	3	1		4	80	25	20	100	-	-	-	-	100	3 hrs

**UNIT- I**

**Marks : 16**

**NATURE OF MATERIALS**

Micro and macro structures – Properties and definitions – Mechanical, thermal, chemical, electrical and magnetic properties – Processing of metals and alloys – Casting – Hot and cold rolling – Extrusion – Forging – Deep drawing – Plastic deformation of metal – Single crystals and poly crystalline metals – Recovery and recrystallization of plastically deformed metals.

**UNIT- II**

**Marks : 16**

**FERROUS AND NON-FERROUS METALS**

Pure iron – Cast iron – Mild steel – Stainless steels – Special steels and alloys – High temperature steels – Iron carbide phase diagram – Heat treatment of plain steels – Carbon steels – Manufacture – Properties and application in chemical industries – Lead, tin and magnesium – Manufacturing methods – Properties and application in process industries

**UNIT- III**

**Marks : 16**

**POLYMERIC AND CERAMIC MATERIALS**

*Polymeric Materials:* Polymerization reactions – Industrial polymerization methods – Crystallinity and stereoisomerism in same thermoplastics – Thermosetting elastomers – Creep and fracture of polymeric materials – *Composite Materials:* Fibre – Reinforced – Plastic composite materials – Manufacturing methods – Concrete – Asphalt and asphalt mixtures – Wood – Sandwich structures – *Ceramic Materials:* Ceramic crystal and silicate structures – Processing of ceramics – Properties of glasses and enamels.

**UNIT- IV**

**Marks : 16**

**INORGANIC MATERIALS**

Manufacture of cement and its properties – Special cement – Cement concrete – Reinforced and prestressed concrete – Properties and applications – Mixing and curing.

**UNIT- V**

**Marks : 16**

**CORROSION AND COATING**



Basic theories and mechanism of corrosion – Types of corrosion – Application of corrosion theories in equipment design and fabrication – Anti-corrosion methods – Organic paints and coatings – Metal coatings – Ceramic coatings – Lining.

**TEXT BOOKS**

1. Van Vlack L.H., “Elements of Material Science and Engineering”, Sixth Edition, PrenticeHall, 1989.
2. Raghavan V., “Materials Science and Engineering: A First Course”, Fifth Edition, PrenticeHall of India (P) Ltd., 2004.

**REFERENCES**

1. William D. and Jr. Callister., “Materials Science and Engineering: An Introduction”, Seventh Edition, John Wiley & Sons, 2007.
2. Smith W F. and Hashemi J., “Foundations of Materials Science and Engineering” Third Edition, McGraw-Hill, 2003.
3. Clauser H.R., “Industrial and Engineering Materials ”, McGraw-Hill, 1975.



**INDUSTRIAL CHEMICAL TECHNOLOGY  
(BTPCE-0304)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d= a+c)	Practical		T W (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPCE -0304	Industrial Chemical Technology	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT I**

**Marks : 16**

**ALKALIES**

Chloro-alkali industries – Manufacture of Soda ash – Caustic Soda – Chlorine.

**UNIT II**

**Marks : 16**

**ACIDS**

Manufacture of Sulphuric acid – Hydrochloric acid – Phosphoric acid.

**UNIT III**

**Marks : 16**

**GLASSES**

Manufacture of glasses – Special glasses – Ceramics and Refractories – Paints and Pigments

**UNIT IV**

**Marks : 16**

**INDUSTRIAL GASES**

Carbon dioxide – Nitrogen – Hydrogen – Oxygen and acetylene.

**UNIT V**

**Marks : 16**

**FERTILIZERS**

Nitrogen fertilizers – Synthetic ammonia – Urea – Ammonium chloride – CAN – Ammonium sulphate – Phosphorous fertilizers – Phosphate rock – Super phosphate – Triple Super Phosphate – MAP and DAP – Potassium fertilizers – Potassium chloride – Potassium sulphate.

**TEXT BOOKS**

1. Austin G.T., “Shreve’s Chemical Process Industries”, Fifth Edition, McGraw Hill, 1998.
2. Gopala Rao M. and Sittig M., “Dryden’s Outlines of Chemical Technology for the 21<sup>st</sup> Century”, Third Edition, Affiliated East-West press, 2007.

**REFERENCES**

1. Shukla S.D. and Pandey G.N., “Text book of Chemical Technology” Vol-I, Vikas publishing house (P) Ltd.,1977.
2. Sharma B.K., “Industrial Chemistry”, Twelfth Edition, Goel Publishing house, 2001.
3. Pandey G.N., “Text Book of Chemical Technology” Vikas publishing house (P) Ltd., 1992.



**DATA STRUCTURES  
(BTPCE-0305)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E-0305	Data Structures	3	1	-	4	80	25	20	100	-	-	-	-	100	3 hrs

**UNIT- I** **Marks : 16**

**PROBLEM SOLVING**

Problem solving – Top-down Design – Implementation – Verification – Efficiency – Analysis – Sample algorithms.

**UNIT II** **Marks : 16**

**LISTS, STACKS AND QUEUES**

Abstract Data Type (ADT) – The List ADT – The Stack ADT – The Queue ADT.

**UNIT III** **Marks : 16**

**TREES**

Binary Trees – The Search Tree ADT – Binary Search Trees – AVL Trees – Tree Traversals – Hashing – General Idea – Hash Function – Separate Chaining – Open Addressing – Linear Probing – Priority Queues (Heaps) – Model – Simple implementations – Binary Heap.

**UNIT IV SORTING** **Marks : 16**

Insertion Sort–Shell Sort – Heap Sort – Merge Sort – Quick Sort – External Sorting.

**UNIT V** **Marks : 16**

**GRAPHS**

Topological Sort – Shortest Path Algorithms – Unweighted Shortest Paths – Dijkstra’s Algorithm – Minimum Spanning Tree – Prim’s Algorithm – Applications of Depth-First Search – Undirected Graphs – Biconnectivity – Introduction to NP Completeness.



**TEXT BOOKS**

1. Dromey R. G., “How to Solve it by Computer” (Chapters 1 -2), Prentice-Hall of India, 2002.
2. Weiss M.A., “Data Structures and Algorithm Analysis in C”, Second Edition, Pearson Education, 2002.

**REFERENCES**

1. Langsam Y. Augenstein M. J. and Tenenbaum A. M., “Data Structures using C”, Pearson Education, 2004
2. Gilberg R.F. and Forouzan B.A., “Data Structures - A Pseudocode Approach with C”, Thomson Brooks / COLE, 1998.
3. Aho J. E. Hopcroft and J. D. Ullman, “Data Structures and Algorithms”, Pearson education, 1983.
4. Harowitz, Sahani, Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, Universities Press, 2007.





**ORGANIC CHEMISTRY LABORATORY  
(BTPCE-0306)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E-0306	Organic Chemistry Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	3 Hrs

**List of Experiments**

1. Estimation of Alcohol
2. Estimation of Aldehydes & Ketones
3. Estimation of Phenol
4. Pigment Analysis
5. Ore/Alloys analysis
6. Estimation of Amines
7. Estimation of Glucose
8. Preparation of Asprin
9. Preparation of Methyl orange
10. Preparation of Schiff's base
11. Synthesis of Porphyrin
12. Qualitative analysis of simple Organic compounds.
13. Polymer Analysis
14. Hydrolysis of Sucrose.
15. Industrial Waste Water analysis

**Recommended books**

- 1 J. R. Chapman
2. V.K. Ahluwalia
3. Michael Edenborough
4. John Leonard, Barry Lygo, Garry Procter - 1994
5. Finar



**COMPUTER AIDED PROCESS  
CALCULATIONS(BTPCE-0307)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPCE -0307	Computer Aided Process Calculations	-	-	2	2	-	-	-	-	50	15	50	100	100	3 Hrs

1. Introduction to Microsoft Excel.
2. Basic Operations
3. Using function
4. Unit conversions of chemical process.
5. Material Balance solution using Excel.
6. Energy Balance Solution Using Excel.

**List of Experiments**

1. Calculation of multi variable equations.(i.e. gausseelimination method)
2. Problems related to flow measurement
3. Problems related to roults law and ideal gas equations.
4. Problems related to material balance (i.e stichiometry, crystallization etc)
5. Problems related to energy balance.

**Recommended books**

- 1 P.C.Sharma - 1999
2. J.Y.H. Fuh, M. W. Fu, A.Y.C. Nee - 2004
3. G. Halevi, R. Weill - 1995
4. S. K. Singh - 2004



**DATA STRUCTURES LABORATORY  
(BTPCE-0308)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g )		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPCE-0308	Data Structures Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	3 Hrs

**List of Experiments**

**Implement the following exercises using C**

1. Array implementation of List ADT
2. Linked list implementation of List ADT
3. Cursor implementation of List ADT
4. Array implementation of Stack ADT
5. Linked list implementation of Stack ADT
6. The following three exercises are to be done by implementing the following source files a. Program for ‘Balanced Paranthesis’
  - b. Array implementation of Stack ADT
  - c. Linked list implementation of Stack ADT
  - d. Program for ‘Evaluating Postfix Expressions’
 An appropriate header file for the Stack ADT should be included in (a) and (d)
  - I. Implement the application for checking ‘Balanced Paranthesis’ using array
  - II. Implementation of Stack ADT (by implementing files (a) and (b) given above)
- II. Implement the application for checking ‘Balanced Paranthesis’ using linked list implementation of Stack ADT (by using file (a) from experiment 1 and implementing file (c))
- III. Implement the application for ‘Evaluating Postfix Expressions’ using array and linked list implementations of Stack ADT (by implementing file (d) and using file (b) - and then by using files (d) and (c))
7. Queue ADT
8. Search Tree ADT – Binary Search Tree
9. Heap Sort
10. Quick Sort

**Recommended books:**

1. Duncan A. Buell - 2011
2. Peter Smith - 2004
3. Jeffrey S. Childs - 2008



**Self Study(Internal Assessment)  
(BTPCE-0309)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPCE-0309	Self Study(Internal Assessment)	-	-	2	2	-	-	-	-	-	-	100	100	100	3 Hrs



**Seminar  
(BTPCE-0310)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPCE-0310	Seminar	-	-	2	2	-	-	-	-	-	-	100	100	100	3 Hrs



**PHYSICAL CHEMISTRY (BTPCE0401)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0401	Physical Chemistry	3	1	-	4	80	25	20	100	-	-	-	-	100	3 hrs

**UNIT I GASEOUS STATE**

**Marks : 16**

Van der Waals equation – Law of equipartition principle – Translational, Rotational and vibrational energies of molecules – Joule-Thomson effect – liquefaction of gases – Critical constants.

**UNIT II CHEMICAL REACTION EQUILIBRIA**

**Marks : 16**

Law of Mass Action – Van't Hoff reaction isotherm – Standard free energy change – Le Chatelier's principle – Application to selected systems – Biological activity – The thermodynamics of ATP.

**UNIT III CHEMICAL KINETICS**

**Marks : 16**

Rate of reaction – Order – Molecularity – Integrated rate law – Kinetics of parallel and opposing reactions – Concept of activation energy – Arrhenius equation – Theory of absolute reaction rates – Kinetics of Enzyme catalyzed reactions.

