REGULATIONS, CURRICULUM & SYLLABI

B.Tech. Pharmaceutical Technology

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS – 2023

CURRICULUM

FOR B.TECH. PHARMACEUTICAL TECHNOLOGY

(For the Students Admitted in the Academic Year 2023-2024 onwards)

FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST101	Professional English - I	HS	3	0	0	3	40	60	100
23MAT101	Matrices and Calculus	BS	3	1	0	4	40	60	100
23HST102	தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23PHE101	Engineering Physics	BS	3	0	2	4	40	60	100
23CYE101	Engineering Chemistry	BS	3	0	2	4	40	60	100
23GEE101	Problemsolving And Python programming	ES	3	0	2	4	40	60	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC101	Soft Skills	EEC	1	0	0	0	100	-	100
MANDATORY COURSE									
23MDC101	Induction Program (2 Weeks)	MC	-	-	-	-	-	-	-
TOTAL CREDITS IN SEMESTER - I			20						

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CURRICULUM

FOR B.TECH. PHARMACEUTICAL TECHNOLOGY

(For the Students Admitted in the Academic Year 2023-2024 onwards)

SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST201	Professional English II	HS	3	0	0	3	40	60	100
23CYT201	Environmental Sciences and Sustainability	HS	3	0	0	3	40	60	100
23PHT201	Material Science	BS	3	0	0	3	40	60	100
23MAT201	Statistics and Numerical Methods with Matlab	BS	3	1	0	4	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23GEE201	Engineering Graphics	PC	3	0	2	4	40	60	100
23EEE202	Basic Electrical And Electronics Engineering	PC	3	0	0	4	40	60	100
PRACTICAL COURSE									
23GEL201	Engineering Practice Laboratory	GE	0	0	4	2	60	40	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC201	Foreign Language / Communication Skills	EEC	0	0	4	1	40	60	100
MANDATORY COURSE									
23MDC201	Life Skill & Leadership Enhancement Programme	MC	3	0	0	0			
TOTAL CREDITS IN SEMESTER - II			25						

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CURRICULUM

FOR B.TECH. PHARMACEUTICAL TECHNOLOGY

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THIRDSEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23PTT301	Transform and Partial Differential Equations	BS	3	1	0	4	40	60	100
23PTT302	Chemical Process Calculations	PC	2	0	0	3	40	60	100
23PTT303	Pharmaceutical Chemistry	PC	3	0	0	3	40	60	100
23PTT304	Biochemistry	PC	3	0	0	3	40	60	100
23PTT305	Human Anatomy and Physiology	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23PTE301	Microbiology	PC	3	0	2	4	40	60	100
PRACTICAL COURSE									
23PTL302	Biochemistry and Physiology Laboratory	PC	0	0	3	1.5	40	60	100
23PTL303	Professional Development	EEC	0	0	2	1	40	60	100
TOTAL CREDITS IN SEMESTER - III			22.5						

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CURRICULUM

FOR B.TECH. PHARMACEUTICAL TECHNOLOGY

(For the Students Admitted in the Academic Year 2023-2024 onwards)

FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23PTT401	Applied Chemical Engineering Thermodynamics	BS	2	1	0	3	40	60	100
23PTT402	Fluid Mechanics	PC	3	0	0	3	40	60	100
23PTT403	Cell and Molecular Biology	PC	3	0	0	3	40	60	100
23PTT404	Pharmaceutical Analysis	PC	3	0	0	3	40	60	100
23PTT405	Unit Operations in Pharmaceutical Industries	PC	3	1	0	4	40	60	100
	NCC Credit Course Level 2								
EMBEDDED COURSE									
23PTE401	Physical Pharmaceutics	PC	3	0	2	4	40	60	100
PRACTICAL COURSE									
23PTL401	Pharmaceutical Chemistry Laboratory	PC	0	0	3	1.5	40	60	100
23PTL402	Industrial Training/Internship I*	EEC							
TOTAL CREDITS IN SEMESTER - IV			21.5						

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CURRICULUM

FOR B.TECH. PHARMACEUTICAL TECHNOLOGY

(For the Students Admitted in the Academic Year 2023-2024 onwards)

FIFTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23PTT501	Pharmaceutical Dosage Forms	PC	3	0	0	3	40	60	100
23PTT502	Pharmacology	PC	3	0	0	3	40	60	100
	Professional Elective I	PE	3	0	0	3	40	60	100
	Professional Elective II	PE	3	0	0	3	40	60	100
	Professional Elective III	PE	3	0	0	3	40	60	100
	Mandatory Course-I	MC	3	0	0	3	40	60	100
PRACTICAL COURSE									
23PTL501	Dosage Forms Laboratory	PC	0	0	3	1.5	40	60	100
23PTL502	Pharmacology Laboratory	PC	0	0	3	1.5	40	60	100
23PTL503	Industrial Training / Internship	EEC	0	0	0	2	40	60	
TOTAL CREDITS IN SEMESTER - V			23						

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CURRICULUM

FOR B.TECH. PHARMACEUTICAL TECHNOLOGY

(For the Students Admitted in the Academic Year 2023-2024 onwards)

SIXTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23PTT601	Heat and Mass Transfer Operations	PC	3	1	0	4	40	60	100
23PTT602	Instrumental Techniques in Drug Analysis	PE	3	0	0	3	40	60	100
	Open Elective – I*	OE	3	0	0	3	40	60	100
	Professional Elective IV	PE	3	0	0	3	40	60	100
	Professional Elective V	PE	3	0	0	3	40	60	100
	Professional Elective VI	PE	3	0	0	3	40	60	100
	Mandatory Course-II	MC	3	0	0	3	40	60	100
	NCC Credit Course Level 3								
PRACTICAL COURSE									
23PTL601	Heat and Mass Transfer Operations Laboratory	PC	0	0	3	1.5	40	60	100
23PTL602	Instrumental Techniques In Drug Analysis Laboratory	PC	0	0	3	1.5	40	60	100
23PTL603	Industry Internship / Project	EEC	0	0	0	0			
TOTAL CREDITS IN SEMESTER - VI			25						

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T : Tutorial
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CURRICULUM

FOR B.TECH. PHARMACEUTICAL TECHNOLOGY

(For the Students Admitted in the Academic Year 2023-2024 onwards)

SEVENTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23PTT701	Regulatory requirements in Pharmaceutical Industries	PC	3	0	0	3	40	60	100
23PTT702	Biopharmaceutics and Pharmacokinetics	PC	3	0	0	3	40	60	100
23PTT703	Human values and Ethics	HSMC	2	0	0	2	40	60	100
	Elective - Management	HSMC	3	0	0	3	40	60	100
	Open Elective – II	OE	3	0	0	3	40	60	100
	Open Elective – III	OE	3	0	0	3	40	60	100
	Open Elective – IV	OE	3	0	0	3	40	60	100
PRACTICALS									
23PT701	Industry Internship / Project	EEC	0	0	0	2	40	60	100
TOTAL CREDITS IN SEMESTER – VII			22						

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
PE	:	Professional Elective
GE	:	General Engineering
OE	:	Open Elective
EEC	:	Employability Enhancement Courses
MC	:	Mandatory Courses
L	:	Lecture
T	:	Tutorial
P	:	Practical
C	:	Credit Point
CIA	:	Continuous Internal Assessment
ESE	:	End Semester Examination
TOT	:	Total

CURRICULUM

FOR B.TECH. PHARMACEUTICAL TECHNOLOGY

(For the Students Admitted in the Academic Year 2023-2024 onwards)

EIGHTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
PRACTICALS									
23PT701	Project Work / Product Development	EEC	0	0	20	20			
TOTAL CREDITS IN SEMESTER – VIII/VII			20						

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FOR B.TECH. PHARMACEUTICAL TECHNOLOGY

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Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
ELECTIVE – MANAGEMENT COURSES									
	Principles of Management	HSMC	3	0	0	3	40	60	100
	Total Quality Management	HSMC	3	0	0	3	40	60	100
	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	40	60	100
	Human Resource Management	HSMC	3	0	0	3	40	60	100
	Knowledge Management	HSMC	3	0	0	3	40	60	100
	Industrial Management	HSMC	3	0	0	3	40	60	100

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Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
MANDATORY COURSES I									
	Introduction to Women and Gender Studies	HSMC	3	0	0	3	40	60	100
	Elements of Literature	HSMC	3	0	0	3	40	60	100
	Film Appreciation	HSMC	3	0	0	3	40	60	100
	Disaster Risk Reduction and Management	HSMC	3	0	0	3	40	60	100
MANDATORY COURSES II									
	Well Being with Traditional Practices -Yoga, Ayurveda and Siddha	MC	3	0	0	3	40	60	100
	History of Science and Technology in India	MC	3	0	0	3	40	60	100
	Political and Economic Thought for a Humane Society	MC	3	0	0	3	40	60	100
	State, Nation Building and Politics in India	MC	3	0	0	3	40	60	100
	Industrial Safety	MC	3	0	0	3	40	60	100

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CURRICULUM

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CREDIT SUMMARY

FOR B.TECH. PHARMACEUTICAL TECHNOLOGY

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
HS	4	7							11
BS	12	7	4	3					26
ES	4								4
GE	0	2							2
PC	0	8	17.5	18.5	9	10	6		69
PEC					9	12			21
OEC						3	9		12
EEC		1	1		2		2	20	26
MC		0			3	3			6
BSC									0
PCC									0
ECC									0
HSMC							5		5
Total	20	25	22.5	21.5	23	25	22	20	179

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU
ESTD 2001
ISO 9001 REGISTERED

23HST101 PROFESSIONAL ENGLISH – I L T P C

(Common to all B.E. & B.Tech. Branches) 3 0 0 3

OBJECTIVES

- To develop learning English language through grammar.
- To use grammar efficiently for demonstrating all the four language skills (LSRW).
- To write business letters, dialogue writing, paragraph and essay writing.
- To speak effectively about self introduction and real time situation.
- To build the reading skills through reading comprehension and note taking

UNIT I VOCABULARY 8

Synonyms and Antonyms - Word Formation - Sentence Types (declarative, imperative, interrogative & exclamatory) - Single Word Substitutes - Use of Abbreviations and Acronyms- Homonyms and Homophones - Collocation - British and American Vocabulary.

UNIT II GRAMMAR 10

Parts of speech - Be, Have and Do verbs - Punctuation - Tenses - Numerical Adjectives - modal verbs - Single line Definition - Direct and Indirect Speech - Gerunds and Infinitives - Same Word Used as Different Parts of Speech.

UNIT III WRITING 9

Letter Writing - Business communications - quotations, placing orders, complaints, replies to queries from business customers - Dialogue Writing – Paragraph Writing (descriptive, narrative, expository & persuasive) - Essay Writing - Writing Instructions.

UNIT IV SPEAKING 9

Self-introduction - Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes - Tongue twisters

UNIT V READING SKILLS 9

Reading Comprehension – Reading techniques, pre-reading, post-reading, comprehension questions (multiple choice questions or short questions) - Short Comprehension Passages, practice skimming - Scanning and Predicting - Reading the passage and taking (Note making) Notes - Scan and understand main contents of the passage.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Use a wide range of vocabulary in oral and written communication
- Frame grammatically correct sentences.
- Write letters, frame paragraphs and Essays, develop conversation.
- Develop speaking skills for self-Introduction, delivering speeches and Technical Presentation
- Read and comprehend the passage, technical content and take notes

TEXT BOOKS

1. Board of Editors. Using English A Course book for Under graduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2015.
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCES

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", 1st Edition, Orient Black Swan, Chennai. 2012.
2. Title: Developing Communication Skills. Publisher: MacMillan. Author: Krishna Mohan, Meera Banerji. Edition: Paperback 2019.

E-RESOURCES

1. http://www.usingenglish.com
2. https://www.khanacademy.org/humanities/grammar

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1						1	3	1	2	3		3		3	
2						1	2	-	1	3		3		3	
3						3	3	2	3	3		3		3	
4						1	2	1	2	3		3		3	
5						1	1	1	1	3		3		3	
6															
AVG						1.40	2.20	1.25	1.80	3.00		3.00		3.00	

1- Low 2-Medium 3-High '-' – No Correlation

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23MAT101	MATRICES AND CALCULUS	L	T	P	C
	(Common to all B.E./ B.Tech. Branches)	3	0	1	4

OBJECTIVES

- To develop the use of matrix algebra techniques those are needed by engineers for practical applications.
- To familiarize the students with differential and integral calculus.
- To describe the student with functions of several variables.
- To acquire the student with mathematical tools needed in evaluating multiple integrals and their applications.
- To acquaint the student with the concepts of vector calculus that is needed for problems in engineering disciplines.
- To determining matrices, functions of several variables, multiple integrals and vector calculus by using MATLAB.

UNIT I MATRICES **9**

Eigen values and Eigen vectors – Properties of Eigen values – Cayley-Hamilton theorem – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of quadratic form.

