AFFILIATED INSTITUTIONS

ANNA UNIVERSITY

R - 2008

B.TECH. PHARMACEUTICAL TECHNOLOGY

II TO VIII SEMESTERS CURRICULA & SYLLABI

SEMESTER II

(Common to all B. E. / B. Tech. Degree Programmes except B. E. – Marine Engineering)

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS2161	Technical English – II*	3	1	0	4
2.	MA2161	Mathematics – II*	3	1	0	4
3.	PH2161	Engineering Physics – II*	3	0	0	3
4.	CY2161	Engineering Chemistry – II*	3	0	0	3
5. a	ME2151	Engineering Mechanics **(For non-circuit branches)**	3	1	0	4
5. b	EE2151	Circuit Theory **(For branches under Electrical Faculty)**	3	1	0	4
5. c	EC2151	Electric Circuits and Electron Devices **(For branches under I & C Faculty)**	3	1	0	4
6. a	GE2151	Basic Electrical & Electronics Engineering **(For non-circuit branches)**	4	0	0	4
6. b	GE2152	Basic Civil & Mechanical Engineering **(For circuit branches)**	4	0	0	4
PRACTICALS						
7.	GE2155	Computer Practice Laboratory-II*	0	1	2	2
8.	GS2165	Physics & Chemistry Laboratory - II*	0	0	3	2
9. a	ME2155	Computer Aided Drafting and Modeling Laboratory **(For non-circuits branches)**	0	1	2	2
9. b	EE2155	Electrical Circuits Laboratory **(For branches under Electrical Faculty)**	0	0	3	2
9. c	EC2155	Circuits and Devices Laboratory **(For branches under I & C Faculty)**	0	0	3	2
			TOTAL : 28 CREDITS			
10.	-	English Language Laboratory +	0	0	2	-

A. <u>CIRCUIT BRANCHES</u>

I   **Faculty of Electrical Engineering**

    1. B.E. Electrical and Electronics Engineering
    2. B.E. Electronics and Instrumentation Engineering
    3. B.E. Instrumentation and Control Engineering

II   **Faculty of Information and Communication Engineering**

    1. B.E. Computer Science and Engineering
    2. B.E. Electronics and Communication Engineering
    3. B.E. Bio Medical Engineering
    4. B.Tech. Information Technology

B. <u>NON – CIRCUIT BRANCHES</u>

I   **Faculty of Civil Engineering**

    1. B.E. Civil Engineering

II   **Faculty of Mechanical Engineering**

    1. B.E. Aeronautical Engineering
    2. B.E. Automobile Engineering
    3. B.E. Marine Engineering
    4. B.E. Mechanical Engineering
    5. B.E. Production Engineering

III   **Faculty of Technology**

    1. B.Tech. Chemical Engineering
    2. B.Tech. Biotechnology
    3. B.Tech. Polymer Technology
    4. B.Tech. Textile Technology
    5. B.Tech. Textile Technology (Fashion Technology)
    6. B.Tech. Petroleum Engineering
    7. B.Tech. Plastics Technology

SEMESTER III

S.No.	Subject Code	Subject	L	T	P	C
		Theory				
1	**MA2211**	Transforms and Partial Differential Equation	3	1	0	4
2	**PY3201**	Pharmaceutical Organic Chemistry	4	0	0	4
3	**GE2021**	Environmental Science and Engineering	3	0	0	3
4	**PY3202**	Physical Pharmaceutics	4	0	0	4
5	**CH3225**	Process Calculations	4	0	0	4
6	**CE3214**	Fluid Flow Operations	3	0	0	3
		Practical				
7	**PY3205**	Pharmaceutical Organic Chemistry Laboratory	0	0	3	2
8	**PY3206**	Physical Pharmaceutics Laboratory	0	0	3	2
9	**CE3221**	Fluid Flow Operations Laboratory	0	0	3	2
		Total	**21**	**0**	**9**	**28**

SEMESTER IV

S.No.	Subject Code	Subject	L	T	P	C
		Theory				
1	**MA3021**	Numerical Methods	3	1	0	4
2	**PY3211**	Biochemistry	3	0	0	3
3	**PY3212**	Microbiology	3	1	0	4
4	**PY3213**	Regulatory Requirements in Pharmaceutical Industries	3	0	0	3
5	**CH3226**	Heat Transfer	4	0	0	4
6	**CH3227**	Chemical Engineering Operations	4	0	0	4
		Practical				
7	**PY3216**	Microbiology Laboratory	0	0	3	2
8	**PY3217**	Biochemistry Laboratory	0	0	3	2
9	**CH3228**	Heat Transfer Laboratory	0	0	3	2
		TOTAL	**20**	**2**	**9**	**28**

SEMESTER V

S.No.	Subject Code	Subject	L	T	P	C
		Theory				
1	**PY3301**	Pharmaceutical Chemistry	3	1	0	4
2	**PY3302**	Pharmaceutical Dosage Forms	4	0	0	4
3	**PY3303**	Pharmacology	3	0	0	3
4	**PC3304**	Engineering Thermodynamics	4	0	0	4
5	**CH3325**	Chemical Reaction Engineering	4	0	0	4
6	**CH3306**	Process Instrumentation	4	0	0	4
		Practical				
7	**PY3307**	Pharmaceutical Chemistry Laboratory	0	0	3	2
8	**PY3308**	Pharmaceutical Dosage Forms Laboratory	0	0	3	2
9	**CH3309**	Chemical Reaction Engineering Laboratory	0	0	3	2
		TOTAL	**22**	**1**	**9**	**29**

SEMESTER VI

S.No.	Subject Code	Subject	L	T	P	C
		Theory				
1	**PY3311**	Instrumental Methods of Pharmaceutical Analysis	3	1	0	4
2	**PY3312**	Separation Technology	3	0	0	3
3	**PY3313**	Process Equipment Design	4	0	0	4
4	**CH3314**	Mass Transfer Operations	4	0	0	4
5	**CS3315**	Object Oriented Programming	3	0	0	3
6	**E1******	Elective I	3	0	0	3
		Practical				
7	**PY3316**	Instrumental Methods of Pharmaceutical Analysis Laboratory	0	0	3	2
8	**CH3317**	Mass Transfer Laboratory	0	0	3	2
9	**GE3318**	Communication Skills Laboratory	0	0	4	2
		TOTAL	**20**	**1**	**10**	**27**

SEMESTER VII

S.No.	Subject Code	Subject	L	T	P	C
		Theory				
1	**PY3401**	Advanced Medicinal Chemistry	3	1	0	4
2	**PY3402**	Novel Drug Delivery System	4	0	0	4
3	PY3403	Pharmaceutical Biotechnology	4	0	0	4
4	**CH3404**	Process Dynamics and Control	4	0	0	4
5	**CH3405**	Technology of Fine Chemicals and Bulk Drugs	4	0	0	4
6	E2****	Elective II	3	0	0	3
		Practical				
7	**PY3406**	Advanced Medicinal Chemistry Laboratory	0	0	3	2
8	**PY3407**	Novel Drug Delivery System Laboratory	0	0	3	2
9	**CH3408**	Process Dynamics and Control Laboratory	0	0	3	2
		TOTAL	**22**	**1**	**9**	**29**

SEMESTER VIII

S.No.	Subject Code	SUBJECT	L	T	P	C
		Theory				
1	**CH3411**	Unit Processes in Organic Synthesis	4	0	0	4
2	**GE2022**	Total Quality Management	3	0	0	3
3	E3****	Elective III	3	0	0	3
		PRACTICAL				
4	**PY3412**	Project Work	0	0	12	6
		TOTAL	**10**	**0**	**12**	**16**

ELECTIVE I

S.No.	Subject Code	Subject	L	T	P	C
THEORY						
1	**PY3001**	Solid Dosage Form Technology	3	0	0	3
2	**PY3002**	Herbal Technology	3	0	0	3
3	**PY3003**	Pharmaceutical Production Management	3	0	0	3
4	**PC3006**	Industrial Management	3	0	0	3

ELECTIVE II

S.No.	Subject Code	Subject	L	T	P	C
THEORY						
1	**PY3005**	Water Treatment and Management	3	0	0	3
2	**PY3006**	Validation in Pharmaceutical Industries	3	0	0	3
3	**PY3007**	Natural Products Chemistry	3	0	0	3
4	**PY3008**	Materials Science and Technology	3	0	0	3

ELECTIVE III

S.No.	Subject Code	Subject	L	T	P	C
THEORY						
1	**PY3009**	Pharmaceutical Packaging Technology	3	0	0	3
2	**PY3010**	Pilot Plant and Scale up Methods	3	0	0	3
3	**PY3011**	Drugs Through Biotechnology	3	0	0	3
4	**MG3012**	Safety and Risk Management	3	0	0	3

HS2161   **TECHNICAL ENGLISH II**   **L T P C**
                                                                                3 1 0 4

AIM

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES

* To help students develop listening skills for academic and professional purposes.
* To help students acquire the ability to speak effectively in English in real-life situations.
* To inculcate reading habit and to develop effective reading skills.
* To help students improve their active and passive vocabulary.
* To familiarize students with different rhetorical functions of scientific English.
* To enable students write letters and reports effectively in formal and business situations.

UNIT I   **12**

Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:

1. Exercises on word formation using the prefix 'self' - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II   **12**

Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:

1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III   **12**

Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

Suggested activities:
1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object –verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV   **12**

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:
1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V   **9**

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:
      1. Case Studies on problems and solutions
      2. Brain storming and discussion
      3. Writing Critical essays
      4. Writing short proposals of 2 pages for starting a project, solving problems,etc.
      5. Writing advertisements.

                                                TOTAL: 60 PERIODS

TEXT BOOK
1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES
1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition,   Pearson Education, 2007.

Extensive Reading:
1.   Robin Sharma**, '**The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

Note:
The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

MA2161   **MATHEMATICS – II**   **L T P C**
                                                                                      3 1 0 4

UNIT I   ORDINARY DIFFERENTIAL EQUATIONS   12
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II   VECTOR CALCULUS   12
Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelpipeds.

UNIT III   ANALYTIC FUNCTIONS   12
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT IV   COMPLEX INTEGRATION   12
Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V   LAPLACE TRANSFORM   12
Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL : 60 PERIODS

TEXT BOOKS

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3rd Edition, Laxmi Publications (p) Ltd., (2008).

2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES

1. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, New Delhi, (2007).

2. Glyn James, "Advanced Engineering Mathematics", 3rd Edition, Pearson Education, (2007).

3. Erwin Kreyszig, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007).

4. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

PH2161 **ENGINEERING PHYSICS – II** **L T P C**
3 0 0 3

UNIT I CONDUCTING MATERIALS 9
Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9
Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9
Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications – magnetic recording and readout – storage of magnetic data – tapes, floppy and magnetic disc drives.
Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V MODERN ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications.
Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA
Nanomaterials: synthesis –plasma arcing – chemical vapour deposition – sol-gels – electrodeposition – ball milling - properties of nanoparticles and applications.
Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications.

TOTAL : 45 PERIODS

TEXT BOOKS
1. Charles Kittel ' Introduction to Solid State Physics', John Wiley & sons, 7th edition, Singapore (2007)
2. Charles P. Poole and Frank J.Ownen, 'Introduction to Nanotechnology', Wiley India(2007) (for Unit V)

REFERENCES
1. Rajendran, V, and Marikani A, 'Materials science'Tata McGraw Hill publications, (2004) New delhi.
2. Jayakumar, S. 'Materials science', R.K. Publishers, Coimbatore, (2008).
3. Palanisamy P.K, 'Materials science', Scitech publications(India) Pvt. LTd., Chennai, second Edition(2007)
4. M. Arumugam, 'Materials Science' Anuradha publications, Kumbakonam, (2006).

CY2161 **ENGINEERING CHEMISTRY – II** **L T P C**
3 0 0 3

AIM
To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES
- The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

UNIT I ELECTROCHEMISTRY 9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^{2+} vs dichromate and precipitation – Ag^+ vs Cl^- titrations) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations,

UNIT II CORROSION AND CORROSION CONTROL 9

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

UNIT III FUELS AND COMBUSTION 9

Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods-knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels-water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

UNIT IV PHASE RULE AND ALLOYS 9

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT V ANALYTICAL TECHNIQUES 9

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

TOTAL: 45 PERIODS

TEXT BOOKS
1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).

REFERENCES
1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).

ME2151   **ENGINEERING MECHANICS**   **L T P C**
                                                                 3 1 0 4

OBJECTIVE

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I   BASICS & STATICS OF PARTICLES   12

Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II   EQUILIBRIUM OF RIGID BODIES   12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III   PROPERTIES OF SURFACES AND SOLIDS   12

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV   DYNAMICS OF PARTICLES   12

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V   FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS   12

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.
Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

                                                        TOTAL: 60 PERIODS

TEXT BOOK
1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES
1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
4. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).

EE2151 **CIRCUIT THEORY** **L T P C**
(Common to EEE, EIE and ICE Branches) **3 1 0 4**

UNIT I   BASIC CIRCUITS ANALYSIS   **12**
Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II   NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS   **12**
Network reduction: voltage and current division, source transformation – star delta conversion.
Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III   RESONANCE AND COUPLED CIRCUITS   **12**
Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV   TRANSIENT RESPONSE FOR DC CIRCUITS   **12**
Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V   ANALYSING THREE PHASE CIRCUITS   **12**
Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL : 60 PERIODS

TEXT BOOKS

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).