**UNIT IV SOLUTIONS**

**Marks : 16**

Ideal and non-ideal solutions – Solubility of gases in liquids – Henry's law – Completely miscible liquids – Raoult's law – Vapour pressure and boiling point diagrams – Partially miscible liquids – Critical solution temperature – Completely immiscible liquids – Nernst distribution law – Dilute solution and their colligative properties – Molecular weight determination using these properties.

**UNIT V ELECTRICAL CONDUCTANCE**

**Marks : 16**

Electrolytes – Strong electrolytes and weak electrolytes – Arrhenius theory of electrolytic dissociation – Debye-Huckel Onsager theory – Ostwald's dilution law – Solubility of electrolytes and solubility product – Common ion effect – Acids – Bases – Definitions based on proton transference – Dissociation constant – Amphoteric electrolyte – pH – Buffer solutions.

**TEXT BOOKS**

1. Atkins P.W. and Paula J.D., "Physical Chemistry", Eighth Edition, W H Freeman & Company, 2006.
2. Puri B.R. and Sharma L.R., "Principles of Physical Chemistry", S.Chand & Company Ltd.,

**REFERENCES**

1. Mortimer R.G., "Physical Chemistry", Second Edition, Academic press, 2000.
2. Soni P.L., "Text Book of Physical Chemistry", S.Chand & Company Ltd., 1970.
3. Bahl B.S., Tuli G.D. and Arun Bahl., "Essentials of Physical Chemistry", S.Chand & Company Ltd., 1998.



**ENGINEERING THERMODYNAMICS  
(BTPCE0402)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks							Grand Total (i= d+h)	Duration of Exam	
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)			Total (h= e+g)
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0402	Engineering Thermodynamics	3	1	-	4	80	25	20	100	-	-	-	-	100	3 hrs

**UNIT I**

**Marks : 16**

**FUNDAMENTAL CONCEPTS AND FIRST LAW OF THERMODYNAMICS**

Scope of thermodynamics – Basic concepts – Thermodynamic System – State and equilibrium – Process and cycles – Temperature and Zeroth law of Thermodynamics – Properties of pure substances – First law of Thermodynamics – First Law Analysis of Closed systems and control volumes and its application.

**UNIT II**

**Marks : 16**

**ENTROPY AND THE SECOND LAW OF THERMODYNAMICS**

The Clausius inequality – Entropy – Causes of entropy change – Entropy change of pure substances – Thermal Energy reservoirs – Heat Engines – Perpetual Motion Machines – Reversible and irreversible processes – The Carnot cycle and principles – The Carnot Heat engine – The Second law Efficiency – Second law analysis of open and closed systems.

**UNIT III**

**Marks : 16**

**REFRIGERATION, VAPOR & COMBINED POWER CYCLES**

Refrigerators and Heat pumps – The Carnot refrigerator and heat pumps – The reversed Carnot cycle – Ideal and Actual vapor compression Refrigeration cycle – Selection of right refrigerants – Heat pumps – Absorption refrigerator system – The Carnot vapor cycle – Rankine cycle – Cogeneration – Second law analysis of vapor power cycles.

**UNIT IV**

**Marks : 16**

**PVT RELATIONS AND THERMODYNAMIC RELATIONS**

PVT relations for gases and liquids – equations of state, Cubic equations of state-Thermodynamic properties from equations of state, Compressibility factor, Generalised properties of fluids-Law of corresponding state, acentric factor, gas mixtures. Thermodynamic relations – Maxwell’s relations – Estimation of thermodynamic properties– Thermodynamic properties of homogeneous mixtures – Partial molar properties, Fugacity and fugacity coefficients – Lewis and Randall rule – Property changes of mixing, activity – Excess properties, activity coefficients.



**UNIT V**

**Marks : 16**

**PHASE EQUILIBRIA AND CHEMICAL REACTION EQUILIBRIA**

Phase equilibria – Pure component and mixtures – Van Laar, Margules equation, Group contribution method – Gibb's Duhem equation – Consistency tests – Partially miscible and immiscible systems – Azeotropes – Retrograde condensation – Thermodynamic diagrams. Chemical equilibria – Heat effects, industrial reactions – Free energy calculations – Homogeneous and heterogeneous reactions – Equilibrium composition.

**TEXT BOOKS**

1. J.M.Smith and Van Ness, "Introduction to Engineering Thermodynamics", Ed.5, McGraw Hill, New York, 1996.
2. K.V.Narayanan, "A Text Book of Chemical Engineering Thermodynamics", Prentice Hall of India, New Delhi, 2002.

**REFERENCES**

1. Hougen and Watson , "Chemical Process Principles" Vol. II, CBS Publishers, New Delhi.2002.
2. Kyle, "Chemical and Process Thermodynamics", Ed. 2. Prentice Hall of India, New Delhi.2000.
3. Y.V.C Rao, "Chemical Engineering Thermodynamics", Universities Press, 1997





**Process Calculations (BTPCE0403)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0403	Process Calculations	3	1	-	4	80	25	20	100	-	-	-	-	100	3 hrs

**UNIT I STOICHIOMETRY**

**Marks : 16**

Introduction – Units and Dimensions – Stoichiometric principles – Composition relations – Density and specific gravity.

**UNIT II IDEAL GASES AND VAPOR PRESSURE**

**Marks : 16**

Behavior of Ideal gases – Application of ideal gas law – Gaseous mixtures – Volume changes with change in composition – Vapor pressure – Effect of Temperature on vapor pressure – Vapor pressure plots – Vapor pressure of immiscible liquids – Solutions.

**UNIT III HUMIDITY AND SOLUBILITY**

**Marks : 16**

Humidity – Saturation – Vaporization – Condensation – Wet and dry bulb thermometry – Solubility and Crystallization – Dissolution – Solubility of gases.

**UNIT IV MATERIAL BALANCE**

**Marks : 16**

Material Balance – Processes involving chemical reaction – Combustion of coal, fuel gases and Sulphur – Recycling operations – Bypassing streams – Degree of conversion – Excess reactant – Limiting reactant.

**UNIT V ENERGY BALANCE**

**Marks : 16**

Thermo chemistry – Calculation of Heat of reaction at other temperatures – Hess’s law – heat of summation – Heat of formation – Heat of reaction – Heat of mixing – Heat of combustion – Mean specific heat – Theoretical flame Temperature.

**TEXT BOOKS**

1. Bhatt B.I. and Vora S. M., “Stoichiometry”, Fourth Edition, Tata McGraw Hill Publishers Ltd., 2005.
2. Hougen O.A., Watson K.M. and Ragatz R.A., "Chemical Process Principles", Vol-I, CBS Publishers and Distributors, 1995.

**REFERENCES**

1. Venkataramani V. and Anantharaman N., “Process calculations”, Prentice Hall of India (P) Ltd., 2003.
2. Himmelblau D., “Basic Principles and Calculations in Chemical Engineering”, Sixth Edition, Prentice Hall of India (P) Ltd., 2000.
3. Chohey N.P. and Hicks T.G., “Handbook of Chemical Engineering Calculations”, Second Edition, McGraw-Hill Inc., 1984.



**Mechanical Operations (BTPCE0404)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d= a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0404	Mechanical Operations	3	1	-	4	80	25	20	100	-	-	-	-	100	3 hrs

**UNIT I PROPERTIES OF FLUIDS AND CONCEPT OF PRESSURE**

**Marks : 16**

Introduction – Nature of fluids – Physical properties of fluids – Types of fluids – Fluid static- Pressure –Density – Height relationships – Pressure Measurement – Units and Dimensions – Dimensional analysis – Similarity – Forces arising out of physical similarity – Dimensionless numbers.

**UNIT II MOMENTUM BALANCE AND ITS APPLICATIONS**

**Marks : 16**

Kinematics of fluid flow – Stream line – Stream tube – Velocity potential – Newtonian and non- Newtonian fluids – Time dependent fluids – Reynolds number experiment and significance – Momentum balance – Forces acting on stream tubes – Potential flow – Bernoulli's equation – Correction for fluid friction – Correction for pump work.

**UNIT III FLOW OF INCOMPRESSIBLE FLUIDS THROUGH DUCTS**

**Marks : 16**

Flow of incompressible fluids in pipes – Laminar and turbulent flow through closed conduits – Velocity profile and friction factor for smooth and rough pipes – Head loss due to friction in pipes and Fittings – Introduction to compressible flow – Isentropic flow through convergent and divergent nozzles and sonic velocity.

**UNIT IV FLOW OF FLUIDS THROUGH SOLIDS**

**Marks : 16**

Form drag – Skin drag – Drag co-efficient – Flow around solids and packed beds – Friction factor for packed beds – Ergun's Equation – Motion of particles through fluids – Motion under gravitational and centrifugal fields – Terminal settling velocity – Fluidization – Mechanism – types – general properties – Applications.

**UNIT V TRANSPORTATION AND METERING**

**Marks : 16**

Measurement of fluid flow – Orifice meter – Venturi meter – Pitot tube – Rotameter – Weirs and notches – Wet gas meter and dry gas meter – Hot wire anemometers – Transportation of fluids – Fluid moving machinery – Performance – Selection and specification – Air lift and diaphragm pumps – Positive displacement pumps – Rotary and Reciprocating pumps – Centrifugal pumps – Performance and characteristics.

**TEXT BOOKS**

- McCabe W.L., Smith J.C. and Harriott P., "Unit operations of Chemical Engineering", Seventh Edition, McGraw-Hill, 2004.
- Coulson J.M., and Richardson J.F., "Coulson and Richardson's Chemical Engineering", Vol- , Third Edition, Butterworth – Heinemann Publishers, 2004.

**REFERENCES**

- Bansal R.K., "Fluid Mechanics and Hydraulic machines", Laxmi Publications (P) Ltd., 1995.
- Nevers N.D., "Fluid Mechanics for Chemical Engineers", McGraw-Hill, 1991.
- De Nevers L., "Fluid Mechanics for Chemical Engineers", McGraw-Hill, 1994.



**MECHANICAL OPERATIONS  
(BTPCE0405)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0405	MECHANICAL OPERATIONS	3	1	-	4	80	25	20	100	-	-	-	-	100	3 hrs

**UNIT I CHARACTERISTICS OF PARTICULATE SOLIDS, SIZE REDUCTION AND SCREENING** **Marks : 16**

Properties and characterization of particulate solids – Analysis, technical methods for measurement of size and surface area distribution of powder – Introduction to size reduction equipment – Determination of energy and power requirement in milling operations – Computer simulation techniques for mill performance – Mechanical classifiers – Screening equipment – Capacity and effectiveness.

**UNIT II FILTRATION** **Marks : 16**

Filtration equipments – Filtration media and filter aids – Principles of filtration and clarification – Estimation of filtration parameters for compressible and incompressible cakes and calculations – Centrifugal filtration equipment and principles of operation.

**UNIT III SETTLING AND SEDIMENTATION** **Marks : 16**

Separation based on the motion of particles through fluids – Gravity settling processes – Sedimentation – Kynch theory of sedimentation – Sedimentation thickeners – Rate of sedimentation and sedimentation zones in continuous thickeners – Design of thickeners and clarifiers – Principles of centrifugal sedimentation.

**UNIT IV AGITATION AND MIXING** **Marks : 16**

Agitation and mixing of liquids – Agitation equipment – Axial and radial flow impellers and flow patterns in agitated vessels – Prevention of swirling – Power consumption in agitated vessels – Blending and mixing – Dispersion operations – Mixing of solids and pastes – types of mixers.

