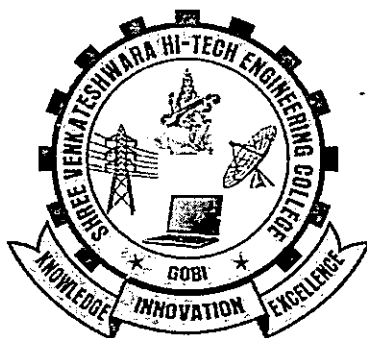


**SHREE VENKATESHWARA HI-TECH ENGINEERING
COLLEGE
(Autonomous)
Gobichettipalayam, Erode-638455**



**Regulation 2023 (Autonomous)
Curriculum and Syllabus
Choice Based Credit System (CBCS)
B.TECH – PHARMACEUTICAL TECHNOLOGY**



SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE

(Autonomous)

Gobichettipalayam, Erode -638455

Regulation 2023 (UG)

Curriculum and Syllabus

B.Tech. Pharmaceutical Technology

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- PEO1: Career Avenues:** To prepare students for prosperous spectrum of career avenues in academia, advanced research, industries of pharmaceutical technology, biomedicine, biotechnology, law, business and government and other pharmaceutical pursuits through dissemination of knowledge and proficiency in engineering and technology fundamentals related to pharmaceutical technology and the ability to solve problems
- PEO2: Professional Endeavors:** To transfuse in students the sense of confidence in professional endeavors by application of the derived knowledge and appreciation of economic impact in a societal context
- PEO3: Health and Welfare:** To provide collegial and nurturing environment for the students to realize the professional, ethical obligations and their concern to protect the health and welfare of the public, and to be accountable for the social and environmental impact of their practice
- PEO4: Multi-disciplinary Function:** To create an enjoyable educational environment in which students participate in multi-disciplinary, team oriented, open-ended curricular and co-curricular activities that prepare them to work either individually and as an integrated team member
- PEO5: Interdisciplinary Research :** To facilitate the students to gain the wisdom of fundamentals and advances to practice pharmaceutical technology and interdisciplinary research as career of constructive service to society and higher learning

II. Program Outcomes (POs)

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

III. PROGRAMME SPECIFIC OBJECTIVES

After successful completion of the program the graduate will be able to

- PSO1: Product Development:** Develop active pharmaceutical ingredients, drug intermediates and pharmaceutical products.
- PSO2: Analytical Tools:** Apply data driven decisions and predictive analytical tools in smaller and larger molecule producing industries.
- PSO3: Interdisciplinary Solutions:** Identify technical issues related to the design, manufacturing of chemicals & pharmaceuticals and provide effective interdisciplinary solutions.
- PSO4: Sustainable Development:** Adapt continuously changing technologies and play pivotal professional role in sustainable societal development.

Mapping of Course Outcome and Programme Outcome

Year	Sem	Course name	PO												PSO			
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
I		Professional English - I	-	-	-	2	-	1	-	-	2	3	-	3	-	-	-	-
		Matrices and Calculus	3	3	1	1	-	-	-	-	2	-	2	3	-	-	-	-
		Engineering Physics	3	3	2	1	2	-	-	-	-	-	-	1	-	-	-	-
		Engineering Chemistry	3	2	2	1	1	2	3	-	-	-	-	1	-	-	-	-
		Problem Solving and Python Programming	2	3	3	3	2	-	-	-	-	-	2	2	3	3	3	-
		தமிழர் மரபு /Heritage of Tamils	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Problem Solving and Python Programming Laboratory	2	3	3	3	2	-	-	-	-	-	2	2	3	3	3	-
		Physics and Chemistry Laboratory	3	3	2	1	1	3	3	1	-	-	-	1	-	-	-	-
		English Laboratory	3	2	1	-	1	3	3	1	-	-	-	1	-	-	-	-
		Mandatory Course - I Yoga for Human Excellence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
II		Professional English - II	3	3	1	1	1	-	1	1	2	3	-	2	-	-	-	-
		Numerical Methods and Statistics	3	3	1	1	1	-	-	-	2	2	2	3	-	-	-	-
		Physics for Electronics Engineering	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
		Basic Electrical and Electronics Engineering	3	3	2	2	-	-	-	-	-	1	-	-	-	-	-	-
		Engineering Graphics	3	1	2	-	2	-	-	-	-	3	-	-	3	3	2	-
		தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Engineering Practices Laboratory	3	2	-	-	1	1	1	-	-	-	-	2	-	-	-	-
		Basic Electrical and Electronics Engineering Laboratory	3	3	2	2	-	-	-	-	-	1	-	-	-	-	-	-
		Communication Laboratory	-	-	2	-	-	-	-	1	3	3	-	3	-	-	-	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation

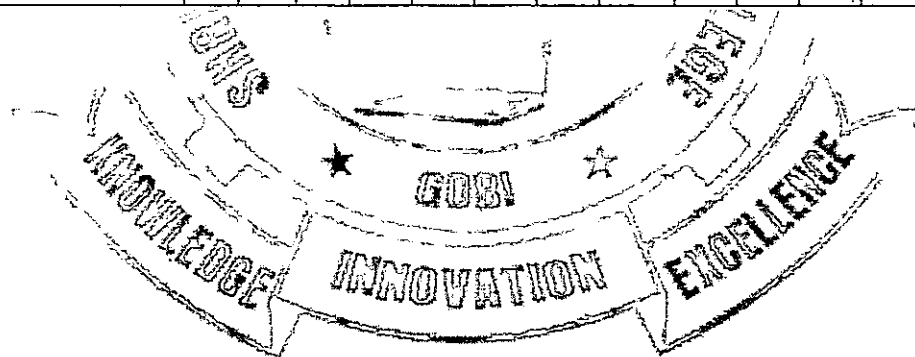
Mapping of Course Outcome and Programme Outcome

Year	Sem	Course name	PO												PSO			
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
II	III	Mathematics III	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-	-
		Chemical Process Calculations	3	3	2	-	3	-	2	-	2	-	-	2	-	-	3	2
		Microbiology	3	3	3	3	3	2	3	2	2	2	2	2	3	2	3	2
		Pharmaceutical Chemistry	3	3	3	3	-	2	1	2	2	2	-	2	2	-	3	2
		Biochemistry	2	3	3	2	2	3	1	3	2	1	3	3	3	3	2	3
		Human Anatomy and Physiology	3	3	3	3	2	-	2	1	2	1	-	3	2	3	2	2
		Entrepreneurship and Startup																
		Microbiology Laboratory	3	3	3	3	2	3	2	-	2			2	2	3	3	2
		Biochemistry and Physiology Laboratory	3	2	3	3	3	-	3	2	2			3	2	3	3	3
	IV	Applied Chemical Engineering Thermodynamics	3	3	3	3	2	1	-	1	1	2		2	3	3	3	3
		Fluid Mechanics	3	3	3	3	2	-	2	-	1	2	-	2	3	3	3	2
		Cell and Molecular Biology	3	2	3	2	2	-	2	1	-	-	-	2	2	-	2	2
		Physical Pharmaceutics	3	1	-	1	1	1	1	1	-	1	1	1	6	-	2	1
		Pharmaceutical Analysis	3	3	2	-	3	2	2	-	2	1	1	2	3	1	2	-
		Environmental Sciences and Sustainability	3	2	1	1	-	2	2	-	-	-	-	2	-	-	-	-
		Pharmaceutical Chemistry Laboratory	3	2	2	2	-	2	1	-	-	-	-	2	3	2	2	2
		Physical Pharmaceutics Laboratory	3	3	-	2	-	-	-	-	1	1	-	1	3	1	2	-

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PROFESSIONAL ELECTIVE COURSES : VERTICALS

S. NO	Course name	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Medicinal Chemistry	3	3	2	3	3	1	2	3	1	2	1	2	3	3	3
2	Bioinformatics and Cheminformatics	3	2	2	1	2	1	1	2	1	1	1	2	3	3	3
3	Protein Structure, Function and Proteomics	3	2	3	2	2	3	1	3	2	2	1	2	3	2	2
4	Computer Aided Drug Design	3	2	3	1	1	1	1	2	1	1	1	2	3	1	2
5	Regulatory Toxicology	3	2	3	-	-	-	1	1	1	-	-	1	1	1	2
6	Clinical Research and Pharmacovigilance	3	3	3	2	2	2	2	1	1	1	1	2	3	3	3
7	Chemistry of Natural Products	3	3	2	3	3	1	2	3	1	2	1	2	3	3	3
8	Molecular Modeling and Drug Design	3	2	3	1	1	1	1	2	1	1	1	2	3	1	2
9	Technology of Fine Chemicals and Bulk drugs	3	3	2	2	2	1	-	-	3	-	1	2	3	2	2
10	Pre formulation Technology	2	3	3	2	1	1	2	-	3	-	2	2	3	2	2
11	Manufacturing Technology of Dosage Forms	2	2	3	2	2	3	3	2	3	2	2	2	2	2	3
12	Industrial Process and Scale up Techniques	3	1	3	2	2	2	3	1	1	1	3	2	3	3	3
13	Novel Drug Delivery Systems	2	2	3	2	3	3	3	2	3	2	3	3	2	2	3
14	Pharmaceutical Packaging Technology	2	3	2	2	3	2	1	2	2	3	3	1	2	2	3



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Mapping of Course Outcome and Programme Outcome

Year	Sem	Course name	PO												PSO			
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
III	V	Pharmaceutical Dosage Forms	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-	-
		Unit Operations in Process Industries	3	3	2	-	3	-	2	-	2	-	-	2	-	-	3	2
		Pharmacology	3	3	3	3	3	2	3	2	2	2	2	2	3	2	3	2
		Professional Elective I*	3	3	3	3	-	2	1	2	2	2	-	2	2	-	3	2
		Professional Elective II*	2	3	3	2	2	3	1	3	2	1	3	3	3	3	2	3
		Professional Elective III*	3	3	3	3	2	2	1	2	2	1	-	3	2	3	2	2
		Dosage Forms Laboratory	3	3	3	3	3	2	3	2	2	2	2	2	3	2	3	2
		Pharmacology Laboratory	3	3	3	3	2	3	2	-	2	2	-	2	2	3	3	2
		Mandatory Course - II&	3	2	3	3	3	-	3	2	2	2	-	3	2	3	3	3
	VI	Heat and Mass Transfer Operations	3	3	3	2	2	-	2	-	-	-	-	2	-	3	2	1
		Instrumental Techniques in Drug Analysis	3	-	2	2	3	-	2	-	-	-	-	-	1	2	1	2
		Open Elective - I**	2	3	3	2	2	3	1	3	2	1	3	3	3	3	2	3
		Professional Elective IV*	3	3	3	3	-	2	1	2	2	2	2	2	2	-	3	2
		Professional Elective V*	2	3	3	2	2	3	1	3	2	1	3	3	3	3	2	3
		Professional Elective VI*	3	3	3	3	2	2	2	1	2	1	-	3	2	3	2	2
		Heat and Mass Transfer Operations Laboratory	3	3	2	2	2	-	-	2	-	-	-	-	3	2	-	2
		Instrumental Techniques In Drug Analysis Laboratory	3	-	3	3	2	-	-	-	-	-	-	-	-	3	-	-
		Mandatory Course- III&	3	2	3	3	3	-	3	2	-	2	-	3	2	3	3	3

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SUMMARY OF CREDITS

S. No	Course Category	Credits per Semester								Total Credits	Credits in %	Credits as per AU Curriculum
		I	II	III	IV	V	VI	VII	VIII			
1	HSS	4	3	-	-	-	-	5	-	12	7.23	12
2	BS	12	7	4	2	-	-	-	-	25	15.06	25
3	ES	5	11	-	-	-	-	-	-	16	9.64	16
4	PC	-	-	18	18	13	10	6	-	65	39.16	65
5	PE	-	-	-	-	9	9	-	-	18	10.84	18
6	OE	-	-	-	-	-	3	9	-	12	7.23	12
7	EEC	1	2	1	-	2	-	2	10	18	10.84	18
8	MC		√		√	√	√					
Total Credits / Semester		22	23	23	20	24	23	23	10	166	100	166

CATEGORIZATION OF COURSES

- Humanities and Social Sciences including Management Courses (HSS)
- Basic Science Courses (BS)
- Engineering Science Courses (ES)
- Professional Core Courses (PC)
- Professional Elective Courses (PE)
- Open Elective Courses (OE)
- Mandatory Courses (MC)
- Employability Enhancement Courses (EEC)
- Other Courses (OC)

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.



SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE

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Gobichettipalayam, Erode -638455

Regulation 2023 (UG)

Curriculum and Syllabus

B.Tech. Pharmaceutical Technology

SEMESTER I

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Induction Program											
1.	23IPA11	Induction Programme						0	-	-	-
Theory											
2.	23ENT11	Professional English - I	HSS	3	0	0	3	3	40	60	100
3.	23MAT11	Matrices and Calculus	BS	3	1	0	4	4	40	60	100
4.	23PHT11	Engineering Physics	BS	3	0	0	3	3	40	60	100
5.	23CYT11	Engineering Chemistry	BS	3	0	0	3	3	40	60	100
6.	23CST11	Problem Solving and Python Programming	ES	3	0	0	3	3	40	60	100
7.	23TAT11	தமிழர் மரபு /Heritage of Tamils	HSS	1	0	0	1	1	40	60	100
Practicals											
8.	23CSL11	Problem Solving and Python Programming Laboratory	ES	0	0	4	4	2	60	40	100
9.	23PCL11	Physics and Chemistry Laboratory	BS	0	0	4	4	2	60	40	100
10.	23ENL11	English Laboratory	EEC	0	0	2	2	1	60	40	100
Total				16	1	10	27	22			

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B.Tech. Pharmaceutical Technology

SEMESTER II

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23ENT21	Professional English - II	HSS	2	0	0	2	2	40	60	100
2.	23MAT21	Numerical Methods and Statistics	BS	3	0	0	4	4	40	60	100
3.	23PHT23	Physics for Electronics Engineering	BS	3	0	0	3	3	40	60	100
4.	23EET22	Basic Electrical and Electronics Engineering	ES	3	0	0	3	3	40	60	100
5.	23MET21	Engineering Graphics	ES	2	0	4	6	4	40	60	100
6.	23TAT21	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HSS	1	0	0	1	1	40	60	100
Practicals											
7.	23MEL21	Engineering Practices Laboratory	ES	0	0	4	4	2	60	40	100
8.	23EEL22	Basic Electrical and Electronics Engineering Laboratory	ES	0	0	4	4	2	60	40	100
9.	23ENL21	Communication Laboratory	EECT	0	0	4	4	2	60	40	100
Mandatory Courses											
10.	23MDC51	Mandatory Course - I Yoga for Human Excellence	MC	0	0	1	1	0	100	-	100
Total				14	1	17	32	23			

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Regulation 2023 (UG)

Curriculum and Syllabus

B.Tech. Pharmaceutical Technology

SEMESTER III

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23MAT34	Mathematics III	BS	3	1	0	4	4	40	60	100
2.	23PTT31	Chemical Process Calculations	PC	2	1	0	3	3	40	60	100
3.	23PTT32	Microbiology	PC	3	0	0	3	3	40	60	100
4.	23PTT33	Pharmaceutical Chemistry	PC	3	0	0	3	3	40	60	100
5.	23PTT34	Biochemistry	PC	3	0	0	3	3	40	60	100
6.	23PTT35	Human Anatomy and Physiology	PC	3	0	0	3	3	40	60	100
7.	23EST31	Entrepreneurship and Startup	EEC	0	0	2	2	1	100	-	100
Practicals											
8.	23PTL31	Microbiology Laboratory	PC	0	0	3	3	1.5	60	40	100
9.	23PTL32	Biochemistry and Physiology Laboratory	PC	0	0	3	3	1.5	60	40	100
Total				17	2	8	27	23			

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Curriculum and Syllabus

B.Tech. Pharmaceutical Technology

SEMESTER IV

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23PTT41	Applied Chemical Engineering Thermodynamics	PC	2	1	0	3	3	40	60	100
2.	23PTT42	Fluid Mechanics	PC	3	0	0	3	3	40	60	100
3.	23PTT43	Cell and Molecular Biology	PC	3	0	0	3	3	40	60	100
4.	23PTT44	Physical Pharmaceutics	PC	3	0	0	3	3	40	60	100
5.	23PTT45	Pharmaceutical Analysis	PC	3	0	0	3	3	40	60	100
6.	23CYT41	Environmental Sciences and Sustainability	BS	2	0	0	2	2	40	60	100
Practicals											
7.	23PTL41	Pharmaceutical Chemistry Laboratory	PC	0	0	3	3	1.5	60	40	100
8.	23PTL42	Physical Pharmaceutics Laboratory	PC	0	0	3	3	1.5	60	40	100
Mandatory Courses											
9.	23MDC41	Mandatory Course - II Soft and Analytical Skills-I	MCCM	1	0	0	1	0	100	-	100
Total				16	1	6	23	20			

© The students individually undergo training in reputed firms/ Research institutes / laboratories for the specified duration (04 Weeks) during IV semester summer vacation. After completion of training, a detailed report should be submitted within ten days from the commencement of V semester.

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Curriculum and Syllabus

B.Tech. Pharmaceutical Technology

SEMESTER V

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23PTT51	Pharmaceutical Dosage Forms	PC	3	0	0	3	3	40	60	100
2.	23PTT52	Unit Operations in Process Industries	PC	3	1	0	4	4	40	60	100
3.	23PTT53	Pharmacology	PC	3	0	0	3	3	40	60	100
4.		Professional Elective I*	PE	3	0	0	3	3	40	60	100
5.		Professional Elective II*	PE	3	0	0	3	3	40	60	100
6.		Professional Elective III*	PE	3	0	0	3	3	40	60	100
Practicals											
7.	23PTL51	Dosage Forms Laboratory	PC	0	0	3	3	1.5	60	40	100
8.	23PTL52	Pharmacology Laboratory	PC	0	0	3	3	1.5	60	40	100
9.	23PTL53	Industrial Training/Internship-I	EEC	0	0	0	0	2	100	-	100
Mandatory Courses											
10.	23MDC51	Mandatory Course - III Soft and Analytical Skills-II	MC	1	0	0	1	0	100	-	100
11.		Mandatory Course - IV*	MC	3	0	0	3	0	100	-	100
Total				21	1	6	28	24			

* Professional Elective - I to IV shall be chosen from the list of Professional electives (Verticals) offered by same Programme.

* Mandatory Course-IV is a Non-credit Course (Student shall select one course from the list given under Mandatory Course-IV)

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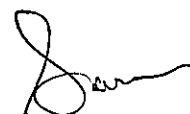
**SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE****(Autonomous)****Gobichettipalayam, Erode -638455****Regulation 2023 (UG)****Curriculum and Syllabus****B.Tech. Pharmaceutical Technology****SEMESTER VI**

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23PTT61	Heat and Mass Transfer Operations	PC	3	1	0	4	4	40	60	100
2.	23PTT62	Instrumental Techniques in Drug Analysis	PC	3	0	0	3	3	40	60	100
3.		Open Elective - I *	OE	-	-	-	-	3	40	60	100
4.		Professional Elective IV *	PE	3	0	0	3	3	40	60	100
5.		Professional Elective V *	PE	3	0	0	3	3	40	60	100
6.		Professional Elective VI *	PE	3	0	0	3	3	40	60	100
Practicals											
7.	23PTL61	Heat and Mass Transfer Operations Laboratory	PC	0	0	3	3	1.5	60	40	100
8.	23PTL62	Instrumental Techniques In-Drug Analysis Laboratory	PC	0	0	3	3	1.5	60	40	100
Mandatory Courses											
9.		Mandatory Course-V*	MCA	3	0	0	3	0	100	-	100
Total				-	-	-	-	22			

* Professional Elective - IV to VI shall be chosen from the list of Professional electives (Verticals) offered by same Programme.

** Open Elective - I shall be chosen from the list of open electives offered by other Programmes

& Mandatory Course-V is a Non-credit Course (Student shall select one course from the list given under Mandatory Course-V)


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(Autonomous)

Gobichettipalayam, Erode -638455

Regulation 2023 (UG)

Curriculum and Syllabus

B.Tech. Pharmaceutical Technology

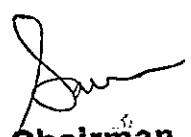
SEMESTER VII

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23PTT71	Regulatory requirements in Pharmaceutical Industries	IPC	3	0	0	3	3	40	60	100
2.	23PTT72	Biopharmaceutics and Pharmacokinetics	PG	3	0	0	3	3	40	60	100
3.	23UHV71	Human values and Ethics	HSS	2	0	0	2	2	40	60	100
4.		Elective - Management #	HSS	3	0	0	3	3	40	60	100
5.		Open Elective - II**	OE	-	-	-	-	3	40	60	100
6.		Open Elective - III**	OE	-	-	-	-	3	40	60	100
7.		Open Elective - IV**	OE	-	-	-	-	3	40	60	100
Practicals											
8.	23PTL71	Industrial Training/Internship II®	EEC	0	0	0	0	2	100	-	100
Total				-	-	-	-	22			

Elective - Management shall be chosen from the list of Elective Management courses

** Open Elective - II to IV shall be chosen from the list of open electives offered by other Programmes

® The students undergone industrial training/internship during VI semester summer vacation and same will be evaluated in VII semester.


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(Autonomous)

Gobichettipalayam, Erode -638455

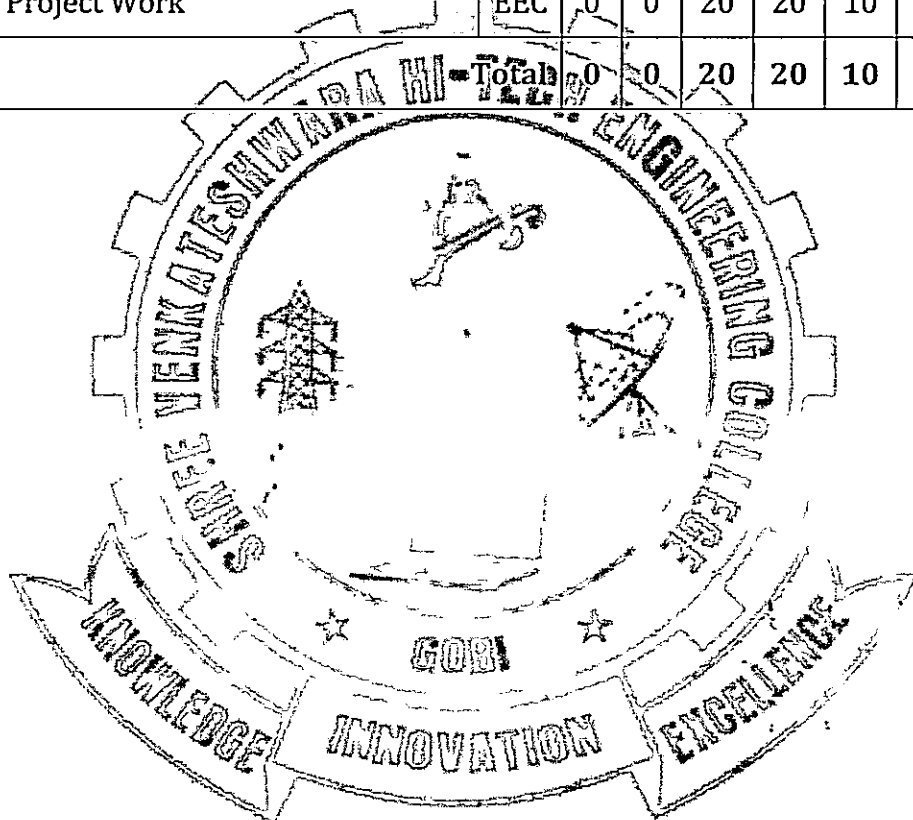
Regulation 2023 (UG)

Curriculum and Syllabus

B.Tech. Pharmaceutical Technology

SEMESTER VIII

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Practicals											
1.	23PTL81	Project Work	EEC	0	0	20	20	10	60	40	100
Total				0	0	20	20	10			



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MANDATORY COURSES IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23MDC52	Introduction to Women and Gender Studies	MC	3	0	0	3	0	100	-	100
2.	23MDC53	Elements of Literature	MC	3	0	0	3	0	100	-	100
3.	23MDC54	Film Appreciation	MC	3	0	0	3	0	100	-	100
4.	23MDC55	Disaster Risk Reduction and Management	MC	3	0	0	3	0	100	-	100

MANDATORY COURSES V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23MDC61	Well Being with Traditional Practices Yoga, Ayurveda and Siddha	MC	3	0	0	3	0	100	-	100
2.	23MDC62	History of Science and Technology in India	MC	3	0	0	3	0	100	-	100
3.	23MDC63	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0	100	-	100
4.	23MDC64	State, Nation Building and Politics in India	MC	3	0	0	3	0	100	-	100
5.	23MDC65	Industrial Safety	MC	3	0	0	3	0	100	-	100

ELECTIVE - MANAGEMENT COURSES

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23MSE71	Principles of Management	HSS	3	0	0	3	3	40	60	100
2.	23MSE72	Total Quality Management	HSS	3	0	0	3	3	40	60	100
3.	23MSE73	Engineering Economics and Financial Accounting	HSS	3	0	0	3	3	40	60	100
4.	23MSE74	Human Resource Management	HSS	3	0	0	3	3	40	60	100
5.	23MSE75	Knowledge Management	HSS	3	0	0	3	3	40	60	100
6.	23MSE76	Industrial Management	HSS	3	0	0	3	3	40	60	100

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

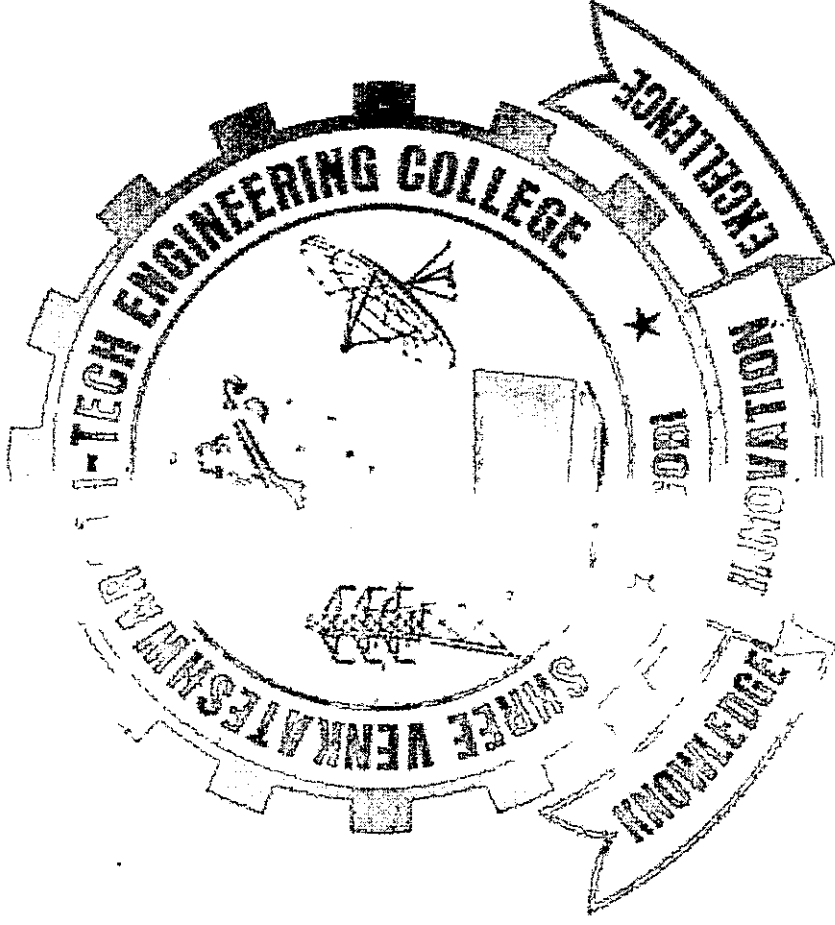
Vertical I Drug Design & Development	Vertical II Formulation and Manufacturing Technology	Vertical III Quality Control and Quality Assurance	Vertical IV Pharmaceutical Industrial Management
Medicinal Chemistry	Technology of Fine Chemicals and Bulk drugs	Biological spectroscopic techniques	Pharmaceutical Production Management
Bioinformatics and Cheminformatics	Pre formulation Technology	Quality Assurance in Pharmaceutical Industries	Pharmaceutical Supply Chain Management
Protein Structure and Function	Manufacturing Technology of Dosage Forms	Audits and regulatory compliance	Safety and Disaster Management
Computer Aided Drug Design	Industrial Process and Scale up Techniques	Validation in Pharmaceutical Industries	Management Information System
Regulatory Toxicology	Novel Drug Delivery Systems	Quality Management system	Industrial Psychology And Human Resource Management
Clinical Research and Pharmacovigilance	Pharmaceutical Packaging Technology	Product development and technology transfer	Project Management for Pharmaceutical Technology
Chemistry of Natural Products	Chemical Reaction Engineering	Instrumentation and Process Control	Biosafety
Molecular Modeling and Drug Design	Immunology	Experimental Design and Biostatistics	Regulatory Issues in Pharmaceutical Industry

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise).