UNIT II DIFFERENTIAL AND INTEGRAL CALCULUS **9**

Differentiation rules: Derivatives of polynomials and exponential functions – The product and quotient Rules – Derivatives of trigonometric functions – The Chain rule – Implicit differentiation – Applications of differentiation: Maximum and Minimum Values – Techniques of integration: Integration by parts – Trigonometric integrals – Integration of rational functions by partial fractions.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9**

Partial derivatives – Homogeneous functions – Euler's theorem – Total derivative – Jacobians – Taylor's theorem for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRALS **9**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double integrals.

UNIT V VECTOR CALCULUS **9**

Scalar and vector point functions – Gradient – Divergence and curl – Line integral – Surface integral – Green's theorem in a plane – Volume integral – Divergence theorem – Irrotational and Solenoidal fields.

OUTCOMES

Upon completion of the course, Students will be able to:

- Classify the matrix algebra methods for solving practical problems.
- Discover differential calculus tools in solving various application problems and compare different methods of integration in solving practical problems.
- Develop differential calculus ideas on several variable functions.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.
- Solve engineering problems using the concept of vector calculus.
- Exposed to MATLAB programming to Computation of Eigen values and Eigenvectors, functions of several variables, multiple integrals and vector calculus.

LIST OF EXPERIMENTS

1. Introduction to MATLAB.
2. Computation of Eigen values and Eigenvectors.
3. Determining Maxima and minima of functions for two variables.
4. Evaluating double and triple integrals.
5. Computing Gradient, divergence and curl of point functions.

TOTAL: 45+15 PERIODS

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, New Delhi, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

REFERENCES

1. Bali N.P, Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Kanti B. Dutta., "Mathematical Methods of Science and Engineering – Aided with MATLAB", Cengage Learning, New Delhi, 2013.

E-RESOURCES

1. https://nptel.ac.in/courses/111105121 (Differential Calculus and Integral Calculus)
2. https://nptel.ac.in/courses/111107112 (matrix analysis)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2								1	2	3		
2	3	3	2								1	2	3		
3	3	3	2								1	2	3		
4	3	3	2								1	2	3		
5	3	3	2								1	2	3		
6	3	3	2								1	2	3		
AVG	3	3	2								1	2	3		

1-Low 2-Medium 3-High '-' – No Correlation

23PHE101 **ENGINEERING PHYSICS** **L T P C**

(Common to Civil, Mechanical, R & A and Pharm.Tech) **3 0 2 4**

OBJECTIVES

The main objective of this course is to:

- Recognize the structure of crystalline materials using crystallographic knowledge.
- Apply the knowledge of material's elasticity, stress, strain for industrial applications.
- Generalize the fundamentals of ultrasonics and sound waves, as well as their applications.
- Investigate the complex physical phenomenon using the fundamental principles of quantum mechanics and Schrödinger's wave equation.
- Demonstrate different materials heat transmission modes and fundamentals of thermal conduction in solid and its applications.
- Judge the Engineering Physics that can be applied to optics, acoustics and ultrasonic's, matter characteristics and to determine thermal properties.

UNIT I CRYSTAL PHYSICS **9**

Lattice and Unit cell – Crystal Systems and Bravais lattice – Lattice planes – Miller Indices – d - Spacing in Cubic lattice – Calculation of Number of Atoms per Unit Cell – Atomic radius – Coordination Number – Packing factor for SC, BCC, FCC and HCP structures – Crystal Growth Techniques –Solution Growth – Melt Growth Techniques (Bridgman and Czochralski).- Silicon chip Production Process.

UNIT II MECHANICAL PROPERTIES OF SOLIDS & FLUIDS **9**

Elasticity – Stress-Strain Diagram and its Uses - Factors Affecting Elastic Modulus – Torsional Stress and Deformations – Twisting Couple - Torsion Pendulum: Theory and Experiment - Bending of beams - B ending Moment – Cantilever: Theory and Experiment – Uniform and Non-Uniform Bending: Theory and Experiment - I-Shaped Girders.

UNIT III ACOUSTICS & ULTRASONICS **9**

ACOUSTICS : Classification of Sound – Decibel - Weber Fechner Law- Reverberation-Sabine's formula (Qualitative) - Factors affecting Acoustics of Buildings and their Remedies.

ULTRASONICS: Properties -Production of Ultrasonics - Magnetostriction and Piezoelectric methods - Acoustic Grating - Non Destructive Testing – Pulse echo system, through Transmission and Reflection modes - Medical applications – Sonogram.

UNIT IV QUANTUM PHYSICS **9**

Black Body Radiation – Planck's Theory (derivation) – Wave particle duality – Electron Diffraction – Wave function and its Physical significance – Schrödinger's Wave Equation: Time independent and time dependent equations – Particle in a One-Dimensional box - Scanning Electron Microscope - Transmission Electron Microscope - Quantum Tunneling – Scanning Tunneling Electron Microscope.

UNIT V THERMAL PHYSICS **9**

Transfer of Heat Energy – Thermal expansion of Solids and Liquids – Expansion joints - Bimetallic strips - Thermal Conduction, Convection and Radiation – Heat conductions in Solids – Thermal Conductivity – Lee's disc method: Theory and Experiment - Conduction through Compound Media (series and parallel) – Geothermal Energy - Geothermal power - Thermal battery - Thermal Energy Storage.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course to :

- Familiarize the structure of crystalline solids by applying knowledge of crystallography.
- Analyze theories of failure and yield criteria as an elements of properties of matter.
- The students will get knowledge on materials characterization techniques.
- Apply the basic principles of quantum mechanics and Schrödinger's wave equation to study the complex physical phenomenon.
- The students will have knowledge on the thermal conductivity and their applications.
- To compose principles of elasticity, optics, acoustics and thermal properties in engineering applications through experiments

TEXT BOOKS

1. P.Mani, " A text book of Engineering Physics " Dhanam Publications, 2018.
2. Rajendran V. "Engineering Physics". TaTa McGraw Hill Publications, 2012.

REFERENCES

1. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2010.
2. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials" Narosa Publishing House, 2009

LIST OF EXPERIMENTS

(**Common to Civil, Mechanical, Robotics & Automation & Pharmaceutical Technology**)

(Eight experiments are to be conducted in Lab)

1. Determination of wavelength of laser.
2. Determination of particle Size lycopodium powder using laser.
3. Determination of wavelength of mercury spectrum- Spectrometer.
4. Determination of Young's modulus - Uniform bending.
5. Torsional Pendulum: Determination of moment of inertia and rigidity modulus.
6. Determination of velocity of ultrasonic in liquid.
7. Determination of Viscosity of a liquid –Poiseulle's Method.
8. Determination of thermal conductivity of bad conductor using Lee's Disc Apparatus.
9. Determination of Specific resistance of a given wire using Carey's Foster's Bridge (Virtual).
10. Radiation with Temperature Change Using Stefan's Law. (Virtual)

TOTAL: 15 PERIODS

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	1									2		1
2	3	3	1	1									2		1
3	3	3	1	1									2		1
4	3	3	1	1									2		1
5	3	3	1	1									2		1
6	3	3	1	1											
Average	3	3	1	1									2		1

1-Low 2-Medium 3-High '-' – No Correlation

23CYE101 **ENGINEERING CHEMISTRY** **L T P C**

(Common to EEE,ECE,CSE,SE(CS),AIDS and Pharm.Tech) **3 0 2 4**

OBJECTIVES

To enable students to,

- Classify the impurities of water and know the treatment and the conditioning methods for domestic and industrial uses.
- Develop an understanding about fundamentals of polymers.
- Gain knowledge about the phase rule and its applications to engineering field.
- Explain the basics of Nanochemistry, synthesis, properties and applications of Nano materials.
- Be familiar with the types of corrosion and control measures and working of batteries
- Acquire practical skills in the determination of water quality parameters, molecular weight of polymer, rate corrosion through volumetric and instrumental analysis.

UNIT- I WATERTECHNOLOGY **9**

Introduction - Characteristics – hardness – estimation of hardness by EDTA method – alkalinity and its estimation - Boiler feed water – requirements –Boilers troubles (Scale and Sludge) – Internal conditioning (colloidal, phosphate, calgon and carbonate conditioning methods) – External conditioning – zeolite process, demineralization process – Desalination of brackish water by reverse osmosis-Nano filtration - Municipality water treatment - Break point chlorination.

UNIT- II POLYMERCHEMISTRY **9**

Introduction - Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting plastic. Functionality – Degree of polymerization. Types of polymerization: Addition Condensation and copolymerization, Properties of polymers: Glass transition Temperature, Tacticity- Molecular weight – weight average, number average and polydispersity index- Preparation, properties and uses of PVC, Nylon 6,6, Polyethylene - Rubbers – types – vulcanization of rubber – Plastics – Moulding constituents of plastics – Moulding of plastics - compression, injection and blow moulding- Biodegradable polymers-Conducting polymers.

UNIT- III PHASE RULE AND ALLOYS **9**

Phase rule - 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: Introduction- definition- properties of alloys- significance of alloying, functions and effect of alloying elements - ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze

UNIT-IV CHEMISTRY OF NANO MATERIALS **9**

Nano chemistry – Basics (Surface area to volume ratio - Quantum confinement – 0D, 1D, 2D& 3D) - Distinction between molecules, nanoparticles and bulk materials- Characterization of nanomaterials using EDX and HR-TEM. Synthesis of nano materials: Top down approach - Ball milling - Bottom up approach - Sol-gel method, Chemical vapour deposition - Properties of nanomaterials and Applications of nanomaterials (Nano products of today).

UNIT-V ELECTROCHEMISTRY, CORROSION AND ITS CONTROL **9**

Introduction- Electrochemical cells, applications of electrochemical series-Reference Electrode-Standard Calomel electrode, ion selective electrode-glass electrode, potentiometric titration - redox titration, conductometric titration-strong acid vs strong base. Corrosion – Types – Chemical Corrosion – Electrochemical Corrosion (galvanic and differential aeration) - Factors influencing corrosion – Material selection and design aspects-Control methods of corrosion –Sacrificial anodic and impressed current cathodic protection.

LABORATORY PART

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by Argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Estimation of sodium and potassium present in water using flame photometer.
7. Conductometric Precipitation Titration using $BaCl_2$ and Na_2SO_4
8. Conductometric titration of strong acid vs strong base.
9. Estimation of Ferrous ions by Potentiometric Titration.
10. Estimation of copper content in the brass by Iodometry.

TOTAL: 45+15 =60 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Identify the method of removal of impurities from water for domestic and industrial purpose.
- Identify the different types of polymers, polymerization processes and some special properties and applications of polymers.
- Apply of phase rule to alloy making for various engineering applications.
- Discuss the fundamentals of the nano materials and nano products of today.

- Analyze the causes of corrosion and discuss the control measures and discuss the functions of batteries.
- Outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TEXT BOOKS

1. Jain P.C and Monika Jain, "Engineering Chemistry", Dhanpet Rai Publishing Company (P) Ltd. New Delhi, 2013.
2. Viswanathan B, "Nanomaterials" Alpha Science International Ltd, 2009.

REFERENCES

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.

E-RESOURCES

1. https://nptel.ac.in/courses/104105039
2. http://library.iitbbs.ac.in/open-access-e-resources.php

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3		1		3					2	3		1
CO2	1		2		1								3		
CO3	2	2	3	1	1	1						1	3		
CO4	1	1	2	1									3		
CO5	2	1	2	1	3		1						3		1
CO6	2	3		2	3								3		1
Avg	1.6	1.6	2.4	1.25	1.8	1	2					1.5	3		1

23GEE101 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
COMMON TO ALL BRANCHES 3 0 2 4

OBJECTIVES

- The main objective of this course is, to
- Understand the basics of algorithmic problem solving.
- Learn to solve problems using Python conditionals and loops.
- Define Python functions and use function calls to solve problems.
- Use Python data structures-lists, tuples, dictionaries to represent complex data.
- Do input/output with files in Python
- Understand the modules and python Packages.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocksofalgorithms(statements,state,controlflow,functions),notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode,debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals:Boolean values and operators, conditional (if), alternative (if-else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,parameters, local and global scope, function composition, recursion; Strings: string slices,immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS,TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation

UNIT V FILES,MODULES, PACKAGES& DATA VISUALIZATION 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file - Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Identification and solving of simple real life or scientific or technical problems, anddeveloping flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. ScientificproblemsusingConditionalsandIterativeloops.(Numberseries,NumberPatterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)
6. Implementing programs using Functions.(Factorial,largestnumberinalist,areaofshape)
7. ImplementingprogramsusingStrings.(reverse,palindrome,charactercount,replacingcharacters)
8. Implementing programs using written modules and Python Standard Libraries(pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling.(copy from one file to another, word count, longest word)Implementingreal-time/technicalapplicationsusingExceptionhandling.(dividebyzeroerror, voter's age validity, student mark range validation)

.TOTAL : 45 +15 = 60 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Develop algorithmic solutions to simple computational problems.
- Develop and execute simple Python programs.
- Write simple Python programs using conditional sand loops for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists,tuples,dictionariesetc.
- Read and write data from/to files in Python programs.

TEXTBOOKS:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MITPress, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. MartinC.Brown,"Python:TheCompleteReference",4thEdition,Mc-GrawHill,2018.