REFERENCES

1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi (2001).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

EC2151   **ELECTRIC CIRCUITS AND ELECTRON DEVICES**   **L T P C**
                        (For ECE, CSE, IT and Biomedical Engg. Branches)   **3 1 0 4**

UNIT I   **CIRCUIT ANALYSIS TECHNIQUES**   **12**
Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II   **TRANSIENT RESONANCE IN RLC CIRCUITS**   **12**
Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT III   **SEMICONDUCTOR DIODES**   **12**
Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

UNIT IV   **TRANSISTORS**   **12**
Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V   SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment only)   12
Tunnel diodes – PIN diode, varactor diode – SCR characteristics and two transistor equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

TOTAL : 60 PERIODS

TEXT BOOKS
1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series,Tata McGraw Hill, (2001)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits",Tata McGraw Hill, 2nd Edition, (2008).
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, (2008).

REFERENCES
1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2nd Edition, 2008.

GE2151   BASIC ELECTRICAL AND ELECTRONICS ENGINEERING   L T P C
(Common to branches under Civil, Mechanical and Technology faculty)   **4 0 0 4**

UNIT I   ELECTRICAL CIRCUITS & MEASURMENTS   12
Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II   ELECTRICAL MECHANICS   12
Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III   SEMICONDUCTOR DEVICES AND APPLICATIONS   12
Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV   DIGITAL ELECTRONICS   12

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V   FUNDAMENTALS OF COMMUNICATION ENGINEERING   12

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL : 60 PERIODS

TEXT BOOKS
1. V.N. Mittle "Basic Electrical Engineering",Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, "Applied Electronics" S. Chand & Co., 2006.

REFERENCES
1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering",Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press (2005).
3. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, (2002).
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, (2003).

GE2152   BASIC CIVIL & MECHANICAL ENGINEERING   L T P C
(Common to branches under Electrical and I & C Faculty)   **4 0 0 4**

A – CIVIL ENGINEERING

UNIT I   SURVEYING AND CIVIL ENGINEERING MATERIALS   15

Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II   BUILDING COMPONENTS AND STRUCTURES   15

Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

TOTAL: 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III   POWER PLANT ENGINEERING   10
Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV   I C ENGINES   10
Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V   REFRIGERATION AND AIR CONDITIONING SYSTEM   10
Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

TOTAL: 30 PERIODS

REFERENCES
1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering",Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham. S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S. "Basic Civil Engineering", Anuradha Agencies, (2005).
4. Venugopal K and Prahu Raja V, "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

GE2155   **COMPUTER PRACTICE LABORATORY – II**   **L T   P C**
                                                                      0 1 2 2

LIST OF EXPERIMENTS

1. UNIX COMMANDS   15

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING   15

Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX   15

Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL : 45 PERIODS

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

- 1 UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

Software

- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

GS2165 **PHYSICS LABORATORY – II** **L T P C**
0 0 3 2

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
4. Determination of viscosity of liquid – Poiseuille's method.
5. Spectrometer dispersive power of a prism.
6. Determination of Young's modulus of the material – uniform bending.
7. Torsional pendulum – Determination of rigidity modulus.

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

GS2165 **CHEMISTRY LABORATORY – II** **L T P C**
0 0 3 2

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using $BaCl_2$ vs Na_2SO_4
4. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper   sulphate)
7. Estimation of Ferric iron by spectrophotometry.

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

ME2155   COMPUTER AIDED DRAFTING AND MODELING LABORATORY   L T P C
0 1 2 2

List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

TOTAL: 45 PERIODS

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility -30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

EE2155   **ELECTRICAL CIRCUIT LABORATORY**   **L T P C**
                             (Common to EEE, EIE and ICE)   **0 0 3 2**

LIST OF EXPERIMENTS
1. Verification of ohm's laws and kirchoff's laws.
2. Verification of Thevemin's and Norton's Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits.
10. Frequency response of single tuned coupled circuits.

TOTAL: 45 PERIODS

EC2155   **CIRCUITS AND DEVICES LABORATORY**   **L T P C**
                                                                            0 0 3 2

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac.
12. Characteristics of Photodiode and Phototransistor.

TOTAL: 45 PERIODS

ENGLISH LANGUAGE LABORATORY (Optional)   L T P C
                                                                           0 0 2 -

1. Listening: **5**
Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations

2. Speaking: **5**
Pronouncing words & sentences correctly – word stress – Conversation practice.

Classroom Session   **20**
    1. Speaking: Introducing oneself, Introducing others, Role play, Debate- Presentations: Body language, gestures, postures.
       Group Discussions etc
    2. Goal setting – interviews – stress time management – situational reasons

Evaluation
    (1) Lab Session – 40 marks
                  Listening   – 10 marks
                  Speaking   – 10 marks
                  Reading   – 10 marks
                  Writing   – 10 marks

    (2) Classroom Session – 60 marks
          Role play activities giving real life context – 30 marks
          Presentation   – 30 marks

Note on Evaluation

       1. Examples for role play situations:
              a. Marketing engineer convincing a customer to buy his product.
              b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.

2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

REFERENCES
1. Hartley, Peter, Group Communication, London: Routledge, (2004).
2. Doff, Adrian and Christopher Jones, Language in Use – (Intermediate level), Cambridge University Press, (1994).
3. Gammidge, Mick, Speaking Extra – A resource book of multi-level skills activities , Cambridge University Press, (2004).
4. Craven, Miles, Listening Extra - A resource book of multi-level skills activities, Cambridge, Cambridge University Press, (2004).
5. Naterop, Jean & Rod Revell, Telephoning in English, Cambridge University Press, (1987).

LAB REQUIREMENTS
1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders.

MA2211	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATION	L	T	P	C
	(Common to all branches)	3	1	0	4

OBJECTIVES
The course objective is to develop the skills of the students in the areas of Transforms and Partial Differtial Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I   FOURIER SERIES   9 + 3
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

UNIT II   FOURIER TRANSFORMS   9 + 3
Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III   PARTIAL DIFFERENTIAL EQUATIONS   9 + 3
Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV   APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   9 + 3

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V   Z -TRANSFORMS AND DIFFERENCE EQUATIONS   9 + 3

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem - Formation of difference equations – Solution of difference equations using Z-transform.

LECTURES: 45 TUTORIALS : 15   TOTAL : 60 PERIODS

TEXT BOOKS

1. Grewal, B.S, 'Higher Engineering Mathematics' 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES

1   Bali.N.P and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications(P) Ltd. (2007)

2. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).

3. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2007).

4. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition-Wiley India (2007).

PY3201   PHARMACEUTICAL ORGANIC CHEMISTRY   L   T   P   C
**   4   0   0   4**

UNIT I   CONCEPT OF AROMATICITY AND AROMATIC CHARACTER   12

General mechanism of aromatic electrophilic substitution reactions – Principle involved in alkylation and acylation – Industrial applications – Hoesch reaction – Formylation reactions – Gattermann reaction – Gattermann-Koch reaction – Vilsmeier reaction – Reimar-Tiemann reaction – Aromatic nucleophilic substitution reaction mechanisms.

UNIT II   MOLECULAR REARRANGEMENTS   12

Wolff rearrangement – Schmidt reaction – Curtius rearrangement – Mechanism and applications – Oxidation mechanism – Applications of the following oxidation reactions – $KMnO_4$ – MnO_2 – Stereochemistry and applications of the following reduction reactions – Catalytic dehydrogenation – Meerwein-Ponndorf-Verley – $NaBH_4$ – Clemmenson.

UNIT III   AROMATIC AMINES AND SULPHONIC ACIDS   12

Methods of introduction of the aromatic amino group into an aromatic nucleus – Diazotization reaction and reactions of aryl diazonium salts such as Sandmeyer – Ullmann – Azo coupling – Deamination – Benzidine rearrangement – Aromatic sulphonic acids – Sulphonation reaction – Chlorosulphonation.

UNIT IV   POLYNUCLEAR AROMATIC HYDROCARBONS   12
Synthesis and reactions of napthalene – Anthracene – Phenanthrene – Diphenyl and triphenyl compounds and its medicinally important derivatives.

UNIT V   HETEROCYCLIC AROMATIC COMPOUNDS   12
Aromaticity of pyrrole – Thiophene – Furan – Pyridine – Dipole moment – Reactive sites and stability of these heterocycles – General principles of heterocyclic synthesis – Methods of preparation and reactions of pyridines – Pyrroles – Thiophenes – Furans – Quinolines – Isoquinolines.

TOTAL: 60 PERIODS

TEXT BOOKS

1.   Bahl, A. and Bahl, B.S., "Advanced Organic Chemistry", 1st Edition, S. Chand and Company, 2004.
2.   Morrison and Boyd, "Organic Chemistry", 6th Edition, Prentice Hall Publications, 2004.

REFERENCES

1.   Kalsi, P.S., "Organic Reaction and Their Mechanisms", 2nd Edition, New Age International Pvt. Ltd. Publications, 2004.
2.   Tewari, N., "Advanced Organic Reaction Mechanism", Books and Allied Publishers, 2006.
3.   Finar, I. L., "Organic Chemistry", 6th Edition, Longmans Publications, 2002.

GE 2021   ENVIRONMENTAL SCIENCE AND ENGINEERING   L T P C
3 0 0 3

AIM
- The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional Endeavour that they participates.

OBJECTIVE
- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I   ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY   14
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 – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II   ENVIRONMENTAL POLLUTION   8
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 individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III   NATURAL RESOURCES   10
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 over-utilization 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 logging, salinity, case studies – 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 an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV   SOCIAL ISSUES AND THE ENVIRONMENT   7
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 accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V   HUMAN POPULATION AND THE ENVIRONMENT   6

Population growth, variation among nations – population explosion – family welfare programme – 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.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill,NewDelhi, (2006).

REFERENCES 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. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

PY3202	**PHYSICAL PHARMACEUTICS**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

UNIT I   MICROMERITICS   12

Particle size and size distribution – Methods of determining particle size – Particle shape and surface area – Methods of determining surface area pore size and derived properties of powders.

UNIT II   RHEOLOGY   12

Newtonian systems – Non newtonian systems – Plastic flow – Pseudo plastic flow – Dilatant flow – Thixotropy – Viscometers – Types of viscometers.

UNIT III   COLLOIDS   12

Electrical and optical properties of colloids – Sedimentation – Stokes law – Stability of colloidal dispersions – Protective colloids – Sensitization of colloidal system – Applications of colloids in pharmacy.

UNIT IV   SUSPENSIONS AND EMULSIONS   12

Interfacial properties of suspended particles – Settling in suspensions – Formulation of suspensions – Theories of emulsification – Physical stability of emulsions – Preservation of emulsions – Rheologic properties of emulsions – Special emulsion system.

UNIT V   DRUG STABILITY   12

Chemical degradation of pharmaceutical products – Hydrolysis, oxidation, isomerization, polymerization, decarboxylation – Physical factors influencing chemical degradations – Temperature, moisture, light, radiation – Factors influencing and methods of reducing chemical degradation – Physical degradation of pharmaceutical products – Accelerated stability testing.

TOTAL: 60 PERIODS

TEXT BOOKS

1.   Martin, A., "Physical Pharmacy", 4th Edition, Lippincott Williams and Wilkins, B.I. Publications, 2002.
2.   Derle, D.V., "Essentials of Physical Pharmacy", 1st Edition, Pharma Book Syndicate, 2006.

REFERENCES

1.   Copper and Gunns, "Tutorial Pharmacy", 6th Edition, CBS Publishers, 2005.
2.   Bentley's, "Text book of Pharmaceutics", 1st Edition, AITBS Publishers, 2006.
3.   Shotton, E., "Physical Pharmaceutics", 1st Edition, Pharma Book Syndicate, 2007.

L	**T**	**P**	**C**
4	**0**	**0**	**4**

CH3225   PROCESS CALCULATIONS

UNIT I   STOICHIOMETRY   12

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

UNIT II   IDEAL GASES AND VAPOR PRESSURE   12

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   12

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

UNIT IV   MATERIAL BALANCE   12

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   12

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

TOTAL: 60 PERIODS

TEXT BOOKS

1.   Bhatt, B.I. and Vora, S.M., "Stoichiometry", 4th 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", 6th Edition, Prentice Hall of India Ltd, 2000.
3.   Chopey, N.P. and Hicks, T.G., "Handbook of Chemical Engineering Calculations", 2nd Edition, McGraw-Hill Inc, 1984.

CE3214	FLUID FLOW OPERATIONS	L	T	P	C
		3	0	0	3

UNIT I   PROPERTIES OF FLUIDS AND CONCEPT OF PRESSURE   9
Introduction – Physical properties of fluids – Types of   fluids – Fluid statics and its applications - Pressure – Density – Height relationships – Pressure measurement – Units and dimensions – Dimensional analysis – Dimensionless numbers.

UNIT II   MOMEMTUM BALANCE AND ITS APPLICATIONS   9
Kinematics of fluid flow – Stream line – Stream tube – Velocity potential – Newtonian and non-newtonian fluids – Time dependent fluids – Reynolds number experiment and significance –Continuity Equation – Momentum balance – Potential flow – Bernoulli's equation – Correction for fluid friction – Correction for pump work.