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However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI. The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E./B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2023 [Clause 12].



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PROFESSIONAL ELECTIVE COURSES: VERTICALS**VERTICAL I: DRUG DESIGN & DEVELOPMENT**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23PTE11	Medicinal Chemistry	PE	3	0	0	3	3	40	60	100
2.	23PTE12	Bioinformatics and Cheminformatics	PE	3	0	0	3	3	40	60	100
3.	23PTE13	Protein Structure, Function and Proteomics	PE	3	0	0	3	3	40	60	100
4.	23PTE14	Computer Aided Drug Design	PE	3	0	0	3	3	40	60	100
5.	23PTE15	Regulatory Toxicology	PE	3	0	0	3	3	40	60	100
6.	23PTE16	Clinical Research and Pharmacovigilance	PE	3	0	0	3	3	40	60	100
7.	23PTE17	Chemistry of Natural Products	PE	3	0	0	3	3	40	60	100
8.	23PTE18	Molecular Modeling and Drug Design	PE	3	0	0	3	3	40	60	100

VERTICAL II: FORMULATION AND MANUFACTURING TECHNOLOGY

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23PTE21	Technology of Fine Chemicals and Bulk drugs	PE	3	0	0	3	3	40	60	100
2.	23PTE22	Pre formulation Technology	PE	3	0	0	3	3	40	60	100
3.	23PTE23	Manufacturing Technology of Dosage Forms	PE	3	0	0	3	3	40	60	100
4.	23PTE24	Industrial Process and Scale up Techniques	PE	3	0	0	3	3	40	60	100
5.	23PTE25	Novel Drug Delivery Systems	PE	3	0	0	3	3	40	60	100
6.	23PTE26	Pharmaceutical Packaging Technology	PE	3	0	0	3	3	40	60	100
7.	23PTE27	Chemical Reaction Engineering	PE	3	0	0	3	3	40	60	100
8.	23PTE28	Immunology	PE	3	0	0	3	3	40	60	100


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VERTICAL III: QUALITY CONTROL AND QUALITY ASSURANCE

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23PTE31	Biological spectroscopic techniques	PE	3	0	0	3	3	40	60	100
2.	23PTE32	Quality Assurance in Pharmaceutical Industries	PE	3	0	0	3	3	40	60	100
3.	23PTE33	Audits and regulatory compliance	PE	3	0	0	3	3	40	60	100
4.	23PTE34	Validation in Pharmaceutical Industries	PE	3	0	0	3	3	40	60	100
5.	23PTE35	Quality Management systems	PE	3	0	0	3	3	40	60	100
6.	23PTE36	Product Development and Technology Transfer	PE	3	0	0	3	3	40	60	100
7.	23PTE37	Instrumentation and Process Control	PE	3	0	0	3	3	40	60	100
8.	23PTE38	Experimental Design and Biostatistics	PE	3	0	0	3	3	40	60	100

VERTICAL IV: PHARMACEUTICAL INDUSTRIAL MANAGEMENT

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23PTE41	Pharmaceutical Production Management	PE	3	0	0	3	3	40	60	100
2.	23PTE42	Pharmaceutical Supply Chain Management	PE	3	0	0	3	3	40	60	100
3.	23PTE43	Safety and Disaster Management	PE	3	0	0	3	3	40	60	100
4.	23PTE44	Management Information System	PE	3	0	0	3	3	40	60	100
5.	23PTE45	Industrial Psychology And Human Resource Management	PE	3	0	0	3	3	40	60	100
6.	23PTE46	Project Management for Pharmaceutical Technology	PE	3	0	0	3	3	40	60	100
7.	23PTE47	Biosafety	PE	3	0	0	3	3	40	60	100
8.	23PTE48	Regulatory Issues in Pharmaceutical Industry	PE	3	0	0	3	3	40	60	100

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OPEN ELECTIVES - OFFERED BY DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23PT011	Nutraceuticals	OE	3	0	0	3	3	40	60	100
2.	23PT012	IPR for Pharma Industry	OE	3	0	0	3	3	40	60	100
3.	23PT013	Pharmaceutical Nanotechnology	OE	3	0	0	3	3	40	60	100
4.	23PT014	Basics of Human Anatomy and physiology	OE	3	0	0	3	3	40	60	100

OPEN ELECTIVES

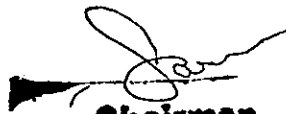
Sl. No	Course Code	Course Title	Category	Periods /Week			Credits	Max. Marks		
				L	T	P		CA	ES	TM

OFFERED BY DEPARTMENT OF CIVIL ENGINEERING

1	23CE011	Civil and Infrastructure Engineering	OE	3	0	0	3	40	60	100
2	23CE012	Environmental Pollution and waste management	OE	3	0	0	3	40	60	100
3	23CE013	Environmental Impact Assessment	OE	3	0	0	3	40	60	100
4	23CE014	Building Services	OE	3	0	0	3	40	60	100
5	23CE015	Water Sanitation and Health	OE	3	0	0	3	40	60	100

OFFERED BY DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

1	23CS011	Foundation of AR/VR	OE	3	0	0	3	40	60	100
2	23CS012	Web Designing	OE	3	0	0	3	40	60	100
3	23CS013	Block Chain fundamentals	OE	3	0	0	3	40	60	100
4	23CS014	Knowledge Management	OE	3	0	0	3	40	60	100
5	23CS015	Cloud Computing Essentials	OE	3	0	0	3	40	60	100

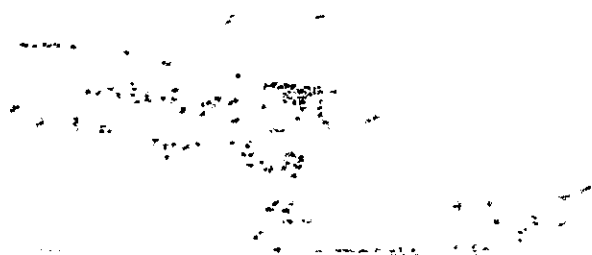

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Sl. No	Course Code	Course Title	Category	Periods /Week			Credits	Max. Marks		
				L	T	P		CA	ES	TM
OFFERED BY DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING										
1	23ECO11	Basics of electronics in automation	OE	3	0	0	3	3	40	60
2	23ECO12	Optical engineering	OE	3	0	0	3	3	40	60
3	23ECO13	E-waste management	OE	3	0	0	3	3	40	60
4	23ECO14	Consumer electronics	OE	3	0	0	3	3	40	60
5	23ECO15	Principles of communication engineering	OE	3	0	0	3	3	40	60
OFFERED BY DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING										
1	23EE011	Renewable Energy Sources	OE	3	0	0	3	40	60	100
2	23EE012	Electrical Vehicle	OE	3	0	0	3	40	60	100
3	23EE013	Energy Auditing and Conservation	OE	3	0	0	3	40	60	100
4	23EE014	Domestic and Industrial Electrical Installations	OE	3	0	0	3	40	60	100
5	23EE015	Microcontroller Based System Design	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING										
1	23ME011	Industrial Instrumentation	OE	3	0	0	3	40	60	100
2	23ME012	Energy Technology	OE	3	0	0	3	40	60	100
3	23ME013	Reverse Engineering	OE	3	0	0	3	40	60	100
4	23ME014	Fire Safety Engineering	OE	3	0	0	3	40	60	100
5	23ME015	Nano Technology	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT ARTIFICIAL INTELLIGENCE AND DATA SCIENCE										
1	23AD011	Introduction to Big Data	OE	3	0	0	3	40	60	100
2	23AD012	Principles of Data Science	OE	3	0	0	3	40	60	100
3	23AD013	Data Visualization and its Applications	OE	3	0	0	3	40	60	100
4	23AD014	Data Warehousing and Mining	OE	3	0	0	3	40	60	100
5	23AD015	Principles of Cyber Security	OE	3	0	0	3	40	60	100

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Sl. No	Course Code	Course Title	Category	Periods /Week			Credits	Max. Marks		
				L	T	P		CA	ES	TM
OFFERED BY DEPARTMENT INFORMATION TECHNOLOGY										
1	23IT011	Basics of Java Programming	OE	3	0	0	3	40	60	100
2	23IT012	Ethical Hacking	OE	3	0	0	3	40	60	100
3	23IT013	E-Commerce and Applications	OE	3	0	0	3	40	60	100
4	23IT014	Basics of Android Application Development	OE	3	0	0	3	40	60	100
5	23IT015	Introduction to Web Design	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY										
1	23PT011	Nutraceuticals	OE	3	0	0	3	40	60	100
2	23PT012	IPR for Pharma Industry	OE	3	0	0	3	40	60	100
3	23PT013	Pharmaceutical Nanotechnology	OE	3	0	0	3	40	60	100
4	23PT014	Basics of Human Anatomy and physiology	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT BIOMEDICAL ENGINEERING										
1	23BM011	Biomedical Instrumentation	OE	3	0	0	3	3	40	60
2	23BM012	Medical Optics	OE	3	0	0	3	3	40	60
3	23BM013	Biometric systems and their applications	OE	3	0	0	3	3	40	60
4	23BM014	Healthcare Management systems	OE	3	0	0	3	3	40	60
5	23BM015	IOT in Medicine	OE	3	0	0	3	3	40	60
OFFERED BY DEPARTMENT BIOTECHNOLOGY										
1	23BT011	Biofertilizer Technology	OE	3	0	0	3	3	40	60
2	23BT012	Ecology	OE	3	0	0	3	3	40	60
3	23BT013	Biotechnology for Forensics	OE	3	0	0	3	3	40	60
4	23BT014	Microbiology and Macromolecule	OE	3	0	0	3	3	40	60
5	23BT015	Biodiversity and Taxonomy	OE	3	0	0	3	3	40	60

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23IPA11

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

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This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character."

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity:

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts:

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later

(iii) Universal Human Values:

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

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Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity:

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules:

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People:

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area:

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations:

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities:

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop.

For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

REFERENCES:

1. Guide to Induction program from AICTE

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02/09/2023

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23ENT11

PROFESSIONAL ENGLISH – I
(Common to B.E./B.Tech. all Branches)

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3 0 0 3

COURSE OBJECTIVES:

- To improve the communicative competence of learners.
- To learn to use basic grammatical structures in suitable contexts.
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text.
- To help learners use language effectively in professional contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT-I	INTRODUCTION TO EFFECTIVE COMMUNICATION AND FUNDAMENTALS OF COMMUNICATION	10
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Introduction to Effective Communication- Barriers of Communication, Seven C's of Effective Communication, Effective Listening, Effective Speaking, Excellence in Reading, Ways to Develop Language and Communication Skills.

Reading- Reading Brochures (Technical Context), Telephone Messages/ Social Media Messages Relevant to Technical Contexts and Emails.

Writing- Writing Emails / Letters Introducing Oneself.

Grammar- Present Tense (Simple and Progressive); Question Types: Wh/ Yes or No/ and Tags.

Vocabulary- Synonyms; One Word Substitution; Abbreviations & Acronyms (as Used in Technical Contexts)

UNIT-II	NARRATION AND SUMMATION	9
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Reading - Reading Biographies, Travelogues, Newspaper Reports, Excerpts from Literature, and Travel & Technical Blogs.

Writing - Guided writing, Paragraph Writing, Short Report on an Event (Field Trip etc.)

Grammar - Past Tense (Simple); Subject-Verb Agreement; and Prepositions.

Vocabulary - Word Forms (Prefixes & Suffixes); Synonyms and Antonyms; Phrasal Verbs.

UNIT-III	DESCRIPTION OF A PROCESS / PRODUCT	9
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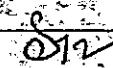
Reading - Reading Advertisements, Gadget Reviews; User Manuals.

Writing - Writing Definitions; Instructions; and Product /Process Description.