E – RESOURCES

1. https://nptel.ac.in/courses/106104074(Introduction to Algorithms)
2. https://archive.nptel.ac.in/courses/106/106/106106182/ (Joy of Computing)

CO's PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2						2	2	3	3	
CO2	3	3	3	3	2						2	2	3		
CO3	3	3	3	3	2						2		3		
CO4	2	2		2	2						1		3		
CO5	1	2			1						1		2		
CO6	2	2			2						1		2		
Avg	2	3	3	3	2						2	2	3	3	

1-low,2-medium,3-high,'-'-nocorrelation

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU
ESTD 2001
ISO 9001 REGISTERED

23HST201 **PROFESSIONAL ENGLISH II** **L T P C**
(Common to all B.E. & B.Tech. Branches) **3 0 0 3**

OBJECTIVES

- To use grammatical components effectively in written communication.
- To read and understand on comprehend technical writing.
- To develop skills for writing email, business letters, Job Application Letter and Resume.
- To write checklist, recommendation, transcoding graphics and letter.
- To speak fluently in real contexts.

UNIT I GRAMMAR **9**

Articles - Prepositions - Compound words - Conditionals - Subject verb agreement - Active and Passive voice - Impersonal Passive Voice.

UNIT II LISTENING & READING **9**

Syllabification – Reading Vocabulary - Reading Newspapers - Listening to Youtube Documentaries - Listening to Podcast - Listening to Motivational Movies.

UNIT III BUSINESS WRITING **9**

E-mail writing - fixing an appointment, cancelling appointment, conference details, training programme details, paper submission for seminars and conferences - Job Application Letter and Résumé.

UNIT IV WRITING **9**

Checklist - Writing Recommendations - Transcoding Graphics - Bar Chart, Flow Chart, Pie Chart and Tables - Formal Letter Writing - inviting dignitaries and declining invitations.

UNIT V SPEAKING **9**

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - Suggesting - Comparing and Contrasting – Expressing - Finding out facts, attitudes and opinions - Situational Role-play.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Use grammar to frame sentences and write sentences in passive forms
- Read vocabulary, newspaper and improve listening skills
- Draft emails, write business letters, construct resume with job application letter.
- Frame checklist, write recommendation and Transcoding graphical representation.
- Develop speaking skill for taking part in Collaborative task and Situational Role-play.

TEXT BOOKS

1. Title: Technical English II Author: S. Sumant Maven Learning.
2. Communicative English by KN Shoba ,Lourdes Joavani Rayen Publised by Cambridge university 2017.

REFERENCES

1. Dr K Elango, Dr. Veena Selvam, Dr. Sujatha Priyadarshini, "Resonance English for Engineers and Technologists", Cambridge University Press, 1st Edition, Foundation Books,New Delhi, 2013.
2. Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.
3. Norman Whitby, Business Benchmark- Pre-Intermediate to Intermediate, Students book, Cambridge University Press, 2006.

E-RESOURCES

1. https://www.fluentu.com/Blog/english/english-small-talk/
2. https://www.britishcouncil.com

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1						1	1		2	3		3		3	
2					2	1	1	1	2	3		3		3	
3					2	1	2	1	2	3		3		3	
4						1	1	1	1	3		3		3	
5						2	1	1	3	3		3		3	
6															
AVG					2.00	1.20	1.20	1.00	2.00	3.00		3.00		3.00	2.00

1- Low 2-Medium 3-High '-' – No Correlation

23CYT201	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY	L	T	P	C
	COMMON TO ALL B.E./B.TECH. BRANCHES	3	0	0	3

OBJECTIVES

To enable students to,

- Understand the importance of the environment and interrelationship between living organism and environment.
- Understand the various kinds of pollutions.
- Be familiar with the social issues to improve the quality of environment.
- Analyze the problems based on over population.
- Create and implement sustainable practices in various industries and contexts.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – 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, rivers, oceans) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Activity: Biodiversity in and around the campus and report submission.

UNIT II ENVIRONMENTAL POLLUTION 9

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 - e-waste – role of an individual in prevention of pollution - pollution case studies – disaster management: floods, earthquake and cyclone.

Activity: Local pollution case study and report submission.

UNIT III SOCIAL ISSUES AND THE ENVIRONMENT 9

From unsustainable to sustainable development – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies - environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – Green Chemistry and principles - environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – Public awareness.

Activity: Creating environmental awareness.

UNIT IV HUMAN POPULATION AND THE ENVIRONMENT 9

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.

Activity: Visit to local primary health center.

UNIT V SUSTAINABLE MANAGEMENT **9**

Sustainability-Concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-Targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Zero waste and R concept, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Energy efficiency, Sustainable transports.

Activity: Field trips to local organizations or facilities with sustainable practices in place

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Acquire knowledge on public awareness & about environment and ecosystem.
- Find solutions for pollutions to improve the quality of environment.
- Promote sustainable development and understand the concept of green chemistry.
- Analyze the effects of human population and issues related to the environment and human health.
- To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development

TEXT BOOKS

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
3. Allen, D. T. and Shonnard, D. R., 'Sustainability Engineering: Concepts, Design and Case Studies', Prentice Hall.

REFERENCES

1. Erach Bharucha, 'Textbook of Environmental Studies', Universities Press(I) Pvt Ltd, Hydrabad, 2015.
2. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/
2. https://swayam.gov.in/nd1_noc19_ge22/preview

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1	3	2		1	3		1			1	3		1
CO2	2	2	2	2	2	2	1						3		1
CO3		2	2	2	1	1	3						3		1
CO4	1	2	2	1	1	2	3	3					3		1
CO5		2	2	2	2	1	1	1		2			2		2
Avg	1.5	1.8	2.2	1.8	1.5	1.4	2.2	2	1	2		1	2.8		1.2

23PHT201 **MATERIAL SCIENCE** **L T P C**

Common to Civil, Mechanical, R&A, PT **3 0 0 3**

OBJECTIVES

The main objective of this course is to:

- Learn the principles of cryogenics and superconductivity, as well as their technological applications.
- Recognize the application of physics concepts to microscopic procedures, nondestructive testing, and engineering.
- Explore different kind of nano materials and synthesis of nano materials, applications.
- Demonstrate the knowledge of advanced engineering and smart materials for various engineering applications.
- Investigate different composite materials heat transmission modes and fundamentals of thermal conduction in solid and its applications.

UNIT I CRYOGENICS **9**

Introduction to Cryogenics - Properties of Cryogenic Fluids- Gas-Liquefaction of gases and Refrigeration Systems – Cryocoolers -Cryogenic Insulations - Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity - High Tc superconductors – General applications of superconductors –Cryotron and Magnetic levitation.

UNIT II MATERIALS CHARACTERIZATION **9**

Introduction to materials and Techniques-X-ray diffraction (XRD) – Atomic force microscopy (AFM)- Fourier Transform Infrared Spectroscopy (FTIR)- UV-Vis Spectroscopy- Non-destructive testing (NDT) : Liquid penetrant test, magnetic detection, Electromagnetic testing, Ultrasonic test, Thermal infrared testing and Spark test.

UNIT III NANOMATERIALS & NANODEVICES **9**

Emergence of Nanoscience - Role of particle size - quantum structures: quantum well, quantum wire and quantum dot- Properties at Nano scale (optical, electronic and magnetic) - Synthesis of Nanomaterials: Physical Vapour Deposition (PVD) - Pulsed Laser Deposition (PLD) - Ball Milling - carbon nanotubes - Micro Electro Mechanical Systems (MEMS) - Nano Electro Mechanical Systems (NEMS).

UNIT IV SMART MATERIALS **9**

Intelligent / Smart materials – Functional materials – Polyfunctional materials – Structural materials, Electrical materials, bio-compatible materials. – Intelligent biological materials Metallic glasses: types, glass forming ability of alloys, melt spinning process, applications - shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy, applications.

UNIT V COMPOSITE MATERIALS **9**

Definitions, Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fibre composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites. Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs.

OUTCOMES

Upon completion of this course the students will be able to,

- Learn the potential applications of superconductors.
- Acquire knowledge on various materials characterization techniques.
- Understand the fundamentals of nano materials and various synthesize methods.
- Get knowledge about smart materials and their applications.
- Recognize the fundamentals of composite materials and synthesize methods.

TEXT BOOKS

1. P.Mani, " A text book of Engineering Physics " Dhanam Publications, 2018
2. Rajendran V. "Engineering Physics". TaTa McGraw Hill Publications, 2012.

REFERENCES

1. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2010.
2. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials" Narosa Publishing House, 2009

E-RESOURCES

1. https://nptel.ac.in/courses/112108150/
2. https://swayam.gov.in/nd1_noc19_mm13/preview

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	1	2	1	1						2		1
CO2	2	3	2	1	2	1	1						2		1
CO3	2	3	2	1	2	1	1						2		1
CO4	2	3	2	1	1	1	1						2		1
CO5	2	3	2	1	2	1	1						2		1
CO6															
Avg	2	3	2	1	1.8	2	3						2		1

1-Low 2-Medium 3-High '-' – No Correlation

23EEE201 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
(Common to AIDS, CSE, CSE-CS, IT, Robotics, PT) 3 0 2 4

OBJECTIVES

- To understand electric circuit laws, single and three phase circuits, wiring and measuring instruments.
- To know working principles of electrical machines.
- To realize the working principle of various electronic devices and applications.
- To apply the principles of digital electronics in digital world.
- To familiarize the use of various measuring instruments.
- To provide practical knowledge on electrical and electronics engineering.

UNIT I ELECTRICAL CIRCUITS 9

DC circuits: Circuit components: Conductor, Resistor, Inductor, Capacitor - Ohm's Law - Kirchhoff's Laws - Independent and Dependent sources - Nodal analysis, Mesh analysis with Independent sources only (Steady state) – Thevenin's theorem – Maximum Power Transfer theorem.
Introduction to AC circuits and parameters: Waveforms, Average value, RMS value, Instantaneous power, real power, reactive power and apparent power, power factor - Steady state analysis of RL, RC & RLC circuits.

UNIT II ELECTRICAL MACHINES 9

DC Generators: Construction and working principle, EMF equation, Types and applications – DC Motors: Working principle, Types and applications - Construction, Working principle and applications: Single phase transformer, Three phase alternator and Three phase induction motor – BLDC Stepper Motor – PMSM.

UNIT III ANALOG ELECTRONICS 9

PN junction diodes and its applications - Zener diode: structure, operation, Zener diode as regulator – Biasing of BJT - JFET, SCR, MOSFET, IGBT - Types, VI characteristics.

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes, Combinational logic - Representation of logic functions - SOP and POS forms, K-map representations - Minimization using K maps - Half adder, Full adder – Multiplexer, Demultiplexer.

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Operating principle and Types of Moving coil and Moving iron meters - Measurement of power and Energy meter - Data acquisition.

LIST OF EXPERIMENTS

1. Verification of KVL & KCL.
2. Load test on DC shunt motor.
3. Characteristics of PN and zener diodes
4. Characteristics of BJT.
5. Half wave and full wave rectifiers
6. Verifications of Half adder and Full adder.
7. Measurement of power and Energy meter.

TOTAL : 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able:

- To understand electric circuits and choose appropriate instruments for electrical measurement for a specific application.
- To understand the concept of different types of DC and AC machines.
- To identify the diode's usage as a rectifier, and Zener diode's usage as an voltage regulator and discuss the basic characteristics of BJT.
- To employ Boolean algebra to implement the combinational logic circuits.
- To understand the operating principles of measuring instruments and choose suitable instrument for measuring the parameters.
- To understand and analyse practical electrical and electronics engineering.

TEXT BOOKS

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", 2nd Edition, McGraw Hill Education, 2020.
2. S. K. Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, 2nd Edition, 2017.

REFERENCES

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", 4th Edition, McGraw Hill Education, 2019.
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2021.

E-RESOURCES

1. https://nptel.ac.in/courses/108108076 - (Basics of Electrical Technology).
2. https://www.digimat.in/nptel/courses/video/108105112/L01.html - (Fundamentals of Electrical Engineering).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1				1				1	3		3
2	3	1		1				1				1	3		3
3	3			1				1				1	3		3
4	3	3	2	1				1				1	3		3
5	3							1				1	3		3
6	3	3	2					1	3	3		1	3	3	3
AVG	3	2.5	2	1				1	3	3		1	3	3	3

1-Low 2-Medium 3-High '-' – No Correlation.

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23MAT201 STATISTICS AND NUMERICAL METHODS WITH MATLAB L T P C
Lab Embedded Theory Course 3 0 1 4

(Common to all B.E./ B.Tech. Branches)

OBJECTIVES

- To provide the necessary basic concepts in testing of hypothesis for small and large samples which plays an important role in real life problems.
- To acquaint the knowledge of classifications of design of experiments.
- To extend the basic concepts of solving algebraic and transcendental equations.
- To apply the numerical techniques of interpolation and integration.
- To produce the knowledge of various techniques in solving ordinary differential equations.
- To determining statistics and numerical methods problems by using MATLAB.