UNIT III   FLOW OF INCOMPRESSIBLE FLUIDS THROUGH DUCTS   9

Flow of incompressible fluids in pipes – Laminar and turbulent flow through closed conduits –Velocity profile and friction factor for smooth and rough pipes – Heat 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   9

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   9

Measurement of fluid flow – Orifice meter – Venturi meter – Pitot tube – Rotameter – Weirs and notches – Hot wire anemometers – Transportation of fluids – Positive displacement pumps – Rotary and Reciprocating pumps – Centrifugal pumps – Performance and characteristics – Air lift and diaphragm pumps.

TOTAL: 45 PERIODS

TEXT BOOKS
1. McCabe, W.L., Smith, J.C. and Harriott, P., "Unit operations of Chemical Engineering", Seventh Edition, McGraw-Hill, 2004.
2. Coulson, J.M., and Richardson, J.F., "Coulson and Richardson's Chemical Engineering", Vol. I, 3rd Edition, Butterworth Heinemann Publishers, 2004.

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

PY3205	PHARMACEUTICAL ORGANIC CHEMISTRY LABORATORY	L	T	P	C
		0	0	3	2

1.   Determination of Impurities

2.   Synthesis of some organic compounds involving single step reactions like nitration, halogenation, acetylation and hydrolysis.

3.   Synthesis of organic compounds involving Two steps

4.   Assay of organic compounds involving acidimetry, alkalimetry, Iodometry etc.

5. Determination of rate of reation in zero, first order reations.

6. Determination of physical constants used as criteria of purity like melting point, boiling point, weight per ml, refractive index and viscosity.

7. Determination of pH, potentiometric and dead stop endpoint technique.

8. Preparation of buffers, sensitivity, specificity, precision and accuracy.

9. Tests for Purity for official compounds mentioned in IP/BP/USP.

10. Limit test for marketed formulations.

11. Functional group analysis

12. Molecular weight calculations

TOTAL: 45 PERIODS

		L	**T**	**P**	**C**
PY3206	**PHYSICAL PHARMACEUTICS LABORATORY**	**0**	**0**	**3**	**2**

1. Determination of density of Liquid.

2. Determination of surface tension/ interfacial tension of liquid.

3. Determination of critical micellar concentration of surfactant.

4. Effect of concentration on adsorption.

5. Determination of half life, rate constant and order of chemical reaction.

6. Effect of temperature on specific rate constant.

7. Determination of specific surface area of powder by adsorption method.

8. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.

9. Effect of electrolytes on the stability of colloids.

10. Preparation of various types of suspensions and determination of their sedimentation parameters.

11. Determination of particle size of powders and globules.

12. Preparation and stability of emulsion.

TOTAL: 45 PERIODS

CE3221   **FLUID FLOW OPERATIONS LABORATORY**

L	T	P	C
0	0	3	2

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. Experiment on Orificemeter.

5. Experiment on Venturimeter.

6. Calibration of Rotameter.

7. To evaluate the performance of Weirs and Notches.

8. To evaluate the performance of centrifugal pump.

9. Draining time of open tank.

10. To verify Ergun's equation.

11. To characterize the behavior of Fluidized bed.

12. Performance of packed bed (Gas- Liquid).

TOTAL: 45 PERIODS

MA3021   **NUMERICAL METHODS**   **L T P C**
                                                                            3 1 0 4

UNIT I   **SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**   **(10 +3)**
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton-Raphson method- Solution of linear system of equations - Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method and by Jacobi's method.

UNIT II   **INTERPOLATION AND APPROXIMATION**   **(8 + 3)**
Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III   **NUMERICAL DIFFERENTATION AND INTEGRATION**   **(9 + 3)**
Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV   **INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL**
                       EQUATIONS   **(9 + 3)**
Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations – Multistep methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

UNIT V **BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS** **(9 + 3)**

Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

L: 45 T: 15 TOTAL : 60 PERIODS

TEXT BOOKS
1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.
2. Sankara Rao, K. "Numerical methods for Scientists and Engineers', 3rd Edition Prentice Hall of India Private Ltd., New Delhi, 2007.

REFERENCES
1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.
3. Brian Bradie, "A friendly introduction to Numerical analysis", Pearson Education Asia, New Delhi, 2007.

PY3211	BIOCHEMISTRY	L	T	P	C
		3	0	0	3

UNIT I **BIOMOLECULES** **9**

Structure and properties of mono, di, oligo and polysaccharides – Fatty acids – Phospholipids – Glycolipids – Steroids – Purine and pyrimidines bases.

UNIT II **BIOSYNTHESIS** **9**

Biosynthesis of amino acids, neocleotides and lipids.

UNIT III **INTERMEDIARY METABOLISM** **9**

Glycogenesis – Glycogenolysis – Gluconeogenesis – Glycolysis – Pentose phosphate pathway – TCA cycle.

UNIT IV **BIOENERGETICS** **9**

Electron transport chain (Phosporylation) in mitochondria – Exergonic and endergonic reactions – Chemiosmotic hypothesis.

UNIT V   ENZYMES   9

Classification and nomenclature – Mechanism of enzyme action – Specificity of enzyme – Factors affecting enzyme activity.

TOTAL: 45 PERIODS

TEXT BOOKS

1.   Berg, J.M., Tymoczko, J.L. and Stryer, L., "Biochemistry", 5th Edition, McMillan Publications, 1994.
2.   Voet, D. and Voet, G., "Biochemistry", 2nd Edition, John Wiley and Sons, 1994.

REFERENCES

1.   David, N.L. and Michael, M.C., "Lehninger Principles of Biochemistry", 3rd Edition, CBS Publications, 1993.
2.   Satyanarayana, U. and Chakrapani, U., "Biochemistry", 3rd Edition, Books and Allied Publishers, 2006.
3.   Robert, K.M., Darryl, K.G., Peter, A.M. and Victor, W.R., "Harper's Illustrated Biochemistry", 26th Edition, McGraw Hill Publications, 2003.

PY3212	**MICROBIOLOGY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

UNIT I   INTRODUCTION TO MICROBIOLOGY   9

Classification and identification of microorganisms – Phase contrast and electron microscopy – Chemistry and structural organization of bacteria, virus, fungi, actinomycetes – Multiplication of bacteriophage, bacteria and organisms such as yeast, fungi.

UNIT II   GROWTH OF MICROORGANISMS   9

Microbial nutrition and environment – Factors controlling growth of microorganisms in different media – Growth curve – Methods of enumeration of multiplying microorganisms – Culture media – Preservation of microbes – Sterilization and disinfection.

UNIT III   MICROBIAL METABOLISM   9

Microbial Metabolism – Metabolic pathways - Production of secondary metabolites and their complication in industry – Beneficial micro organisms and products – Formation of toxic materials by microorganisms – A general study of food, industrial and agricultural microbiology.

UNIT IV   CONTROL OF MICROORGANISMS   9

Diseases caused by microorganisms and control – Chemotherapeutic agents – Beta-lactum antibiotics – Macrolide antibiotics – Cephalosoprins – Quiolones – Sulphonamides and disinfectants.

UNIT V   ENVIRONMENTAL APPLICATIONS OF MICROBIOLOGY   9

Recycling of waste biomass – Production of biogas – Leaching of ores by microorganism –Application of biofertilizers and bio-pesticides – Bioremediation.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

1.   Katheelen, P.T., "Foundations in Microbiology", 5th Edition, McGraw-Hill, 2004.

2.   Pelczar, M.J., Chan, E.C.S. and Kreig, N.R., "Microbiology", Tata McGraw-Hill Edition, 1993.

REFERENCES

1.   Purohit, S.S., "Microbiology (Fundamental and application)", 6th Edition, Agrobios, 2001.

2.   James, M.J., "Modern Food Microbiology", Chapman and Hall Inc, 2005.

3.   Madigan, M.T. and Martinko, J.M., "Brock Biology of Microorganisms", 11th Edition, Prentice Hall, 2005.

PY3213	REGULATORY REQUIREMENTS IN	L	T	P	C
	PHARMACEUTICAL INDUSTRIES	3	0	0	3

UNIT I   REGULATORY CONCEPTS   9

Quality assurance – Quality control – Practice of cGMP – Schedule M – USFDA.

UNIT II   REGULATORY ASPECTS   9

Pharmaceuticals – Bulk drug manufacture – Biotechnology derived products.

UNIT III   INTELLECTUAL PROPERTY RIGHTS   9

Patent system – Different types of patents – Filing process of application for patent – Infringement of patents – The patent rules 2003 as amended by the patents (amendment) rule 2006.

UNIT IV   ICH GUIDELINES   9

Quality guidelines – Impurities in new drug substances (Q3A R) – Impurities in   new drug products – Validation of analytical procedures text and methodology (Q2 R1).

UNIT V   QUALITY AUDIT AND SELF INSPECTIONS   9

SOPs – Documentation – Loan license auditing – Common technical documentation (CTD) – Drug master file (DMF).

TOTAL: 45 PERIODS

TEXT BOOKS

1.   Robert, I.R., Nash, R.A., Wachter, A.H. and Swarbrick, J., "Pharmaceutical Process Validation", 3rd Edition, Maarcel Dekker Inc., 2003.
2.   Willig, H., Tuckeman, M.M. and Hitchings, W.S., "Good Manufacturing Practices for Pharmaceuticals", 5th Edition, Marcel Dekker Inc., 2000.

REFERENCES

1.   Subbaram, N.R., "What Everyone Should Know About Patents", 2nd Edition, Pharma Book Syndicate, 2005.
2.   Banker, G.S. and Rhodes, C.T., "Modern Pharmaceutics", 4th Edition, Marcel Dekker Inc., 2002.
3.   Sharma, P.P., "How to Practice GMPs", 3rd Edition, Vandana Publications, 2006.

CH3226	**HEAT TRANSFER**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

**UNIT I   FUNDAMENTAL CONCEPTS AND CONDUCTIVE HEAT
                   TRANSFER   12**

Modes of heat transfer – Fourier's law – Newton's law– Thermal conductance and resistance – Temperature field and temperature gradient – Heat transfer by conduction – General heat conduction equation – Thermal diffusivity and equivalent thermal conductivity – One dimensional steady state conduction through thick cylindrical shells – Critical thickness of insulation for cylindrical surfaces.

**UNIT II   CONVECTIVE HEAT TRANSFER AND BOUNDARY LAYER
                   THEORY   12**

Heat transfer coefficient – Forced convection – Free convection – Dimensional analysis and empirical correlation – Physical significance of dimensionless groups – Concept of hydrodynamic and thermal boundary layers.

UNIT III THERMAL RADIATION 12

Thermal radiation – Spectrum of electromagnetic radiation – Monochromatic emissive power of black body – Planck's distribution law – Kirchoff's law – Total emissive power – Problems of Stefan Boltzmann law and Weins displacement law – Configuration factor determination – Typical examples.

UNIT IV DESIGN OF HEAT EXCHANGERS 12

Heat exchangers – Types and variation in design – Overall heat transfer coefficient – LMTD – Correction factors for multiple pass heat exchanger – Illustrative examples – Number of transfer units and effectiveness of heat exchangers.

UNIT V HEAT TRANSFER IN EVAPORATORS 12

Evaporation – Type of evaporators – Single and multiple effect operation – Capacity and economy of multiple effect evaporators – Effect of liquid head and boiling point elevation – Duhrings rule – Material and energy balance in evaporators – Illustrative examples.

TOTAL: 60 PERIODS

TEXT BOOKS
1. Nesati, O.M., "Heat Transfer: A Basic Approach", McGraw-Hill, 1985.
2. McCabe, W.L., Smith, J.C. and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edition, McGraw Hill, 2005.

REFERENCES
1. Donald, Q.K., "Process Heat Transfer", 1st Edition, Tata McGraw Hill Publishing Co, 1997.
2. Mikheyev, M., "Fundamentals of Heat Transfer", Mir Publishers, 1968.

CH3227	CHEMICAL ENGINEERING OPERATIONS	L	T	P	C
		4	0	0	4

UNIT I PARTICLE SEPARATION 12
Properties and characterization of particulate solids – Analysis and technical methods for size and surface area distribution of powder – Introduction – Preparation and techniques for the measurement of nanoparticles – Introduction to storage and conveying of solids – Principles of magnetic separation.

UNIT II SIZE REDUCTION 12
Size reduction equipment – Determination of energy and power requirement in milling operations – Screening equipment – Capacity and effectiveness.

UNIT III FILTRATION 12
Filtration equipment – 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 IV   SETTLING AND SEDIMENTATION   12

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

UNIT V   AGITATION AND MIXING   12

Introduction to 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 and types of mixers.

TOTAL: 60 PERIODS

TEXT BOOKS

1. McCabe, W.L., Smith, J.C. and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edition, McGraw Hill, 2005.
2. Badger, W.L. and Banchero, J.T., "Introduction to Chemical Engineering", Tata McGraw Hill, 2002.

REFERENCES

1. Raymond, A.K., "Materials Handling Handbook", 3rd Edition, Wiley - Interscience Publications, 1985.
2. Coulson, J.M. and Richardson, J.F., "Chemical Engineering", 3rd Edition, Butterworth Heineman Publications, 1977.