Grammar - Imperatives; Adjectives; Degrees of Comparison; Present & Past Perfect Tenses.

Vocabulary- Compound Nouns, Homonyms; and Homophones, Discourse Markers (Connectives & Sequence Words)

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UNIT-IV

CLASSIFICATION AND RECOMMENDATIONS

9

Reading - Newspaper Articles; Journal Reports -and Non Verbal Communication (Tables, Pie Charts etc...)

Writing - Note-making / Note-taking (*Study skills to be taught, not tested); Writing Recommendations; Transferring Information from Non Verbal (Chart, Graph etc, to Verbal Mode)

Grammar - Articles; Pronouns - Possessive & Relative Pronouns.

Vocabulary - Collocations; Fixed / Semi Fixed Expressions

UNIT-V

EXPRESSION

8

Reading - Reading Editorials; and Opinion Blogs;

Writing - Essay Writing (Descriptive or Narrative).

Grammar- Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences.

Vocabulary - Cause & Effect Expressions – Content vs. Function Words.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the Course the students will able to

- CO1:** Use appropriate words in a professional context
- CO2:** Gain understanding of basic grammatical structures and use them in right context
- CO3:** Read and infer the denotative and connotative meanings of technical text
- CO4:** Read and interpret information presented in tables, charts and other graphic forms
- CO5:** Write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS:

1. Department of English, Anna University, "English for Engineers & Technologists" Orient Blackswan Private Ltd, 2020.
2. Dr.Veena Selvam, Dr.Sujatha Priyadarshini, & CO, Department of English, Anna University, "English for Science & Technology" Cambridge University Press, 2021.

REFERENCE BOOKS:

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communication-Principles and Practices", Oxford Univ. Press, New Delhi, 2016.

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- 2 Lakshminarayanan, "A Course Book on Technical English", Scitech Publications (India) Pvt.Ltd. 2012.
- 3 Aysha Viswamohan, "English For Technical Communication (With CD)", Mcgraw Hill Education, ISBN : 0070264244, 2008.
- 4 Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House, 2016.

E. RESOURCES:

- <https://learnenglish.britishcouncil.org/>

CO's-PO's MAPPING :

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	-	-	-	-	-	-	-	-	2	3	-	3
C02	-	-	-	-	-	1	-	-	2	3	-	2
C03	-	-	-	-	-	1	-	-	3	3	-	3
C04	-	-	-	2	-	-	-	-	3	3	-	3
C05	-	-	-	-	-	-	-	-	2	3	-	2
AVR	-	-	-	2	-	1	-	-	2	3	-	3

1- Low, 2- Medium, 3-High, "-" No Correlation

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23MAT11

MATRICES AND CALCULUS
(Common to B.E./B.Tech. all Branches)

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications
- To familiarize the students with differential calculus
- To familiarize the student with functions of several variables. This is needed in many branches of engineering
- To make the students understand various techniques of integration
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications

UNIT-I

MATRICES

9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications : Stretching of an elastic membrane.

UNIT-II

DIFFERENTIAL CALCULUS

9+3

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules(sum, product, quotient, chain rules) - Implicit differentiation - Applications : Maxima and Minima of functions of one variable.

UNIT-III

FUNCTIONS OF SEVERAL VARIABLES

9+3

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT-IV

INTEGRAL CALCULUS

9+3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Improper integrals - Applications : Hydrostatic force and pressure, moments and centre of mass.

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UNIT-V

MULTIPLE INTEGRALS

9+3

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 and triple integrals – Applications: Moments and centre of mass, moment of inertia.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- CO1:** Use the matrix algebra methods for solving practical problems
- CO2:** Apply differential calculus tools in solving various application problems.
- CO3:** Use differential calculus ideas on several variable functions
- CO4:** Apply different methods of integration in solving practical problems
- CO5:** Apply multiple integral ideas in solving areas, volumes and other practical problems

TEXT BOOKS :

1. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2019. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8]
2. Grewal. B. S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018

REFERENCE BOOKS :

1. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2022
2. Anton. H, Bivens. I and Davis. S, "Calculus ", Wiley, 10th Edition, 2021
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016
4. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016

CO's – PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	-	-	-	2	-	2	3
CO2	3	3	1	1	-	-	-	-	3	-	2	3
CO3	3	3	1	1	-	-	-	-	2	-	2	3
CO4	3	3	1	1	-	-	-	-	2	-	2	3
CO5	3	2	1	1	-	-	-	-	2	-	2	3
AVG	3	3	1	1	-	-	-	-	2	-	2	3

1- Low, 2- Medium, 3-High, "-" No Correlation

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23PHT11

ENGINEERING PHYSICS
(Common to B.E./B.Tech. all branches)

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To make the students effectively achieve an understanding of mechanics
- Provide knowledge of elastic property, thermal property of materials and its applications
- Impart knowledge of laser and their applications
- Introduce the essential principles of fiber optics and its applications
- Equipping the students to successfully understand the importance of quantum physics

UNIT-I

MECHANICS

10

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia – theorems of M – M.I of a diatomic molecule – torque – rotational dynamics of rigid bodies – rotational energy state of a rigid diatomic molecule – torsional pendulum – double pendulum

UNIT-II

PROPERTIES OF MATTER AND THERMAL PHYSICS

10

Elasticity- Hooke's law – stress – strain diagram – Poisson's ratio – Factors affecting elasticity – bending of beams- Bending moment equation – Depression of a cantilever- Young's modulus by uniform bending – I-shaped girders- Modes of heat transfer – thermal conductivity – Newton's law of cooling – Linear heat law – Lee's disc method – conduction through compound media (series and parallel)

UNIT-III

LASER

9

Lasers: Stimulated absorption – Spontaneous emission – Stimulated emission – Population inversion- Einstein's coefficients derivation and their relations – Pumping methods – Types of lasers – Nd:YAG, CO₂ laser, Semiconductor lasers (homojunction & heterojunction) – Industrial and Medical Applications of lasers

UNIT-IV

FIBER OPTICS

8

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle – Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending – Fiber optics communication system (qualitative) – Temperature and displacement sensors – fiber optic endoscope

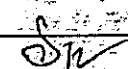
UNIT-V

QUANTUM PHYSICS

8

Photons and light waves – Electrons and matter waves – Compton effect: theory of scattering – Derivation and experimental verification – The Schrodinger equation (Time dependent and

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time independent forms) – particle in a one-dimensional rigid box for eigen value and eigen function – tunneling (qualitative) – scanning tunneling microscope

TOTAL: 45 PERIODS

COURSE OUTCOME:

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

- CO1: Understand the importance of mechanics.
- CO2: Describe the Elastic property of solid materials and thermal conductivity of solids in industrial applications
- CO3: Demonstrate a foundational knowledge in lasers
- CO4: The students will get knowledge on fiber optics
- CO5: Understand the importance of quantum physics

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow, "An Introduction to Mechanics," McGraw Hill Education (Indian Edition), 2017
2. Arthur Beiser, Shobhit Mahajan, S.Rai Choudhury, "Concepts of Modern Physics," McGraw-Hill (Indian Edition), 2017

REFERENCE BOOKS:

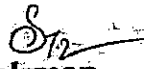
1. K.Thyagarajan and A.Ghatak, "Lasers: Fundamentals and Applications," Laxmi Publications, (Indian Edition), 2023
2. D.Halliday, R.Resnick and J.Walker, "Principles of Physics," Wiley (Indian Edition), 2021
3. N.Garcia, A.Damask and S.Schwarz, "Physics for Computer Science Students," Springer-Verlag, 2012

CO's- PO's MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	-	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	-	-	-	-	-
CO3	3	2	2	1	2	-	-	-	-	-	-	1
CO4	3	2	2	1	2	-	-	-	-	-	-	1
CO5	3	3	1	1	2	-	-	-	-	-	-	-
AVG	3	3	2	1	2	-	-	-	-	-	-	1

1- Low, 2- Medium, 3-High, "-" No Correlation

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23CYT11

ENGINEERING CHEMISTRY
(Common to B.E./B. Tech. all branches)

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatment techniques
- To impart knowledge on the basic principles and preparatory methods of nanomaterials
- To introduce the basic concepts and applications of phase rule and composites
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices

UNIT-I

WATER AND ITS TREATMENT

9

Water: Sources and impurities, **Water quality parameters:** turbidity, pH, hardness, alkalinity, TDS, COD and BOD. **Desalination of brackish water:** Reverse Osmosis. **Boiler troubles:** Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming & foaming. **Treatment of boiler feed water:** Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralisation and zeolite process. **Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination)

UNIT-II

NANOCHEMISTRY

9

Basics: Distinction between molecules, nanomaterials and bulk materials; **Size-dependent properties** (optical, electrical, mechanical and magnetic); **Types of nanomaterials:** Definition, properties and uses of – nanoparticle, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, electrochemical deposition. **Applications of nanomaterials** with examples in medicine, agriculture, energy, electronics and catalysis.

UNIT-III

PHASE RULE AND COMPOSITES

9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system – Pattinson's process.

Composites: Introduction: Definition & Need for composites; **Constitution:** Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Properties and applications of:** Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites.

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UNIT-IV : FUELS AND COMBUSTION 9

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). **Petroleum and Diesel:** Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; **Solid biofuels, Compressed biogas, Power alcohol and biodiesel.**

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Flue gas analysis - ORSAT Method. **CO₂ emission and carbon foot print.**

UNIT-V ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear energy: light water nuclear power plant, breeder reactor. **Solar energy conversion:** Principle, working and applications of solar cells; **Recent developments in solar cell materials.** **Wind energy; Geothermal energy; Batteries:** Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; **Electric vehicles-working principles; Fuel cells:** H₂-O₂ fuel cell, microbial fuel cell; **Supercapacitors:** Storage principle, types and examples

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able

- CO1:** To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- CO2:** To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- CO3:** To apply the knowledge of phase rule and composites for material selection requirements.
- CO4:** To recommend suitable fuels for engineering processes and applications.
- CO5:** To recognize different forms of energy resources and apply them for suitable applications in energy sectors

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018
2. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018

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REFERENCE BOOKS:

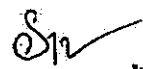
1. Shashi Chawla, "A Text Book of Engineering Chemistry", Dhanpar Rai & Co (Pvt.) Ltd, New Delhi, 2011
2. O.G. Palanna, "Engineering Chemistry", McGraw Hill Education (India) Private Limited, 2nd Edition, 2017
3. Dr. A.Ravikrishnan, "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Limited, 23rd Edition, 2023

CO's- PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	1	3	3	-	-	-	-	-
CO2	3	2	1	1	2	2	-	-	-	-	-	1
CO3	3	3	1	1	1	1	-	-	-	-	-	-
CO4	3	2	1	1	1	1	-	-	-	-	-	-
CO5	3	2	2	1	2	2	2	-	-	-	-	-
AVG	3	2	2	1	1	2	3	-	-	-	-	1

1- Low, 2- Medium, 3-High, "-" No Correlation

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23CST11

PROBLEM SOLVING AND PYTHON PROGRAMMING

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

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To solve problems using computational thinking methods using pseudo code and flowchart
- To understand the fundamentals of algorithmic problem solving basics and strategies
- To define variables data types and error messages
- To learn to solve problems using Python conditionals loops lists tuples and dictionaries to represent complex data
- To understand the functions modules and do input/output with files in Python

UNIT-I

COMPUTATIONAL THINKING

8

Introduction - Problem solving and Decomposition - Abstraction - Notations Pseudo code - Flow chart - Programming language

UNIT-II

ALGORITHMIC PROBLEM SOLVING

8

Algorithm Implementation - Top down design - Simple strategies for developing algorithms - Iteration - Recursion - Fundamental algorithms - Anticipating and Dealing with Errors

UNIT-III

BASICS BUILDING BLOCKS OF PYTHON

9

Variables - Immutable variables - Data types - Operators - Python Reserved Words - Understanding error messages

UNIT-IV

CONTROL STATEMENTS AND STRUCTURED TYPES

10

Control Flow - Indenting - if Statement - while Loop - break and continue - for Loop - String - Lists - Tuples - Sets - Dictionaries

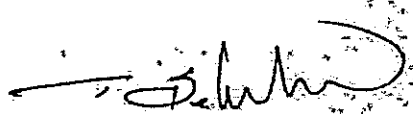
UNIT-V

FUNCTIONS, MODULES AND FILES

10

Definition - Hiding redundancy - Arguments and return values - Variable Number of Arguments - Scope - Passing Functions to a Function - Mapping Functions in a Dictionary - Lambda function - Recursive Functions - Modules: Standard Modules - OS and SYS modules - User defined Modules - Importing modules - Writing into a File - Reading from a File - File Methods

TOTAL : 45 PERIODS


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COURSE OUTCOMES:

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

- CO1: Develop algorithmic solutions for simple computational problems to develop and execute simple Python programs.
- CO2: Write the Algorithms for problem solving basics and strategies to solve complex problems
- CO3: Compose simple Python programs using to illustrate variables data types and error messages.
- CO4: Represent compound data using Python conditionals loops lists tuples dictionaries for solving problems
- CO5: Create functions modules read and write data from/to files in Python programs.