**UNIT V STORAGE AND CONVEYING OF SOLIDS** **Marks : 16**

Storage and conveying of solids – Bins, Hoppers and silos – Flow out of bins – Design consideration of bins – Loading and unloading of solids – Bucket elevators – Apron conveyors – Belt conveyors – Types of belt conveyors – Selection considerations.



**TEXT BOOKS**

1. McCabe W.L., Smith J.C. and Harriott P., "Unit operations of Chemical Engineering", Seventh Edition, McGraw Hill, 2004.
2. Badger W.L., and Banchero J.T., "Introduction to Chemical Engineering", Tata McGraw Hill, 1997.

**REFERENCES**

1. Raymond A. Kulweic., "Materials Handling Handbook", Third Edition, Wiley-Interscience Publications, 1985.
2. Richardson J.F. and Harker J.H., "Coulson and Richardson's Chemical Engineering", Vol-II, Fourth Edition, Butterworth Heineman, 2004.
3. Bhattacharaya., "Mechanical Operations", Khanna publishers, 2001.



**PHYSICAL CHEMISTRY LABORATORY  
(BTPCE0406)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0406	Physical Chemistry Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	3 hrs

**List of Experiments**

1. Molecular weight determination of Polymer by using
  - a) Rast's Method
  - b) Viscometer
2. Partition Coefficient Studies  
For Benzene – Water system
3. Phase rule Studies  
Simple Eutectic system
4. Conductivity Studies
  - a) Precipitation Titration
  - b) Mixtures of acid – Strong Base Titration
5. EMF Studies  
Estimation of Fe<sup>2+</sup> by Potentiometric Titration
6. Kinetic Studies
  - a) Kinetic studies of Persulphate – Iodide reaction
  - b) Kinetic studies of Iodination of Acetone.
  - c) Determination of Rate constant of Acid catalyst hydrolysis of an Ester.
7. Polarimetry Studies - Kinetic study of Inversion of Cane sugar.
8. Adsorption Studies - Freundlich Adsorption Isotherm
9. Determination of Transition Temperature.
10. Determination of Critical solution temperature for the Phenol - Water system.
11. Determination of Saponification value of an oil.
12. To determine the moisture & volatile contents in a given coal sample by proximate analysis.
13. pH metric measurements
  - a) To prepare buffer solutions and standardization of pHmeter (pH4 and 9)
  - b) Determine the molarity of HCl by pH-metrically, using 0.1 M Sodium Hydroxide.

**Recommended books:**

1. B.P. Levitt Findlays Practical Physical Chemistry ( 9th.ed.)
2. Vogel's Text Book of Practical Organic Chemistry
3. Atkins, P.W. & Paula, J. Physical Chemistry



**FLUID FLOW OPERATIONS  
LABORATORY (BTPCE0407)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Mi n (f)				
BTPC E0407	Fluid Flow Operations Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	3 hrs

**List of Experiments**

1. To verify Hagen-Poiseuille Equation.
2. To relate Reynolds Number and Friction factor.
3. To study the effect of coil diameter on Friction factor.
4. To evaluate the performance of Centrifugal pump and Reciprocating Pump
5. To verify Ergun's equation.
6. To determine the discharge coefficient of Orifice meter, Venturimeter and Rotameter.
7. To evaluate the performance of Weirs and Notches.
8. To characterize the behavior of Fluidized bed.
9. Losses due to friction in pipe lines and fittings
10. Reynold's Apparatus
11. Bernoulli's Theorem Apparatus
12. Efflux time Apparatus.
13. Calibration Test Rig for Pitot Tube
14. Flow Through Pipes, Minor Losses due to sudden expansion, Sudden Contraction

**Recommended books:**

1. Roger C. Baker - 2005
2. T.S. Desmukh - 2001
3. Colt, J.E. Huguenin - 2002
4. Gustavo V. Barbosa-Canovas, Li Ma, Blas J. Barletta - 1997



**MECHANICAL OPERATIONS  
LABORATORY (BTPCE0408)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0408	MECHANICAL OPERATIONS LABORATORY	-	-	2	2	-	-	-	-	50	15	50	100	100	3 hrs

**List of Experiments**

1. Screen Effectiveness
2. Jaw Crusher and Smooth roll crusher
3. Ball Mill
4. Vacuum Leaf Filter
5. Plate and Frame Filter press
6. Batch Sedimentation
7. Cyclone Separator
8. Terminal settling velocity - Stokes law Verification.
9. Rod mill
10. Hammer Mill
11. Vibrating Screen
12. ContiniousThickener
13. Plate & Frame Filter press
14. Belt conveyor
15. Drop weight crusher
16. Beaker Decantation

**Recommended books**

1. Earl B. Smith - 1909
2. Fernand Dahan - 2000
3. Charles William Messersmith, Cecil Francis Warner - 1958
4. Robert A. OLSEN, Cecil Francis WARNER - 1958



**Self Study(Internal Assessment)  
(BTPCE-0409)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPCE-0409	Self Study(Internal Assessment)	-	-	2	2	-	-	-	-	-	-	100	100	100	3 Hrs





**Seminar  
(BTPCE-0410)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPCE-0410	Seminar	-	-	2	2	-	-	-	-	-	-	100	100	100	3 Hrs



**ENVIRONMENTAL SCIENCE AND  
TECHNOLOGY (BTPCE 0501)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d= a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0501	Environmental Science and Technology	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**

**Marks : 16**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers –energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values hot-spots of biodiversity –threats to biodiversity , endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

**UNIT- II POLLUTION**

**Marks : 16**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT- III NATURAL RESOURCES**

**Marks : 16**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of.



**UNIT- IV SOCIETY & ETHICS**

**Marks : 16**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accident studies . environment protection act Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest pollution control boards- Public awareness.

**UNIT- V HUMAN POPULATION AND THE ENVIRONMENT**

**Marks : 16**

Population growth, variation among nations – population explosion – family welfare program –environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**Text Books**

1. Benny Joseph, ‘Environmental Science and Engineering’, Tata McGraw- Hill, New Delhi
2. Gilbert M.Masters, ‘Introduction to Environmental Engineering and Science’, 2nd edition, Pearson Education (2004).

**Reference Books**

1. R.K. Trivedi, ‘Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards’, Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, ‘Environmental Encyclopedia’, Jaico Publ., House, Mumbai, 2001.
3. Rajagopalan, R, ‘Environmental Studies-From Crisis to Cure’, Oxford University Press (2005).



**THERMODYNAMICS (BTPCE0502)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0502	Thermodynamics	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I INTRODUCTION AND FIRST LAW OF THERMODYNAMICS      Marks:16**

Scope of thermodynamics – Basic concepts – Thermodynamic system – State and equilibrium – Process and cycles – Temperature and zeroth law of thermodynamics – Properties of pure substances – First law of thermodynamics – First law analysis of closed systems and control volumes and its application.

**UNIT- II ENTROPY AND THE SECOND LAW OF THERMODYNAMICS      Marks: 16**

The Clausius inequality – Entropy – Causes of entropy change – Entropy change of pure substances – Thermal energy reservoirs – Heat engines – Perpetual motion machines – Reversible and irreversible processes – The Carnot cycle and principles – The Carnot Heat engine – The second law efficiency – Second law analysis of open and closed systems.

**UNIT- III REFRIGERATION AND POWER CYCLES      Marks : 16**

Refrigerators and Heat pumps – The Carnot refrigerator and heat pumps – The reversed Carnot cycle – Ideal and Actual vapor compression Refrigeration cycle – Selection of right refrigerants – Heat pumps – Absorption refrigerator system – The Carnot vapor cycle – Rankine cycle – Cogeneration – Second law analysis of vapor power cycles.

**UNIT- IV THERMODYNAMIC RELATIONS      Marks :16**

PVT relations for gases and liquids – Equations of state – Cubic equations of state – Thermodynamic properties from equations of state – Compressibility factor – Generalized properties of fluids – Law of corresponding state – Acentric factor – gas mixtures. Thermodynamic properties of homogeneous mixtures – Partial molar properties , Fugacity and fugacity coefficients – Lewis and Randall rule – Property changes of mixing, activity – Excess properties, activity coefficients. Thermodynamic relations – Maxwell’s relations – Estimation of thermodynamic properties

**UNIT- V PHASE EQUILIBRIA      Marks :16**

Phase equilibria – Pure component and mixtures – Van Laar, Margules equation – Group contribution method – Gibb’s Duhem equation – Consistency tests – Partially miscible and immiscible systems – Azeotropes – Retrograde condensation – Thermodynamic diagrams. Homogeneous and heterogeneous reactions – Equilibrium composition.



**Text Books**

1. Smith, J.M. and Van Ness, “Introduction to Engineering Thermodynamics”, 5th Edition, McGraw Hill, 1996.
2. Narayanan, K.V., “A Text Book of Chemical Engineering Thermodynamics”, Prentice Hall of India, 2002.

**Reference Books**

1. Hougen and Watson, “Chemical Process Principles” Vol. II, CBS Publishers, 2002.
2. Kyle, “Chemical and Process Thermodynamics”, 2nd Edition, Prentice Hall of India, 2000.
3. Rao, Y.V.C., “Chemical Engineering Thermodynamics”, Universities Press, 1997.



**PETROLEUM EXPLORATION AND  
EXPLOITATION TECHNIQUES  
(BTPCE0503)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d= a+c)	Practical		T W (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0503	Petroleum Exploration and Exploitation Techniques	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I ORIGIN AND OCCURRENCE OF PETROLEUM**

**Marks : 16**

Origin of oil – Important factors that control petroleum occurrence – Migration and accumulation – Source and reservoir rocks – Oil bearing rocks – Continental environment – Transitional environment – Marine environment.

**UNIT- II GEOLOGICAL STRUCTURE AND GEOLOGGING**

**Marks : 16**

Various traps – Anticline – Fracturing – Well logging – Geological control – Gas logging – Drilling control important formation evaluation using wire line logging data.

**UNIT- III DRILLING FLUIDS AND WORK COMPLETION**

**Marks : 16**

Drilling Fluids: Function, composition, and classification – Packer fluid – Casing packs – Solids removal – Completion methods – stimulation methods

**UNIT- IV EXPLORATION METHODS**

**Marks : 16**

Geological exploration methods – Geophysical exploration methods – Geochemical methods prognostication – Classification of drilling locations – Economic analysis – Well programme – Geotechnical order.

**UNIT- V OFF – SHORE TECHNOLOGY**

**Marks : 16**

Seismic technology – Sniffer survey – Drilling technology – Off-shore rigs – Primary and secondary enhanced oil recovery techniques and methods – Major well complication and Remedies.



**Text Books**

1. Bhagwan Sahay “Petroleum Exploration and Exploitation Practices” Allied Publishers Ltd., Chennai, 1994.
2. Richard Dawe, “Modern Petroleum Technology”, Vol.I, Upstream, 6th Edition, John and Wiley Sons Ltd, 2000.

**Reference Books:**

1. Howard B. Bradley, “Petroleum Engineering Handbook”, Society of Petroleum Engineers, 1987.
2. Norman J. Hyne., “Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production”, 2nd Edition, Pennwell Books, 2001.



**CHEMICAL REACTION TECHNOLOGY  
(BTPCE0504)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0504	Chemical Reaction Technology	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I NON – IDEAL REACTORS**

**Marks : 16**

Residence time distribution function and its measurement – Characteristics of tracer – Mean residence time – Conversion in non-ideal flow reactors.