PY3216	MICROBIOLOGY LABORATORY	L	T	P	C
		0	0	3	2

1. Sterilization techniques (lecture / demonstration)
2. Preparation of various culture media.
3. Culturing of micro-organisms
   (a) Isolation of specific group of microbes symbiotic – asymbiotic, chemolithotrophs, organotrophs
   (b) Pure culture techniques – Streak plate, pour plate, isolation and preservation of bacterial culture, single spore isolation.
4. Identification of microorganisms by staining techniques
5. Identification of microorganisms by biochemical testing.
6. Quantification of microorganisms by turbidimetry
7. Quantification of microorganisms by serial dilution, MPM.
8. Preservation of cells, slants stabs, use of mineral oil, liquid paraffin, whey, glycerol, sterile water, lyophilization.
9. Environmental sample analysis – Polluted soil and effluent.
10. Food microbiology – Milk – Fermented food – Yogurt, meat, ice cream
11. Clinical microbiology – Normal mouth flora, pus, urine.
12. Determination of MIC of antimicrobial agents

TOTAL: 45 PERIODS

PY3217	**BIOCHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

1. Study of units for volume, weight, measurements and concentration. sensitivity, specificity, precision and accuracy.
2. Preparation of buffers and pH measurements.
3. Qualitative tests for carbohydrates.
4. Qualitative tests for amino acids.
5. Estimation of Reducing sugars by the Benedict's method.
6. Estimation of amino acids by ninhydrin method.
7. Protein estimation by various methods.
8. Acid hydrolysis of proteins
9. Enzyme assays: Phosphatase from potato, Amylase from sweet potato, Trypsin digestion of proteins, Assay of proteases, NADH Dehydrogenase, Catalase and peroxidase.
10. Extraction of lipids.
11. Phospholipids: Ashing and estimation of phosphate.
12. Estimation of cholesterol.
13. Estimation of nucleic acids.

TOTAL: 45 PERIODS

CH3228	**HEAT TRANSFER LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

To determine the conductivity of metal rod.
1. To determine the conduction parameters using composite wall.
2. To determine individual heat transfer film coefficient in forced convection.
3. To determine individual heat transfer film coefficient in free convection.
4. To determine Stefan Boltzmann law constant.
5. To determine condensing heat transfer coefficient in vertical condenser.
6. To determine condensing heat transfer coefficient in horizontal condenser.
7. To determine rate of evaporation in open pan evaporator.
8. To determine overall heat transfer coefficient of double pipe heat exchanger by parallel flow.
9. To determine overall heat transfer coefficient of double pipe heat exchanger by counter flow.
10. To determine overall heat transfer coefficient of shell and tube heat exchanger.
11. To determine overall heat transfer coefficient of plate type heat exchanger by parallel flow.
12. Apparatus for determination of emissivity.
13. To determine the thermal conductivity of insulating powder.

TOTAL: 45 PERIODS

PY3301 **PHARMACEUTICAL CHEMISTRY** **L T P C**
                                         3 1 0 4

UNIT I PHYSICO-CHEMICAL PROPERTIES ON BIOLOGICAL ACTION OF DRUGS 9

Physical properties – Optical isomers – Geometric isomers – Bioisosterism – Receptors – Occupational theory – Affinity theory.

UNIT II AUTONOMIC AND CENTRAL NERVOUS SYSTEM ACTING DRUGS 9

Structure – Synthesis – Uses – Pilocarpine – Neostigmine – Propanthallene – Salbutamol – Amphetamine – Phenoxy benzamine – Tolazoline – Thiopentone – Diazepam – Chlorpromazine – Haloperidol.

UNIT III CARDIOVASCULAR AND RESPIRATORY SYSTEM ACTING DRUGS 9

Synthesis – Uses – Digoxin – Digitoxin – Procainamide – Diltiazem – Isosorbide dinitrate – Captopril – Frusemide – Lovastatin – Clofibrate.

UNIT IV ANTIMICROBIAL AGENTS 9

Preparation – Therapeutic uses – Cephalosporine – Silver Sulphadiazine – Cotrimoxazole – Roxithromycin – Isoniazid – Pyrazinamide – Dapsone – Clofazimine – Idoxuridine – Zidovudine – Quinine – Primaquine – Cyclophosphamide – Methotrexate – Griseofulvin.

UNIT V PERIPHERAL NERVOUS SYSTEM AND GASTROINTESTINAL DRUGS 12

Structure – Synthesis – Uses – Gallamin triethiodide – Dantrolene Sodium – Ranitidine – Omeprazole – Metronidazole – Cinnarizine – Dicyclomine – Bisacodyl.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXTBOOKS

1. Ilango, K. and Valentina, P., "Text Book of Medicinal Chemistry", Vol. I, 1st Edition, Keerthi Publishers, 2007.
2. Kadam, S.S., Mahadik, K.R. and Bothara, K.G., "Principles of Medicinal Chemistry", Vol. I and II, Nirali Prakashan Publications, 1997.

REFERENCES

1. Chatwal, G., "Organic Chemistry of Natural Products", Vol. I and II, 3rd Edition, Himalaya Publishing House, 2002.
2. Wolff, M.E., "Burgers: Medicinal Chemistry", Vol. I to VI, 5th Edition, John Willy and Sons, 2005.
3. Bentley and Driver's "Text Book of Pharmaceutical Chemistry", 8th Edition, Oxford University Press, 2002.

PY3302 **PHARMACEUTICAL DOSAGE FORMS** **L T P C**
                                            4 0 0 4

UNIT I   PREFORMULATION   12

Concepts – Aqueous solubility – Partition coefficient – Dissolution – Melting point – Polymorphism – Assay development – Crystal morphology – Particle size – Powder flow properties – Compression properties – Excipient compatibility – Permeability – Stability.

UNIT II   LIQUID DOSAGE FORMS   12

Classification – Solubility – Importance of aqueous solubility – Choice of solvents – Additives used in liquid orals – Formulation – Manufacturing – Packing – Labeling and storage of solutions – Syrups – Dry syrups – Lotions – Liniments – Formulation and manufacturing of suspension – Emulsion – Evaluations of suspension – Emulsion – Physical – Chemical stability – Stability testing of suspension – Emulsion.

UNIT III   SEMISOLID DOSAGE FORMS   12

Classification – Advantages – Disadvantages – Semisolid bases types – Mechanism of drug penetration – Factors influencing penetration – Selection – General formulation – Manufacturing procedure – Evaluation – Packaging – Labeling – Storage requirements of ointments – Paste – Gels.

UNIT IV   PARENTERAL DOSAGE FORMS   12

Routes of administration – Official types of injections – Vehicles – Solutes – Containers – Devices – Formulation – Production – Sterilization – Packaging – Evaluations – Ophthalmic preparations – Formulation – Packaging – Storage – Official methods of evaluation.

UNIT V   AEROSOLS   12

Advantage and disadvantage of aerosols – Components of aerosol package – Aerosol systems – Aerosol formulations – Selection of components – Aerosol filling – Quality control of pharmaceutical aerosol.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Aulton, M.E., "Pharmaceutics – The Science of Dosage form Design", 2nd Edition, ELBS Publications, 2002.
2. Lachman, L. and Liberman, H.A., "Theory and Practice of Industrial Pharmacy", 3rd Edition, Varghese Publishing House, 1991.

REFERENCES

1. Gennaro, A.R., "Remington: The Science and Practice of Pharmacy", 21st Edition, Vol. I and II, Lippincott Williams and Willkins, 2005.
2. Carter, S.J., "Cooper and Gunn's Dispensing Pharmacy for Pharmaceutical Students", 12th Edition, CBS Publishers and Distributors, 1987.
3. Banker, G.S. and Rhodes, C.T., "Modern Pharmaceutics", 4th Edition, Informa Health Care, 2002.

PY3303   **PHARMACOLOGY**   **L T P C**
                                                                3 0 0 3

UNIT I   GENERAL PHARMACOLOGY   9

Routes of administration – Pharmacokinetics – Pharmacodynamics – Receptors – Theories of receptors – Occupational theory – Affinity theory – Mechanism of action of drugs – Agonist – Antagonist – Factors modifying drug action – Dosage calculations.

UNIT II   SYSTEMIC PHARMACOLOGY   9

Mechanism of action – Pharmacology – Acetylcholine – Atropine – Adrenaline – Prazosin – Propranolol – Barbiturates – Benzodiazepine – Chlorpromazine – Imipramine

UNIT III   CARDIOVASCULAR PHARMACOLOGY   9

Classification – Mechanism of action – Pharmacology – Digoxin – Glyceryl trinitrate – Verapamil – Clonidine – Hydralazine – Quinidine – Statins

UNIT IV   ANTIMICROBIAL PHARMACOLOGY   9

Mode of action – Pharmacology – Sulphonamides – Ciprofloxacin – Penicillin G – Erythromycin – Rifampicin – Amphotericin B – Acyclovir – Chloroquine – Alkylating agents – Paclitaxel

UNIT V   PERIPHERAL NERVOUS SYSTEM AND GASTROINTESTINAL PHARMACOLOGY   9

Classification – Mechanism of action – d-Tubocurarine – Succinyl choline – Cimetidine – Metoclopramide – Amoxicillin – Ondansetron – Lactulose.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Satoskar, R.S., Bhandarkar, S.D. and Rege, N.N., "Pharmacology and Pharmacotherapeutics", Popular Prakashan (P) Ltd., 2006.

2. Tripathi, K.D., "Essentials of Medical Pharmacology", 4th Edition, Jaypee Brothers Medical Publishers (P) Ltd, 1999.

REFERENCES

1. Hardman, J.G. and Limbird, L.E., "Goodman and Gilman's: The Pharmacological Basis of Therapeutics" 10th Edition, Medical Publishing Division, 2001.

2. Lawrence, D.R., Bennett, P.N. and Brown, M.J., "Clinical Pharmacology" 8th Edition, Churchill Livingstone, 1998.

3. Das, M.M., "Pharmacology for Second Professional Students" 5th Edition, Books and Allied (P) Ltd, 2004.

PC3304	**ENGINEERING THERMODYNAMICS**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

UNIT I   FUNDAMENTAL CONCEPTS AND FIRST LAW OF THERMODYNAMICS   12

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   12

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, VAPOR and COMBINED POWER CYCLES   12

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   PVT RELATIONS AND THERMODYNAMIC RELATIONS   12

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 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   PHASE EQUILIBRIA AND CHEMICAL REACTION EQUILIBRIA   12

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.

TOTAL: 60 PERIODS

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.

REFERENCES

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.

CH3325	CHEMICAL REACTION ENGINEERING	L	T	P	C
		4	0	0	4

UNIT I   REACTION KINETICS   12

Chemical kinetics – Classification of chemical reactions – Concentration and temperature dependent term of rate equation – Arrhenius collision and transition state theory – Searching for a mechanism.

UNIT II   INTERPRETATION OF BATCH REACTOR DATA   12

Integral and differential methods of analysis – Half-life method – Zero order reaction – Empirical rate equation of nth order – Irreversible first and second order reactions for variable and constant volume systems.

UNIT III   REACTOR DESIGN   12

Ideal reactors – Batch reactor – Plug flow reactor – Mixed flow reactor – Space time – Space velocity – Performance equations and their graphical representation.

UNIT IV   HEAT EFFECTS   12

Temperature and pressure effects on single and multiple reactions – Adiabatic – Non-adiabatic – Isothermal and non-isothermal operations.

UNIT V   DESIGN OF REACTOR FOR SINGLE AND MULTIPLE REACTIONS 12

Single reactions – Size comparison of single reactors – Recycle reactor – Auto catalytic reactions – Multiple reactions – Irreversible reactions in series and parallel.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Levenspiel, O., "Chemical Reaction Engineering", 3rd Edition, John Wiley Publications, 1999.

2. Fogler, W., "Chemical Reaction Engineering", 3rd Edition, Prentice Hall of India, 1999.

REFERENCES

1. Smith, J.M., "Chemical Engineering Kinetics", 3rd Edition, McGraw Hill, 1981.

2. Dawande, S.D., "Principles of Reaction Engineering", 1st Edition, Central Techno Publications, 2001.

3. Richardson, J.F. and Peacock, D.G., "Coulson Richardson - Chemical Engineering", Vol. III, 3rd Edition, Butterworth- Heinemann- Elsevier, 2006.

CH3306	PROCESS INTRUMENTATION	L	T	P	C
		4	0	0	4

UNIT I   PHYSICAL PROPERTY MEASUREMENT   12

Density and specific gravity – Viscosity and consistency – Refractive index analyzers – Boiling point – Flash point analyzers – Thermal conductivity.

UNIT II   TEMPERATURE MEASUREMENT   12

Differential expansion and fluid expansion types – Resistance thermometers – Thermoelectric pyrometers – Radiation pyrometers – Optical pyrometers – Pyrometric cones – Ultrasonic thin wire thermometer.

UNIT III   PRESSURE MEASUREMENT   12

Absolute pressure – Gauge pressure or vacuum – Liquid types and spring balanced types – Differential pressure – Manometer types – Simple U tube and inclined tube manometer and sealed bell types – Pressure transmitters.

UNITIV   FLOW MEASUREMENT   12

Volumetric meters – Variable head meters – Orifice meter – Venturi meter – Pitot tube – Closed channel and open channel types – Variable area meters – Velocity and current meters – Anemo meter – Ultrasonic flowmeter – Mass meters.

UNIT V   LEVEL MEASUREMENT   12

Measurement of head and level – Float methods – Hydrostatic pressure methods – Gauge Glass automatic detector – Ultrasonic probe – Electronic level gauge – Continuous capacitance gauge.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Nakra B.C. and Chaudhry K.K., "Instrumentation, Measurement and Analysis" Second

    Edition, Tata McGraw- Hill, 2004.