TEXT BOOKS:

1. R. G. Dromey "How to Solve it by Computer", Pearson Education., 2015
2. Charles Dierbach "Introduction to Computer Science using Python: A Computational Problem- Solving Focus", Wiley India., 2015

REFERENCE BOOKS:

1. John V. Guttag "Introduction to Computation and Programming using Python", The MIT press. 2021 (3rd Edition).
2. Paul Gries, Jennifer Campbell, Jason Montojo "Practical Programming: An Introduction to Computer Science using Python 3", Pragmatic Programmers., 2013 , Second edition
3. Robert Sedgewick, Kevin Wayne, Robert Dondero "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India., 2016
4. Karl Beecher "Computational Thinking - A beginner's guide to problem solving and Programming", BCS Learning & Development., 2017

E-RESOURCES:

1. <http://www.flowgorithm.org/>
2. <https://www.python.org/>
3. <https://nptel.ac.in/courses/106104074>

CO's - PO's & PSO's MAPPING

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

1 - low, 2 - medium, 3 - high, '-' - no correlation

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23TAT11

HERITAGE OF TAMILS
(Common to B.E./B.Tech. all branches)

L T P C
1 0 0 1

COURSE OBJECTIVES:

- To understand the Sangam and modern literature of Tamil
- To learn the heritage of Tamil culture
- To recognize the various art forms of Tamils
- To explain the Thinal concept of Tamils
- To realize the contribution of Tamils to Indian national movement and Indian culture

UNIT-I

LANGUAGE AND LITERATURE

3

Language Families in India - Dravidian Languages - Tamil as a Classical Language - Classical Literature in Tamil - Secular Nature of Sangam Literature - Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land- Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT-II

**HERITAGE - ROCK-ART PAINTINGS
TO MODERN ART - SCULPTURE**

3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, -Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yash and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT-III

FOLK AND MARTIAL ARTS

3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT-IV

THINAI CONCEPTS OF TAMILS

3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT-V

**CONTRIBUTION OF TAMILS TO INDIAN
NATIONAL MOVEMENT AND INDIAN CULTURE**

3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India - Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine - Inscriptions & Manuscripts - Print History of Tamil Books.

TOTAL: 15 PERIODS

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COURSE OUTCOMES:

At the end of the course the student will be able to

- CO1:** Gain knowledge about various literatures of Tamil
- CO2:** Learn the uniqueness of Tamil cultural heritage
- CO3:** Find various art forms of Tamil Nadu
- CO4:** Understand the Thinaï concepts in Tamil
- CO5:** Distinguish the contribution of Tamils to Indian national movement and Indian culture

E- RESOURCES:

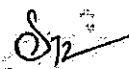
1. <https://www.tamilvu.org/>

CO's -PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	1	-	1	-	-
CO2	-	-	-	-	-	1	1	1	-	1	-	-
CO3	-	-	-	-	-	1	1	1	-	1	-	-
CO4	-	-	-	-	-	1	1	1	-	1	-	-
CO5	-	-	-	-	-	1	1	1	-	1	-	-
AVG	-	-	-	-	-	1	1	1	-	1	-	-

1- Low, 2- Medium, 3-High, "-" No Correlation

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23TAT11

தமிழர் மரபு

L T P C
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(B.E./B.Tech- அனைத்து பாடப்பிரிவுகளுக்கும் பொதுவானது)

பாடநெறி நோக்கங்கள்:

- தமிழின் இலக்கியங்கள் மற்றும் நவீன இலக்கியங்களைப் புரிந்துகொள்ளுதல்
- தமிழ் கலாச்சார பாரம்பரியத்தைக் கற்றுக்கொள்ளுதல்
- தமிழர்களின் பல்வேறு கலைவடிவங்களைக் கண்டறிதல்
- தமிழர்களின் திணைக்கோட்பாடுகளை விளக்குதல்
- இந்திய சுதந்திர போராட்ட இயக்கங்களுக்கும் இந்திய கலாச்சாரத்திற்குமான தமிழர்களின் பங்களிப்பை உணர்தல்

அலகு - I

மொழி மற்றும் இலக்கியம்

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் ஆறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமணப் பெளத்த மதங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு - II

மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு - III

நாட்டப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகள்

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு - IV

தமிழர்களின் திணைக் கோட்பாடுகள்

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவு, கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி

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அலகு -V

இந்திய தேசிய இயக்கம் மற்றும்

3

இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிற்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

மொத்தம்: 15 பாடவேளைகள்

பாடநெறி முடிவுகள்:

இப்பாடத்தைப் படிப்பதின் முடிவில் மாணவர்கள்

- CO1: தமிழின் பல்வேறு இலக்கியங்களைப் பற்றிய அறிவைப் பெறுவார்கள்
- CO2: தமிழ் கலாச்சார பாரம்பரியத்தின் தனித்தன்மையைக் கற்றுக்கொள்வார்கள்
- CO3: தமிழகத்தின் பல்வேறு கலைவடிவங்களைக் கண்டறிவார்கள்
- CO4: தமிழர்களின் திணைக்கோட்பாடுகளை அறிந்துகொள்வார்கள்
- CO5: தமிழ் சுதந்திரப்போராட்ட வீரர்கள் மற்றும் தமிழ் கலாச்சாரத்தை இந்தியாவின் மற்ற பகுதியுடன் ஒப்பிடும் திறனைப் பெறுவார்கள்

மின் -ஆதாரங்கள்:

1. <https://www.tamilvu.org/>

CO's -PO's விவரணையாக்கம்:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	1	-	1	-	-
CO2	-	-	-	-	-	1	1	1	-	1	-	-
CO3	-	-	-	-	-	1	1	1	-	1	-	-
CO4	-	-	-	-	-	1	1	1	-	1	-	-
CO5	-	-	-	-	-	1	1	1	-	1	-	-
AVG	-	-	-	-	-	1	1	1	-	1	-	-

1- Low, 2- Medium, 3-High, "-" No Correlation

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**PROBLEM SOLVING AND PYTHON PROGRAMMING
LABORATORY**

23CSL11

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

L T P C

0 0 4 2

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

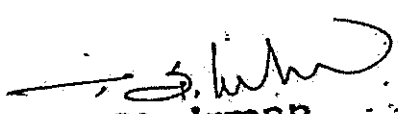
LIST OF EXPERIMENTS

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing 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. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, 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, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
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)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

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CS&IT

COURSE OUTCOMES:

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

- CO1: Develop algorithmic solutions to simple computational problems
- CO2: Develop and execute simple Python programs.
- CO3: Implement programs in Python using conditionals and loops for solving problems.
- CO4: Deploy functions to decompose a Python program.
- CO5: Process compound data using Python data structures and Utilize Python packages in developing software applications.

TEXT BOOKS:

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.

REFERENCE BOOKS:

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, MIT Press, 2021.
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

E-RESOURCES:

1. <http://www.flowgorithm.org/>
2. <https://www.python.org/>
3. <https://nptel.ac.in/courses/106104074>

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	3
CO2	3	3	3	3	2	-	-	-	-	-	2	-	3	3	-
CO3	2	2	-	2	2	-	-	-	-	-	1	-	3	3	3
CO4	1	2	-	-	1	-	-	-	-	-	1	-	2	3	3
CO5	2	2	-	-	2	-	-	-	-	-	1	-	2	3	3
AVG	2	3	3	3	2	-	-	-	-	-	2	2	3	3	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

23PCL11

PHYSICS AND CHEMISTRY LABORATORY
(Common to B.E./B. Tech. all branches)

L	T	P	C
0	0	4	2

PHYSICS LABORATORY
(Any Seven Experiments)

COURSE OBJECTIVES:

- Determination of the physical parameters such as young's modulus by Uniform bending method, Non-Uniform bending method, Simple harmonic oscillations of cantilever and rigidity modulus of wire
- To impart knowledge in the determination of the thermal conductivity of a bad conductor by Lee's Disc method and band gap of a semiconductor
- Determination of the wavelength of the laser using grating, numerical aperture and acceptance angle in an optical fiber and width of the groove in a compact disc by using laser
- Determination of the velocity of sound and compressibility of liquids by using ultrasonic interferometer
- Knowledge on the frequency of alternating current using electrically vibrating tuning fork by using Melde's apparatus

LIST OF EXPERIMENTS

1. Determination of Young's modulus by Uniform bending method
2. Determination of Young's modulus by non-uniform bending method
3. Simple harmonic oscillations of cantilever
4. Determination of rigidity modulus of wire and moment of inertia of regular objects - Torsion pendulum
5. Determination of thermal conductivity of a bad conductor - Lee's Disc method
6. Determination of band gap of a semiconductor
7. Determination of the wavelength of the laser using grating
8. a) Determination of numerical aperture and acceptance angle in an optical fiber
b) Determination of width of the groove in a compact disc by using laser
9. Determination of the velocity of sound and compressibility of liquids by using ultrasonic interferometer
10. Determination of the frequency of alternating current using electrically vibrating tuning fork - Melde's apparatus

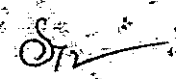
TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- CO1:** Experiment and determine the physical characteristics of given solid materials using Young's modulus-Uniform bending method, non-uniform bending method, cantilever method and Torsion Pendulum.
- CO2:** Experiment and determine the thermal conductivity of a bad conductor using Lee's Disc method and band gap energy of a given semiconducting material using Zener diode.
- CO3:** Experiment and determine the optical property of light sources, acceptance angle of optical fiber and width of the groove in a compact disc using Laser.
- CO4:** Experiment and determine the velocity of ultrasonic waves using ultrasonic interferometer.
- CO5:** Experiment and determine the frequency of alternating current using electrically vibrating tuning fork by using Melde's apparatus

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TEXT BOOKS:

1. Dr. P. Mani, Engineering Physics Practicals, Dhanam Publications (2022)

CO's - PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	3	1	1	-	-	-	-	-	-	-	-
C02	3	3	1	1	-	-	-	-	-	-	-	-
C03	3	3	1	1	-	-	-	-	-	-	-	-
C04	3	3	1	1	-	-	-	-	-	-	-	-
C05	3	3	1	1	-	-	-	-	-	-	-	-
AVG	3	3	1	1	-	-	-	-	-	-	-	-

CHEMISTRY LABORATORY
(Any Seven Experiments)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as acidity, alkalinity.
- To acquire the knowledge in total hardness and dissolved oxygen and its impacts in industries through experiments
- To understand the impacts of chlorine in water sample through volumetric analysis.
- To induce the students to familiarize with electroanalytical techniques in the determination of impurities in aqueous solutions.
- To determine the amount of metal ions through spectroscopic techniques.

LIST OF EXPERIMENTS

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard.
2. Determination of types and amount of alkalinity in a water sample
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Conductometric titration of barium chloride against sodium sulphate (precipitation titration).
9. Estimation of iron content of the given solution using potentiometer.
10. Estimation of sodium /potassium present in water using a flame photometer.

TOTAL: 30 PERIODS

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COURSE OUTCOMES:

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

- CO1: Analyse the quality of water samples with respect to their acidity and alkalinity of water samples
- CO2: Examine the water quality parameters like total hardness and DO with volumetric analysis.
- CO3: Learn the permissible limit of chlorine in the given water sample
- CO4: Analyse the impurities in solution by electro analytical techniques quantitatively
- CO5: Determine the amount of metal ions through spectroscopic techniques.

CO's - PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	3	3	1	-	-	-	1
CO2	3	2	2	-	-	3	3	1	-	-	-	1
CO3	3	2	1	-	-	3	3	1	-	-	-	1
CO4	3	2	2	-	1	2	1	-	-	-	-	-
CO5	3	2	1	-	1	2	1	-	-	-	-	-
Avg.	3	2	1	-	1	3	2	1	-	-	-	1

TEXT BOOKS:

1. "Vogel's Textbook of Quantitative Chemical Analysis", (8th Edition, 2014)
2. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, "Vogel's Textbook of Quantitative Chemical Analysis", (2009)

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

23ENL11

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

L T P C
0 0 2 1

COURSE OBJECTIVES:

- To improve the communicative competence of learners.
- To help learners use language effectively in academic /work contexts.
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities those are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT-I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6

Listening- Listening for General Information-Specific Details- Conversation: Introduction to Classmates - Audio / Video (Formal & Informal); Telephone Conversation; Listening to Voicemail & Messages; Listening and Filling a Form.

Speaking- Making Telephone Calls- Self Introduction; Introducing a Friend; - Politeness Strategies- Making Polite Requests, Making Polite Offers, Replying to Polite Requests and Offers- Understanding Basic Instructions (Filling out a Bank Application for Example).

UNIT-II NARRATION AND SUMMATION 6

Listening - Listening to Podcasts, Anecdotes / Stories-/ Event Narration; Documentaries and Interviews with Celebrities.

Speaking - Narrating Personal Experiences / Events-Talking about Current and Temporary Situations & Permanent and Regular Situations - Describing Experiences and Feelings- Engaging in Small Talk- Describing Requirements and Abilities.

UNIT-III DESCRIPTION OF A PROCESS / PRODUCT 6

Listening - Listen to Product and Process Descriptions; A Classroom Lecture; and Advertisements about Products.

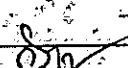
Speaking - Picture Description- Describing Locations in Workplaces- Giving Instruction to Use the Product- Explaining Uses and Purposes- Presenting a Product- Describing Shapes and Sizes and Weights- Talking about Quantities (Large & Small)- Talking about Precautions.

UNIT-IV CLASSIFICATION AND RECOMMENDATIONS 6

Listening - Listening to Technology, Entertainment and Design (TED) Talks; Listening to Lectures - and Educational Videos.

Speaking - Small Talk; Discussing and Making Plans-Talking about Tasks-Talking about Progress-Talking about Positions and Directions of Movement-Talking about Travel Preparations- Talking about Transportation.

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UNIT-V

EXPRESSION

6

Listening - Listening to Debates/ Discussions; Different Viewpoints on an Issue; and Panel Discussions.