UNIT I TESTING OF HYPOTHESIS 9

Sampling distribution – Testing of significance for single proportion, single mean and difference of means – Test of significance for small samples by't' test – Snedecor's F- test of significance – Chi-square test : Chi-square test of goodness of fit – Independent of attributes.

UNIT II DESIGN OF EXPERIMENTS 9

Basic principles of experimental design – Completely randomised design – Analysis of vaiance for one way classification – Randomised block design – Analysis of variation for two factor experiments variations – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Solution of algebraic and transcendental equations by Newton Raphson method – Solution of simultaneous algebraic equations by Gauss elimination, Gauss Jordan and Gauss Seidel methods – Matrix Inversion by Gauss Jordan method – Eigen values of a matrix by Power method.

UNIT IV INTERPOLATION AND NUMERICAL INTEGRATION 9

Interpolation: Newton's forward and backward interpolation formulae – Lagrange's interpolation formula – Newton's divided difference formula – Numerical integration by Trapezoidal and Simpson's 1/3 rule –Numerical double integration by Trapezoidal rule.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9

Euler's method – Modified Euler's method – Fourth order Runge - Kutta method for solving first order equations – Predictor-corrector methods: Milne's method – Adams-Bash forth method.

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Summarize the numerical techniques of interpolation in various intervals and apply the numerical techniques of integration for engineering problems.
- Produce various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial conditions by using certain techniques with engineering applications.
- Exposed to MATLAB programming to solve statistics and numerical methods problems.

LIST OF EXPERIMENTS

1. Solving one sample and paired sample't' test.
2. Determination of roots of a polynomial.
3. Solution of linear system of equations by Gauss Seidel methods.
4. Evaluation of line integrals by Trapezoidal rule.
5. Solution of ordinary differential equations by Euler's method.

TOTAL:45+15 PERIODS

TEXT BOOKS

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Dr.Kandasamy. P, Dr.Thilagavathy . K and Dr. Gunavathy .K., "Statistics and Numerical Methods", S. Chand and Company Ltd., NewDelhi, 2010.

REFERENCES

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 12th Edition, New Delhi, 2020.

E-RESOURCES

1. https://nptel.ac.in/courses/111/105/111105041/ (Statistics)
2. https://nptel.ac.in/courses/111/107/111107105/ (Numerical Methods)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	1	2				1		2	3	3		
2	3	3	1	1	2				1		2	3	3		
3	3	3	1	1	2				1		2	3	3		
4	3	3	1	1	2				1		2	3	3		
5	3	3	1	1	2				1		2	3	3		
6	3	3	1	1	2				1		2	3	3		
AVG	3	3	1	1	2				1		2	3	3		

1-Low 2-Medium 3-High '-' – No Correlation

23GEE201 **ENGINEERING GRAPHICS** **L T P C**
Common to All Department **3 0 2 4**

OBJECTIVES

- To understand the principles in graphic skill to communicate the concepts, ideas and design of engineering components.
- To learn projections of points, lines, planes viewed in different positions.
- To learn the projection of solids viewed in different positions.
- To gain the knowledge about the section of solids and development of surfaces of the given solids.
- To expose the international standards of technical drawing.

UNIT I PLANE CURVES (Manual drafting) 9+3

Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of Lines, Dimensioning Systems as per BIS conventions. **(Not for Examination),**Construction of ellipse – Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES (Manual drafting) 9+3

Projection of points – Projection of straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to one reference planes.

UNIT III ORTHOGRAPHIC AND PERSPECTIVE PROJECTIONS (Manual drafting) 9+3

Conversion of isometric projection into orthographic projection (Freehand Sketch). Perspective projection of prisms, pyramids, cones and cylinders by visual ray method.

UNIT IV PROJECTION OF SOLIDS (CAD software) 9+3

Projections of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT V SECTION OF SIMPLE SOLIDS AND DEVELOPMENT OF SURFACES (CAD software) 9+3

Sectioning of simple solids like prisms – pyramids, cylinder and cone - Inclined to one reference plane. Development of lateral surfaces of simple and truncated solids: Prisms, Pyramids, Cylinders and Cones.

TOTAL : 45+15=60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Construct multiple views of engineering components.
- Prepare the pictorial drawings as per the standards.
- Develop the projection of solids.
- Draw the section of solids drawings and development of surfaces of given objects.
- Apply free hand sketching and concept of isometric in engineering practice.

TEXT BOOKS

1. Venugopal K. and Prabhu Raja V., - "Engineering Graphics", 15th Edition, New Age International (P) Limited, New Delhi, 2018.
2. Natarajan K.V., "Engineering Graphics", 32nd Edition, Dhanalakshmi Publishers, Chennai, 2019.

REFERENCES

1. K.R. Gopalakrishna, "Engineering Drawing Volume 1 & 2", 55th Edition, Subhas Publications, Bangalore, 2017.
2. T.Jeyapoovan., "Engineering Graphics using Auto CAD" 3rd Edition, vikas publishing house Pvt Ltd, New Delhi, 2017.

E- RESOURCES

1. https://nptel.ac.in/courses/112/103/112103019/ - (Geometric Constructions)
2. https://nptel.ac.in/courses/105/104/105104148/ - (Projections)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2		2					3		2	2	2	
2	3	1	2		2					3		2	2	2	
3	3	1	2		2					3		2	2	2	
4	3	1	2		2					3		2	2	2	
5	3	1	2		2					3		2	2	2	
Avg	3	1	2		2					3		2	2	2	

1-Low 2-Medium 3-High '-' – No Correlation

23GEL201 ENGINEERING PRACTICES LABORATORY L T P C
(Common to all Branches of B.E. / B.Tech. Programmes) 0 0 4 2

OBJECTIVES

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work;
- Sawing; planning; making joints in wood materials used in common household wood work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like; Assembling simple mechanical assembly of common household equipments;
- Making a tray out of metal sheet using sheet metal work.
- Cutting mild steel for machining various simple processes.

GROUP – A (CIVIL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side of a pump

d) Laying pipe connection to the delivery side of a pump.

WOOD WORK:

a) Sawing,

b) Planning and

c) Making joints like T-Joint Mortise joint and Tenon joint and Dovetail joint.

GROUP – B (MECHANICAL)

PART II MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints.

b) Welding of Tee Joints.

SHEET METAL WORK:

a) Making of a square tray

b) Making of a Funnel

FITTING

a) Cutting of a Mild Steel

TOTAL = 30 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Understand the concept of plumbing work and fittings in common household applications.
2. Ability to saw, plan and join wood materials used in common household wood applications.
3. Perform various weld joints in steel plates using arc welding work
4. Assemble simple mechanical household equipments; Make a tray out of metal sheet using sheet metal work.
5. Understand the concept of cutting mild steel in common machining applications.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2			1		1					3	3	3	1
2	3	2			1		1					3	3	3	1
3	3	2			1		1					3	2	2	1
4	3	2			1		1					3	3	3	1
5	3	2			1		1					3	2	2	1
Avg	3	2			1		1					3	2.6	2.6	1

1-Low 2-Medium 3-High '-' – No Correlation

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23EEC201 **COMMUNICATION SKILLS** **L T P C**

(Common to all B.E. & B.Tech. branches) **1 0 0 1**

OBJECTIVE

- To use vocabularies appropriately in a sentence and various situations.
- To improve communicative competence through listening.
- To make effective presentations and group discussions.
- To read and recognize different context.
- To write paragraph, essay and special addresses.

Unit I VOCABULARY **6**

Vocabulary building – Articulate ideas and thoughts; usage of palindromes, greetings, wishes, festival related words - Vocabulary Words with Sentences. - Idiomatic Expressions.

Unit II LISTENING **6**

Listening Skill- Its importance – Purpose - Process - Types- Barriers - Effective Listening strategies- Listening to telephonic conversations – Watching Inspiring Speech videos on Youtube - Listening native speaker's videos for pronunciation - Listening to broadcast, messages, announcements - Listening to Instagram Videos.

Unit III SPEAKING **6**

JAM Talk - Role play - Debate - Conversational skills (formal and informal) - Conversation practice - Group Discussion and Interview Skills – Introducing oneself and others – Goal Settings - Immediate, Long term and short term.

Unit IV READING **6**

Reading for the Main idea- Finding Specific Information - Reading for Detail - Read and recognize different text types ranging from newspaper, articles, magazines, books and Reading autobiographies.

Unit V WRITING **6**

Paragraph Writing - Essay writing - Creative writing - Special Address on Specific topic - Welcome Address, vote of Thanks.

OUTCOMES

Upon completion of the course, the students will be able to:

- Improve vocabulary and express the same contextually.
- Listen and comprehend the general and technical text.
- Speak effectively in presentation, debate and group discussions.
- Read and understand the concept from newspapers, articles, magazines and books.
- Draft special addresses, welcome address, vote of thanks and write paragraph and essay.

TEXT BOOKS

1. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011
2. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011

REFERENCES

1. Davis, Jason and Rhonda Llss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan:
3. Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press 1992.
4. Technical communication by Asraf rezvi

EXTENSIVE READING

1. Dr. A. P. J. Abdul Kalam " Wings of Fire "

E-RESOURCES

1. youglish.com
2. newsinlevels.com
3. Britishcouncil.org
4. writeandimprove.com

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	1	1	1	1	3	-	3	-	3	-
2	-	-	-	-	-	1	-	-	1	3	-	3	-	3	-
3	-	-	-	-	-	1	2	2	3	3	-	3	-	3	-
4	-	-	-	-	-	2	2	-	3	3	-	3	-	3	-
5	-	-	-	-	-	1	1	-	1	3	-	3	-	3	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	-	-	-	-	-	1.20	1.50	1.50	1.80	3.00	-	3.00	-	3.00	-

2- **Low 2-Medium 3-High '-' – No Correlation**

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23MDC201 **UNIVERSAL HUMAN VALUES & LIFE SKILLS** **L T P C**
(Common to all First year / First Semester B.E., B.Tech., Branches) **0 0 1 0**

OBJECTIVES

To enable students to,

- Inculcate critical thinking process on problem solving
- Have an overview on career skills required in their profession
- Learn professional Ethics and Moral values.
- Formulate and implement effective leadership strategies.
- Apply the key benefits of leadership skills in different situations.

UNIT I UNIVERSAL HUMAN VALUES **3**

Understanding harmony in the human being - understanding harmony in the family and society - understanding harmony in the nature and existence - understanding of harmony on professional ethics

UNIT II LIFE SKILLS **3**

Soft Skills – Positive Attitude - Empathy - Effective Communication - Decision-Making Skills - Communication Skills - Problem Solving - Critical Thinking- Analytical thinking

UNIT III EMOTIONAL SKILLS **3**

Self-Awareness - Interpersonal Relationship - Stress – Stress management **-** Focus and Self Control - Positive Thinking – Anger management

UNIT IV PROFESSIONAL SKILLS **3**

21st century skills – Hard Skills **-** General computer skills - Spreadsheet proficiency - Career Skills - developing a long - term career plan – Team Work -- Time management

UNIT V LEADERSHIP SKILLS **3**

Leadership, Levels of Leadership, Making of a leader, Types of leadership, describing a leadership style.

TOTAL: 15 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Develop the capabilities needed to increase team's work productivity.
- Think critically on a particular problem solving.
- Explore the career skills with stress management.
- Implement the professional Values and ethics.
- More confident as a leader and find new ways of influencing the teams they lead.

TEXT BOOKS

1. Life Skills for Engineers, McGraw Hill Education (India) Private Ltd., 2016
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Sydänmaanlakka Pentti. "Intelligent leadership and leadership competencies". Dissertation Series.

REFERENCES

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.
2. Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.

23PTT301 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
3 1 0 4

OBJECTIVES

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems?
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations –Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types

.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV FOURIER TRANSFORMS 12

Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V - TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Convergence of Z-transforms - – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS

- Grewal B.S., "Higher Engineering Mathematics", 44thEdition, Khanna Publishers, New Delhi, 2018.
- Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016.

REFERENCES:

- Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999.
- Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2015.
- James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi, 2016.
- Narayanan. S., ManicavachagomPillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
- Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
- Wylie. R.C. and Barrett . L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	1					2			3			
2	3	3	1	1					2			3			
3	3	3	1	1					2			3			
4	3	3	1	1					2			3			
5	3	3	1	1					2			3			
Average	3	3	1	1					2			3			

23PTT302 **CHEMICAL PROCESS CALCULATIONS** **L T P C**
(B.Tech Pharmaceutical Technology) **3 0 0 3**

OBJECTIVES

The main objective of this course is to:

- learn about the basic calculation techniques used in process industries
- learn the laws about the behaviour of gases, liquids and solids, for analysing and designing chemical processing equipment with the help of data sources containing relevant physical and chemical properties.

UNIT I UNITS AND DIMENSIONS **9**

Fundamental and derived units - conversion, dimensional consistency of equations - conversions of equations - Dimensional and dimensionless constants - mass and volume relations - Stoichiometric and composition relations.