2. Singh S.K., "Industrial Instrumentation and Control", Second Edition, Tata McGraw-Hill, 2007.

REFERENCES

1. Doebelin E.O., "Measurement system Application and Design", Fourth Edition, McGraw Hill, 1998.

2. Patranabis D., "Principles of Industrial Instrumentation", Second Edition, Tata McGraw-Hill, 2007.

3. Sawhney A.K., "A Course in Electrical, Electronics measurement and Instrumentation", Dhanpat Rai and sons, 1999.

PY3307	PHARMACEUTICAL CHEMISTRY LABORATORY	L	T	P	C
		0	0	3	2

1. Determination of percentage purity given drug sample.

2. Estimation of amount of active ingredient present in the given sample.

3. Chromatographic identification of organic compounds.

4. Analysis and identification of functional groups of pharmaceutical substances.

5. Analysis of impurities in fine chemicals / pharmaceutical substances by conventional chemical methods.

6. Official limit tests for impurities in pharmaceutical raw materials.

7. Determination of physical constants – melting point, boiling point, weight per ml, refractive index and viscosity.

8. Purification techniques for bulk drugs.

TOTAL: 45 PERIODS

PY3308   PHARMACEUTICAL DOSAGE FORMS LABORATORY

L	T	P	C
0	0	3	2

1. Preparation of three official solutions.

2. Preparation of two official syrups.

3. Preparation of three official lotions.

4. Preparation of two official liniments.

5. Preparation of official ointments with different classes of bases.

6. Preparation of two creams.

7. Preparation of two pastes.

8. Preparation of two suspensions.

9. Preparation of two emulsions.

10. Preparation and evaluation of injection.

11. Preparation of granules and effervescent granules.

12. Determination of stability of emulsion.

13. Formulation of two powders.

14. Preparation of microcapsules by solvent evaporation method.

TOTAL: 45 PERIODS

CH3309   CHEMICAL REACTION ENGINEERING LABORATORY

L	T	P	C
0	0	3	2

1. Determination of reaction rate constant for a saponification reaction in batch reactor.

2. Determination of reaction rate constant for a saponification reaction in plug flow reactor.

3. Determination of reaction rate constant for a saponification reaction in mixed flow reactor.

4. Determination of mean residence time by RTD studies in plug flow reactor.

5. Determination of mean residence time by RTD studies in mixed flow reactor.

TOTAL: 45 PERIODS

**PY3311   INSTRUMENTAL METHODS OF PHARMACEUTICAL   L   T   P   C
                                ANALYSIS   3   1   0   4**

UNIT I   UV – VISIBLE SPECTROSCOPY   9

Properties   of electromagnetic spectrum – Chromophore concept –   Beer's and
Lambart's law – Limitations – Theory of electronic spectroscopy – Choice of solvent and
solvent effects – Modern instrumentation – Design and working principle – Applications
of UV-Visible spectroscopy – Nephlometry and turbidimetry – Principle – Instrumentation
– Applications.

UNIT II   INFRARED AND NMR SPECTROSCOPY   9

Principles of vibrational spectroscopy – Instrumentation and sampling techniques –
Applications in pharmaceutical sciences – NMR principles – Instrumentation –
Applications.

UNIT III   MASS AND ATOMIC SPECTROSCOPY   9

Principles – Instrumentation – Ionization techniques – Electron impact ionization –
Chemical ionization – Applications – Atomic absorption spectroscopy – Principle –
Instrumentation – Applications.

UNIT IV   CHROMATOGRAPHIC TECHNIQUES   9

Chromatographic methods – Paper chromatography – Thin layer chromatography – Ion
exchange chromatography – Column chromatography – High performance liquid
chromatography – Applications.

UNIT V   ELCTROCHEMICAL METHODS OF ANALYSIS   9

Potentiometry – Types of electrodes – Measurement of EMF and pH – Applications –
Conductometry – Measurement of conductivity – Conductometric titrations.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

1.   Beckett, A.K. and Stenlake, J.B., "Practical Pharmaceutical Chemistry", Part I
       and II, 4th Edition, CBS Publications, 1997.
2.   Chatwal, G.R. and Anand, S.K., "Instrumental Methods of Chemical Analysis",
       Himalaya Publishing House, 2005.

REFERENCES

1.   Willard, H.H., Merritt Jr, L.L., Dean, J.A. and Settle Jr, F.A., "Instrumental
       Methods of Analysis", 7th Edition, CBS Publications, 1986.
2.   Skoog, D.A., Holler, F.J. and Nieman, T.A., "Principles of Instrumental Analysis",
       5th Edition, Harcourt College Publishers, 2001.
3.   Settle, F., "Hand Book of Instrumental Techniques for Analytical Chemistry",
       Pearson Education (P) Ltd, 2004.

PY3312　　　　　　　**SEPARATION TECHNOLOGY**　　　　　**L　T　P　C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3　0　0　3

UNIT I　　　　BIO-SEPARATION　　　　　　　　　　　　　　　　**9**

Characterization of biomolecules – Fermentation broths – Role of downstream processing in biotechnology – Broad strategies for design of bio-separation processes.

UNIT II　　　　DOWNSTREAM PROCESSING　　　　　　　　　　**9**

Cell disruption – Mechanical and chemical methods – Cake filtration and microfiltration – Centrifugation and sedimentation – Membrane processes – Dialysis – Ultra filtration – Reverse osmosis and electro-dialysis.

UNIT III　　　　LIQUID-LIQUID SEPARATIONS AND PROTEIN SEPARATIONS　　9

Solvent extraction of small molecules – Aqueous two-phase extraction of proteins – PEG/Dextran separation – Precipitation of proteins with salts and organic solvents – Salting out method – Electrostatic interaction – Protein solvation with polyelectrolytes – Polyvalent metal ions – Sorption.

UNIT IV　　　　CHROMATOGRAPHIC SEPARATIONS　　　　　　　**9**

Adsorption processes – Principles of chromatographic separation – Gel filtration – Reversed phase – Hydrophobic interaction – Ion-exchange – Immuno-bio-affinity chromatography – Design and selection of chromatographic matrices – Modes of operations – Design of large scale chromatographic separation processes – Electrophoresis.

UNIT V　　　　PRODUCT PURIFICATION　　　　　　　　　　　**9**

Crystallization – Crystal geometry – Equilibrium and yields – Nucleation – Crystal growth – Equipments for crystallization – Continuous crystallizer – Draft tube baffle crystallizer – Drying and lyophillization – Principles – Temperature patterns – Heat transfer in dryers – Bound –Unbound water – Freeze drying or lyophillization – Equipments for drying – Tray dryer – Fluidised bed dryer – Spray dryer.

　　　　　　　　　　　　　　　　　　　　　　　　　TOTAL: 45 PERIODS

TEXTBOOKS

1.　　Geankoplis, C.J., "Transport Processes and Separation Process Principles", 4th Edition, Prentice-Hall, Inc, 2003.
2.　　Mukhopadhyay, S.N., "Process Biotechnology Fundamentals", 2nd Edition, Viva Books (P) Ltd., 2004.

REFERENCES

1. Adamovies, J.A., "Chromatographic Analysis of Pharmaceuticals", 2nd Edition, Marcel Dekker, 1997.
2. McCabe, W.L., Smith, J.C and Harriot, P., "Unit Operations of Chemical Engineering", 6th Edition, McGraw Hill Publications, 2001.
3. Cruger, W. and Cruger,V., "A Text Book of Industrial Microbiology", 2nd Edition, Prentice-Hall, Inc, 1997.

PY3313	PROCESS EQUIPMENT DESIGN	L	T	P	C
	(To Consider as Practical Subject for Examination Purpose)	4	0	0	4

UNIT I   HEAT EXCHANGERS   12

Design of shell and tube heat exchangers- Double pipe heat exchangers

UNIT II   EVAPORATORS   12

Design of single and multiple effect evaporators.

UNIT III   DISTILLATION   12

Design of distillation columns – sieve and bubble cap towers.

UNIT IV   ABSORPTION COLUMNS   12

Design of absorption columns – plate & packed columns

UNIT V   DRYERS   12

Design of batch and continuous dryers.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Perry, R.H., "Chemical Engineers Handbook", 7th Edition, McGraw Hill Co, 1988.
2. Coulson, J.M. and Richardson, J.F., "Chemical Engineering", Vol. 6, Pergamon Press, 1977.

REFERENCES

1. Bhattacharya, B.C., "Introduction to Chemical Equipment Design Mechanical Aspects", 1st Edition, CBS Publishers and Distributors, 1985.
2. Dawande, S.D., "Process Design of Equipment", Central Techno Publications, 2005.
3. Donald, Q.K., "Process Heat Transfer", 1st Edition, Tata McGraw Hill Publishing Co, 1997.

Note: Necessary Data Book is to be issued while conducting Practical Examination

CH3314	MASS TRANSFER OPERATIONS	L	T	P	C
		4	0	0	4

UNIT I   DIFFUSION   12

Diffusion in fluids: Molecular and eddy diffusion measurement and calculation of diffusivities – Ordinary diffusion in multi component gaseous mixtures – Interphase mass transfer – Mass transfer coefficients – Theories of mass transfer.

UNIT II   ABSORPTION   12

Gas absorption: Principles of absorption and desorption – Selection of solvents for absorption – Tray tower absorber – Absorption factor – Calculation of number of theoretical stages – Murphree efficiency – Point efficiency – Tray efficiency and overall tray efficiency – Calculation of actual number of trays – Packed tower absorber – Tower packing and characteristics – Calculation of NTU- HTU- HETP and height of absorption towers.

UNIT III   DISTILLATION   12

Basic concepts of distillation: Vapour-liquid equilibrium – Pressure – Temperature – Concentration – Phase diagram – Isothermal and isobaric equilibrium – Relative volatility – Ideal solutions – Raoult's law – Deviations from ideality – Minimum and maximum boiling azeotropes – Different methods of distillation: flash steam – Vacuum – Molecular – Azeotropic – Extractive distillations – Continuous fractionation: multistage tower – Bubble cap – Sieve tray and valve tray towers – McCabe Thiele method.

UNIT IV   LEACHING   12

Solid-liquid extraction – Description of leaching operations and technologies – Applications of leaching – Preparation of solid – Methods of operation and classification of equipment – Solid-liquid equilibrium in leaching – Multi stage cross current and counter current leaching – Calculation of composition and number of stages.

UNIT V   DRYING   12

Drying – Principle and definitions – Estimation of drying rates – Drying rate curve – Critical and equilibrium moisture content – Calculation of drying time under constant drying conditions – Different types of dryers.

TOTAL: 60 PERIODS

TEXT BOOKS

1.   McCabe, W.L., Smith, J.C. and Harriot. P., "Unit Operations of Chemical Engineering", 6th Edition, McGraw-Hill Book Co., 2001.
2.   Treybal, R.E., "Mass Transfer Operations", 3rd Edition, McGraw-Hill Book Co., 1980.

REFERENCES

1.   Coulson, J.M. and Richardson, J.F., "Chemical Engineering", Vol. I, II and III, Pergamon Press, 1977.
2.   Bennett, C.O. and Myers, J.E., "Momentum Heat and Mass Transfer", 3rd Edition, McGraw Hill Book Company, 1983.
3.   Geankoplis, C.J., "Transport Processes and Unit Operations", 3rd Edition, Prentice Hall of India Pvt. Ltd, 2000.

CS3315	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

UNIT I   FUNDAMENTALS   9

Object oriented programming concepts – Encapsulation – Programming elements – Program structure – Enumeration types – Functions and pointers – Function invocation – Overloading functions – Scope and storage class – Pointer types – Arrays and pointers – Call-by-reference – Assertions – Standard template library.

UNIT II   IMPLEMENTING ADTS AND ENCAPSULATION   9

Aggregate type structure – Structure pointer operators – Unions – Bit fields – Data handling and member functions – Classes – Constructors and destructors – Static member – This pointer – Reference semantics – Implementation of simple ADTs.

UNIT III   POLYMORPHISM   9

ADT conversions – Overloading – Overloading operators – Unary operator overloading – Binary operator overloading – Function selection – Pointer operators.

UNIT IV   INHERITANCE   9

Derived class – Typing conversions and visibility – Code reuse – Virtual functions – Run-time type identifications – Exception – Handlers – Standard exceptions.

UNIT V   TEMPLATES AND FILE HANDLING   9

Template class – Function templates – Class templates – C++ streams – Console streams – Console stream classes – Formatted and unformatted console I/O operations – Manipulators – File streams – Classes file modes – File pointers and manipulations – File I/O – Exception handling.

TOTAL: 45 PERIODS

TEXT BOOKS

1.   Ira Pohl, "Object-Oriented Programming Using C++", Pearson Education, 2nd Edition, 2003.
2.   Venugopal, K.R., Buyya, R. and Ravishankar, T., "Mastering C++", Tata McGraw Hill, 2003.

REFERENCES

1.   Ashok, B. and Kamthane, N., "Object-Oriented Programming with ANSI and Turbo C++", Pearson Education, 2006.
2.   Stroustrup, "The C++ Programming Language", Addison Wesley, 2000.
3.   Hubbard, J.R., "Programming with C++", Schaums Outline Series, Tata McGraw Hill, 2003.