Speaking - Making Predictions- Talking about a Given Topic-Giving Opinions- Understanding a Website- Describing Processes.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able

- CO1:** To listen to and understand general and complex academic information
- CO2:** To listen to and understand different points of view in a discussion
- CO3:** To speak fluently and accurately in formal and informal communicative contexts
- CO4:** To describe products and processes and explain their uses clearly as well as accurately
- CO5:** To express their opinions effectively in both formal and informal discussions

E. RESOURCES:

- <https://www.ted.com/about/programs-initiatives/ted-talks-education>
- <https://learnenglish.britishcouncil.org/>

CO's & PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	3
CO3	-	-	-	-	-	-	-	1	2	3	-	2
CO4	-	-	-	-	-	-	-	-	2	3	-	2
CO5	-	-	-	-	-	-	-	1	3	3	-	2
AVR	-	-	-	-	-	-	-	1	3	3	-	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

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23ENT21

PROFESSIONAL ENGLISH - II
(Common to B.E./B.Tech. all Branches)

L T P C
2 0 0 2

COURSE OBJECTIVES:

- To engage learners in meaningful language activities to improve their reading and writing skills.
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT-I

MAKING COMPARISONS

6

Reading - Reading Advertisements, User Manuals, Brochures Emails.

Writing - Professional Emails, Email Etiquette - Compare and Contrast Essay.

Grammar - Mixed Tenses, Prepositional Phrase.

UNIT-II

EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING

6

Reading - Reading Longer Technical Texts- Cause and Effect Essays, and Letters / Emails of Complaint.

Writing - Writing Responses to Complaints.

Grammar - Active Passive Voice Transformations, In initive and Gerunds.

UNIT-III

PROBLEM SOLVING

6

Reading - Case Studies, Excerpts from Literary Texts, News Reports etc.

Writing - Letter to the Editor, Checklists, Problem Solution Essay / Argumentative Essay.

Grammar - Error Correction; If Conditional Sentences.

UNIT-IV

CLASSIFICATION AND RECOMMENDATIONS

6

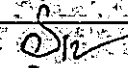
Reading - Newspaper Articles.

Writing - Recommendations, Transcoding, Accident Report, Survey Report

Grammar - Reported Speech, Modals.

Vocabulary - Conjunctions- Use of Prepositions.

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UNIT-V

EXPRESSION

6

Reading - Company Profiles, Statement of Purpose, (SOP), An Excerpt of Interview with Professionals.

Writing - Job / Internship Application – Cover Letter & Resume.

Grammar - Numerical Adjectives, Relative Clauses.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the Course the students will able to

- CO1:** Compare and contrast products and ideas in technical texts.
- CO2:** Identify and report cause and effects in events, industrial processes through technical texts
- CO3:** Analyse problems in order to arrive at feasible solutions and communicate them in the written format
- CO4:** Present their ideas and opinions in a planned and logical manner
- CO5:** Draft effective resumes in the context of job search.

TEXT BOOKS:

1. Department of English, Anna University, "English for Engineers & Technologists" Orient Blackswan Private Ltd, 2020.
2. Dr.Veena Selvam, Dr.Sujatha Priyadarshini, & CO, Department of English, Anna University, "English for Science & Technology" Cambridge University Press, 2021.

REFERENCE BOOKS:

1. Raman, Meenakshi, Sharma & Sangeeta, "Professional English", Oxford University Press, New Delhi, 2019.
2. Dr. V. Chellammal, "Learning to Communicate", Allied Publishers, New Delhi, 2003
3. V.N. Arora and Laxmi Chandra, "Improve Your Writing", Oxford University Press, New Delhi, 2001.

E. RESOURCES:

- <https://learnenglish.britishcouncil.org/>

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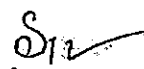
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CO'S-PO'S MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	-	1	-	-	-	-	-	1	2	3	-	2
C02	-	-	-	-	-	-	1	-	3	3	-	3
C03	-	1	1	-	-	-	-	-	3	3	-	3
C04	-	-	-	-	-	-	-	-	2	3	-	2
C05	-	-	-	-	-	-	-	-	2	3	-	2
AVG	-	1	1	-	-	-	1	1	2	3	-	2

1. Low, 2- Medium, 3-High, "-" No Correlation


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23MAT21

NUMERICAL METHODS AND STATISTICS

L T P C

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

3 1 0 4

COURSE OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations
- To introduce the numerical techniques of interpolation in various intervals and differentiation and integration in engineering and technology
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of engineering and statistical quality control

UNIT-I

SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

9+3

Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method- Solution of linear system of equations - Gauss elimination method - Pivoting-Gauss Jordan method - Iterative methods of Gauss Jacobi and Gauss Seidel - Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT-II

**INTERPOLATION, NUMERICAL DIFFERENTIATION AND
NUMERICAL INTEGRATION**

9+3

Lagrange's and Newton's divided difference interpolations - Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules

UNIT-III

**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL
EQUATIONS**

9+3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

UNIT-IV

TESTING OF HYPOTHESIS

9+3

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) - Tests for single variance and equality of variances - Chi square test for goodness of fit - Independence of attributes

UNIT-V

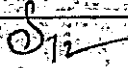
DESIGN OF EXPERIMENTS

9+3

One way and two way classifications - Completely randomized design - Randomized block design - Latin square design - 2^2 factorial design.

TOTAL: 60 PERIODS

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COURSE OUTCOMES:

At the end of the Course the students will be able to

- CO1 :** Apply the numerical techniques of interpolation in various intervals and differentiation and integration for engineering problems
- CO2 :** Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations
- CO3 :** Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications
- CO4 :** Apply the concept of testing of hypothesis for small and large samples in real life problems
- CO5 :** Apply the basic concepts of classifications of design of experiments in the field of agriculture

TEXT BOOKS:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2023
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2019

REFERENCE BOOKS:

1. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020
2. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016
3. Devore, J.L., "Probability and Statistics for Engineering and the Sciences", Cengage
4. Learning, New Delhi, 8th Edition, 2014
- 5 Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, India, 2022

CO's - PO's MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	-	-	-	2	-	2	3
CO2	3	3	1	1	1	-	-	-	2	-	2	2
CO3	3	3	1	1	1	-	-	-	2	-	2	3
CO4	3	3	1	1	1	-	-	-	2	-	2	3
CO5	3	2	1	1	1	-	-	-	2	-	3	3
AVG	3	3	1	1	1	-	-	-	2	-	2	3

1- Low, 2- Medium, 3-High, "-" No Correlation

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23PHT23

PHYSICS FOR ELECTRONICS ENGINEERING
(for B.E. / B.TECH - ECE, EEE and PT)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the electrical properties of materials
- To instill knowledge on physics of semiconductors, determination of charge carriers and device applications
- To understand the theory and applications of dielectric materials
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
- To provide the students a sound platform towards learning about new engineering materials and their applications

UNIT-I

ELECTRICAL PROPERTIES OF MATERIALS

9

Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, expression - Wiedemann-Franz law - Success and failures - electrons in metals - Fermi- Dirac statistics - Density of energy states - Electron in periodic potential - Energy bands in solids.

UNIT-II

SEMICONDUCTING MATERIALS

9

Intrinsic Semiconductors - Energy band diagram - direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors - extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors - variation of Fermi level with temperature and impurity concentration -Hall effect and devices - Ohmic contacts - Schottky diode.

UNIT-III

DIELECTRIC MATERIALS

9

Dielectrics - Dielectric constant - Polarization - Displacement vector - Electric susceptibility - Types of polarization mechanisms: Electronic, ionic, orientational and space-charge - Frequency and temperature dependence - Internal field - Clausius-Mosotti relation - Dielectric loss - Dielectric breakdown - Ferroelectric materials.

UNIT-IV

OPTICAL PROPERTIES OF MATERIALS

9

Classification of optical materials - Optical processes in semiconductors: optical absorption and emission, charge injection and recombination, optical absorption, loss and gain - Optoelectronic devices: light detectors and solar cells - light emitting diode - laser diode - OLED

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UNIT-V

NEW ENGINEERING MATERIALS

9

Ceramics – types and applications – Composites: classification, role of matrix and reinforcement – processing of fibre reinforced plastics and fibre reinforced metals – Metallic glasses: Properties, preparation and applications – Shape memory alloys: Characteristics and applications – Carbon nanotubes: Properties and applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Gain knowledge on the electrical properties of materials and their applications
- CO2:** Understand clearly of semiconductor physics and functioning of semiconductor devices
- CO3:** Get knowledge on theories and applications of dielectric materials
- CO4:** Understand the optical properties of materials and working principles of various optical devices
- CO5:** The students will understand the basics of ceramics, composites and nanomaterials

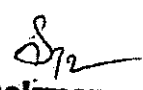
TEXT BOOKS:

1. S.O. Kasap, "Principles of Electronic Materials and Devices", McGraw Hill Education (Indian Edition), 2020.
2. R.Balasubramaniam, Callister's Materials Science and Engineering. Wiley (Indian Edition), 2020.

REFERENCE BOOKS:

1. Laszlo Solymar, Walsh, Donald, Syms and R.A. Richard, "Electrical Properties of Materials", Oxford Univ. Press (Indian Edition) 2015.
2. Jasprit Singh, "Semiconductor Optoelectronics: Physics and Technology", McGraw-Hill Education (Indian Edition), 2019.
3. Charles Kittel, "Introduction to Solid State Physics", Wiley India Edition, 2022.

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CO's -PO's MAPPING:

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	2	1	-	-	-	-	-	-	-	-	-
C02	3	2	1	-	-	-	-	-	-	-	-	-
C03	3	2	1	-	-	-	-	-	-	-	-	-
C04	3	2	1	-	-	-	-	-	-	-	-	-
C05	3	1	1	-	-	-	-	-	-	-	-	-
AVG	3	2	1	-	-	-	-	-	-	-	-	-

1- Low, 2- Medium, 3-High, "-" No Correlation

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23EET22	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
	(For B.E./B.Tech- CIVIL, CSE, MECH, AI&DS, BME, IT, Pharm.Tech branches)	3	0	0	3

COURSE OBJECTIVES:

- To learn the basic concepts of electric circuits and analysis.
- To analyze the magnetic circuits and domestic wiring.
- To understand the basics of working principles and application of electrical machines.
- To impart knowledge about analog devices and their characteristics.
- To educate on the fundamental concepts of digital electronics.

UNIT-I	ELECTRIC CIRCUITS	10
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Basic components of electric circuits, Charge, Current, Voltage and Power, Voltage and current sources, Ohm's law, Kirchhoff's laws, Series and parallel connected independent sources, Resistors in series and parallel, Voltage division and current division rule, Mesh current and node voltage methods of analysis-DC Circuits.

UNIT-II	MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS	10
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Magnetic circuits-definitions-MMF, flux, reluctance, Magnetic field intensity, Flux density, Fringing, Self and Mutual inductances-simple problems. Domestic wiring, Wires and Cables - types, Earthing, Protective devices, Switch fuse unit, Safety precautions and First Aid.

UNIT-III	ELECTRICAL MACHINES	10
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Construction and working principle- DC generators, EMF equation, Types and applications. Working principle of DC motors, Types and applications. Construction, Working principle and applications of 1 ϕ Transformer, Three phase alternator, Three phase induction motor and Synchronous motor.

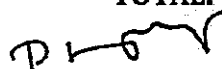
UNIT-IV	ANALOG ELECTRONICS	8
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Resistor, Inductor and Capacitor in electronic circuits, PN Junction diodes, Rectifier, Zener diode-Characteristics-Applications, Construction and characteristics of bipolar junction transistor-Biasing, JFET, MOSFET, IGBT, SCR, Amplifier -Applications.

UNIT-V	DIGITAL ELECTRONICS	7
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Review of number systems, Binary codes, Error detection and correction codes, Combinational logic Circuits, Representation of logic functions-SOP and POS forms, K-map representations, Minimization using K maps - Simple Problems.

TOTAL: 45 PERIODS


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COURSE OUTCOME

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

- CO1** Explain circuit's behavior using circuit laws and analyze the mesh analysis and nodal analysis.
- CO2** Analyze the Magnetic circuits, earthing and wiring.
- CO3** Understand the working principle and applications of electrical machines.
- CO4** Analyze the characteristics of analog electronic devices.
- CO5** Explain the basic concepts of digital electronics.

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020.
2. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019.
3. James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley, 2018.
4. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

REFERENCE BOOKS:

1. Muhammad H.Rashid, "Spice for Circuits and electronics", 4th Edition, Cengage India, 2019.
2. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
3. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
4. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010.

E-RESOURCES:

1. NPTEL-Online Courses and Video lectures: <https://nptel.ac.in/>

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	2	1	1	-	-	-	-	-	1	-	-	3	2	1
CO2	3	3	2	2	-	-	-	-	-	1	-	-	3	3	2
CO3	3	3	3	3	-	-	-	-	-	1	-	-	3	3	3
CO4	3	3	3	3	-	-	-	-	-	1	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	1	-	-	3	3	3
AVG	3	3	2	2	-	-	-	-	-	1	-	-	3	3	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

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BoS/EEE

23MET21

ENGINEERING GRAPHICS
(Common to: B.E./B.Tech. all Branches)

L	T	P	C
2	0	4	4

Course Objectives:

The main learning objective of this course is to prepare the students for:

- Drawing engineering curves.
- Drawing projection of points, lines and plane surface.
- Drawing projection of solids and freehand sketching.
- Drawing of sectioned solids and development of surfaces
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT-I PLANE CURVES

5+12

Basic Geometrical constructions, Curves used in engineering practices: Conics — 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 above curves.

UNIT-II PROJECTION OF POINTS, LINES AND PLANE SURFACE

6+12

Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT-III PROJECTION OF SOLIDS AND FREEHAND SKETCHING

6+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Orthographic projection- Freehand sketching of multiple views from pictorial views of objects.

UNIT-IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

7+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

UNIT-V ISOMETRIC AND PERSPECTIVE PROJECTIONS

6+12

Principles of isometric projection — isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL : 90 PERIODS

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

COURSE OUTCOMES:

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

- CO1:** Construct the conic curves, involutes and cycloid
- CO2:** Solve practical problems involving projection of lines, Planes.
- CO3:** Draw Projection of solids and can draw freehand sketch.
- CO4:** Draw projection of sectioned solids and development of surfaces
- CO5:** Draw the isometric and perspective projections.