**UNIT- II HETEROGENEOUS REACTION AND CATALYSIS**

**Marks : 16**

Rate equation for heterogeneous reactions – Nature of catalysis – Adsorption isothermal and rates of adsorption – Desorption and surface reaction analysis of rate equation – Rate controlling steps.

**UNIT- III GAS – LIQUID REACTIONS**

**Marks : 16**

Various ways of carrying out gas – liquid reactions catalyzed by solids – General rate equation – Resistances in series in the gas – liquid reaction on catalyst surface.

**UNIT- IV GAS – SOLID CATALYTIC REACTORS**

**Marks : 16**

Characteristics of catalyzed reactions – Mechanism of solid catalyzed reactions – Pore diffusion resistance combined with surface kinetics – Performance equations for reactors containing porous catalysts.

**UNIT- V GAS – SOLID NON – CATALYTIC REACTORS**

**Marks : 16**

Selection of the kinetic model – Progressive – conversion model, shrinking – core model Shrinking-core model for spherical particles of unchanging size – Shrinking-core model for cylindrical particles of unchanging size.

**Text Books**

1. Levenspiel, O., “Chemical Reaction Engineering”, 3rd Edition, Wiley Asian Edition, 1990.
2. Smith, J.M., “Chemical Engineering Kinetics”, 2nd Edition, McGraw Hill, 1984.

**Reference Books**

1. Scott Fogler, H., “Elements of Chemical Reaction Engineering”, 4th Edition, Prentice Hall of India, 2009
2. Gavanhe, K.A., “Chemical Reaction Engineering I”, Nirali Prakashan Publishers, 2007.
3. Dawande, D., “Principles of Reaction Engineering”, 1st Edition, Central Techno Publications, 2001.







**Text Books**

- 1 Katz and Lee “Hand Book of Natural Gas Engineering” McGraw Hill, 1968.
2. Lyons, W.C., “Standard Handbook of Petroleum and Natural Gas Engineering”, Vol. 2, Gulf Professional Publishing, Elsevier Inc., 2006.

**Reference Books**

1. Katz, D. L. and Lee, R.L., “Natural Gas Engineering”, McGraw Hill, 1990.
2. Dring, M.M., “The Natural Gas Industry – A Review of World Resources and Industrial Applications”, Butterworth, 1974.
3. Saied Mokhatab, William A. Poe, and James G. Speight, “Handbook of Natural Gas Transmission and Processing”, Gulf Professional Publishing, Elsevier Inc.



**MASS TRANSFER II (BTPCE0506)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0506	Mass Transfer II	3	1	-	4	80	25	20	100	-	-	-	-	100	3Hrs

**UNIT- I ADSORPTION**

**Marks : 16**

Types of adsorption – Nature of adsorbents – Adsorption equilibria – Adsorption hysteresis adsorption isotherms – Effect of temperature and pressure – Freundlich equation – Stage wise adsorption: Single and multistage crosscurrent adsorption – Multistage countercurrent adsorption – Break through curves and rates of adsorption – Calculations of composition and number of stages.

**UNIT- II CONTINUOUS FRACTIONATION**

**Marks : 16**

Multistage tray tower : Material and enthalpy balance of a fractionator – McCabe - Thiele Method – Introduction of feed – Influence on operating lines – q-lines and location of feed tray – Effect of reflux ratio – Total reflux, minimum reflux, optimum reflux – Lewis-Sorel method – Ponchon- Savarit method – Reboiler arrangements – Use of open steam – Feed conditions.

**UNIT- III DISTILLATION**

**Marks : 16**

Basic concepts of distillation: Vapour- liquid equilibrium pressure – Temperature-concentration – phase diagram – Isothermal and isobaric equilibrium – Relative volatility – Ideal solutions – Raoult's law – Henry's law – Deviations from ideality – Minimum and maximum boiling Different Methods of distillation: flash, steam, vacuum, molecular, azeotropic and extractive distillations.

**UNIT- IV EXTRACTION PROCESS**

**Marks : 16**

Description of liquid extraction , Application of ternary liquid equilibrium –Representation in equilateral triangular co-ordinate of different type systems – Effect of temperature – Criteria for selection of solvent Types of extractors and their brief description – Stage wise contact – Cross and counter current extraction.

**UNIT- V LEACHING TECHNOLOGY**

**Marks : 16**

Solid liquid extraction: Description of leaching operations and technologies – Applications of leaching – Preparation of solid – Methods of Operation and classification of equipment.



**Text Books:-**

1. McCabe, W.L., Smith, J.C. and Harriot, P., "Unit Operations in Chemical Engineering", 6th Edition, McGraw Hill Book Co., 2001.
2. Treybal, R.E., "Mass Transfer Operations", 3rd Edition, McGraw Hill Book Co.

**Reference Books:-**

1. Coulson, M. and Richardson, J.F., "Chemical Engg.", Vol-II, 3rd Edition, Pergamon Press, 1987.
2. Alan S. Foust., Leonard A. Wenzel., Curtis W. Clump., Louis Maus., and L.Bryce Andersen, "Principles of Unit Operations", 2nd Edition, John Wiley and Sons (Asia) Pvt. Ltd, 1994.



## Heat Transfer Laboratory (BTPCE0507)

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i=d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h = e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPCE0507	Heat Transfer Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	3 Hrs

### List of Experiments

1. 1. Determination of heat transfer coefficient using composite wall.
2. 2. Determination of heat transfer coefficient using convection apparatus.
3. 3. Determination of condensing Heat transfer coefficient using vertical condenser.
4. 4. Determination of condensing heat transfer coefficient using horizontal condenser.
5. 5. Study the effect of coil diameter on heat transfer coefficient.
6. 6. Determination of overall heat transfer coefficient using shell and tube heat exchanger.
7. 7. Determination of overall heat transfer coefficient using double pipe heat exchanger.
8. 8. Study the effect of evaporation using jacketed pan evaporator and open pan evaporator.

### Recommended books

9. "Process Heat Transfer" D. Q. Kern, McGraw Hill.
10. "Heat Transmission" : W. H. McAdams, McGraw Hill, 3rd Edition.
11. "Process Heat Transfer" : D. Q. Kern, McGraw Hill.
12. Fundamentals of Engineering heat and mass transfer by R.C. Sachdeva

### Other Instructions

1. Equipment should be handled with care & cleaned regularly.
2. Experiments should be performed under the supervision of Lab Technician.



**Technical Analysis Laboratory  
(BTPCE0508)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0508	Technical Analysis Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	3 hrs

**List of Experiments**

1. Oil Analysis:

- a) Acid value
- b) Saponification value
- c) Iodine value

2. Soap Analysis:

- a) Moisture and Volatile matter
- b) Fatty acid content of Soap
- c) Total Alkali
- d) Free alkali or free fatty acid

3. Determination of CaO in the given sample of commercial lime.

4. Analysis of water:

- a) Total solids including suspended matter
- b) pH
- c) Conductivity
- d) Alkalinity
- e) Temporary Hardness



f) Permanent Harness

5. Estimation of Nitrogen by Kjeldahl method

6. Estimation of metal ions (Copper, Nickel, Chromium).

7. Effluent water Analysis (COD, BOD, DO, TDS, TSS)

**Recommended books:**

1. Analytical Chemistry, by Cotton & Wilkinson.

2. Engineering Chemistry by Jain & Jain.



**COMMUNICATION SKILLS LABORATORY  
(BTPCE0509)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0509	Communication Skills Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	3 Hrs

**List of Experiments**

**A. ENGLISH LANGUAGE LAB**

**1. LISTENING COMPREHENSION:**

Listening and typing – Listening and sequencing of sentences – Filling in the blanks -Listening and answering questions.

**2. READING COMPREHENSION:**

Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

**3. SPEAKING:**

Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English.

Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

**B. DISCUSSION OF AUDIO-VISUAL MATERIALS**

**1. RESUME / REPORT PREPARATION / LETTER WRITING**

Structuring the resume / report - Letter writing / Email Communication - Samples.

**2. PRESENTATION SKILLS:**

Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples PC based session.





3. SOFT SKILLS:

Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. GROUP DISCUSSION:

Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs -Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. INTERVIEW SKILLS:

Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews-Video samples.

1. Resume / Report Preparation / Letter writing: Students prepare their own resume and report.
2. Presentation Skills: Students make presentations on given topics.
3. Group Discussion: Students participate in group discussions.
4. Interview Skills: Students participate in Mock Interviews

**Recommended books**

1. Anderson, P.V, Technical Communication, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash, P, Verbal and Non-Verbal Reasoning, Macmillan India Ltd., Second Edition, New Delhi, 2004.
3. John Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi,.
4. Evans, D, Decisionmaker, Cambridge University Press,
5. Thorpe, E, and Thorpe, S, Objective English, Pearson Education, Second Edition, New Delhi,
6. Turton, N.D and Heaton, J.B, Dictionary of Common Errors, Addison Wesley Longman Ltd., Indian reprint



**Seminar/Group Discussion  
(BTPCE-0510)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPCE-0510	Seminar	-	-	2	2	-	-	-	-	-	-	100	100	100	3 Hrs



**Material Technology (BTPCE0601)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d= a+c)	Practical		TW (g)	Total (h= e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0601	Material Technology	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I STRUCTURE & PROPERTIES OF MATERIALS**

**Marks : 16**

Micro and macro structures – Properties and definitions – Mechanical, thermal, chemical, electrical and magnetic properties – Processing of metals and alloys – Casting – Hot and cold rolling – Extrusion – Forging – Deep drawing – Plastic deformation of metal – Single crystals and poly crystalline metals – Recovery and recrystallization of plastically deformed metals.

**UNIT- II POLYMERIC AND CERAMIC MATERIALS**

**Marks : 16**

Polymeric Materials – Polymerization reactions – Industrial polymerization methods – Crystallinity and stereoisomerism in some thermoplastics – Thermosetting elastomers – Creep and fracture of polymeric materials – Composite Materials – Fibre – Plastic composite materials – Manufacturing methods – Concrete – Asphalt and asphalt mixtures – Wood – Sandwich structures – Ceramic materials – Ceramic crystal and silicate structures – Processing of ceramics – Properties of glasses and enamels.

**UNIT- III FERROUS AND NON-FERROUS METALS**

**Marks : 16**

Pure iron – Cast iron – Mild steel – Stainless steels – Special steels and alloys – High temperature steels – Iron carbide phase diagram – Heat treatment of plain steels – Carbon steels – Manufacture – Properties and application in chemical industries – Lead, tin and magnesium – Manufacturing methods – Properties and application in process industries.

**UNIT- IV INORGANIC MATERIALS**

**Marks : 16**

Manufacture of cement and its properties – Special cement – Cement concrete – Reinforced and prestressed concrete – Properties and applications – Mixing and curing.

**UNIT- V CORROSION AND PREVENTION**

**Marks : 16**

Basic theories and mechanism of corrosion – Types of corrosion – Application of corrosion Prevention of corrosion – Anti-corrosion methods – Organic paints and coatings – Metal coatings – Ceramic coatings – Lining.