PY3316	INSTRUMENTAL METHODS OF PHARMACEUTICAL ANALYSIS LABORATORY	L	T	P	C
		0	0	3	2

1.   Determination of impurities by limit test.
2.   Determination of λmax.
3.   Determination of isobestic point.
4.   Determination of the percentage purity of a drug using colorimetry.
5.   Determination of percentage purity of drug in marketed tablets and capsules using UV spectrophotometer by $E^{1\%}_{1cm}$ method.
6.   Determination of percentage purity of marketed or formulated tablets using UV spectrophotometer using calibration method.
7.   Separation of mixtures of drugs by TLC.
8.   Determination of R_f values of drugs using paper chromatography.
9.   Determination of EMF using potentiometer.
10.   Effect of pH   on absorbance spectrum of phenolic compounds (Paracetamol).

TOTAL: 45 PERIODS

CH3317   **MASS TRANSFER LABORATORY**   **L   T   P   C**
                                                                 0   0   3   2

1.   Determination of the critical moisture content and drying rate.

2.   Determination of the critical moisture content and drying rate under vacuum.

3.   Verification of Rayleigh equation.

4.   Determination of the efficiency of steam distillation.

5.   Determination of diffusion coefficient.

6.   Determination of HETP.

7.   Optimization of the number of leaching stages.

8.   Determination of the break point for adsorption.

9.   Mass transfer coefficient and Reynolds number relation.

10. Verification of adsorption isotherms

TOTAL: 45 PERIODS

GE3318   **COMMUNICATION SKILLS LABORATORY**   **L T P C**
                                                            0 0 4 2

Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students' overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES:

▪   To equip students of engineering and technology with effective speaking and listening skills in English.
▪   To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
▪   To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

I. PC based session periods	(Weightage 40%)	24

A. ENGLISH LANGUAGE LAB   **(18 Periods)**

1. LISTENING COMPREHENSION: **(6)**
Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. READING COMPREHENSION: **(6)**
Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. SPEAKING: **(6)**
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   **(6 PERIODS)**

(Samples are available to learn and practice)

1.   RESUME / REPORT PREPARATION / LETTER WRITING   (1)

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

2.   PRESENTATION SKILLS: **(1)**
Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3.   SOFT SKILLS: **(2)**
   Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4.   GROUP DISCUSSION: **(1)**
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: **(1)**
Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews-Video samples.

II. Practice Session   (Weightage – 60%)   24

1.   Resume / Report Preparation / Letter writing: Students prepare their   **(2)**
own resume and report.

2.   Presentation Skills: Students make presentations on given topics.   **(8)**

3.   **Group Discussion**: Students participate in group discussions**.**   **(6)**

4.   **Interview Skills**: Students participate in Mock Interviews   **(8)**

TEXT 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.

REFERENCES
1. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2004.
2. Evans, D, **Decisionmaker**, Cambridge University Press, 1997.
3. Thorpe, E, and Thorpe, S, **Objective English**, Pearson Education, Second Edition, New Delhi, 2007.
4. Turton, N.D and Heaton, J.B, **Dictionary of Common Errors**, Addison Wesley Longman Ltd., Indian reprint 1998.

LAB REQUIREMENT

1.   Teacher console and systems for students.
2.   English Language Lab Software
3.   Career Lab Software

Requirement for a batch of 60 students

Sl.No.	Description of Equipment	Quantity required
1.	**Server** o PIV system o 1 GB RAM / 40 GB HDD o OS: Win 2000 server o Audio card with headphones (with mike) o JRE 1.3	1 No.
2.	**Client Systems** o PIII or above o 256 or 512 MB RAM / 40 GB HDD o OS: Win 2000 o Audio card with headphones (with mike) o JRE 1.3	60 No.

3.	Handicam Video Camera (with video lights and mic input)	1 No.
4.	Television - 29"	1 No.
5.	Collar mike	1 No.
6.	Cordless mikes	1 No.
7.	Audio Mixer	1 No.
8.	DVD Recorder / Player	1 No.
9.	LCD Projector with MP3 /CD /DVD provision for audio / video facility - **Desirable**	1 No.

PY3401   **ADVANCED MEDICINAL CHEMISTRY**   **L T P C**
                                                      3 1 0 4

UNIT I   QUANTITATIVE DESCRIPTION OF PHYSICOCHEMICAL PROPERTIES   9

Quantitative description of physicochemical properties of drug molecules with reference to electronic effects in drugs – Hydrophobic properties of drugs – Methods of calculating partition coefficient – 3D structure of drugs – Other physicochemical parameters in relation to biological action.

UNIT II   QUANTITATIVE STRUCTURE ACTIVITY RELATIONSHIP   9

History and development of QSAR – Classification of QSAR methodology – Hansch analysis – Free Wilson analysis – Applications advantages and pitfalls of QSAR.

UNIT III   DESIGN OF ENZYME INHIBITORS   9

Forces involved information of enzyme substrate and enzyme inhibitor complexes – Design of rapid reversible inhibitors – Multisubstrate inhibitors – Mechanism based inhibitors – Application with recent examples from literature.

UNIT IV DOCKING OF FLEXIBLE MOLECULES 9

Docking of flexible molecules in protein/enzyme active sites – Docking by energy minimization superimposition – Molecular dynamic – Monte Carlo – Distance geometry and build-up methods – Applications with recent examples from literature.

UNIT V COMPUTER-AIDED DEVELOPMENT OF THREE-DIMENSIONAL PHARMACOPHORE MODES 9

Direct and indirect ligand design – The pharmacophore concept – Steps in 3-D-pharamacophore identification – Selection of pharmacophore elements – Representation of pharmacophore elements as ligand points or site points – Receptor exclude and receptor essential volumes.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

1. Kadam, S.S., Mahadik, K.R. and Bothara, K.G., "Principles of Medicinal Chemistry", Vol. I and Vol. II, 7th Edition, Nirali Prakashan Publications, 1999.

2. Remers, W.A. and Delgado, J.N., "Wilson and Gisvold's Textbook of Pharmaceutical Organic Chemistry", Lippincott William and Wilkins, 2004.

REFERENCES

1. Wolff, M.E., "Burger's Medicinal Chemistry", 5th Edition, Vol. I – V, John Willey and Sons, 2003.

2. Hansch, C., "Comprehensive Medicinal Chemistry", Vol.4, Pergamon Press, 1998.

3. Leach A.R., "Molecular Modeling and Drug Design" 2nd Edition, Pearson Prentice-Hall, 2001.

PY3402	NOVEL DRUG DELIVERY SYSTEM	L	T	P	C
		4	0	0	4

UNIT I POLYMERS 12

Polymers used in controlled drug delivery modules – Classification – Advantages and disadvantages of polymers – Polymerization mechanisms – Degradation mechanism – Polymer characterization.

UNIT II SUSTAINED RELEASE DRUG DELIVERY SYSTEMS 12

Physicochemical and biological properties of drugs – Oral dosage forms – Diffusion systems – Systems utilizing dissolution – Osmotic systems – Ion exchange resins.

UNIT III TARGETED DRUG DELIVERY SYSTEM 12

Nanoparticles – Liposomes – Resealed erythrocytes – Immunologically based system – Antibodies for drug delivery – Magnetic microspheres.

UNIT IV   MODULE FOR GASTRO INTESTINAL TRACTS   12

Approaches to increase gastric retention – Factors affecting gastric retention – Formulation development of floating drug delivery system – Expanding systems – Systems for colon specific delivery – Targeting approaches to colon.

UNIT V   MUCOADHESIVE DRUG DELIVERY SYSTEMS   12

Buccal drug delivery – Concepts – Advantages – Disadvantages – Permeability enhancers – In vitro and in-vivo evaluation – Nasal drug delivery system – Pulmonary drug delivery system – Applications.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Robinson, J.R. and Lee, V.H.L., "Controlled Drug Delivery Systems", 2nd Edition, Marcel Dekker, 1992.
2. Vyas, S.P. and Khar, R.K., "Controlled Drug Delivery Concepts and Advantages", 1st Edition, 2002.

REFERENCES

1. Chein, Y.W., "Novel Drug Delivery Systems", 2nd Edition, Marcel Dekker Inc, 1992.
2. Gennaro, A R., "Remington: The Science and Practice of Pharmacy", Vol. I and II, 21st Edition, Lippincott Williams and Willkins, 2005.
3. Jain, N.K., "Advances in Controlled and Novel Drug Delivery", 1st Edition, CBS Publishers and Distributors, 2001.

PY3403   PHARMACEUTICAL BIOTECHNOLOGY

	L	T	P	C
	4	0	0	4

UNIT I   FERMENTATION TECHNOLOGY   12

Industrial fermentation processes and products – Role of bioprocess engineer – Unit operations in an integrated bioprocess – Process flowsheet – Survey of organisms – Processes – Products – Market economics of modern industrial biotechnology.

UNIT II   RAW MATERIALS FOR FERMENTATION PROCESS   12

Isolation of microorganisms – Preservation and improvement of industrial microorganisms for overproduction of primary and secondary metabolites – Medium requirements for fermentation process – Carbon, nitrogen, minerals, vitamins, and other nutrients – Simple and complex media.

UNIT III   PRIMARY METABOLITES   12

Primary metabolite – Methods for the production of citric acid – Itaconic acid – Lactic acid-Acetic acid – Gluconic acid – Tartaric acid .

UNIT IV   SECONDARY METABOLITES   12

Production of low molecular weight secondary metabolites – Penicillins – Cephalosporins -Streptomycin – Kanamycin – 1,2-benzoquinones – Ciprofloxacin – Gatifloxacin.

UNIT V   PRODUCTION AND CONTROL OF BIOTECH DERIVED
             PRODUCTS   12

Recombinant DNA products – Insulin – Growth hormones – Erythropoietin – Cytokines – Diagnostic proteins – Protein A – Protein G – Antibodies.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Stanbury, P.F., Whitaker, A. and Hall, S.J., "Principles of Fermentation Technology", 2nd Edition, Aditya Books (P) Ltd, 1995.
2. Shuler, M.L. and Kargi, F., "Bioprocess Engineering Basic Concepts", 2nd Edition, Prentice Hall of India, 2004.

REFERENCES

1. Purohit, S.S., Saluja, A.K. and Kulkarni, H.N., "Pharmaceutical Microbiology", 1st Edition, Agrobios (India), 2003.
2. Hugo, W.B. and Russel, A.D., "Pharmaceutical Microbiology", 6th Edition, Blackwell Science, 2003.
3. Casida Jr, L.E., "Industrial Microbiology", 2nd Edition, Wiley Eastern Ltd, 1968.

CH3404	PROCESS DYNAMICS AND CONTROL	L	T	P	C
		4	0	0	4

UNIT I   FIRST ORDER SYSTEMS   12

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

UNIT II   HIGHER ORDER SYSTEMS   12

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   12

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

UNIT IV   FREQUENCY RESPONSE   12

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

UNIT V   SPECIAL CONTROLS   12

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

TOTAL: 60 PERIODS

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, 1997.

REFERENCES

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.

CH3405	TECHNOLOGY OF FINE CHEMICALS AND BULK DRUGS	L	T	P	C
		4	0	0	4

UNIT I   INTRODUCTION OF FINE CHEMICALS AND BULK DRUGS   12

Concept of fine and Bulk drugs and their salient features – Evolution of process – Process chemistry – Research and development strategies in pharmaceutical industries.

UNIT II   PRODUCTION, PLANNING AND CONTROL   12

Flow sheets – Types of flow sheets – Flow symbols – Line symbols – Concept of all purpose and multipurpose plants – Plant design – Layout – Construction – Process economics – Materials of construction – Effluent treatment – Solvent recovery for fine chemicals – Bulk drugs.

UNIT III   BASE CHEMICAL PRODUCTION   12

Industrial Production of following base chemicals – Mineral acids (sulpuric acid, nitric acid, phosphoric acid) – Naphthalene – Ammonia – Caustic soda – Industrial alcohol – Butyl alcohol – Benzene – Phenol.

UNIT IV   DRUG INTERMEDIATES AND FINE CHEMICAL PRODUCTION   12

Manufacture of following chemicals and their applications – Urea – Acrylonitrile – Ethylacetate – Butadiene – Quinoline – Aniline – Tetrahydrofuran – Titaniumdioxide – Vanillin.

UNIT V   BULK DRUGS   12

Raw Materials – Production Techniques – Reaction Flow Sheet – Equipments – Utilities for the production of drugs below – Paracetamol – Aspirin – Ibuprofen – Diazepam – Darvon – Niacinamide – Chloramphenicol.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Gopal Rao, M. and Sittig, M., "Dryden's Outlines of Chemical Technology", 3rd Edition, Affiliated East West Press Pvt. Ltd., 2001.
2. Austin, G.T., "Shreve's Chemical Process Industries", 5th Edition, McGraw Hill Book Company, 1984.

REFERENCES

1. Moulijin, J.A., Makkee, M. and Diepan, A.V., "Chemical Process Technology", John Wiley and Sons, 2001.
2. Shah, K.M., "Hand Book of Industrial Chemistry", Vol. I and II, Multi-Tech Publishing Co, 1999.
3. Pandey, G.N., "A Text Book of Chemical Technology", Vol. II, Vikas Publishing House (P) Ltd., 2000.