TEXT BOOKS:

1. K Venugopal, Engineering Drawing and Graphics, Sixth edition, New Age International, 2013.
2. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.

REFERENCE BOOKS:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.

E-RESOURCES:

1. <https://archive.nptel.ac.in/courses/112/102/112102304/>
2. https://onlinecourses.nptel.ac.in/noc20_me79/preview
3. <https://www.youtube.com/watch?v=ANEvQyt3PnU>

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	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO2	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO3	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO4	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO5	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

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23TAT21

TAMILS AND TECHNOLOGY
(Common to B.E./B.Tech. all branches)

L T P C
1 0 0 1

COURSE OBJECTIVES:

- To understand about weaving and ceramic technology of Tamils
- To compare the design and constructive technology of Cheras, Cholas, Pallavas and Nayakkars
- To gain knowledge in various manufacturing technology of Tamils
- To analyse the agriculture and fishery knowledge of Tamils
- To learn about scientific Tamil and its usage in online platforms

UNIT-I

WEAVING AND CERAMIC TECHNOLOGY

3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT-II

DESIGN AND CONSTRUCTION TECHNOLOGY

3

Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple)-Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.

UNIT-III

MANUFACTURING TECHNOLOGY

3

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making-industries Stone beads – Glass beads – Terracotta beads – Shell beads/ bone beads – Archeological evidences – Gem stone types described in Silappathikaram.

UNIT-IV

**AGRICULTURE AND
IRRIGATION TECHNOLOGY**

3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoombu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society

UNIT-V

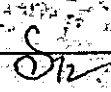
SCIENTIFIC TAMIL & TAMIL COMPUTING

3

Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL: 15 PERIODS

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COURSE OUTCOMES:

At the end of the course the student will be able to

- CO1:** Relate the weaving ceramic technology of Tamils
- CO2:** Understand the knowledge of Tamils in design and construction technology
- CO3:** Recognize the manufacturing technology knowledge of Tamils
- CO4:** Criticize the agriculture and isherly knowledge of Tamils
- CO5:** Apply scienti ic Tamil in Various online platforms

E- RESOURCES:

1. <https://www.tamilvu.org/>
2. <https://sorkuvai.com/>

CO's-PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	1	1	1	1	1	-	1
CO2	2	-	-	-	-	2	2	2	2	2	-	2
CO3	2	-	-	-	-	2	2	2	2	2	-	2
CO4	1	-	-	-	-	1	1	1	1	1	-	1
CO5	2	-	-	-	-	2	2	2	2	2	-	2
AVG	2	-	-	-	-	2	2	2	2	2	-	2

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23TAT21

தமிழரும் தொழில்நுட்பமும்

L T P C
1 0 0 1

(B.E./B.Tech- அனைத்து பாடப்பிரிவுகளுக்கும் பொதுவானது)

பாடநெறி நோக்கங்கள்:

- > நெசவு மற்றும் பாணைத்தொழில்நுட்பத்தைப் புரிந்து கொள்ளுதல்
- > சேர், சோழ, பல்லவ மற்றும் நாயக்கர்களின் வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பத்தை ஒப்பிடுதல்
- > தமிழர்களின் பல்வேறு உற்பத்தி தொழில்நுட்பத்தைப் பற்றிய அறிவைப் பெறுதல்
- > தமிழர்களின் வேளாண்மை மற்றும் கடல்சார் அறிவைப் பெற்றுக்கொள்ளுதல்
- > அறிவியல் தமிழையும் அதன் இணையப்பயன்பாட்டையும் கற்றல்

அலகு - I

நெசவு மற்றும் கட்டிடத் தொழில்நுட்பம்

3

சங்க காலத்தில் நெசவுத்தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்சங்க காலத்தில் நெசவுத்தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்

அலகு - II

வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்

3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமானப்பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரம் சிற்பங்களும் கோவில்களும் - சோழர் காலத்து பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை

அலகு - III

உற்பத்தித் தொழில்நுட்பம்

3

கப்பல் காட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்

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அலகு - IV

வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம்

3

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுதித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்

அலகு - V

அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்

3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்

மொத்தம்: 15 பாடவேளைகள்

பாடநெறி முடிவுகள்:

இப்பாடத்தைப் படிப்பதின் முடிவில் மாணவர்கள்

- CO1: நெசவு மற்றும் பாளைத்தொழில்நுட்பத்தை பற்றிப் புரிந்துகொள்வார்கள்
- CO2: வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பத்தில் தமிழர்களின் அறிவைப் பெறுவார்கள்
- CO3: தமிழர்களின் உற்பத்தி தொழில்நுட்பத்தை கண்டறிவார்கள்
- CO4: தமிழர்களின் வேளாண்மை மற்றும் கடல்சார் அறிவைக் குறித்து விவாதிப்பார்கள்.
- CO5: பல்வேறு இணையப் பயன்பாடுகளில் அறிவியல் தமிழைப் பயன்படுத்திப்பார்ப்பார்கள்

மின் -ஆதாரங்கள்:

1. <https://www.tamilvu.org/>
2. <https://sorkuvai.com/>

CO's -PO's விவரணையாக்கம்:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	1	1	1	1	1	-	1
CO2	2	-	-	-	-	2	2	2	2	2	-	2
CO3	2	-	-	-	-	2	2	2	2	2	-	2
CO4	1	-	-	-	-	1	1	1	1	1	-	1
CO5	2	-	-	-	-	2	2	2	2	2	-	2
AVG	2	-	-	-	-	2	2	2	2	2	-	2

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Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

23MEL21

ENGINEERING PRACTICES LABORATORY
(Common to: B.E./B.Tech. all Branches)

L T P C
0 0 4 2

Course Objectives:

- Acquire skills in operating hand tools and instruments. Provide hands on training on common household plumbing work and wood work
- Provide hands on training on welding processes.
- Provide hands on training on various simple machining processes. Making a tray out of metal sheet using sheet metal work.
- Wiring various electrical joints in common household electrical wire network.
- Soldering and testing simple electronic circuits. Assembling and testing simple electronic components on PCB.

GROUP - A (CIVIL & MECHANICAL)

I) CIVIL ENGINEERING PRACTICES

(12)

PLUMBING WORK:

Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components – External thread cutting

WOOD WORK:

Hands-on-exercise: Sawing, Planing and Making joints

II) MECHANICAL ENGINEERING PRACTICES

(18)

WELDING WORK:

Fabrication of Models with MS Plate using Arc Welding

BASIC MACHINING WORK:

- a) Simple Turning
- b) Drilling and Tapping Practice

SHEET METAL WORK:

Model making – Trays and funnels

ASSEMBLING AND DISMANTLING WORK:

Assembling a centrifugal pump

GROUP B (ELECTRICAL & ELECTRONICS)

III) ELECTRICAL ENGINEERING PRACTICES

(15)

- a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
- b) Staircase wiring
- c) Fluorescent Lamp wiring with introduction to CFL and LED types.
- d) Energy meter wiring and related calculations/ calibration
- e) Study of Iron Box wiring and assembly
- f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
- g) Study of emergency lamp wiring/Water heater

IV) ELECTRONIC ENGINEERING PRACTICES

(15)

SOLDERING WORK:

Soldering simple electronic circuits and checking continuity

ELECTRONIC ASSEMBLY AND TESTING WORK:

Assembling and testing electronic components on a small PCB

ELECTRONIC EQUIPMENT STUDY:

- Study elements of smart phone
- Assembly and dismantle of LED TV
- Assembly and dismantle of computer/ laptop

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Make a wooden model using carpentry Process.
- Make various shapes using welding processes.
- Make various shapes using manufacturing processes like machining and sheet metal work.
- Wires various electrical joints in common household electrical wire network.
- Solder and test simple electronic circuits. Assemble and test simple electronic components on PCB.

REFERENCE:

- Manual prepared by the faculty of Civil, Mechanical, Electrical and Electronics and Communication Engineering Department, SVHEC.

E-RESOURCES:

- <https://www.youtube.com/watch?v=GPnQjCrb83Y>
- <https://www.youtube.com/watch?v=njwdsMI3PcY>

CO's - PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	-	-	3	-	-	-	-	-	-	-	-	2	1	1
C02	3	-	-	3	-	-	-	-	-	-	-	-	2	1	1
C03	3	-	-	3	-	-	-	-	-	-	-	-	2	1	1
C04	3	-	-	3	-	-	-	-	-	-	-	-	2	1	1
C05	3	-	-	3	-	-	-	-	-	-	-	-	2	1	1
Avg	3	-	-	3	-	-	-	-	-	-	-	-	2	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

23EEL22

**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
LABORATORY**

L T P C
0 0 4 2

(for B.E./B.Tech- CIVIL, MECH, Pharm.Tech branches)

COURSE OBJECTIVES:

- To train the students in conducting load tests on electrical machines.
- To gain practical experience in characterizing electronic devices.
- To train the students to use DSO for measurements.

LIST OF EXPERIMENTS

1. Verification of ohms and Kirchhoff's Laws.
2. Speed control of DC Shunt Motor.
3. Load test on Self Excited DC Shunt Generator.
4. Load test on Single phase Transformer.
5. Load Test on 1Ø Induction Motor.
6. Characteristics of PN and Zener Diodes.
7. Characteristics of BJT and MOSFET.
8. Characteristics of SCR.
9. Half wave and Full Wave rectifiers.
10. Implementation of Binary Adder and Subtractor.
11. Study of Logic Gates.
12. Study of DSO.

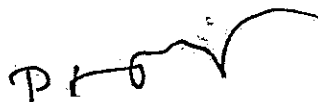
TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of this course the students will be able to

- C01** Verify the Ohm's and Kirchhoff's Laws.
- C02** Analyze experimentally the load characteristics of electrical machines.
- C03** Analyze the characteristics of basic electrical devices.
- C04** Use DSO to measure the various parameters.
- C05** Analyze the characteristics of basic electronic devices.

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REFERENCE BOOKS:

1. SVHEC- Basic Electrical and Electronics Engineering Laboratory Manual.

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	2	1	1	-	-	-	2	-	-	-	3	3	-
CO2	3	3	2	1	1	-	-	-	2	-	-	-	3	3	-
CO3	3	3	2	1	1	-	-	-	2	-	-	-	3	1	-
CO4	3	3	2	1	1	-	-	-	2	-	-	-	3	1	-
CO5	3	3	2	1	1	-	-	-	2	-	-	-	3	1	-
AVG	3	3	2	1	1	-	-	-	2	-	-	-	3	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

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BoS / EEE

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

23ENL21

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

L T P C
0 0 4 2

COURSE OBJECTIVES:

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context

UNIT-I

MAKING COMPARISONS

12

Speaking - Role Play Exercises Based on Workplace Contexts- Talking about Competition- Discussing Progress toward Goals- Talking about Experiences- Talking about Events in Life- Discussing Past Events.

Writing - Writing Emails (Formal & Semi-Formal)

UNIT-II

**EXPRESSING CAUSAL RELATIONS IN SPEAKING AND
- WRITING**

12

Speaking - Discussing News Stories – Talking about Frequency- Talking about Travel Problems- Discussing Travel Procedures- Talking about Travel Problems- Making Arrangements- Describing Arrangements- Arrangements Discussing Plans and Decisions- Discussing Purposes and Reasons- Understanding Common Technology Terms.

Writing - Writing Different Types of Emails.

UNIT-III

PROBLEM SOLVING

12

Speaking - Discussing Predictions- Describing the Climate- Discussing Forecasts and Scenarios- Talking about Purchasing- Discussing Advantages and Disadvantages- Making Comparisons- Discussing Likes and Dislikes- Discussing Feelings about Experiences- Discussing Imaginary Scenarios.

Writing - Short Essays and Reports- Formal/Semi-Formal letters.

UNIT-IV

CLASSIFICATION AND RECOMMENDATIONS

12

Speaking - Discussing the Natural Environment- Describing Systems- Describing Position and Movement Explaining Rules (Example- Discussing Rental Arrangements)- Understanding Technical Instructions.

Writing - Writing Instructions - Writing a Short Article.

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UNIT-V

EXPRESSION

12

Reading - Describing Things Relatively-Describing Clothing-Discussing Safety Issues (Making Recommendations) Talking about Electrical Devices-Describing Controlling Actions.

Writing - Job Application (Cover Letter + Curriculum Vitae) – Writing Recommendations.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the Course the students will able to

- CO1:** Speak effectively in group discussions held in a formal/semi formal contexts
- CO2:** Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions
- CO3:** Create emails, letters and effective job applications with resume.
- CO4:** Write critical reports to convey data and information with clarity and precision
- CO5:** Deliver suitable instructions and recommendations for safe execution of tasks

E-RESOURCES:

- <https://www.englishclub.com/speaking/>
- <https://learnenglish.britishcouncil.org/>

CO's-PO's MAPPING :

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	2	-	-	-	-	-	3	3	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	2
CO4	-	-	-	-	-	-	-	-	3	3	-	3
CO5	-	-	1	-	-	-	-	1	3	3	-	2
AVG	-	-	2	-	-	-	-	1	3	3	-	3

1- Low, 2- Medium, 3-High, "-" No Correlation

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

23MDC21

YOGA FOR HUMAN EXCELLENCE
(Common to B.E./B.Tech. all Branches)

L T P C
0 0 1 0

UNIT-I

SIMPLIFIED PHYSICAL EXERCISES

3

Physical exercises: Hand exercises – Leg exercises. Breathing exercises: Eye exercises – Kapalabathi. Makarasana. Body massages: Acupressure – Relaxation.

UNIT-II

KAYA KALPA

3

Kaya Kalpa Exercise – Aswini Mudra – Moola Bandha – Ojas Breath (Kayakalpa Exercise should be learnt directly from the World Community Service Centre.)