UNIT II IDEAL GASES AND VAPOUR PRESSURE **9**

Ideal gas law - Dalton's Law - Amagat's Law and Average molecular weight of gaseous mixtures - Effect of temperature on vapour pressure - Vapour pressure plot (Cox chart) - Vapour pressures of miscible and immiscible liquids and solutions - Raoult's Law and Henry's Law.

UNIT III HUMIDITY AND SOLUBILITY **9**

Partial saturation, Humidity- Absolute Humidity-Vaporization process-Molal humidity-Relative and percentage saturation-dew point-humid heat-wet bulb and dry bulb temperatures-use of humidity charts-adiabatic vaporization and adiabatic saturation temperature

UNIT IV MATERIAL BALANCE **9**

Tie substance limiting reactant-excess reactant-General material balance equation for steady and unsteady state-Typical steady state material balances in distillation-absorption-extraction-crystallization-Combustion of coal-fuel gases and sulphur – Recycling operations – Bypassing streams – Degree of conversion – Excess reactant – Limiting reactant Selectivity and Yield

UNIT V ENERGY BALANCE **9**

General steady state energy balance equation - Heat capacity – Enthalpy - Heat of formation-Heat of reaction - Heat of combustion and Calorific values - Heat of solution - Heat of mixing-Heat of crystallization-determination of ΔHR at standard and elevated temperatures-Theoretical flame temperature and adiabatic flame temperature.

TOTAL: 45 PERIODS

COURSE OUTCOMES

- Have a clear idea of various types of unit systems and students will be able to convert unitsfrom one form to another.
- Comprehend the different gas laws, and students would be able to solve the problems onstoichiometry quantity of gaseous substances in industry.
- Know the various measurements of humidity and clear about applying humidity charts,psychometric charts, and concepts of vaporization and vapor pressure laws
- analyze the behaviour of recycle processes, performing approximate material balances byhand and setting up calculations for rigorous solution by computer.
- attain the energy balance concepts necessary for solution of energy balance of differentchemical engineering processes in industries
- Independently develop a stoichiometry problem solving ability in a number of usefulmathematical and chemical operations.

TEXT BOOKS

- Narayanan, K.V. and Lakshmikutty, B. "Stoichiometry and Process Calculations", 2nd Edition.PHI Learning Pvt. Ltd., 2017
- Bhatt, B.I. and Thakore, S.M., "Stoichiometry", 5th Edition, Tata McGraw Hill, Education Pvt. Ltd, 2017. 3. Gavhane, K. A. "Introduction to Process Calculations", Nirali Publication, 2016.

REFERENCES

- Venkataramani, V., Anantharaman, N. and Meera Sheriffa Begum K. M. "Process Calculations", 2nd ed.PHI Learning Pvt. Ltd., 2011
- Himmelblau, D. M. and Riggs, B. J. "Basic Principles and Calculations in ChemicalEngineering", 8th Edition, Prentice Hall International series, 2015.
- Sikdar, C.D., "Chemical Process Calculations", PHI Learning Pvt. Ltd., 2013.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3				3	2		2			2			
2	3	3				2	2		2					3	
3	3	3	2		3	2			2					3	2
4	3	3	3		3	2	3							3	2
5	3	3	2		3		3		2					3	2
6	3	3	2		3				2					3	
Average	**3**	**3**	**2.25**		**3**	**2.25**	**2.5**		**2**			**2**		**3**	**2**

1- **Low 2-Medium 3-High '-' – No Correlation**

23PTT303 **PHARMACEUTICAL CHEMISTRY** **L T P C**
(B.Tech Pharmaceutical Technology) **3 0 0 3**

OBJECTIVES

- To inculcate understanding of the properties and principles of medicinal agents that originates from organic and inorganic sources and their application in pharmaceutical industry.
- To provide knowledge on the basic functional group identification, molecular rearrangement, chemical bonding with their reaction mechanism.
- To provide the knowledge on fundamental principles involved in the identification, preparation of pharmaceutical aids and to apply the principle of coordination compounds in pharmaceutical substances.

UNIT I STRUCTURE AND PROPERTIES **9**

Atomic orbitals - molecular orbitals theory - wave equation - bonding and antibonding orbitals- hybrid orbitals - covalent bond - polarity of bonds and molecules - dipole moment – resonance - inductive - mesomeric and electromeric effects - intramolecular and intermolecular hydrogen bonding – Isomers - optical activity – stereoisomerism - specification of configuration – chirality.

UNIT II CHEMISTRY OF ALIPHATIC, AROMATIC AND HETEROAROMATIC COMPOUNDS **9**

Characteristics of organic compounds - structure, nomenclature, preparation and reaction mechanism of alkyl and aryl halides - Nucleophilic aliphatic substitution reaction - Elimination reactions - electrophilic addition reactions - Markownikoff's orientation - AntiMarkownikoff's orientation - Huckel's rule – structures – synthesis - properties and chemical reactions of benzenoid and nonbenzenoid compounds - Electrophilic aromatic substitution reaction - General principles of heterocyclic synthesis – Methods of preparation and reactions of Pyridines – Pyrroles – Thiophenes – Furans – Quinolines – Isoquinolines.

UNIT III QUALITY CONTROL OF DRUGS AND PHARMACEUTICALS **9**

Importance of quality control - significant errors - methods used for quality control - History of Pharmacopoeia - Identification and characterization of impurities in Pharmaceutical substances- Limit tests: Definition, importance, general procedure for limit test for chlorides - sulphates, iron- arsenic - heavy metals and lead with suitable examples - Identification test for Magnesium hydroxide - Ferrous sulphate - Calcium gluconate - Copper sulphate - Test for purity: Swelling power of Bentonite - Neutralizing capacity of aluminum hydroxide gel - Determination of potassium iodate and iodine in potassium Iodide Preparation of inorganic pharmaceuticals: Boric acid, Potash alum and Ferrous sulphate.

UNIT IV STUDY OF ORGANIC REACTIONS AND MOLECULAR REARRANGEMENTS 9

Alder Reaction - Formylation reactions - Gattermann Reaction - Gattermann-Koch reaction - Vilsmeier reaction - Azide-Alkyne Cycloaddition - Catalytic hydrogenation - Meerwein-Ponndorf-Verley - Birch reduction – Clemmenson – Sandmeyer - Haloform reactions - Azo coupling - Beckmann Rearrangement - Benzidine rearrangement.

UNIT V RADIOPHARMACEUTICALS AND CO-ORDINATION COMPOUNDS 9

Radio activity - Measurement of radioactivity- Properties of α, β, γ radiations - Half life - radio isotopes and study of radio isotopes - Sodium iodide I131, Storage conditions - precautions & pharmaceutical application of radioactive substances- Theory of co-ordination compounds with special reference to application in Pharmacy: EDTA, Dimercaprol, Penicillamine, 1, 10-Phenanthroline.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

1. Identify the relationship between structure and physical properties pharmaceutical substances and make predictions of chemical bonding along with their reaction mechanism.
2. Draw the structures and outline the synthesis of simple pharmaceutically active organic compounds having five and six membered heterocyclic compounds.
3. Describe the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals.
4. Distinguish between various reaction mechanisms and well acquainted with the synthesis of some important class of drugs.
5. Apply the knowledge in the handling of radiopharmaceuticals and synthesis of new drug molecule with special reference to organic, inorganic and coordination chemistry.

TEXT BOOKS

1. V.Algarsamy, Pharmaceutical Organic Chemistry, Kindle edition, 2020.
2. V.N.Rajasekaran, Textbook of Pharmaceutical Inorganic Chemistry Theory and Practical, CBS Publishers, 2019
3. R.K. Sharma, Text Book of Coordination Chemistry, 1stEdition,Discovery Publishing House Pvt. Ltd.2011.

REFERENCES

1. Jr. Leroy G. Wade , Jan William Simek , Maya Shankar Singh , Organic Chemistry, 9 Edition, Pearson Publisher, 2019
2. L.M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry, 8th Edition, Oxford Publisher, 2020
3. P. L. Soni, VandnaSoni,The Chemistry of Coordination Complexes and Transition Metals, 1st Edition, CRC Press, 2021.
4. Jie Jack Li, Name Reactions A Collection of Detailed Mechanisms and Synthetic Applications, 6th Edition, Springer Publisher, 2021.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3				2	1			2		2			
2	3	2	3				1			2		2		3	
3	3	3	3				2			2		2		3	
4	3	1		3			1			2		2		3	
5	3	1		3			1			2		2			1
6	3	1		3		2	2		2	2		2		3	2
Average	3	1.8	3	3		2	1.3		2	2		2		3	1.6

2- **Low 2-Medium 3-High '-' – No Correlation**

23PTT304	BIOCHEMISTRY	L T P C
	(B.Tech Pharmaceutical Technology)	3 0 0 3

OBJECTIVES

- To enable students learn the fundamentals of Biochemical Processes and Biomolecules

UNIT I INTRODUCTION TO BIOMOLECULES - CARBOHYDRATES 9

Basic principles of organic chemistry role of carbon - types of functional groups - chemical nature of water - pH and biological buffer - bio molecules structure and properties of Carbohydrates (mono, di, oligo & polysaccharides) Proteoglycans – glucosaminoglycans – mutarotation - glycosidic bond - reactions of monosaccharides - reducing sugars – Starch – glycogen - cellulose and chitin – Proteoglycans – glycosaminoglycans - hyaluronic acid-chondroitin sulfate

UNIT II STRUCTURE AND PROPERTIES OF OTHERBIOMOLECULES 9

Structure and properties of Important Biomolecules

Lipids: fatty acids – glycerol – saponification – iodination – hydrogenation – phospholipids – glycolipids – sphingolipids –cholesterol - steroids - prostaglandins.

Protein: Amino Acids, Peptides, Proteins, measurement, structures, hierarchy of organization primary, secondary, tertiary and quaternary structures, glycoproteins, lipoproteins. Determine of primary structure.

UNIT III METABOLISM CONCEPTS AND CARBOHYDRATE METABOLISM 9

Functions of Proteins - Enzymes, introduction to biocatalysts - metabolic pathways - primary and secondary metabolites - Interconnection of pathways and metabolic regulation – Glycolysis-TCA cycle – gluconeogenesis - pentose phosphate shunt & glyoxalate shunt

UNIT IV INTERMEDIARY METABOLISM AND REGULATION 9

Fatty acid synthesis and oxidation - reactions of amino acids – deamination - transamination and decarboxylation - urea cycle - Bioenergetics - High energy compounds - electronegative potential of compounds - respiratory chain - ATP cycle - calculation of ATP yield during oxidation of glucose and fatty acids

UNIT V PROTEIN TRANSPORT AND DEGRADATION 9

Protein targeting - signal sequence - secretion- Folding - Chaperone and targeting of organelle proteins - Protein degradation - receptor-mediated endocytosis – turnover

TOTAL: 45 PERIODS

COURSE OUTCOMES

- Ensure students have a strong foundation in the structure and reactions of biomolecules.
- Introduce them to metabolic pathways of the major biomolecules and relevance to clinical conditions.
- Correlate biochemical processes with biotechnology application.
- Understand in detail about structures, types and classifications of amino acid.
- Illustrate the metabolism of carbohydrates through various anabolic and catabolic pathways.
- Relate the structure of DNA with its function in replication and gene expression.

TEXT BOOKS

- Lehninger Principles of Biochemistry 6th Edition by David L. Nelson, Michael M. Cox W.H.Freeman and Company 2017
- Satyanarayana, U. and U. Chakerapani, "Biochemistry" 3rd Rev. Edition, Books & Allied Ltd., 2006.
- Rastogi, S.C. "Biochemistry" 2nd Edition, Tata McGraw-Hill, 2003.
- Conn, E.E., etal., "Outlines of Biochemistry" 5th Edition, John Wiley & Sons, 1987.
- Outlines of Biochemistry, 5th Edition: By E E Conn, P K Stumpf, G Bruening and R Y Doi. pp 693. John Wiley and Sons, New York. 1987.

REFERENCES

- Berg, Jeremy M. et al. "Biochemsitry", 6th Edition, W.H. Freeman & Co., 2006.
- Murray, R.K., etal "Harper's Illustrated Biochemistry", 31st Edition, McGraw-Hill, 2018.
- Voet, D. and Voet, J.G., "Biochemistry", 4th Edition, John Wiley & Sons Inc.,2010.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	2	3	2	2	2	3	3	3	3	3
2	2	2	3	2	2	2	2	2	-	3	2	3	2	2	2
3	3	3	3	2	3	-	2	1	-	2	1	1	3	3	2
4	2	3	3	3	2	-	3	-	1	2	1	1	3	3	2
5	2	3	3	2	3	2	3	2	2	1	2	2	2	2	3
6	2	3	3	2	2	3	1	3	2	1	3	3	3	3	2
Aver age	3	3	2	2	2	2	3	2	2	2	3	3	3	3	3

3- **Low 2-Medium 3-High '-' – No Correlation**

23PTT305	HUMAN ANATOMY AND PHYSIOLOGY	L T P C
	(B.Tech Pharmaceutical Technology)	3 0 0 3

OBJECTIVES

- To explain the gross morphology, structure and functions of various organs of the human body and describe the various homeostatic mechanism and their imbalance

UNIT I HEMOPOIETIC SYSTEM **9**

Composition and functions of blood – Hemopoiesis - blood components - blood groups - clotting factors and mechanism of coagulation - platelets.