**Text Books**

1. Van Vlack, L.H., “Elements of Material Science and Engineering”, 6th Edition, Prentice Hall, 1989.
2. Raghavan V., “Materials Science and Engineering: A First Course”, 5th Edition, Prentice Hall of India (P) Ltd.,

**Reference Books**

1. William, D. and Callister, J.R., “Materials Science and Engineering: An Introduction”, 7th Edition, John Wiley and Sons, 2007.
2. Smith, W F. and Hashemi J., “Foundations of Materials Science and Engineering” 3rd Edition, McGraw-Hill, 2003.
3. Clauster, H.R., “Industrial and Engineering Materials”, McGraw-Hill,



**Process Dynamics and Control  
(BTPCE0602)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0602	Process Dynamics and Control	3	1		4	80	25	20	100					100	3hrs

**UNIT- I FIRST ORDER SYSTEMS**

**Marks : 16**

Linear open to loop systems – Laplace transformation – Transform of standard functions – First order and linearised first order systems – Response to various disturbances – Inversion

**UNIT- II HIGHER ORDER SYSTEMS**

**Marks : 16**

First order in series – Linearization and its application in process control – Higher order systems – Second order and Transportation lag – Response to various disturbances.

**UNIT- III CLOSED LOOP CONTROL SYSTEMS**

**Marks : 16**

Closed loop control systems – Development of block diagram for feed – back control systems –Servo and regulator problems – Principles of pneumatic and electronic controllers – Transient response of closed-loop control systems and their stability.

**UNIT- IV SPECIAL CONTROLS**

**Marks : 16**

Cascade – Feed forward and ratio control – Dead time compensation – Internal model control – Control valves – Process identification.

**UNIT- V FREQUENCY RESPONSE**

**Marks : 16**

Introduction to frequency response of closed-loop systems – Routh analysis – Control system design by frequency – Bode diagram – Stability criterion – Tuning of controller settings.

**Text Books**

1. Coughnowr, D.P., “Process Systems Analysis and Control”, 2nd Edition, McGraw Hill , 1991.
2. Smith , C .A. and Corripio, A.B., “Principles and Practice of Automatic Process Control”, 2nd Edition, John Wiley,

**Reference Books**

1. Harriot, P., “Process Control”, Tata McGraw Hill, 1984.
2. George Stephanopolous., “Chemical Process Control”, Prentice – Hall of India Pvt. Ltd., 1990.
3. Patranabis, D., “Principles of Process control”, 2nd Edition, Tata McGraw – Hill Publishing Co. Ltd., 1981.



## Equipment Design and Drawing-I (BTPCE0603)

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0603	Equipment Design and Drawing-I	3	1		4	80	25	20	100	-	-	-	-	100	3 hrs

**UNIT- I DESIGN OF REACTION VESSEL AND STORAGE TANK** **Marks : 16**

Design and schematic of storage tank, (vertical and horizontal) supports, agitated vessel.

**UNIT- II DESIGN OF PIPE FITTINGS AND JOINTS** **Marks : 16**

Design and schematic of simple bolts and screws – Riveted joints – Design and drawing of shafts and couplings.

**UNIT- III DESIGN OF HIGH PRESSURE SYSTEMS** **Marks : 16**

Design of high pressure vessels and reactors.

**UNIT- IV DESIGN OF PHASE SEPARATION EQUIPMENT** **Marks : 16**

Design of physical separation equipments such as cyclones, centrifuges, thickeners, filtration equipment

**UNIT- V DRAWING OF HEAT EXCHANGERS AND COLUMNS** **Marks : 16**

Drawing of physical process equipments such as double pipe heat exchangers – Shell and tube heat exchangers – Plate and frame heat exchangers.

**Text Books**

1. Dawande, S.D., “Process Design of Equipments” Central Techno Publishers.
2. Perry, R. H., “Chemical Engineers Handbook”, 7th Edition, McGraw Hill, 1998.

**Reference Books**

1. Coulson, J. M. and Richardson, J. F., “Chemical Engineering”, Vol 6, Butterworth Heinmann, 2000.
2. Walas, S.M., “Chemical Process Equipment” Butterworth Heinmann, 1998.
3. Joshi, M. V., “Process Equipment Design”, 2nd Edition, Mac Millan Press, 1996.
4. Brownell, L. E. and Young, E.H., “Process Equipment Design”, John Wiley, 1968.



**PETROLEUM CRUDE PROCESSING  
TECHNOLOGY (BTPCE0604)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d= a+c)	Practical		T W (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0604	Petroleum Crude Processing Technology	3	1		4	80	25	20	100	-	-	-	-	100	3Hrs

**UNIT- I INTRODUCTION**

**Marks : 16**

Origin – Exploration and production of petroleum – Types of crudes, crude composition – Characteristics and classification – Crude oil properties – Indigenous and imported crudes –Crude availability Vs demands.

**UNIT- II CRUDE PROCESSING**

**Marks : 16**

Pretreatment of crude for Refining – Dehydration and desalting – Atmospheric distillation, Vacuum distillation of residue products – Types of trays, flow pattern in the trays – Reflux types and its significance.

**UNIT- III TESTING OF PETROLEUM PRODUCTS**

**Marks : 16**

Standard – Testing of Petroleum crude – Products: Specifications and their Significance.

**UNIT- IV LUBE DISTILLATE TREATMENT TECHNIQUES**

**Marks : 16**

Treatment techniques for vacuum distillates with different processes like solvent extraction – Deasphalting, dewaxing, hydrofining, catalytic dewaxing and clay contact process – Production of lubricating oils.

**UNIT- V FINAL TREATMENT TECHNIQUES**

**Marks : 16**

Asphalt manufacture, Air blowing technology, Bitumen Types and their properties, Acid gasremoval and sulphur removal techniques.

**Text Books**

1. Ram Prasad, “Petroleum Refining Technology”, Khanna Publishers.
2. Bhaskara Rao, B.K., “Modern Petroleum Refining Processes”, 3rd edition, Oxford and IBH Publishing Company Pvt. Ltd.

**Reference Books**

1. James H. Gary and Glenn E. Handwerk., “Petroleum Refining Technology and Economics”, 4th Edition, Marcel Dekker Inc., 2001.
2. Nelson, W.L., “Petroleum Refinery Engineering”, McGraw Hill Publishing Company Limited, 1985.



**WATER TREATMENT AND MANAGEMENT  
(BTPCE0605)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0605	Water Treatment and Management	3	1		4	80	25	20	100					100	3 Hrs

**UNIT- I INTERNAL TREATMENT PROCESS**

**Marks : 16**

Character and properties – Water problem and solution – Water Sedimentation - Coagulation – Filtration – Disinfection – Theory, necessity, process, equipment, application, location, limitation.

**UNIT- II EXTERNAL TREATMENT PROCESS**

**Marks : 16**

Softening by Ion – exchange process, Demineralization – Cation exchange materials – Removal of ion, Manganese, odour, colour taste – Deaeration – Oxidation – Fluoridation – Dealkalisation – Desalination by Reverse osmosis.

**UNIT- III WATER MANAGEMENT IN INDIA**

**Marks : 16**

Water resources and planning – Water policy – Indian scene – Main aspects of water management – Hydrological cycle – Hydrosphere – Water transport – Water exchange – Causes and problems in irrigation, rural water, urban water – Water conservation resource management – Rain Harvesting.

**UNIT- IV WASTE WATER TREATMENT**

**Marks : 16**

Waste water in Industry- Home and Agriculture – waste water treatment processes – Optimization – Benefits and costs – Microbial and sanitation water treatment – Biofilm formation and removal – Microbial trend analysis – Pretreatment system and equipment.

**UNIT- V BOILER WATER AND COOLING WATER**

**Marks : 16**

Concept – Importance – Location – Commonly used desalination process – Distillation – Electrodialysis – Reverse osmosis – Freezing – Solar distillation- Purpose – Problem associated with water quality and equipment – Steam system fundamentals – Hot water closed system Measurement and control of pH, corrosion, fouling – Microbial analysis – Ozone control – Study of microorganism.





**Text Books**

1. P.C.Bansil “Water Management in India”, Concept Publishing company, New Delhi, First Edition, 2004.
2. G.S.Bridie and J.S.Bridie “Water Supply and Sanitary Engineering”, Dhanpat Raj Publishing the company (P) Ltd., New Delhi, 7 Edition, 2003.

**Reference Books**

1. Austin G.T., “Shreve’s Chemical Process Industries”, Fifth Edition, McGraw Hill, 1998.
2. S.C. Rangwala, “Water supply and Sanitary Engineering”, Eighteenth Edition, Charotar Publishing House, 2003.
3. Pandey G.N., “Text Book of Chemical Technology”, Vikas Publishing House Pvt. Ltd. , New Delhi, 1992.



**INSTRUMENTATION AND INSTRUMENTAL ANALYSIS (BTPCE0606)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0606	Instrumentation and Instrumental Analysis	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I**

**Marks : 16**

**INTRODUCTION TO INSTRUMENTS, CHARACTERISTICS AND SIGNAL CONDITIONING**

Introduction to Instruments and Their representation: Introduction, Elements, Classification, Standards, Calibration procedures Static and Dynamic Characteristics of Instruments, Formulation of First order and second order system equations, Dynamic response Principals of Analog signal conditioning, converters, guidelines for analog signal conditioning design , Principles of digital signal conditioning, computer interface, DACs, ADCs, DAS hardware, DAS software.

**UNIT- II TEMPERATURE, PRESSURE, LEVEL MEASUREMENTS**

**Marks : 16**

Temperature measurement: Temperature scales, Non electrical methods, Electrical methods, Radiation methods  
 Pressure measurement: Moderate pressure measurement, High pressure measurement, vacuum measurement  
 level measurement: measurement techniques for Liquids and slurries, advance measurement techniques.

**UNIT- III FLOW MEASUREMENTS AND STUDY OF VALVES**

**Marks : 16**

Flow measurement: Introduction, Review of Venturimeter, orifice meters, rotameters, Pitot tube, working of turbine, vortex shedding, electromagnetic flow meters  
 Introduction to Advanced flow measurement techniques: Hot Wire anemometer, Laser Doppler anemometer, Ultrasound, Particle image Velocimetry  
 Study of Valves: Types of Valves, Actuators, Positioners, Valve characteristics, Controllability and Rangeability, Cavitation, Flashing, choking, Valve Sizing for incompressible fluids.



**UNIT- IV WORKING AND INTERPRETATION OF INSTRUMENTAL      Marks : 16**

**ANALYTICAL METHODS:** Spectroscopic techniques: Ultraviolet – visible (UV-VIS), fluorescence, infrared (IR), Raman spectroscopy, mass spectrometry (MS), nuclear magnetic resonance (NMR) Chromatographic Techniques: gas chromatography (GC), chromatography, gel permeation chromatography (GPC) , thin layer chromatography (TLC), Classification of spectroscopic and chromatographic techniques for Analysis of fuels Lubricant Analysis: constituents of lubricants, characterization of lubricants.

**UNIT- V INTRODUCTION TO QUALITY CONTROL AND ANALYTICAL      Marks : 16**

**TECHNIQUES:** Introduction to principles of Analytical techniques: Spectroscopic Techniques, Chromatographic techniques, Crystallography, electrochemical analysis, thermal analysis, electrophoresis, calorimetry.

**Text Books**

1. Eckman, D. P.; Industrial Instrumentation; Wiley Eastern, 1991.
2. Johnson, C.; Process Control Instrumentation Technology; 4th ed., Prentice-Hall International.
3. Liptak, B. G., Venczel, K.; Instrument Engineer's Handbook, Process Measurement; Chilton Book Company.