		L	T	P	C
PY3406	**ADVANCED MEDICINAL CHEMISTRY**	0	0	3	2
	LABORATORY				

1. Design of structures using chemsketch
2. Finding C log P value for drug structures
3. Determination of pKa value of drugs and drugs intermediates
4. Determination of partition co-efficient and calculation of partition co-efficient values of various drugs
5. Determination of physicochemical properties of synthesized drugs

6. Determination of electronic properties of drug molecules using simulation softwares
7. Finding potential lead molecules using docking software
8. Studies on QSAR for the synthesized drugs

TOTAL: 45 PERIODS

PY3407	NOVEL DRUG DELIVERY SYSTEM LABORATORY	L	T	P	C
		0	0	3	2

1. Preparation and evaluation of liposomes
2. Formulation and evaluation of egg albumin microspheres by single emulsion technique
3. Formulation and evaluation of microspheres by emulsion solvent evaporation method
4. Formulation and evaluation of microcapsules through coacervation phase separation by solvent evaporation method
5. Formulation and evaluation of solid dispersion by fusion method
6. Formulation and evaluation of solid dispersion by melting point solvent technique
7. Preparation and evaluation of magnetic microsphere
8. Formulation and evaluation of transdermal films
9. Formulation and evaluation of sustained release matrix tablets
10. Comparison of in vitro release studies of marketed sustained release tablets
11. In vitro release studies of marketed enteric coated tablets

TOTAL: 45 PERIODS

CH3408	PROCESS DYNAMICS AND CONTROL LABORATORY	L	T	P	C
		0	0	3	2

1. ON-OFF control of thermal process
2. Flow control loop and Flow Transmitter
3. Level Control loop and Level Transmitter
4. Pressure control loop and Pressure Transmitter
5. Control valve characteristics
6. Verifying the response of Non-Interacting and interacting level System
7. Optimum controller setting using Ziegler's Nichols Methods
8. Optimum Controller Tuning on Level Process Station
9. pH control system
10. First order and second order system

11.   Computer controlled heat exchanger (Shell and tube and Double pipe)
12.   Pneumatic control valve positioned trainer
13.   Cascade control trainer
14.   I/P and P/I converter

*Minimum 10 experiments shall be offered.

TOTAL: 45 PERIODS

CH3411	UNIT PROCESSES IN ORGANIC SYNTHESIS	L	T	P	C
		4	0	0	4

UNIT I   SULFONATION AND SULFATION   12

Sulfating – Sulfonating agents – Applications – Chemical and physical factors in sulfonation and sulfation – Thermodynamics mechanism – Kinetic considerations – Industrial equipments and techniques – Sulfonation of benzene – Aniline.

UNIT II   NITRATION   12

Nitrating agents – Aromatic nitration – Thermodynamics – Kinetics of nitration process – Nitration of benzene – Toluene – Phenol – Glycerine – Naphthalene – Industrial equipments for nitration – Preparation of m-dinitrobenzene – Chloro-nitro benzenes – Continuous nitration process.

UNIT III   AMINATION BY REDUCTION   12

Methods of reduction – Bechamp method – Reduction mechanism – Preparation of aniline, p-phenylenediamine – Catalytic hydrogenation process – Catalyst involved in the reduction process – Reduction mechanism – Manufacture of aniline using catalytic reduction – Manufacture of   p-aminophenol – Electrolytic reduction.

UNIT IV   HALOGENATION   12

Halogenating agents – Thermodynamic and kinetic considerations – Chlorination of methane – Ethane – Propane – Photohalogenation – Manufacture of allyl chloride – Chloroacetic acid – Chloral hydrate – Ethylene chlorohydrin – Chloromethane – Vinyl chloride.

UNIT V   OXIDATION   12

Oxidation reactions – Oxidizing agents – Liquid phase and vapour phase oxidation with air and oxygen – Catalysts used – Kinetics and thermodynamic consideration – Manufacture of phthalic anhydride – Acetaldehyde – Acetic acid – Benzaldehyde – Salicylic acid.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Groggins, P.H., "Unit Processes in Organic Synthesis", 5th Edition, McGraw Hill Ltd., 1995.
2. Morison, R.T. and Boyd, R.N., "Organic Chemistry", 6th Edition, Prentice Hall of India (P) Ltd, 2006.

REFERENCES

1. Mukharjee, S. and Singh, S.P., "Reaction Mechanism in Organic Chemistry", 3rd Edition, Mc Millan India Ltd., 2000.
2. Jerry, M., "Advanced Organic Chemistry – Reactions, Mechanism and Structure", 4th Edition, John-Wiley and Sons, 1992.
3. Bruckner, R., "Advanced Organic Chemistry- Reactions Mechanisms", Academic Press, 2002.

GE2022   **TOTAL QUALITY MANAGEMENT**   **L T P C**
                                                3 0 0 3

UNIT I   INTRODUCTION   9
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II   TQM PRINCIPLES   9
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, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III   TQM TOOLS & TECHNIQUES I   9
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   9
Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V   QUALITY SYSTEMS   9
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 implementation in manufacturing and service sectors including IT.

TOTAL: 45 PERIODS

TEXT BOOK:
1. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

PY3412	PROJECT WORK	L	T	P	C
		0	0	12	6

The project may be considered as the ultimate exercise presented to the final semester student before graduation to measure accumulated technical 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 three students. The project topic allotted may be of theoretical, experimental or industrial projects to be carried out under the supervision of internal guide 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 300 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.

PY3001	SOLID DOSAGE FORM TECHNOLOGY	L	T	P	C
		3	0	0	3

UNIT I   POWDERS AND GRANULES   9

Advantages and disadvantages of powdered and granulated products – Mixing and dividing of powders – Problems in manufacturing powders – Effervescent granules – Reasons for granulation – Granulation mechanisms – Pharmaceutical granulation equipments.

UNIT II   TABLETS AND COATING   9

Types of tablets – Formulation – Manufacturing of tablets – Tableting problems – Evaluation of Tablets – Tablet coating **–** Film coating – Sugar Coating – Enteric coating – Evaluation of coated tablets – Applications.

UNIT III   CAPSULES   9

Classification – Hard gelatin capsules – Composition and size – Materials and method of production of hard gelatin capsule – Formulation and filling of capsules – Soft gelatin capsules – Rationale – Manufacturing and formulation of soft gelatin capsules – Evaluation of capsules.

UNIT IV   MICROENCAPSULATION   9

Types of microcapsules – Application of microencapsulation in pharmaceutical sciences – Microencapsulation by coacervation – Phase separation – Multi-orifice centrifugation – Spray congealing – Polymerization – Air suspension technique – Pan coating and other techniques – Evaluation of microcapsules.

UNIT V   ADVANCES IN TABLETING TECHNIQUES   9

Compression coating – Inlay tablets – Layer tablets – Mouth dissolving tablets – Tablets in tablets.

TOTAL: 45 PERIODS

TEXT BOOKS
1.   Aulton, M.E., "Pharmaceutics – The Science of Dosage form Design", 2nd Edition, ELBS Publications, 2002.
2.   Lachman, L. and Liberman, H.A., "Theory and Practice of Industrial Pharmacy", 3rd Edition, Varghese Publishing House, 1991.

REFERENCES

1. Liberman, H.A., Lachman, L. and Schwartz, J.B., "Pharmaceutical Dosage Form: Tablets", 2nd Edition, Volume II, Mercel Dekker, 1999.

2. Gennaro, A.R., "Remington: The Science and Practice of Pharmacy", Vol. I and II, 21st Edition, Lippincott Williams and Willkins, 2005.

3. Banker, G.S. and Rhodes, C.T., "Modern Pharmaceutics", 4th Edition, Informa Health Care, 2002.

PY3002	HERBAL TECHNOLOGY	L	T	P	C
		3	0	0	3

UNIT I   INDIAN SYSTEMS OF MEDICINE   9

Ayurveda – Unani – Homeopathy – Siddha – Yoga and naturopathy – Classification of herbs – Taxonomy – Harvesting – Post harvesting – Conditions of storage.

UNIT II   IN-VITRO CULTURE OF MEDICINAL PLANTS   9

Requirements – Setting up a tissue culture lab – Basic laboratory procedure – Processing of plat tissue culture – Growth profile – Growth measurement – Plant tissue culture methods – Callus culture – Types of tissue culture – Tissue culture of medicinal plants – Applications of plant tissue culture.

UNIT III   EXTRACTION, ISOLATION AND ANALYSIS OF PHYTOPHARMACEUTICALS   9

Infusion – Decoction – Digestion – Maceration – Percolation – Successive solvent extraction – Super critical fluid extraction – Steam distillation – Head space techniques – Sepbox – Selection of a suitable extraction process – Carbohydrates – Proteins – Alkaloids – Glycosides.

UNIT IV   SCREENING METHODS FOR HERBAL DRUGS   9

Screening methods for anti-fertility agents – Antidiabetic drugs – Anti anginal drugs – Cardiac glycosides – Analgesic activity – Antipyretic activity – Anti cancer activity – Evaluation of hepatoprotective agents – Anti ulcer drugs.

UNIT V   STANDARDIZATION AND CONSERVATION OF HERBAL DRUGS   9

Importance of standardization – Problems involved in the standardization of herbs – Standardization of single drugs and compound formulations – WHO guidelines for quality standardized herbal formulations – Estimation of parameter limits used for standardization – Conversation strategies of medicinal plants – Conservation types – Government policies for protecting the traditional knowledge.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Agarwal, S.S. and Paridhavi, M., "Herbal Drug Technology" Universities Press (India) Private Limited, 2007.
2. Wallis, T.E., "Textbook of Pharmacognosy" 5th Edition, CBS Publishers and Distributors, 1985.

REFERENCES

1. Evans, W.C., "Trease and Evans Pharmacognosy" 15th Edition, Elsevier Health Sciences, 2001.
2. Lanza, R.P. and Atala, A., "Methods of Tissue Engineering" Elsevier Publications, 2006.
3. Daniel, M., "Herbal Technology: Concepts and Advances" Satish Serial Publishing House, 2008.

PY3003	PHARMACEUTICAL PRODUCTION MANAGEMENT	L	T	P	C
		3	0	0	3

UNIT I   PILOT PLANT AND SCALE-UP TECHNIQUES   9

Pharmaceutical Pilot plant – Pilot plant design – Case studies for tablets – Capsules – Aerosols – Liquid orals – Parenterals – Sustained release preparation – Semi-solid preparation – Basic requirements – Design of product – Facility – Equipment selection and personnel.

UNIT II   PRODUCTION, PLANNING, SCHEDULING AND FORECASTING   9

Production systems – Production department – Production process routing and loading – Scheduling – Despatching of records – Production control.

UNIT III   FORMULATION PRODUCTION MANAGEMENT   9

Plant site selection and layout – Material handling for various pharmaceutical products – Service facilities – Preventive maintenance in pharmaceutical companies – Group and individual replacement.

UNIT IV   MATERIAL MANAGEMENT   9

Materials – Quality and quantity – Value analysis – Purchasing – Centralized and decentralized – Vendor development – Buying techniques – Purchasing cycle and procedures – Stores management – Salvaging and disposal of scrap surplus – Selective inventory control – RQM and EOQ – Modern inventory management systems – Cost and savings in inventory.

UNIT V   HUMAN RESOURCE DEVELOPMENT   9

Human resource planning – Job analysis and design – Recruitment – Personnel selection – Orientation and placement – Training and development – Supervision – Performance appraisal – Remuneration and salaries – Compensation – Industrial relations – Motivation – Labour welfare.

TOTAL: 45 PERIODS

TEXT BOOKS

1.   Vidyasagar, G., "Pharmaceutical Industrial Management", 3rd Edition, Varghese Publications, 2001.
2.   Subramaniam, C.V.S., "Textbook of Pharmaceutical Production Management", Vallabh Prakashan, 2000.

REFERENCES

1.   Lachman, L. and Liberman, H.A., "The Theory and Practice of Industrial Pharmacy", 3rd Edition, Varghese Publications, 1986.
2.   Evans, J., Sweeny, A. and Wiliams, H "Applied Production and Operations Management", 3rd Edition, West Publishing Company Ltd., 1992.
3.   Drucker, P.F., "Management (Task, Responsibility and Practices)", Allied Publication, 1993.

PC3006	**INDUSTRIAL MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

UNIT I   PERSONNEL MANAGEMENT   9

Principles and functions – Handling union – Negotiation process – Labour legislation in India – Managerial decision making process, tools and techniques – Role of employee through empowerment – Industrial management program – Public relation.

UNIT II   TQM TOOLS AND TECHNIQUES   9

Bench marking process – Concept, reason, application – Quality function deployment and its benefits – Study of manufacturing costs and techniques for financial control – Tools and techniques for six sigma philosophy – Tacuchi law functions – Statistical process control.

UNIT III   QUALITY AND ENVIRONMENTAL MANAGEMENT SYSTEMS   9

Philosophy of Total Quality Management – ISO registration procedure and benefits – Concepts of ISO 9000, 14000, 18000 standards – Internal quality audit – Quality improvement and customer satisfaction – Importance of documentation procedure – Plant safety and industrial hygiene.

UNIT IV   ENGINEERING ECONOMICS   9

Micro and Macro economics – Accounting procedures and preparation of financial statements – Principles of lean manufacturing philosophy – Study of global market – Methods to overcome competitiveness.