UNIT II CARDIOVASCULAR SYSTEM **9**

Anatomy and function of the heart - circulation: pulmonary, coronary, and systematic circulation; electrocardiogram (ECG) - cardiac cycle and heart sounds - blood pressure - its maintenance and regulation.

UNIT III RESPIRATORY SYSTEM **9**

Anatomy of respiratory organs and functions - mechanism/physiology of respiration and regulation of respiration - transport of respiratory gases - respiratory volumes and capacities

UNIT IV NERVOUS SYSTEM **9**

Classification of the nervous system – anatomy – physiology and functional areas of the cerebrum – cerebellum – midbrain – thalamus - hypothalamus and basal ganglia - spinal cord: structure and reflexes.

UNIT V ENDOCRINE SYSTEM **9**

Classification of hormones - mechanism of hormone action - structure and functions of pituitary gland - thyroid gland - parathyroid gland - adrenal glands – pancreas - pineal gland - thymus.

TOTAL: 45 PERIODS

COURSE OUTCOMES

- Acquire the gross histology, structure and functions of various organs of the human body
- Implement the physiological tests and appreciate the interlinked mechanisms in the maintenance of normal functioning of human body
- Perform basic physiological and pharmacological experiments and to record and interpret the results for its clinical significance.
- Demonstrate laboratory procedures used to examine anatomical structures and evaluate physiological functions of each organ system
- Interpret graphs of anatomical and physiological data.
- Apply the methods to evaluate the potency of drugs, toxicity of drugs in animal models.

TEXT BOOKS

- Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
- Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrjee, Academic Publishers Kolkata.

REFERENCES

- Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.
- Vander's Human Physiology: The Mechanisms of Body Function, Eric Widmaier, Hershel Raff, Kevin Strang, 2015, Edition:14, Publisher: McGraw-Hill
- Hole's human anatomy & physiology David Shier, Ricki Lewis, Jackie Butler Year: 2019, Edition: Fifteenth, Publisher: Mcgraw hill Education
- Germann, W.J., Stanfield, C.L. (eds.) (2002) Principles of Human Physiology, Pearson Education, Inc./ Benjamin Cummings, San Francisco, CA.
- Guyton AC and Hall JE (eds.) (2000) Textbook of Medical Physiology, 10th edition. W.B. Saunders Co., Philadelphia, PA.
- Tortora, G.J. and Grabowski, S.R. (eds.) (2000) Principles of Anatomy and Physiology, 9th edition. John Wiley & Sons, Inc., New York, NY.
- Anatomy and Physiology 2e J. Gordon Betts, Tyler, Texas Kelly A. Young, Long Beach, California James A Wise, Hampton, Virginia Copyright Year: 2021

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		3					2	1	2				3		2
2	3	3			2		3							3	2
3		3		3	2							3			3
4	3	3					3						2	3	
5			3		2		2								3
6	3	3	3		3		2			1			2		
Avg	3	3	3	3	2.2		2.4	1	2	1		3	2.3	3	2.5

1-Low 2-Medium 3-High '-' – No Correlation

23PTE301 **MICROBIOLOGY** **L T P C**

(B.Tech Pharmaceutical Technology) **3 0 0 3**

OBJECTIVES

- To introduce students to the principles of Microbiology to emphasize structure and biochemical aspects of various microbes.
- To solve the problems in microbial infection and their control.

UNIT I INTRODUCTION **9**

Basics of microbial existence - history of microbiology - classification and nomenclature of microorganisms - microscopic examination of microorganisms - light and electron microscopy- principles of different staining techniques like gram staining - acid fast - capsular staining - flagellar staining.

UNIT II MICROBES- STRUCTURE AND MULTIPLICATION **9**

Structural organization and multiplication of bacteria – viruses - algae and fungi - special mention of life history of actinomycetes - yeast - mycoplasma and bacteriophages.

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM **9**

Nutritional requirements of bacteria - different media used for bacterial culture - growth curve and different methods to quantify bacterial growth - aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules

UNIT IV CONTROL OF MICROORGANISMS **9**

Physical and chemical control of microorganisms- host-microbe interactions- anti-bacterial, anti-fungal and anti-viral agents - mode of action and resistance to antibiotics - clinically important microorganisms

UNIT V INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY **9**

Primary metabolites - secondary metabolites and their applications - preservation of food;production of penicillin – alcohol - vitamin B-12 - biogas – bioremediation - leaching of ores by microorganisms - biofertilizers and biopesticides - microorganisms and pollution control – biosensors.

TOTAL: 45 PERIODS

COURSE OUTCOMES

1. Microorganisms and examination of microorganisms
2. Structural organization of microorganisms
3. Nutritional requirements of microorganisms, their growth and metabolism
4. Control of microorganisms
5. Metabolites, bioremediation, biofertilizers, biopesticides and biosensors
6. Understand the advanced technical information pertaining to laboratory bio-safety and preventive measures from pathogenic microorganism.

LIST OF EXPERIMENTS

1. Demonstration of efficiency of sterilization techniques.
2. Preparation of various types of culture media: nutrient broth and agar
3. Culture techniques: isolation and preservation of cultures: broth: flask, test tubes; agar: pour plates, streak plates, slants, stabs
4. Microscopic identification of bacteria
5. Staining techniques: simple, differential- gram's staining, spore /capsule staining
6. Quantification of microbes: sampling and serial dilution; bacterial count, total count and viable count.
7. Determination of phenol coefficient to demonstrate efficiency of a disinfectant
8. Perform and report sensitivity of antibiotics (Disc diffusion and well diffusion)
9. Inoculate, Incubate and plot the growth curve of bacteria (E.coli)
10. Effect of pH, Temperature, UV radiation on Growth of bacteria (E.coli)
11. Determination of microbial inhibitory concentration (MIC).
12. Biochemical identification of unknown microbes
13. Demonstration of alcohol fermentation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Pelczar MJ, Chan ECS and Krein NR, Microbiology, Tata McGraw Hill Edition, New Delhi, India,2009
2. Prescott L.M., Harley J.P., Klein DA, Microbiology, 3rd Edition, Wm. C. Brown Publishers, 1996.

REFERENCES

1. Black, Text book of microbiology. Freeman Publishers,2016
2. Talaron K, Talaron A, Casita, Pelczar and Reid. Foundations in Microbiology, W.C. Brown Publishers, 1993.
3. Ananthanarayan, CK Jayaram Panikars. Text book of Microbiology, 2005, Orient Blackswan Publishers.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2
2	3	3	2	3	2	2	3	2	2	3	2	2	3	3	2
3	2	3	2	3	3	2	3	2	2	3	2	2	3	2	3
4	2	3	3	3	3	2	2	2	2	2	3	3	3	2	3
5	2	3	2	3	3	2	2	-	2	-	2	2	3	3	3
6	3	2	3	3	3	3	3	2	2	-	3	2	2	2	3
Aver age	3	3	3	3	3	2	3	2	2	2	2	2	3	2	3

4- **Low 2-Medium 3-High '-' – No Correlation**

23PTL302 **BIOCHEMISTRY AND PHYSIOLOGY LABORATORY** **L T P C**

(B.Tech Pharmaceutical Technology) **0 0 3 1.5**

OBJECTIVES

- Learn and understand the principles behind the qualitative and quantitative estimation of biomolecules (proteins, carbohydrates, lipids, metabolites etc.,).
- To learn the gross histology, structure and functions of various organs of the human body and perform the physiological tests and appreciate the interlinked mechanisms in the maintenance of normal functioning of human body

LIST OF EXPERIMENTS

Biochemistry

1. Qualitative tests for carbohydrates–distinguishing reducing from non-reducing sugars and keto from aldo sugars.
2. Quantitative method for aminoacid estimation usingbninhydrin–distinguishing amino from imino acid.
3. Quantitative analysis of carbohydrates (Benedict's method etc.,)
4. Protein estimation by Biuret, Lowry's method, Bradford and spectroscopic methods
5. Extraction of lipids and analysis byTLC.
6. Enzymatic assay:phosphatase from potato.
7. Enzymatic assay: estimation of glucose by GOD-POD method.
8. Estimation of chloride, glucose, ammonia and creatinine in urine.

Physiology

1. Study of different systems with the help of models (axial skeleton, appendicular skeleton, cardiovascular system, respiratory system, digestive system, urinary system, nervous system, special senses, reproductive system)
2. Determination of bleeding and clotting time
3. Determination of R.B.C. and W.B.C count of blood
4. Estimation of Haemoglobin
5. Determination of differential count of blood WBCs.
6. Enumeration of RBC
7. Determination of Erythrocyte Sedimentation Rate
8. Blood group determination
9. Observation of osmotic fragility of RBCs
10. Determination of packed cell volume and calculation of blood indices
11. Heart rate and blood pressure recording
12. ECG recording
13. Examination of respiratory system and recording of respiratory movements

14. Preparation of physiological solution: Ringers' solution, Tyrode solution, Krebs solution, Normal saline.

TOTAL HOURS: 45

COURSE OUTCOMES

- Apply basic principles of chemistry to biological systems and molecular biology.
- Correlate molecular structure and interactions present in proteins, nucleic acids, carbohydrates and lipids
- Perform procedure to characterize the biomolecules using microscopy.
- Understand the gross histology, structure and functions of various organs of the human body
- Implement the physiological tests and appreciate the interlinked mechanisms in the maintenance of normal functioning of human body
- Perform basic physiological and pharmacological experiments and to record and interpret the results for its clinical significance.

REFERENCES

- Human anatomy & physiology laboratory manual. Cat version Marieb, Elaine Nicpon, Mitchell, Susan J., Smith, Lori A., Zao, Peter Z. Year: 2016 Edition: Twelfth edition, cat version. Publisher: Pearson
- Laboratory Manual for Anatomy & Physiology Featuring Martini Art, Cat Version Year: 2016 Edition: 6th Edition Publisher: Pearson
- Practical Biochemistry with Clinical Correlation for MBBS Students, Poonam Agrawal. Year: 2020, Edition: 1, Publisher: CBS Publishers and Distributors Pvt Ltd
- Practical Biochemistry for Colleges, E. J. Wood (Eds.) Year: 1989 Edition: 1st ed Publisher: Pergamon Press
- Experimental Biochemistry, Robert L. Switzer, Liam F. Garrity Year: 1999 Edition: 3rd ed Publisher: W. H. Freeman and Co
- Principles and techniques of practical biochemistry and molecular biology. Keith Wilson, John Walker Year: 2005 Edition

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1												3	3		
2	3			3			2							3	
3	3	2		3	3			1							
4	3				3		3						2	3	
5	3			3	2					2					2
6	3	2	3		3			3					2		3
Aver age	3	2	3	3	2.5		2.5	2		2		3	2.3	3	2.5

1-Low 2-Medium 3-High '-' – No Correlation

23PTL303 **PROFESSIONAL DEVELOPMENT** **L T P C**
(B.Tech Pharmaceutical Technology) **0 0 2 1**

OBJECTIVES

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize,interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD **10**

Create and format a document - Working with tables - Working with Bullets and Lists - Working with styles, shapes, smart art, charts - Inserting objects, charts and importing objects from other office tools - Creating and Using document templates - Inserting equations, symbols and special characters - Working with Table of contents and References, citations - Insert and review comments - Create bookmarks, hyperlinks, endnotes footnote - Viewing document in different modes - Working with document protection and security - Inspect document for accessibility

MS EXCEL **10**

Create worksheets, insert and format data - Work with different types of data: text, currency, date, numeric etc. - Split, validate, consolidate, Convert data - Sort and filter data - Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,) - Work with Lookup and reference formulae - Create and Work with different types of charts - Use pivot tables to summarize and analyse data - Perform data analysis using own formulae and functions - Combine data from multiple worksheets using own formulae and built-in functions to generate results - Export data and sheets to other file formats - Working with macros Protecting data and securing the workbook

MS POWERPOINT **10**

Select slide templates, layout and themes - Formatting slide content and using bullets and numbering - Insert and format images, smart art, tables, charts - Using Slide master, notes and handout master - Working with animation and transitions - Organize and Group slides - Import or create and use media objects: audio, video, animation - Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

COURSE OUTCOMES

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

23PTT401 APPLIED CHEMICAL ENGINEERING THERMODYNAMICS L T P C
2 1 0 3

OBJECTIVES

Students will learn about the behavior of fluids, laws of thermodynamics, thermodynamic property relations and their application in different chemical processes.

UNIT I CONCEPTS OF THERMODYNAMICS 9

Scope of thermodynamics, basic concepts and definitions, Equilibrium state and phase rule, Energy, Work, Temperature and Zeroth Law of Thermodynamics, reversible and irreversible process, Ideal gas- Equation of State involving ideal and real gas, Law of corresponding states, Compressibility chart, First Law of Thermodynamics and its consequences.