**Reference Books**

1. Nakra, B. C.; Chaudhary K. K.; Instrumentation Measurement and Analysis; Tata McGraw Hill, New Delhi, 1998.
2. Patranabis, D.; Principles of Industrial Instrumentation; Tata McGraw Hill, New Delhi, 1996.
3. Silverstein, Bassler, Morrill; Spectrometric Identification of Organic Compounds; JohnWiley Publication, 1991.
4. Gary J.H. and Handework G.E., "Petroleum Refining Technology and Economics", Marcel Dekker, Inc., 1984.



**MASS TRANSFER LABORATORY  
(BTPCE0607)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks							Grand Total (i= d+h)	Duration of Exam	
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)			Total (h= e+g )
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0607	Mass Transfer Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	3 Hrs

**List of Experiments**

1. Simple distillation.
2. Steam distillation.
3. Packed column distillation.
4. Bubble cap distillation.
5. Liquid-liquid extraction.
6. Vacuum Dryer.
7. Tray dryer.
8. Rotary dryer.

**Recommended books**

1. Mass transfer operation"by R.E.Treybal, Mc-Graw Hill international.
- 2 "Mass Transfer" by Sherwood,Pigford & Wilke, Mc-Graw Hill international.
- 3 "Chemical Engineering", Volume-2 ,4th edition by Coulson & Richardson.
- 4 Perry's Chemical Engineers handbook,7th edition by Perry & Green, Mc-Graw Hill international.
- 5 Unit Operations of Chemical Engg. By W.L. McCabe , J. C. Smith & Harriott, 6th edition Mc-Graw Hill international.



**PETROLEUM PHYSICAL PROPERTIES  
TESTING LABORATORY (BTPCE0608)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks							Grand Total (i= d+h)	Duration of Exam	
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)			Total (h= e+g )
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0608	Petroleum Physical Properties Testing Laboratory			2	2					50	15	50	100	100	3 Hrs

**List of Experiments**

1. Determination of flash point by Pensky Marten Closed Cup Apparatus.
2. Determination of flash point by Abel Open cup Apparatus.
3. Determination of Kinematic Viscosity by Redwood viscometer.
4. Moisture determination by Dean and Stark Method.
5. Vacuum Distillation.
6. Determination of Calorific Value by Junker's Gas Calorific meter.
7. Calorific value by Bomb calorimeter.
8. Melting point test.

**Recommended books**

1. Salvatore J. Rand - 2003
2. R. A. NAND KARNI
3. Arthur J. Caines, Roger F Haycock - 2004
4. M. A. Mian, Mohammed A. Mian



**CHEMICAL REACTION ENGINEERING  
LABORATORY (BTPCE0609)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks							Grand Total (i= d+h)	Duration of Exam	
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)			Total (h= e+g )
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0609	Chemical Reaction Engineering Laboratory			2	2					50	15	50	100	100	3 Hrs

**List of Experiments-**

1. Determination of reaction rate constant for a saponification reaction in batch reactor I.
2. Determination of reaction rate constant for a saponification reaction in batch reactor II.
3. Determination of reaction rate constant for a saponification reaction in packed bed reactor.
4. Determination of reaction rate constant for a saponification reaction in mixed flow reactor.
5. Determination of reaction rate constant for a saponification reaction in isothermal – batch reactor.
6. Determination of the rate frequency factor and activation energy for acetic anhydride hydrolysis using adiabatic reactor.
7. Determination of the rate constant for a saponification reaction in equal sized CSTR's in series.

**Recommended books-**

1. Octave Levenspiel, "Chemical Reaction Engineering", 3rd Edition, John Wiley & Sons (Asia) Pvt Ltd.
2. H. Scott Fogler, "Elements of Chemical Reaction Engineering" 3rd Edition November, Prentice Hall of India Pvt Ltd.
3. L. D. Schmidt, "The Engineering of Chemical Reactions", Oxford Press.
4. J.M. Smith, "Chemical Engineering Kinetics", 2nd, McGraw-Hill.



**TRANSPORT PHENOMENA (BTPCE0701)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0701	Transport Phenomena	3	1		4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I FUNDAMENTALS OF TRANSPORT PHENOMENA**

**Marks: 16**

The nature of transport phenomena: Importance, mechanism, driving force, analogous nature – Conservation laws Phenomenological laws of transport properties – Newtonian and non Newtonian fluids – Effect of pressure and temperature on viscosity.

**UNIT- II ONE DIMENSIONAL TRANSPORT IN LAMINAR FLOW (SHELL BALANCE)**

**Marks: 16**

General methods of shell balance approach to transfer problems – Momentum flux and velocity distribution for flow of Newtonian fluids in pipes, planes, slits and annulus – Heat flux and temperature distribution for heat sources such as electrical, viscous – Mass flux and concentration profile for diffusion in stagnant gas systems involving reaction.

**UNIT- III**

**Marks: 16**

**TRANSPORT IN TURBULENT AND BOUNDARY LAYER FLOW**

Time smoothed equation of change for velocity and temperature distribution – Time smoothed velocity distribution near a wall and circular jet – Time smoothed temperature profile near a wall, turbulent flow in pipes and jets – Time smoothed concentration and equation of continuity with application to turbulent mixing and reaction – Boundary layer theory, thickness, velocity separation.

**UNIT- IV EQUATION OF CHANGE AND THEIR APPLICATIONS**

**Marks: 16**

Development of the equation of change for isothermal systems, non-isothermal systems and multicomponent system – Use of equation of change for flow in a circular pipe – Rotating liquid –Temperature distribution in a rotating cylinder with viscous dissipation and flow of a newtonian fluid with constant energy flux – Concentration profile in a tubular reactor and gas diffusion through a solid.

**UNIT- V ANALOGIES BETWEEN TRANSPORT PROCESSES**

**Marks: 16**

Importance of analogy - Development and applications of analogies between momentum – Heat and mass transfer – Reynolds, Prandtl, Von Karman and Colburn analogies.



**Text Books**

1. Bird, R.B., Stewart, W.E. and Light Foot, E.N., “Transport Phenomena” John Wiley and sons, 2002.
2. Welty, J.R., Wick, C.E., and Wilson, R.E., “Fundamentals of Momentum, Heat and Mass Transfer”, John Wiley Sons, 2002.

**Reference Books**

1. Thomson, W. J., “Introduction to Transport Phenomena”, Pearson Education Asia, 2000.
2. Griskey, R.G., “Transport Phenomena and Unit Operations”, Wiley-Interscience, 2002.
3. Beek, W.J., Mutzall, K.M.K. and Van Heuven, J.W., “Transport Phenomena”, 2nd Edition.





**EQUIPMENT DESIGN AND DRAWING (BTPCE0702)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks							Grand Total (i= d+h)	Duration of Exam	
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)			Total (h= e+g )
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0702	Equipment Design and Drawing-II	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I HEAT EXCHANGER DESIGN**

**Marks : 16**

Design of double pipe heat exchangers, Heat exchanger types and its selection – shell and tube heat exchangers and Condensers – Effectiveness – NTU method of heat exchanger analysis.

**UNIT- II EVAPORATOR DESIGN**

**Marks : 16**

Steam – Uses of steam – Outstanding qualities of steam – BPE – Duhring’s rule – Principle of multiple effect evaporation – Temperature driving force – Evaporators types and its selection –Design of single and multiple effect evaporators.

**UNIT- III THERMODYNAMIC PROPERTIES EVALUATION**

**Marks : 16**

Physical properties evaluation, Thermodynamic properties of gases and binary mixtures – Methods of calculations –Vapor-liquid equilibrium data for ideal and non-ideal mixtures. Bubble points and dew points.

**UNIT- IV COLUMN DESIGN**

**Marks : 16**

Design of distillation columns and Absorption columns.

**UNIT- V PUMPS, FANS AND COMPRESSORS**

**Marks : 16**

Pumps, fans and compressors – Types and its applications – Characteristics – Piping and pressure drop calculations – Performance analysis of pumps, fans and compressors.

**Text Books:-**

1. Ernest E. Ludwig., “Applied Process Design for Chemical and Petrochemical Plants”, Vol.I, II and III, Gulf Professional Publishing, 2002.
2. D. Q. Kern, “Process Heat Transfer”, Tata McGraw Hill Publishing Co., New Delhi, 1990.

**Reference Books:-**

1. Coulson, M. and Richardson, J.F., “Chemical Engineering”, Vol.6, 3rd Edition, Pergamon Press, 1987.
2. Robert H. Perry and Don W. Green, “Perry’s Chemical Engineer’s Hand Book”, 7th Edition, Mc Graw Hill – International, 1997.
3. Van Winkle, “Distillation Operations”, McGraw Hill Publications, 1987.



**PETROLEUM SECONDARY PROCESSING  
TECHNOLOGY(BTPCE0703)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0703	Petroleum Secondary Processing Technology	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I SECONDARY PROCESSING TECHNOLOGY**

**Marks : 16**

Need and significance – Types and functions of secondary processing – Visbreaking – Processes, Operating parameters and advantages.

**UNIT- II CRACKING**

**Marks : 16**

Thermal cracking – Processes, operating parameters, feed stock selection and product yields – Advantages – Free radical mechanism. Fluid catalytic cracking – processes, Catalyst used and regeneration – Cation mechanism.

**UNIT- III HYDROCRACKING AND HYDROTREATING**

**Marks : 16**

Hydrocracking, principles, process requirements, product yields and qualities and residcracking – Hydrotreating – Sulphur removal, aromatics removal, hydrofinishing.

**UNIT- IV ISOMERISATION ,ALKYLATION & POLYMARIZATION**

**Marks : 16**

Isomerisation – Processes, operating parameters, advantages – Alkylation – Processes, operating parameters, advantages processes, operating parameters, advantages.

**UNIT- V REFORMING**

**Marks : 16**

Reforming – Principles, processes, operating parameters – Catalyst types, performance, effects of operating parameters – Feed quality and regeneration.

**Text Books**

1. Ram Prasad, “Petroleum Refining Technology”, Khanna publishers, 2007.
2. Bhaskara Rao, B.K., “Modern Petroleum Refining Processes”, 4th Edition, Oxford and IBH Publishing Company Pvt. Ltd, 2002.



**Reference Books**

1. Gary, J. H. and Handwerk, G.E., "Petroleum Refining Technology and Economics", 4th Edition, Marcel Dekker Inc., 2001.
2. Nelson, W.L., "Petroleum Refinery Engineering", McGraw Hill Publishing Company Limited, 1985.
3. Hobson, G.D., "Modern Petroleum Refining Technology", 5th Edition, John Wiley Publishers, 1984.





**UNIT- V**

**Marks :16**

**PROFITABILITY:ALTERNATIVE INVESTMENT & REPLACEMENT**

Profitability: Alternative investments and replacements, profitability standards, discounted cash flow, rate of return, capitalized cost, payment period, alternative investments, analysis with small investments, increments and replacements, Break Even Analysis.

**Text Books**

- 1 M.S. Peters and K. D. Timmerhaus, "Plant Design and Economics for Chemical Engineers", Fourth Edition, McGraw Hill International Book Co., 1991
- 2 James R. Cooper, "Process Engineering Economics", Marcel Delkker Inc, New York, 2003

**Reference Books**

- 1 Coulson, J.M., Richardson J.E. and Sinnott R.K., "Chemical Engineering", Vol. VI, Pergamon Press, 1991.
- 2 R. Turton, R. C. Bailie, W. B. Whiting, and J. A. Shaeiwitz, " Analysis, Synthesis, and Design of Chemical Processes", Prentice Hall, Upper Saddle River, New Jersey, 1998.
- 3 L. S. Srinath, "PERT and CPM, Principles and Applications", Third Edition, East-West Press, 2002.