UNIT V   PROCESS ECONOMICS   9

Amortisation, Capital recovery, Depreciation - Economics of selecting alternatetives – Rate of return and payout time – Budgeting – Operation Management – Strategic analysis – Problem solving technioques – Preparation of technical reports – Process Improvement.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Peters and Haus, T., "Plant Design and Economics for Chemical Engineering", 4th Edition, McGraw Hill Book Co., 1991.
2. Monappa, A. and Saiyadain, M.S., "Personnel Management", 2nd Edition, Tata McGraw Hill Publishing Company Ltd., 2003.

REFERENCES

1. Kermath Case, J.A. and Prat, D., "Principle of Engineering Economics", 4th Edition, John Wiley Publishers, 1997.
2. Schwyer, H.E., "Process Engineering Economics", 1st Edition, McGraw Hill Book Co., 1962.
3. Bhat, K.S., "Total Quality Management", 1st Edition, Himalaya Publishing House, 2002.

PY3005	WATER TREATMENT AND MANAGEMENT	L	T	P	C
		3	0	0	3

UNIT I   INTERNAL TREATMENT PROCESS   9

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

UNIT II   EXTERNAL TREATMENT PROCESS   9

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   BOILER WATER AND COOLING WATER   9

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 – Energy efficient operations and maintenance.

UNIT IV   WASTE WATER TREATMENT   9

Waste water in Industry- Home and Agriculture – Various 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   WATER MANAGEMENT IN INDIA   9

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.

TOTAL: 45 PERIODS

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 company (P) Ltd., New Delhi, 7th Edition, 2003.

REFERENCES

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.

PY3006   VALIDATION IN PHARMACEUTICAL INDUSTRIES   L   T   P   C
                                                      3   0   0   3

UNIT I   DRUGS AND COSMETICS ACT AND GMP FOR API   9

Drugs and cosmetics act, 1948 – Organization and personnel – Buildings and facilities – Equipment – Documentation and records – Material management – Production and in-process control – Packaging and labeling – Storage Distribution.

UNIT II   IMPURITIES IN DRUG SUBSTANCES AND DRUG PRODUCTS   9

Quality USP description of impurities – Validation and impurity issue related to manufacturing – Processing of drug substances – Enantiomers as impurities – Polymorphs as unwanted components.

UNIT III   CLEANING FOR API MANUFACTURING FACILITIES   9

Regulatory requirements – Multiple vs dedicated equipment – Unique nature of API – Multiple level approach to cleaning – Nature of contaminants – Selection of a worst case – Cleaning techniques – Sampling – Analytical methods – Limits and acceptance criteria, documentation.

UNIT IV   STABILITY TESTING   9

Reasons for stability testing – Modes of degradation – Shelf lives and expiration dates – Possible strategies to improve shelf lives – Stability testing of new drug substances and products (Q_1A) – Photo stability testing of new substances and products (Q_1B) – Validation on analytical procedures (Q_2A).

UNIT V   GMP FOR BIOLOGICAL PRODUCTS   9

Organization and personnel – Buildings and facilities – Equipment – Documentation – Production and in-process control – Packaging and labeling – Storage – Distribution – Disposal of bio medical waste.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ira, R.B. and Harpaz, D., "Validation of Active Pharmaceutical Ingredients", 2nd Edition, CRC Press, 2001.

2. Anjaneyulu, Y. and Maraya, R., "Quality Assurance and Quality Management in Pharmaceutical Industry", Pharma Book Syndicate, 2005.

REFERENCES

1. Willig, S.H., "Good Manufacturing Practice for Pharmaceuticals", 5th Edition, Marcel Dekker, 2005.

2. Iyer, S., "Guidelines on cGMP and Quality of Pharmaceutical Products", 1st Edition, D.K. Publications, 2003.

3. Carstensen, J.T. and Rhodes, C.T., "Drug Stability Principles and Practice", 3rd Edition, Marcel Dekker, 1995

PY3007	**NATURAL PRODUCTS CHEMISTRY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

UNIT I   PROTEINS AND AMINO ACIDS   9

Classification – Properties – Reaction and preparation of amino acids – Essential amino acids.

UNIT II   TERPENOIDS   9

Classification – General methods of determining the structure – Chemistry and uses of citral – Menthol – Thymol – Camphor – α-Terpineol – α-pinene.

UNIT III   ALKALOIDS   9

Classification – General methods of structural elucidation – Chemistry and pharmacological activity of atropine and related compounds – Quinine and quinidine – Reserpine – Morphine and related compounds – Papaverine.

UNIT IV   GLYCOSIDES   9

Basic ring system – Nomenclature and stereochemistry of steroid nucleus – Chemistry of digitoxin, digoxin, lanatosides, diosgenin and sarasapogenin, hecogenin and sennosides.

UNIT V   VITAMINS   9

Chemistry and pharmaceutical uses of vitamin A, D, E, K, B_1, B_2, B_6, B_{12} and folic acid.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Finar, I.L., "Organic Chemistry", 5th Edition, Vol. II, Longman Scientific and Technical Publishers, 2000.
2. Chatwal, G.R., 'Organic Chemistry of Natural Products", Vol. I and II, Himalaya Publishing House, 2001.

REFERENCES

1. Evans, W.C., "Trease and Evans Pharmacognosy", 15th Edition, Elsevier Health Sciences, 2001.
2. Agarwal, O.P., "Chemistry of Natural Products", Vol. II, Goel Publications, 2008.
3. Nelson, D.L. and Cox, M.M., "Lehninger's Principles of Biochemistry" 4th Edition, W.H.Freemen and Co., 2005.

PY3008	MATERIAL SCIENCE AND TECHNOLOGY	L	T	P	C
		3	0	0	3

UNIT I   BONDING IN SOLIDS   9

Structure of atoms and molecules – Bonding in solids – Types of bonds and their energies – Classification of engineering materials – Engineering requirement of materials – Selection of materials – Level of structure.

UNIT II   CRYSTAL STRUCTURE AND IMPERFECTIONS   9

Crystal structure – Crystal geometry – Structure of solids – Methods of determining structures – Imperfection in crystals – Types of imperfection – Point imperfection – Diffusion – In solids – Fick's law – Self diffusion.

UNIT III   PROPERTIES AND CORROSION   9

Electrical and magnetic properties of materials – Chemical, thermal and technological properties of materials – Corrosion – Theories of corrosion – Control and prevention of corrosion.

UNIT IV   ENGINEERING METALS   9

Ferrous metals – Iron and steel – Iron – Carbon equilibrium diagram – Non ferrous metals and alloys – Aluminium – Copper – Zinc – Lead – Nickel and their alloys with special reference to their application in chemical industries.

UNIT V   INORGANIC AND ORGANIC MATERIALS   9

Inorganic materials – Ceramics – Glass and refractories – Organic materials – Wood – Plastics and rubber with special reference to the applications in chemical industries.

TOTAL: 45 PERIODS

TEXT BOOKS

1.   Lawrence H. and Van Vlack., "Elements of Material Science and Engineering", Addison Wesley   Publications, 1971.
2.   Hajra Choudhury, S.K., "Material Science and Processes", 1st Edition, Indian Book Distribution Co, 1977.

REFERENCES

1.   Manas, C., "Science of Engineering Materials", 1st Edition, McMillan Co. India Ltd., 1979.
2.   Raghavan, V., "Materials Science", 5th Edition, Prentice Hall of India, 2004.
3.   Paul, E.D., Black, J.J. and Ronald, A.K., "Materials and Process in Manufacturing", 8th Edition, Prentice Hall of India, 2008.

PY3009	**PHARMACEUTICAL PACKAGING TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

UNIT I   PHARMACEUTICAL PACKAGING   9

Status – Scope in pharmaceutical industry – Classification of packaging material – Primary and secondary packaging – Functions of packaging.

UNIT II   PRIMARY PACKAGING MATERIAL   9

Glass containers – Metals containers – Fiber and paper board for bulk – Films and foils for lamination – Equipments used in strip and blister packaging.

UNIT III   SECONDARY PACKAGING MATERIALS   9

Folding cartons and sets of boxes – Materials of construction – Design – Specifications – Packaging inserts – Specifications – Test methods – Quality control – Cushioning materials – Applications – Tapes and adhesives – Cap threads – Cap liners – Bands – Shrink bands – Stoppers and plugs.

UNIT IV   QUALITY CONTROL OF PACKAGING MATERIALS   9

Specifications – Quality control tests – Methods and evaluation of packaging of materials – Labels and labeling – Sterilization of containers.

UNIT V   STABILITY AND REGULATIONS   9

Stability of Packaging materials – Law and regulations governing packaging.

TOTAL: 45 PERIODS

TEXT BOOKS
1.   Deak, D.A., Evans, E.R. and Hall, I.H., "Pharmaceutical Packaging Technology", Taylor and Francis, 2000.
2.   Harburn, K., "Quality Control of Packaging Materials in the Pharmaceutical Industry", Informa Healthcare, 1990.

REFERENCES
1.   Anonymous, "Quality Assurance of Pharmaceuticals: A Compendium Of Guidelines And Related Materials", 2nd Edition, World Health Organization, 2004.
2.   Styres, L.K., "Modern Packaging Encyclopedia", Packaging Catalog Corporation Publications, 1969.
3.   Selke, S.E.M., "Understanding: Plastics Packaging Technology", Hanser Verlag Publications, 1997.

PY3010	PILOT PLANT AND SCALE UP METHODS	L	T	P	C
		3	0	0	3

UNIT I   NECESSITY AND PURPOSE   9

Function – Size estimation – Location personnel requirements – Operation programming – Sampling data – Report of results – Cost factor – Safety factors.

UNIT II   PRINCIPLE   9

Principle of similarity – Dimensional analysis – Scale up equations – Extrapolations – Analog models.

UNIT- III   DESIGN   9

Pilot plant design for flow ducts – Mixing equipments – Heat transfer equipments.

UNIT- IV   METHODS   9

Design methods for packed towers – Batch and continuous distillation columns.

UNIT- V   EQUIPMENTS   9

Pilot plants for reactors – Furnaces – Filters and mechanical operations equipments.

TOTAL: 45 PERIODS

TEXT BOOKS

1.   Bisio, A. and Kabel, R.L., "Scale Up of Chemical Processes", John Wiley Publishers, 1990.
2.   Johnstone, R.E. and Thring, M.W., "Pilot Plants Models and Scale Up Methods in Chemical Engineering", McGraw Hill Book Co., 1987.

REFERENCES

1.   Ernest, J. and Staffin, K.H., "Stage-wise Process Design", John Wiley Publications, 1989.
2.   Levin, M., "Pharmaceutical Process Scale-Up", Informa Healthcare, 2002.
3.   Hynes, M.D., "Preparing for FDA Pre-approval Inspections", Informa Healthcare, 1998.

PY3011   DRUGS THROUGH BIOTECHNOLOGY   L   T   P   C
**   3   0   0   3**

UNIT I   GENETIC ENGINEERING   9

Recombinant DNA Technology – Aims – Genetic engineering applications – Genetic engineering tools – General techniques of genetic engineering – Transformation and analysis of recombinants.

UNIT II   VECTORS   9

Design of Plasmid vectors – Bacteriophage vectors – Cosmids – Eukaryotic vectors – Genomic and DNA Libraries – Screening procedures.

UNIT III   IMMUNOGLOBULINS   9

Antigens – Adjuvants – Monoclonal antibodies – Hybridoma cells – Applications of monoclonal antibodies – Idiotypic antibodies – Enzymes linked immuno-sorbant assay – Radiimmuno assay.

UNIT IV   **IMMUNOTHERAPY**   **9**

Vaccine technology – DNA based vaccines – Pathogenesis of infections microorganism – Antobody Engineering – Applications – Catalytic antibodies – Humanised monoclonal antibodies.

UNIT V   **GENE THERAPY**   **9**

Strategies – Future scope – Potential – Recent developments in biopharmaceuticals – Production through biotechnology – Geneome-based medicine – Molecular modeling – Drug designing.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Taybor, J.M., "Genetic Engineering Technology in Industrial Pharmacy – Principles and Applications", Marcel Dekker, 1989.
2. De Roberts, E.D.P. and De Robers, E.M.F., "Cell and Molecular Biology", 8th Edition, Lea and Febiger, 1987.

REFERENCES

1. Trevan, M.D., Boffey, S., Goulding, K.H. and Stan Burg, P., "Biotechnology: The Biological Principles", Tata McGraw Hill, 1987.
2. Rehin, H.J. and Reed, G., "Biotechnology – A Comprehensive Treatise", Verlag Chemic, 1983.
3. Manfred, E.W., "Burger's Medicinal Chemistry and Drug Discovery", Vol.I, John Wiley, 1995.

MG3012	SAFETY AND RISK MANAGEMENT	L	T	P	C
		3	0	0	3

UNIT I   **INDUSTRIAL SAFETY**   **9**

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

UNIT II   **HAZARD IDENTIFICATION AND CONTROL**   **9**

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   **RISK MANAGEMENT**   **9**

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 – Gas processing complex, refinery – First aids.

UNIT IV   SAFETY PROCEDURES   9

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.

UNIT V   SAFETY IN HANDLING AND STORAGE OF CHEMICALS   9

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

TOTAL: 45 PERIODS

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.

REFERENCES

1.   Geoff Wells, "Hazard Identification and Risk Assessment", I.ChE.
2.   John Ridley and John Channing, "Safety at Work", 6th Edition. Butterworth-Heinemann, 2003.
3.   Raghavan, K.V. and Khan, A.A., "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.