UNIT II LAWS OF THERMODYNAMICS 9

Joule's experiment, internal energy, enthalpy, Application of first Law of Thermodynamics for Flow and non flow processes.Limitations of the first Law, statements of second Law of Thermodynamics and its Applications, Heat Engine and Heat Pump.

UNIT III THERMODYNAMIC POTENTIALS 9

Thermodynamic Potentials, thermodynamic correlation, Maxwell relations, criteria for Equilibria and stability. Clapeyron equation, partial molar properties, ideal and non-ideal solutions, standardstates definition and choice

UNIT IV ACTIVITY COEFFICIENT 9

Activity coefficient-composition models, Gibbs-Duhem equation, effect of pressure and temperature on activity co-efficient, activity and property change of mixing, excess properties of mixtures.

UNIT V PHASE EQUILIBRIA 9

Thermodynamic consistency of phase equilibria, phase equilibrium in single and multi component systems, Duhem's theorem, vapor-liquid equilibria and non-ideal solutions. Chemical reaction equilibria, Extent of reaction, equilibrium constant and standard free energy change.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the students would be able to

1. Understand the basic concepts, laws and different process related to chemical engineeringthermodynamics.
2. Identify the laws related to chemical engineering thermodynamics, thermodynamicprinciples, flow process and its thermodynamic application
3. Understand the thermodynamic potential, its correlation and analyze and distinguishbetween ideal and non-ideal solution.
4. Understand and demonstrate the activity coefficient and activity property of solution.
5. Demonstrate the Chemical and phase equilibria equations

6. Understand the interrelationships between different thermodynamic properties and becomefamiliar with the Thermodynamic plots.

TEXT BOOKS

1. Sonntag, Borgnakke, Van Wylen, Fundamentals of Thermodynamics, 7th Edition, WileyIndia, New Delhi, 2009.
2. Narayanan, K.V. A Textbook of Chemical Engineering Thermodynamics Prentice Hall India,2004
3. Smith, J.M., Van Ness, H.C. and Abbott, M.M "Chemical Engineering Thermodynamics",7th Edition, McGraw Hill, New York, 2005

REFERENCES

1. S. I. Sandler, Chemical, Biochemical and Engineering Thermodynamics, Wiley New York, 2006
2. Y V C Rao, "Chemical Engineering Thermodynamics", Universities Press, Hyderabad 2005.
3. Pradeep ahuja," Chemical Engineering Thermodynamics", PHI Learning Ltd (2009).
4. Gopinath Halder," Introduction to Chemical Engineering Thermodynamics", PHI Learning Ltd(2009).

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/
2. https://swayam.gov.in/nd1_noc19_ge22/preview

Course articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3							1			2			3
2		3	3		2										3
3			3	3	2	2			1	2				3	
4		3			3				2	1				3	
5	3		3	2		1							3		
Avg	3	3	3	2.5	2.33	1.5			1	1.5		2	3	3	3

23PTT402 **FLUID MECHANICS** **L T P C**
3 0 0 3

OBJECTIVES

- To provide the basic fundamental knowledge about the flow properties of different types offluids and its momentum balance.
- To provide the knowledge about the various transporting and flow measurement and fluidmachineries.

UNIT I FUNDAMENTAL CONCEPTS **6**

Methods of analysis and description - fluid as a continuum – Velocity and stress field - Newtonianand non-Newtonian fluids — Classification of fluid motion

UNIT II FLUID STATICS **9**

Fluid statics – basic equation - equilibrium of fluid element – pressure variation in a static fluid - application to manometry – Differential analysis of fluid motion – continuity, equation of motions, Bernoulli equation and Navier- Stokes equation.

UNIT III DIMENSIONAL ANALYSIS **9**

The principle of dimensional homogeneity – dimensional analysis, Rayleigh method and the Pi- theorem - non-dimensional action of the basic equations - similitude - relationship between dimensional analysis and similitude

UNIT IV FLOW IN PIPES **12**

Reynolds number regimes, internal flow - flow through pipes – pressure drop under laminar and turbulent flow conditions – major and minor losses; Line sizing; External flows - boundary layer concepts, boundary layer thickness under laminar and turbulent flow conditions- Flow over a sphere – friction and pressure drag - flow through fixed and fluidized beds.

UNIT V FLOW MEASUREMENT **9**

Flow measurement - Constant and variable head meters; Velocity measurement techniques; Types, characteristics and sizing of valves; Classification, performance characteristics and sizing of pumps.

TOTAL : 45 PERIODS

COURSE OUTCOMES

On completion of the course, the students would be able to

1. Understand the fluid properties; apply the knowledge and equipments to determine thepressure by different techniques.
2. Ability to solve and analyze the mathematical model associated with physical fluid-flow systemand its applications.
3. Describe the different flow pattern in various fluid ducts like pipes and fittings
4. Understand the fluid flow properties through solids and its application.
5. Know the various transporting and metering devices of fluid flow in bulk pharmaceuticalmanufacturing and in chemical process.

6. Understand the interrelationships between different fluid flow properties and become familiar with the graphs to utilize these properties during various manufacturing processes.

TEXT BOOKS:

1. Noel de Nevers, "Fluid Mechanics for Chemical Engineers ", Second Edition, McGraw-Hill,(1991).
2. Munson, B. R., Young, D.F., Okiishi, T.H. "Fundamentals of Fluid Mechanics", 5th Edition",John Wiley, 2006

REFERENCES:

1. White, F.M., "Fluid Mechanics ", IV Edition, McGraw-Hill Inc., 1999.
2. James O Wilkes and Stacy G Bike, "Fluid Mechanics for Chemical Engineers' Prentice HallPTR (International series in Chemical Engineering) (1999)
3. McCabe W.L, Smith, J C and Harriot. P "Unit operations in Chemical Engineering", McGrawHill, VII Edition, 2005

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/
2. https://swayam.gov.in/nd1_noc19_ge22/preview

Course articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3			3								2		3	
2		3			3					2				3	
3	3			3									3		
4		3	3				1								3
5	3	3		3	2		2		1				3		
Avg	3	3	3	3	2.5		1.5		1	2		2	3	3	3

23PTT403 CELL AND MOLECULAR BIOLOGY L T P C
3 0 0 3

OBJECTIVES

The course aims to

- Enable students understand the structure and function of prokaryotic and eukaryotic cell with its organelles.
- Expose the concepts on the genetic information in the eukaryotic cell and its regulation.
- Provide knowledge on the application of recombinant DNA technology inbiotechnological research.
- Illustrate creative use of modern tools and techniques for sequencing and amplificationof DNA.
- Develop students in strategizing research methodologies employing genome analysis.

UNIT I CELL STRUCTURE AND FUNCTIONS OF THE ORGANELLES 9

Prokaryotic, Eukaryotic cells, Sub-cellular organelles, membrane systems and functions Differences and similarities between prokaryotic and eukaryotic cells. Cytoskeletal proteins. Extra cellular matrix, cell-cell junctions, Cell division: mitosis, Extra- and intracellular signal transduction

UNIT II MOLECULAR GENETICS 10

Introduction to nucleic acids, Structure and function of DNA, DNA replication, Telomere replication in eukaryotes. Mutagens, DNA mutations and various types of repair mechanisms. Structure and function of mRNA, rRNA and tRNA. RNA synthesis: Initiation, elongation and termination; Elucidation of genetic code, Codon degeneracy, Wobble hypothesis, Steps in translation: Initiation, Elongation and termination of protein synthesis. Inhibitors of protein synthesis. Posttranslational modifications and its importance. Organization of genes in prokaryotic and eukaryotic chromosomes.

UNIT III RECOMBINANT DNA TECHNOLOGY 10

Manipulation of DNA – Restriction and Modification enzymes. Characteristics of cloning and expression vectors based on plasmid and bacteriophage, Vectors for yeast, insect and mammalian systems, Prokaryotic and eukaryotic expression host systems, Introduction of recombinant DNA into host: Insulin, Interferons, Erythropoietin, DNA libraries: Construction of genomic and cDNA libraries.

UNIT IV SEQUENCING AND AMPLIFICATION OF DNA **8**

Amplification of DNA; Types of PCR, Real-time PCR/qPCR – SYBR green assay, Taqman assay, Site directed mutagenesis. Maxam Gilbert's and Sanger Coulson's and automated methods of DNA sequencing, Next generation sequencing technologies, Genetic maps and Physical maps.

UNIT V GENOME ANALYSIS AND GENOMICS **8**

Gene therapy and Transgenic technology, Introduction to Functional genomics, Microarrays, Serial Analysis of Gene expression (SAGE), Web resources for Genomics, Regulation of Eukaryotic Gene Expression by Small RNAs (RNA Interference, RNA).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of the course the student will be able to

1. Acquire knowledge on the structure and functions of prokaryotic and eukaryotic cells.
2. Illustrate an overview of nucleic acids and the central dogma of life and its significance
3. Employ the knowledge of DNA manipulation techniques in the production of commerciallyimportant recombinant proteins.
4. Understand the concepts of PCR techniques and genome sequencing techniques inbiotechnological applications.
5. Apply the knowledge of genome analysis and genomics in disease diagnostics and therapy.
6. Integrate knowledge of molecular biology principles for understanding of various disorders and genetic engineering principles for its diagnosis and therapy.

TEXT BOOKS:

1. David Friedfeld, "Molecular Biology." Narosa Publications, 4th edition, 2008.
2. Primrose S B and R. Twyman "Principles of Gene Manipulation & Genomic BlackwellScience Publications, 7th edition, 2006.
3. Principles of Genome Analysis and Genomics by S.B. Primrose and R.M. Twyman, ThirdEdition (Blackwell Publishing), 2003.

REFERENCES:

1. Tropp, Burton. "Molecular Biology: Genes to Proteins", 4th Edition. Jones and Bartlett,2011.
2. David P Clark, Nanette J Pazdernik, Michelle R. McGehee." Molecular Biology", 3rd edition,Elsevier science, 2018.
3. Genomes 4 by T.A.Brown, fourth Edition (Garland Science Publishing), 2018.

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/
2. https://swayam.gov.in/nd1_noc19_ge22/preview

Course articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	1	-	-	1	-	-	-	-	-	1	-	1
2	3	1	2	1	-	-	1	-	-	-	-	-	1	-	1
3	3	3	3	3	2	-	2	1	-	-	-	-	3	-	3
4	3	3	3	2	2	-	2	-	-	-	-	-	-	-	-
5	3	3	3	3	2	-	2	-	-	-	-	1	-	-	1
Avg	3	2.2	2.8	2	2		1.6	1				1	1.6		1.5

23PTT404 PHARMACEUTICAL ANALYSIS L T P C
3 0 0 3

OBJECTIVE:

To facilitate students to acquire knowledge about the principles and applications of pharmaceutical analysis.

UNIT I PROCESS ANALYTICAL TECHNOLOGY 9

On-line PAT Applications of Spectroscopy in the Pharmaceutical Industry: Reaction Monitoring - Crystallization - API Drying - Nanomilling - Hot-melt Extrusion — Granulation - Wet granulation - Roller compaction - Powder Blending - Lubrication - Powder flow - Compression — Coating - Biologics - Fermentation - Freeze-drying - Cleaning Validation.

UNIT II SAMPLE PREPARATION AND SPECIFIC METHODS 9

Strategies of sample preparation – liquid – liquid extraction, solid-liquid extraction – solid phase extraction techniques – radiometric analysis – Analysis of biological compounds – analysis of water.

UNIT III PHYSICAL ANALYTICAL METHODS 9

Solubility determination – Molecular weight determination – viscosity determination – Surface tension determination – Particle size analysis – X-ray diffraction – Polarimetery – refractometry.

UNIT IV CHEMICAL ANALYTICAL METHODS 9

Appearance, absorbance, pH, related substances, residual solvents, foreign anions, sulfated ash, elemental impurities, loss on drying, moisture and water, oxidizing substances, acid value, hydroxyl value, iodine value, peroxide value, saponification value, unsaponifiable matter – Functional group analysis

UNIT V CONTROL OF THE QUALITY OF ANALYTICAL METHODS 9

Control of errors in analysis – calibration methods - Accuracy and precision – validation of analytical procedures – SOPs – compound random errors – reporting of results – terms used in the control of analytical procedures – calculations in pharmaceutical analysis: percentage, dilutions, preparation of standard stock solutions, parts per million calculations – normality – molarity – molality – analytical standards – fundamentals of statistical analysis in pharmaceutical analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students would be able to

1. highlight the sources of impurities and methods to determine the impurities in inorganic drugsand pharmaceuticals.
2. demonstrate the skills on various types of extraction techniques
3. develop skills on range of physical analytical methods
4. determine the chemical properties of pharmaceutical compound
5. control the errors in the analysis of drug sample
6. illustrate the methods used for quality control of drug samples.

TEXT BOOKS

1. Pharmaceutical Analysis P. D. Chaithanya Sudha, Pearson, 2013.
2. Pharmaceutical Drug Analysis, Ashutosh Kar. New Age international Pvt Ltd. 2005.
3. Siddiqui, Anees A. "Pharmaceutical Analysis". Vol.I&II, CBS,2006
4. A.H. Beckett & J. B. Stenlake, "Practical Pharmaceutical Chemistry", Part II, 4th Edition,Bloomsbury Academic, 2001.