**REFINERY PROCESS DESIGN  
(BTPCE0705)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d= a+c)	Practical		T W (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0705	Refinery Process Design	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I PETROLEUM REFINERY DISTILLATION**

**Marks : 16**

TBP, EFV, ASTM distillation curves and their relevance, Material balance and flash zone calculations for petroleum refinery distillation columns, Pump around and pump back calculations, Overall energy requirements, Estimation of number of equilibrium stages, Design using Packie charts and Watkins method.

**UNIT- II MULTICOMPONENT DISTILLATION**

**Marks : 16**

Dew point and bubble point for multicomponent mixtures. Design of multicomponent distillation column, Number of variables, Selection of key components, Selection of column pressure, Feed condition, Plate-to-plate calculations, Empirical short cut methods.

**UNIT- III COLUMN DESIGN**

**Marks : 16**

Process design of distillation towers. Flooding charts. Trays and packings. Vacuum devices. Pressure drops. Height, diameter, supports. Piping requirements. Aspects of mechanical design. A typical P&ID for a distillation column.

**UNIT- IV PUMPS AND COMPRESSORS**

**Marks : 16**

Types of pumps and compressors. Selection criteria. Power rating calculations based on process duty. Use of operating curves of centrifugal pump. NPSHR and NPSHA. Pump Cavitation. Surge problem in compressors.

**UNIT- V FIRED HEATERS**

**Marks : 16**

Heat load calculations for furnace heaters used in crude refining, Basic constructional features, Different furnace types, Review of factors to be considered in the design of fired heaters.



**Text Books**

1 Van Winkle M., "Distillation", McGraw Hill, 1967.

2 Watkins, "Petroleum Refinery Distillation", McGraw Hill, 1993

**Reference Books**

1 Sinnott R. K., "Coulson and Richardson's Chemical engineering", Vol. 6, Third Edition, Butter Worth-Heinemann, 1999.

2 Kern D. Q., "Process Heat Transfer", McGraw Hill, 1965.

3 Cao Eduardo,"Heat Transfer in Process Engineering",McGraw Hill,2010.



**ELECTIVE-I (BTPCE0706)**

**PROCESS MODELLING AND SIMULATION (BTPCE0706 A)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks							Grand Total (i= d+h)	Duration of Exam	
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)			Total (h= e+g)
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0 706	E1 Elective -	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I INTRODUCTION ON MODELS**

**Marks : 16**

Introduction – Models and model building – Principles of model formulation – Fundamental laws – continuity equation – Energy equation – Equations of motion – Transport equation – Equations of state – Equilibrium and kinetics – Classification of mathematical models. Numerical solutions of model equations – Linear and non linear algebraic equations in one and more than one variable..

**UNIT- II LUMPED PARAMETER MODELS**

**Marks : 16**

Formulation and solution techniques to be discussed for vapour liquid equilibrium models – Dew point and flash calculations for multicomponent systems – Distillation operations, batch and continuous distillation models – Tank models – Mixing tank – Stirred tank with heating – CSTR with multiple reactions – Non-isothermal CSTR – Multiplicity and stability control at the unsteady state – Non- ideal CSTR models – Multi-Parameter models with dead space and bypassing – Staged operation.

**UNIT- III DISTRIBUTED PARAMETER MODELS(STEADY STATE)**

**Marks : 16**

Formulation and solution of split boundary value problems – Shooting technique, quasi – linearization techniques, counter current heat exchanger, tubular reactor with axial dispersion, counter current gas absorber. Pipe line gas flow – Tubular permeation process – Pipe line flasher.

**UNIT- IV UNSTEADY STATE DISTRIBUTED PARAMETER MODELS**

**Marks : 16**

Solution of partial differential equations using finite difference method – Convective problems, diffusive problems – Combined convective and diffusive problems – Unsteady state conduction and diffusion, unsteady state heat exchangers – Dynamics of tubular reactor with dispersion – Transfer function models for distributed parameter systems.

**UNIT- V MODEL PARAMETERS ESTIMATION**

**Marks : 16**

Introduction – Method of least squares, curve fitting, parameter estimation of dynamic transfer function models – Least square and recursive least square methods – Parameter estimation of RTD models – Moments method.





**Text Books**

1. Ramirez, W.F., “Computational Methods in Process Simulation”, Butterworth Publishers, 1989.
2. Roger E. Franks, “Modelling and Simulation in Chemical Engineering”, John Wiley and Sons, 1972.

**Reference Books**

1. Luyben, W.L., “Process Modelling, Simulation and Control for Chemical Engineers”, 1990.
2. Santhos Kumar Gupta, “Numerical Methods for Engineers”, Tata McGraw Hill, 1995.
3. Seinfeld and Lapidus, “Mathematical Methods in Chemical Engineering”, Prentice Hall, 1974.



**FERTILIZER TECHNOLOGY  
(BTPCE0706 B)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0706	Elective -I	3	1	-	4	80	25	20	100	-	-	-	-	100	3 Hrs

**UNIT- I NITROGENOUS FERTILISERS**

**Marks : 16**

Methods of production of nitrogenous fertilizer-ammonium sulphate, nitrate, urea and calcium ammonium nitrate; ammonium chloride and their methods of production, characteristics and specifications, storage and handling.

**UNIT- II PHOSPHATIC FERTILISERS**

**Marks : 16**

Raw materials; phosphate rock, sulphur; pyrites etc., processes for the production of sulphuric and phosphoric acids; phosphates fertilizers - ground rock phosphate; bone meal-single superphosphate, triple superphosphate, triple superphosphate, thermal phosphates and their methods of production, characteristics and specifications.

**UNIT- III POTASSIC FERTILISERS**

**Marks : 16**

Methods of production of potassium chloride, potassium schoenite, their characteristics and specifications.

**UNIT- IV COMPLEX AND NPK FERTILISERS**

**Marks : 16**

Methods of production of ammonium phosphate, sulphate diammonium phosphate, nitrophosphates, urea, ammonium phosphate, mono-ammonium phosphate and various grades of NPK fertilizers produced in the country.

**UNIT- V MISCELLANEOUS FERTILISERS**

**Marks : 16**

Mixed fertilizers and granulated mixtures; biofertilisers, nutrients, secondary nutrients and micro nutrients; fluid fertilizers, controlled release fertilizers, controlled release fertilizers.



**Text Books**

1. "Handbook of fertilizer technology", Association of India, New Delhi, 1977.
2. Menno, M.G.; "Fertilizer Industry - An Introductory Survey", Higginbothams Pvt. Ltd., 1973.

**Reference Books**

1. Sauchelli, V.; "The Chemistry and Technology of Fertilizers", ACS MONOGRAPH No. 148, Reinhold Publishing Cor. New York, 1980.
2. Fertiliser Manual, "United Nations Industrial Development Organisation", United Nations, New York, 1967.
3. Slack, A.V.; Chemistry and Technology of Fertilisers, Interscience, New York, 1966.



**PROCESS DYNAMICS AND CONTROL  
LABORATORY (BTPCE0707)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0707	Process Dynamics and Control Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	3 Hrs

**List of Experiments**

1. Flow control loop and Flow Transmitter.
2. Level Control loop and Level Transmitter.
3. Control valve characteristics.
4. Verifying the response of Non-Interacting and interacting level System.
5. Optimum controller setting using Ziegler's Nichols Methods.
6. pH control system.
7. First order and second order system.
8. Computer controlled heat exchanger (Shell and tube and Double pipe).

**Recommended books**

1. Bohdan T. Kulakowski, John F. Gardner, J. Lowen Shearer - 2007
2. William L. Luyben - 1990



**PETROCHEMICAL  
ANALYSIS LABORATORY (BTPCE0708)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks							Grand Total (i= d+h)	Duration of Exam	
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)			Total (h= e+g)
						Max (a)	Min (b)			Ma x (e)	Mi n (f)				
BTP CE07 08	Petrochemical Analysis Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	

**List of Experiments**

1. Sulphur content determination.
2. Flue gas Analysis – Orsat Apparatus.
3. Aromatic Content determination.
4. Hydrogen sulphide content determination.
5. Oil separation from lubricating Grease (Oil Separation Apparatus).
6. Analysis of petrochemicals using UV spectrophotometer.
7. Analysis of petrochemicals using NMR.
8. Analysis of petrochemicals using Gas chromatography.
9. Refractive index of petrochemicals.
10. Determination of moisture content.

**Recommended books**

1. Emma P. Popek - 2003
2. Donald A. Burns, Emil W. Ciurczak
3. Klaus H. Altgelt - 1993



**PETROLEUM PRODUCT TESTING  
LABORATORY (BTPCE0709)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Mi n (f)				
BTPC E0709	Petroleum Product Testing Laboratory	-	-	2	2	-	-	-	-	50	15	50	100	100	3 Hrs

**List of Experiments**

1. Determination of aniline point and diesel index.
2. Ductility and penetration number of bitumen.
3. Cloud and pour point determination.
4. Smoke point determination.
5. Copper corrosion testing of petroleum products.
6. Sediment content of crude oil and fuel oils.
7. Coking tendency of oil.
8. Saybolt color of petroleum products / loviband tintometer.
9. Refractive index of petroleum products.
10. Carbon residue determination.

**Recommended books**

1. R. A. Nadkarni - 2007
2. F. McLennan, Bruce R. Kowalski - 1995
3. J. G. Speight - 2002
4. Arthur J. Caines, Roger F. Haycock



**Seminar/Group Discussion  
(BTPCE-0710)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPCE-0710	Seminar	-	-	2	2	-	-	-	-	-	-	100	100	100	3 Hrs



**TOTAL QUALITY MANAGEMENT  
(BTPCE0801)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0801	Total Quality Management	3	1	-	4	80	25	20	100	-	-	50	-	150	3 hrs

**UNIT- I INTRODUCTION**

**Marks : 16**

Introduction - Need for quality - Evolution of quality - Definition of quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming,

**UNIT- II TQM PRINCIPLES**

**Marks : 16**

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Supplier partnership – Partnering, Supplier selection, Supplier Rating.

**UNIT- III TQM TOOLS & TECHNIQUES I**

**Marks : 16**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

**UNIT- IV TQM TOOLS & TECHNIQUES II**

**Marks : 16**

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

**UNIT- V QUALITY SYSTEMS**

**Marks : 16**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM.





**Recommended Books**

1. Dale H.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint (2006)
2. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 6thEdition, South-Western (Thomson Learning), 2005.
3. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
4. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd.,2006.
5. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.



**SAFETY AND RISK MANAGEMENT  
(BTPCE0802)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks							Grand Total (i= d+h)	Duration of Exam	
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)			Total (h= e+g )
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0 802	Safety and Risk Management	3	1	-	4	80	25	20	100	-	-	50	-	150	3 hrs

**UNIT- I RISK MANAGEMENT**

**Marks : 16**

Overall risk analysis – Chapains model, E and FI model– Methods for determining consequences effects: Effect of fire, Effect of explosion and toxic effect – Disaster management plan – Emergency planning – Onsite and offsite emergency planning – Risk management.

**UNIT- II HAZARD IDENTIFICATION AND CONTROL**

**Marks : 16**

HAZOP, job safety analysis – Fault tree analysis – Event tree analysis – Failure modes and effect analysis and relative ranking techniques – Safety audit – Plant inspection – Past accident analysis.

**UNIT- III INDUSTRIAL SAFETY**

**Marks : 16**

Concepts of safety – Hazard classification chemical, physical, mechanical, ergonomics, biological and noise hazards – Hazards from utilities like air, water, steam.

**UNIT- IV SAFETY IN HANDLING AND STORAGE OF CHEMICALS**

**Marks : 16**

Safety measures in handling and storage of chemicals – Fire chemistry and its control –Personnel protection – Safety color codes of chemicals.

**UNIT- V SAFETY PROCEDURES**

**Marks : 16**

Safety in plant design and layout – Safety provisions in the factory act 1948 – Indian explosive act 1884 – ESI act 1948 – Advantages of adopting safety laws.

**Text Books**

1. Blake, R.P., “Industrial Safety”, Prentice Hall, 1953.
2. Lees, F.P., “Loss Prevention in Process Industries”, 2nd Edition, Butterworth Heinemann, 1996.

**Reference Books**

1. Geoff Wells, “Hazard Identification and Risk Assessment”, I.ChE.
2. John Ridley and John Channing, “Safety at Work”, 6thEdition. Butterworth- Heinemann, 2003.



**ELECTIVE II- (BTPCE0803)**

**ENERGY MANAGEMENT IN CHEMICAL INDUSTRIES (BTPCE0803 A)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0803 -A	Elective -II ENERGY MANAGEM ENT IN CHEMICAL INDUSTRIES	3	1	-	4	80	25	20	100	-	-	-	100	200	3 hrs

**UNIT- I ENERGY RESOURCES**

**Marks : 16**

Energy sources – Coal oil, natural gas – Nuclear energy – Hydro electricity – Other fossil fuels – Geothermal – Supply and demand – Depletion of resources of resources – conservation Technology

**UNIT- II ENERGY AND ENVIRONMENT**

**Marks : 16**

Energy – Various forms – Energy storage – Structural properties of environment – Bio-geo – chemical cycles – Society and environment population and technology.

**UNIT- III ENERGY ALTERNATIVES**

**Marks : 16**

Sources of continuous power – Wind and water – Geothermal – Tidal and solar power – MHD, fuel cells – Hydrogen as fuel

**UNIT- IV MANAGEMENT OF ENERGY CONSERVATION**

**Marks : 16**

Chemical industries – Classification – Conservation in unit operation such as separation –Cooling tower – Drying –Conservation applied to refineries, petrochemical, fertilizers, cement, pulp and paper, food industries.

**UNIT- V ECONOMIC BALANCE IN ENERGY CONSUMPTION**

**Marks : 16**

Cost analysis – Capacity – Production rate – System rate – System cost analysis – Corporate models – Production analysis and production using fuel inventories – Input-output analysis –Economics – Tariffs.



**Text Books**

1. Krentz, J. H., “Energy Conservation and Utilisation”, Allyn and Bacur Inc., 1976.
2. Gramlay, G. M., “Energy”, Macmillon Publishing Co., 1975.

**Reference Books**

1. Rused C.K., “Elements of Energy Conservation”, McGraw – Hill Book Co., 1985.
2. Judson King; “Separation Processes”, McGraw – Hill Book Co., 1985.
3. Samir Sarkar, “Fuels and Combustion”, 2nd Edition, Orient Longman Publication, 1988.



**NOVEL SEPARATION PROCESS  
(BTPCE0803-B)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Max (e)	Min (f)				
BTPC E0803	Elective -II NOVEL SEPARATION PROCESS	3	1	-	4	80	25	20	100	-	-	-	100	200	3 hrs

**UNIT- I MEMBRANE SEPARATIONS**

**Marks : 16**

Types and choice of membranes – Plate and frame membranes, tubular membranes, spiral wound membranes, hollow fibre membrane and their relative merits, membrane reactors, membrane permeators involving Dialysis – Reverse osmosis – Ultrafiltration .

**UNIT- II CHROMATOGRAPHY TECHNIQUES**

**Marks : 16**

Affinity chromatography, immuno chromatography and Ion exchange chromatography –Introduction – Principles – Types of equipment – Commercial processes – Applications.

**UNIT- III SEPARATIONS BY ADSORPTION TECHNIQUES**

**Marks : 16**

Types of adsorption – Nature of adsorbents – Adsorption equilibria – Adsorption hysteresis adsorption isotherms – Effect of temperature and pressure – Freundlich equation – Stagewise adsorption – Single and multistage crosscurrent adsorption – Break through curves and rates of adsorption.

**UNIT- IV IONIC SEPARATIONS**

**Marks : 16**

Electrophoresis – Introduction – Electrokinetics – The electrical double layer – Zeta potential and electrophoresis – Laboratory methods – Analytical and Preparative methods – Applications.

**UNIT- V ZONE MELTING**

**Marks : 16**

Zone melting – Introduction – Equilibrium Diagram – Apparatus and Applications – Large scale and continuous operations – Limitations.



### **Text Books**

1. Schoen, H.M., "New Chemical Engineering Separation Techniques", Interscience Publishers, 1972.
2. Treybal, R.E., "Mass Transfer Operations", 3rd Edition, McGraw Hill Book Co., 1980.

### **Reference Books**

1. Geankoplis, C.J. "Transport Processes and Unit Operations", 3rd Edition, Prentice Hall of India Pvt. Ltd, 2000.
2. Sivasankar, B., "Bioseparations Principles and Techniques", Prentice Hall India Pvt. Ltd, 2006.
3. Seader, J.D. and Henley, E.J., "Separation Process Principles", 2nd Edition, John Wiley and Sons, Inc, 2006.



**MULTICOMPONENT DISTILLATION  
(BTPCE0803 C)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0803	Elective –II MULTICOMPONENT DISTILLATION	3	1	-	4	80	25	20	100	-	-	-	100	200	3 hrs

**UNIT- I THERMODYNAMIC PRINCIPLES**

**Marks : 16**

General considerations in the design of columns – Column sequencing – Heuristics for column sequencing – Key components – Distributed components – Non-Distributed components – Adjacent keys. Estimation of the fugacity coefficients for the vapor phase of polar gas mixtures.

**UNIT- II THERMODYNAMIC PROPERTY EVALUATION**

**Marks : 16**

Fundamental principles involved in the separation of multi component mixtures – Determination of bubble-point and Dew Point Temperatures for multi component mixtures – equilibrium flash distillation calculations for multi component mixtures – separation of multi component mixtures at total reflux.

**UNIT- III VARIOUS METHODS OF MCD COLUMN DESIGN**

**Marks : 16**

Theta method of convergence – Kb method and the constant composition method – Application of the Theta method to complex columns and to system of columns – Lewis Matheson method

**UNIT- IV VARIOUS TYPES OF MCD COLUMNS**

**Marks : 16**

Design of sieve, bubble cap, valve trays and structured packing columns for multi component distillation – computation of plate efficiencies.

**UNIT- V MINIMUM REFLUX RATIO FOR MCD SYSTEM**

**Marks : 16**

Definition of minimum reflux ratio – calculation of  $R_m$  for multi component distillation – Underwood method – Colburn method.



**Text Books**

1. Holland, C.D., “Fundamentals of Multi Component Distillation”, McGraw Hill Book Company, 1981
2. Van Winkle, “Distillation Operations”, McGraw Hill Publications, 1987.

**Reference Books**

1. King, C.J., “Separation Process Principles”, Mc Graw Publications, 1986.
2. Treybal, R.E., “Mass Transfer Operations”, 5th Edition, Mc Graw Hill publications. 1996.
3. McCabe and Smith, J.C., Harriot, “Unit Operation of Chemical Engineering”, 6th Edition, McGraw Hill, 2001.





**POLYMER TECHNOLOGY  
(BTPCE0803 D)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0803	Elective –II POLYMER TECHNOLOGY	3	1	-	4	80	25	20	100	-	-	-	100	200	3 hrs

**UNIT- I CHARACTERISTICS OF POLYMERS**

**Marks : 16**

The science of large molecules – Theory of polymer solutions – Measurement of molecular weight and size – Analysis and testing of polymers.

**UNIT- II STRUCTURE AND PROPERTIES OF POLYMER MATERIAL**

**Marks : 16**

Deformation, flow and melt characteristics – Morphology and order in crystalline polymers – Rheology and the mechanical properties of polymers – Polymer structure and physical properties.

**UNIT- III POLYMER SYNTHESIS**

**Marks : 16**

Condensation polymerization – Addition polymerization – Ionic and coordination polymerization – Copolymerisation – Polymerization conditions and polymer reactions.

**UNIT- IV INDUSTRIAL POLYMERS**

**Marks : 16**

Hydrocarbon plastics and elastomers – Other carbon chain polymers – Heterochain thermoplastics, thermosetting resins

**UNIT- V PROCESSING OF POLYMERS**

**Marks : 16**

Polymers developed for synthetic plastics, fibres and elastomer applications – Plastics technology Fiber technology – Elastomer technology.



**Text Books**

1 Billmeyer - 2007

2.Robert O. Ebeuele - 2000

**Reference Books**

1 Thomas Roy Crompton - 2006

2.Robert O. Ebeuele - 2000



**PROJECT WORK  
(BTPCE0804)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d= a+c)	Practical		T W (g)	Total (h= e+g)		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPC E0804	Project Work	-	-	2	2	-	-	-	-	200		200	400	400	3 hrs

The project may be considered as the ultimate exercise presented to the final semester student before graduation to measure accumulated engineering knowledge and experience. At the same

time, the project itself should provide the students with some new skills, innovation and information, and strengthen the acquired ones.

The project programme consists of different assignment, allotted time, submission of report under internal faculty guidance and evaluation by external member along with internal faculty. The activities performed during a project may cover one or more of the following; .

Data collection . Critical literature review . Laboratory experience and tests . Mathematical modeling. Software application . Industrial visits . Design and/or assembly . Process analysis The major project may be assigned to a group of two students. The project topic allotted may be of theoretical, experimental or industrial projects to be carried out under the supervision of internalguide and external guide (in case of industrial projects).

Major projects are to be executed strictly as per the project schedule prepared during VIII semester.

A committee of departmental faculty members comprising the project guide, one more faculty member and the head of department will monitor and review the progress achieved by the student at various

stages. The internal assessment will be done by the committee based on the progress achieved on completion of the project work.

On completion of the project work, each student has to prepare a project report and submit the same in triplicate to the department. The project work and the report will be evaluated by the internal assessment committee for a total of 100 marks. The external university examination, which carries a total of 100 marks, will have report evaluation and viva voce examination conducted by a committee of one external examiner and one internal examiner appointed by the university.



**Seminar  
(BTPCE-0805)**

Course Code	Title of the Paper	Periods Per week				Distribution of Marks								Grand Total (i= d+h)	Duration of Exam
		L	T	P	C	Theory		MST (c)	Total (d = a+c)	Practical		TW (g)	Total (h= e+g )		
						Max (a)	Min (b)			Ma x (e)	Min (f)				
BTPCE-0805	Seminar	-	-	2	2	-	-	-	-	-	-	100	100	100	3 Hrs