REFERENCE BOOKS

1. Pharmaceutical Analysis A Textbook for Pharmacy Students and Pharmaceutical Chemists.Third Edition David G. Watson. Churchil Livingstone Elsevier. 2012.
2. Pharmaceutical Analysis for Small Molecules, First Edition. Edited by Behnam Davani. © 2017 John Wiley & Sons, Inc. Published 2017 by John Wiley & Sons, Inc.
3. Mendham J, "Vogel's Text Book of Quantitative Chemical Analysis", 6th Edition, Pearson Education 2009.
4. Process Analytical Technology: Spectroscopic Tools and Implementation Strategies for the Chemical and Pharmaceutical Industries, Second Edition Edited by Katherine A. Bakeev © 2010 John Wiley & Sons, Ltd. ISBN: 978-0-470-72207-7.
5. Introduction to Pharmaceutical Analytical Chemistry, Stig Pedersen-Bjergaard, BenteGammelgaard, Trine Grønhaug Halvorsen, Second Edition 2019, Wiley.

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/
2. https://swayam.gov.in/nd1_noc19_ge22/preview

Course articulation matrix

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1	3	3	2		3	2	2					2	3	-	2
2	3	3	2		3	2	2				1	2	3	1	2
3	3	3	2		3	2	2				1	2	3	1	2
4	3	3	2		3	2	2				1	2	3	1	2
5	3	1	1		3	2	2				1	2	3	1	2
Avg	3	2	1.8		3	2	2				1	2	3	1	2

23PTT405 OPERATIONS IN PHARMACEUTICAL INDUSTRIES L T P C
3 1 0 4

OBJECTIVES

- To provide the basics of unit operations.
- To recognize various unit operations such as size reduction, separation, filtration, centrifugation, crystallization, and mixing.

UNIT I INTRODUCTION 9

Introduction to Unit Operations and Pharmaceutical industry- Overview of composition, resistance, properties and applications of the materials of construction with special reference to stainless steel and glass- Corrosion and its Prevention.

UNIT II SIZE REDUCTION & SEPARATION 9

Properties and characterization of particulate solids - Analytical methods for size determination of AZpowders - Size reduction- Mechanism- equipment – Size separation –mechanism - equipment

UNIT III CRYSTALLIZATION 9

Characters of crystals like purity, size, shape, geometry, habit, forms, size and its factors- Solubility curves- Super saturation theory and its limitations- nucleation mechanism and crystal growth- crystallisers- Swenson Walker crystalliser, etc., - Caking of crystals and its prevention.

UNIT IV FILTRATION AND CENTRIFUGATION 9

Theory of filtration, Filter aids, Filter media- Factors affecting filtration- Industrial filters including Filter press, Rotary filter, Edge filter, etc.,- Principles of centrifugation- industrial centrifugal filters - sedimentation centrifuges.

UNIT V MIXING 9

Mixing of powdered materials – Mechanism of random mixing and interactive mixing. Factors affecting the mixing process - Types of mixers - Characteristics and operation of Liquid, Semisolid and Solid Mixers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The student will be able to

1. Elucidate the various materials for pharmaceutical plant construction and industrial hazards
2. Recognize the properties of particulate matter and size reduction and separation equipment.
3. Describe the properties of crystals and working of crystallisers
4. Appreciate the theory of filtration and centrifugation and the equipment used for these unit operations
5. Define the principle of mixing and the working of mixers in pharma industries.
6. Recognize the applications of principles of unit operations in industry

TOTAL:45 PERIODS

TEXT BOOKS:

1. W.L. McCabe, J.C. Smith, P . Harriott, "Unit operations of Chemical Engineering", 7th ed., McGraw-Hill, 2017
2. Girish K.Jani, "Pharmaceutical Engineering I, Unit Operation, I"B.S.ShahPrakashan, India, 2006.
3. Cooper and Gunn's Tutorial Pharmacy, Edited by S J Carter, CBS Publishers, New Delhi, 2005

REFERENCES:

1. Coulson, J.M. and et al. "Coulson & Richardson's Chemical Engineering", 4th Edition, Vol.6, Elsevier Butterworth – Heinemann, MA, 2005
2. Badger, W.L and Banchero, J.T "Introduction to Chemical Engineering" Tata McGraw Hill, 2002
3. K. Sambamurthy, Pharmaceutical Engineering New Age International (P) Ltd., Publishers, New Delhi, 2003

Course articulation matrix

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1	3	3	2		3	2	2					2	3		2
2	3	3	2		3	2	2				1	2	3	1	2
3	3	3	2		3	2	2				1	2	3	1	2
4	3	3	2		3	2	2				1	2	3	1	2
5	3	1	1		3	2	2				1	2	3	1	2
Avg	3	2.6	2.2		3	2	2				1	2	3	1	2

23PTE401 PHYSICAL PHARMACEUTICS L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge on fundamental principles and concepts involved in pharmaceuticalpowders, liquid flow and dispersions
- To provide the knowledge about kinetics and drug stability

UNIT I MICROMERITICS AND POWDER RHEOLOGY 9

Particle size and distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, Dynamic light scattering (DLS) technique, measurement of particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness and flow properties.

UNIT II SURFACE AND INTERFACIAL PHENOMENON 9

Liquid interface, surface and interfacial tension, surface free energy, measurement of surface and interfacial tensions, free energy, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interface, solid gas and solid-liquid interface, complex films, electrical properties of interface.

UNIT III VISCOSITY AND RHEOLOGY 9

Newtonian system, Law of flow, kinematic viscosity, effect of temperature on viscosity, non-Newtonian systems, plastic, pseudoplastic, dilatant, thixotropy, thixotropy in formulation, determination of viscosity: capillary, falling ball, rotational viscometers

UNIT IV DISPERSION SYSTEMS 9

Colloidal dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy. Suspensions and Emulsions: Interfacial properties of suspended particles, settling in suspension, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicle, rheological considerations, emulsions; types, theories, physical stability.

UNIT V KINETICS AND DRUG STABILITY 9

General considerations and concepts of drug reaction kinetics; zero order, first order and pseudo first order, half-life determination, Influence of temperature, light, catalytic species, solvent and other factors, Stabilization of drugs, Accelerated stability study, expiration dating.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course the students will able to

1. Explain the methods used for determining particle size, particle volume and surface area along with the derived properties of powders
2. Differentiate the surface and interfacial phenomenon,
3. Distinguish between Newtonian and non-Newtonian system and to identify methods for determining viscosity.
4. Describe the types and properties of colloidal dispersions, suspensions and emulsions alongwith its applications
5. Understand drug reaction kinetics, stabilization of drugs and its accelerated stability testing
6. Apply the knowledge of physical properties of powders, liquids, colloidal and coarse dispersions in the design of pharmaceutical dosage forms

LIST OF EXPERIMENTS:

1. Determination of particle size, particle size distribution using various methods of particlesize analysis.
2. Determination of surface area of powders.
3. Determination of derived properties of powders like density, porosity, compressibility, angleof repose, etc.
4. Determination of effect of glidant on angle of repose of powder
5. Determination of surface/interfacial tension, HLB value
6. Determination of critical micellar concentration (CMC) of surfactants.
7. Study of rheological properties of various types of systems using different viscometers.
8. Study of different types of colloids and their properties.
9. Preparation of various types of suspensions and determination of their sedimentationparameters.
10. Preparation and stability studies of emulsions.
11. Determination of half-life, rate constant and order of reaction.
12. Preparation of pharmaceutical buffers and determination of buffer capacity.
13. Determination of shelf life of a product based on Arrhenius principle

TOTAL:45 PERIODS

TEXT BOOKS:

1. Manavalan, R. and Ramasamy. C. "Physical Pharmaceutics" 2nd Ed., Vignesh Publishers,2015.
2. C.V.S. Subrahmanyam, Text book of physical pharmaceutics,3rdEdn.,Vallabhprakashan, 2015.Hadkar. U. B., Physical Pharmacy, NiraliPrakashan; 12th edition, 2017.

REFERENCES:

1. Alfred N. Martin, Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences, sixth edition, Lippincott Williams & Wilkins, 2011.
2. David B. Troy, Paul Beringer, Remington: The science and practice of pharmacy, 21stEdition,Lippincott Williams and Wilkins, 2006

3. Humphrey Moynihan and Abinacrean "Physicochemical Basis of Pharmaceuticals" Oxford University Press, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/
2. https://swayam.gov.in/nd1_noc19_ge22/preview

Course articulation matrix

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1	3	1				1	1					1	2		1
2	3	1		1								1	1		3
3	3	1		1								1	1		3
4	3							1			1		2		2
5	3	1					1					1	3		2
Avg	3	1		1		1	1	1			1	1	1.8		2.2

23PTL401 **PHARMACEUTICAL CHEMISTRY** **L T P C**
0 0 0 4

LABOR ATORY OBJECTIVES:

1. To provide students with the practical laboratory skills of pharmaceutical chemistry
2. To demonstrate the effect of the different synthetic methodology.
3. To clarify theoretical concepts of chemical synthesis of drug molecules.

LIST OF EXPERIMENTS

1. To determine the strength of a given unknown solution of HCl by titrating it against with the help of a known solution of NaOH using Phenolphthalein indicator.
2. To determine the strength of a given unknown solution of aOH by titrating it against with the help of a known solution of HCl using methyl orange indicator.
3. To prepare and standardize 200 ml of 0.1 M silver nitrate solution.
4. Determination of physical constants: melting point, boiling point, viscosity and pKa.
5. Determination of partition coefficient of any medicinal compound by shake flask method.
6. Preparation and identification tests of the following official (IP) compounds: Magnesium sulphate, Calcium Carbonate, Ferrous sulphate, Boric acid
7. Determination of impurities by limit test
8. Synthesis of compounds by hydrolysis reaction: Salicylic acid from Alkyl Benzoate.
9. Synthesis of compounds by oxidation reaction: Benzoic acid from Benzyl chloride.
10. Synthesis of compounds involving Electrophilic substitution reaction:
    Benzoylation: Benzanilide, Phenyl benzoate, 2-Naphthyl benzoate
    Acetylation: Aspirin
    Nitration: Picric acid, p-nitro aniline, m - dinitro benzene
    Halogenaion: p-bromo acetanilide
    Haloform: Iodoform
11. Synthesis of compounds by naming reaction: 7- hydroxy -4- methyl coumarin (Pechmann reaction), 1- phenyl azo-2-napthol (Diazotization and Coupling reaction)
12. Synthesis of major industrial compounds: Paracetamol from p-aminophenol, Benzocaine from p-nitro benzoic acid

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

1. Apply safe laboratory practices in the preparation of reagents, handling and storage ofchemicals.
2. Identify/confirm the unknown organic compounds by melting point determination, pKa,boiling point, Viscosity etc.
3. Carry out quality control tests for fine chemicals and bulk drugs.
4. Implement the knowledge of chemistry in designing the synthetic scheme of organiccompounds.

5. Demonstrate feasible synthesis of some important class of drugs using chemical reactions.
6. Develop the reaction mechanism and orientation of chemical bonds in the synthesis ofmajor industrial compounds.

REFERENCES:

1. K.Yogananda Reddy, Dr.K.N. Jayaveera&Dr.S.Subramanyam, Practical MedicinalChemistry, S.Chan Publishing, 2013
2. Vogel's Textbook of Practical Organic Chemistry, 5th edition, Pearson Publisher, 2003.
3. Mann & Saunders, Practical Organic Chemistry, 4th edition, Pearson Publisher, 2009.
4. Chatwal G.R, "Pharmaceutical chemistry inorganic" Himalaya publishing house, Ed5th,2010, pp 127-128.
5. N.M. Raghavendra &Sayan Dutta Gupta, Laboratory manual of Pharmaceutical OrganicChemistry- I, Vallabh Prakashan, 1st edition. 2013.

Course articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3		2	2					2		2	
2	3	1	2	2			1					2	2	2	3
3	3	1	2	2			1					2	3		3
4	3	1	2	2			1					2	3	3	2
5	3	1	2	2			1					2			2
Avg	3	1.2	2.2	2.2		2	1.2					2	2.6	2.3	2.5

23PTL402 INDUSTRIAL TRAINING / INTERNSHIP I **L T P C**
0 0 0 2

OBJECTIVES:

To enable the students to

- Get connected with industry/ laboratory/research institute
- Get practical knowledge on production process in the industry and develop skills to solverelated problems
- Develop skills to carry out research in the research institutes/laboratories

The students individually undergo training in reputed firms/ research institutes / laboratories for thespecified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.

No. of.Weeks: 04

OUTCOMES:

On completion of the course, the student will know about

- Plant layout, machinery, organizational structure and production processes in the firm orresearch facilities in the laboratory/research institute
- Analysis of industrial / research problems and their solutions
- Documenting of material specifications, machine and process parameters, testingparameters and results
- Preparing of Technical report and presentation