UNIT-III

MEDITATION

3

Agna. Santhi : Clearence. Thuriya. Thuriyatheetham meditation

UNIT-IV

HUMAN RESOURCES DEVELOPMENT

3

Eradication of worries – Bene its of Blessings – Greatness of Friendship – Neutralization of anger - Individual peace and world peace

UNIT-V

YOGASANAS

3

Suriya Namaskar, Padmasana, Vajrasana, Sukasana, Chakrasana (side posture), Viruchasana, Bhujangasana, Yoga mudra, Ustrasana, Maha Mudra, Vakkarasana.

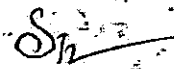
TOTAL : 15 PERIODS

TEXT BOOKS:

1. Yoga Practices – I: VISION, Vethathiri Publications.
2. Yogasana – Vethathiri Publications

REFERENCE BOOKS:

1. Simplified Physical Exercises – Vethathiri Publications.
2. Sound health through yoga – Dr. K. Chandrasekaran.


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23MAT34

MATHEMATICS-III
(for B.Tech. PT)

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations
- 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 transform techniques used in wide variety of situations
- To introduce the basic concepts of Laplace transform and inverse transform in Engineering disciplines.

UNIT-I **PARTIAL DIFFERENTIAL EQUATIONS** **9+3**

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

UNIT-II **APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS** **9+3**

Classification of PDE - Method of separation of variables - Fourier series solutions of one- dimensional wave equation - One dimensional equation of heat conduction

UNIT-III **FOURIER SERIES** **9+3**

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-IV **FOURIER TRANSFORMS** **9+3**

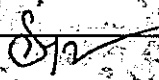
Statement of Fourier integral theorem- Fourier transform pair - Fourier sine and cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity

UNIT-V **LAPLACE TRANSFORMS** **9+3**

Existence conditions-Transforms of elementary functions-Transform of unit step function and unit impulse function-Basic properties-Shifting theorems-Transforms of derivatives and integrals-Initial and final value theorems-Inverse transforms-Convolution theorem-Transform of periodic functions-solution of linear second order ordinary differential equations with constant coefficients

TOTAL : 60 PERIODS

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COURSE OUTCOMES:

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

- CO1:** Understand how to solve the given standard partial differential equations.
- CO2:** Appreciate the physical significance of Fourier series techniques in solving one- and two- dimensional heat flow problems and one-dimensional wave equations
- CO3:** Solve differential equations using Fourier series analysis which plays a vital role in engineering applications
- CO4:** 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
- CO5:** Understand the Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2023.
2. Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2023.

REFERENCE BOOKS:

1. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2021.
2. James. Glyn., "Advanced Modern Engineering Mathematics", 5th Edition, Pearson Education, New Delhi, 2018.
3. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
4. Wylie. R.C. and Barrett. L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc24_ma37/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma20/preview

CO's - PO's MAPPING:

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

1 - low, 2 - medium, 3 - high, - - no correlation

SVHEC-R2023

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BoS/S&H

23PTT31

CHEMICAL PROCESS CALCULATIONS

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:

- 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.

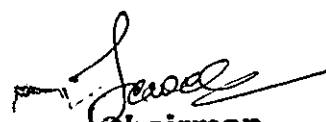
UNIT-V

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 ΔH_R at standard and elevated temperatures, Theoretical flame temperature and adiabatic flame temperature. Process flow diagram/chart for material and energy balances.

TOTAL : 45 PERIODS


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COURSE OUTCOMES:

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

- C01 :** Have a clear idea of various types of unit systems and students will be able to convert units from one form to another.
- C02 :** Comprehend the different gas laws, and students would be able to solve the problems on stoichiometry quantity of gaseous substances in industry
- C03 :** Know the various measurements of humidity and clear about applying humidity charts, psychometric charts, and concepts of vaporization and vapor pressure laws
- C04 :** Analyze the behaviour of recycle processes, performing approximate material balances by hand and setting up calculations for rigorous solution by computer.
- C05 :** Attain the energy balance concepts necessary for solution of energy balance of different chemical engineering processes in industries and Independently develop a stoichiometry problem solving ability in a number of useful mathematical and chemical operations.

TEXT BOOKS:

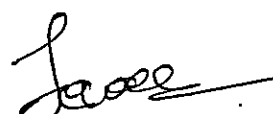
1. Narayanan, K.V. and Lakshmikutty, B. "Stoichiometry and Process Calculations", 2nd Edition. PHI Learning Pvt. Ltd., 2017
2. Himmelblau, D. M. and Riggs, B. J. "Basic Principles and Calculations in Chemical Engineering", 8th Edition, Prentice Hall International series, 2015.

REFERENCE BOOKS:

1. Venkataramani, V., Anantharaman, N. and Meera Sheriffa Begum K. M. "Process Calculations", 2nd ed. PHI Learning Pvt. Ltd., 2011
2. 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.
3. Sikdar, C.D., "Chemical Process Calculations", PHI Learning Pvt. Ltd., 2013.

E-RESOURCES:

1. <https://archive.nptel.ac.in/courses/103/103/103103165/>
2. <https://archive.nptel.ac.in/courses/103/105/103105209/>

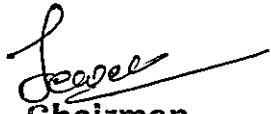

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Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	3	-	-	-	3	2	-	2	-	-	2	-	-	-	-
C02	3	3	-	-	-	2	2	-	2	-	-	-	-	-	3	-
C03	3	3	-	2	3	2	-	-	2	-	-	-	-	-	3	2
C04	3	3	-	3	3	2	3	-	-	-	-	-	-	-	3	2
C05	3	3	-	2	3	-	3	-	2	-	-	-	-	-	3	2

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTT32

MICROBIOLOGY

L	T	P	C
3	0	0	3

COURSE 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

MICROBIAL FORMS AND MULTIPLICATION

9

Structural organization and multiplication of bacteria, viruses, algae and fungi, with special mention of life cycle 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.

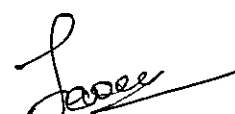
UNIT-V

INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY

9

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

TOTAL : 45 PERIODS


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COURSE OUTCOMES:

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

- CO1 :** Microorganisms and examination of microorganisms
CO2 : Structural organization of microorganisms
CO3 : Nutritional requirements of microorganisms, their growth and metabolism
CO4 : Control of microorganisms
CO5 : Metabolites, bioremediation, biofertilizers, biopesticides and biosensors

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.

REFERENCE BOOKS:

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.

E-RESOURCES:

1. <https://archive.nptel.ac.in/courses/102/103/102103015/>
2. <https://dth.ac.in/medical/courses/Microbiology/block-1/1/index.php>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	3	3	2	3	2	2	3	2	2	3	2	2	3	3	2	2
CO3	2	3	2	3	3	2	3	2	2	3	2	2	3	2	3	3
CO4	2	3	3	3	3	2	2	2	2	2	3	3	3	2	3	2
CO5	2	3	2	3	3	2	2	-	2	-	2	2	3	3	3	2

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTT33

PHARMACEUTICAL CHEMISTRY

L T P C

3 0 0 3

COURSE 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

CHEMISTRY OF ALIPHATIC, AROMATIC 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, Anti-Markownikoff's orientation - Huckel's rule - Electrophilic aromatic substitution reaction.

UNIT-II

HETEROCYCLIC COMPOUNDS

9

Introduction to methods of synthesis - Pharmaceutical compounds - Physical, chemical and biological & AI structures, synthesis, properties and chemical reactions of benzenoid and nonbenzenoid compounds, General principles of heterocyclic synthesis - Methods of preparation and reactions of Pyridines - Pyrroles - Thiophenes - Furans - Quinolines - Isoquinolines.

UNIT-III

STUDY OF ORGANIC REACTIONS AND MOLECULAR REARRANGEMENTS

9

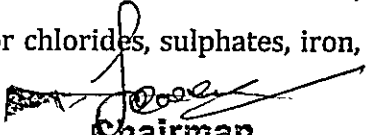
Alder Reaction, Formylation reactions, Gattermann Reaction, Gattermann-Koch reaction, Vilsmeier reaction, Azide-Alkyne Cycloaddition, Catalytic hydrogenation, Meerwein-Ponndorf-Verley, Birch reduction, Clemmenson, Sandmeyer, Haloform reactions, Azo coupling, Beckmann Rearrangement, Benzidine rearrangement.

UNIT-IV

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,


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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-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

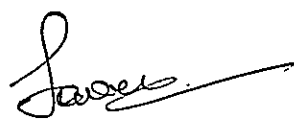
COURSE OUTCOMES:

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

- Identify the relationship between structure and physical properties pharmaceutical substances and make predictions of chemical bonding along with their reaction mechanism
- C01:**
- Draw the structures and outline the synthesis of simple pharmaceutically active organic compounds having five and six membered heterocyclic compounds.
- C02 :**
- Describe the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- C03 :**
- Distinguish between various reaction mechanisms and well acquainted with the synthesis of some important class of drugs.
- C04 :**
- Apply the knowledge in the handling of radiopharmaceuticals and synthesis of new drug molecule with special reference to organic, inorganic and coordination chemistry
- C05 :**

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, 1st Edition, Discovery Publishing House Pvt. Ltd.2011.


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REFERENCE BOOKS:

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.

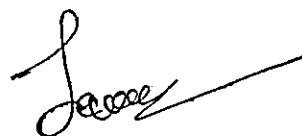
E-RESOURCES:

1. <https://archive.nptel.ac.in/courses/104/106/104106106/>
2. <https://fdspharmacy.in/pharmaceutical-chemistry/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	-	-	-	2	1	-	-	2	-	2	3	-	-	2
CO2	3	2	3	-	-	-	1	-	-	2	-	2	2	-	3	-
CO3	3	3	3	-	-	-	2	-	-	2	-	2	3	-	3	-
CO4	3	1	-	3	-	-	1	-	-	2	-	2	2	-	3	-
CO5	3	1	-	3	-	-	1	-	-	2	-	2	3	-	-	1

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTT34

BIOCHEMISTRY

L	T	P	C
3	0	0	3

COURSE 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 buffers, 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 OTHER BIOMOLECULES 9

Nucleic acids: purines, pyrimidines, nucleoside, nucleotide, RNA, DNA-Watson-Crick structure of DNA, reactions, properties, measurement, nucleoprotein complexes

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

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

UNIT-III METABOLISM CONCEPTS PATHWAYS 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 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

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COURSE OUTCOMES:

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

- CO1:** 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 and Relate the structure of DNA with its function in replication and gene expression.
- CO2:** conditions and Relate the structure of DNA with its function in replication and gene expression.
- CO3:** Illustrate the metabolism of carbohydrates through various anabolic and catabolic pathways.
- CO4:** Understand in detail about structures, types and classifications of amino acid
- CO5:** Correlate biochemical processes with biotechnology application.

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., et al., "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.

REFERENCE BOOKS:

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

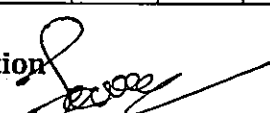
E-RESOURCES:

- <https://archive.nptel.ac.in/courses/104/105/102105034/>
- <https://archive.nptel.ac.in/courses/104/105/104105102/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	2	2	2	3	2	2	2	3	3	3	3	3	2
CO2	2	2	3	2	2	2	2	2	-	3	2	3	2	2	2	1
CO3	3	3	3	2	3	-	2	1	-	2	1	1	3	3	2	1
CO4	2	3	3	3	2	-	3	-	1	2	1	1	3	3	2	2
CO5	2	3	3	2	3	2	3	2	2	1	2	2	2	2	3	3

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTT35

HUMAN ANATOMY AND PHYSIOLOGY

L	T	P	C
3	0	0	3

COURSE 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
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Composition and functions of blood, Hemopoiesis, blood components, blood groups, clotting factors and mechanism of coagulation, platelets

UNIT-II	CARDIOVASCULAR SYSTEM	9
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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
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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
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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
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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:

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

- CO1 :** Acquire the gross histology, structure and functions of various organs of the human body
- CO2 :** Implement the physiological tests and appreciate the interlinked mechanisms in the maintenance of normal functioning of human body
- CO3 :** Perform basic physiological and pharmacological experiments and to record and interpret the results for its clinical significance
- CO4 :** Demonstrate laboratory procedures used to examine anatomical structures and evaluate physiological functions of each organ system
- CO5 :** Interpret graphs of anatomical and physiological data and apply the methods to evaluate the potency of drugs, toxicity of drugs in animal models


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TEXT BOOKS:

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

REFERENCE BOOKS:

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

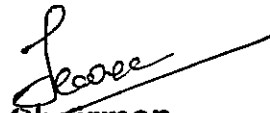
E-RESOURCES:

1. <https://dth.ac.in/medical/course.php>
2. <https://www.skillmd.com/course/anatomy-nptel-video-lessons/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
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CO3	-	3	-	3	2	-	-	-	-	-	-	3	-	-	3	-
CO4	3	3	-	-	-	-	3	-	-	-	-	-	2	3	-	-
CO5	-	-	3	-	2	-	2	-	-	-	-	-	-	-	3	2

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23EST31

ENTREPRENEURSHIP AND STARTUP
(Common to: B.E / B.Tech. all Branches)

L	T	P	C
1	0	0	1

Course Objectives:

The main learning objective of this course is to prepare the students :

- To develop a knowledge on basic concepts of entrepreneurship.
- To know about business opportunities and project evaluation criteria.
- To explore the concept of startups, government schemes and other financial institutions support

UNIT-I

ENTREPRENEURSHIP CONCEPTS

5

Entrepreneurship-Meaning-Origin-Functions-Factors Affecting Entrepreneurial Growth- - Role of Entrepreneurship in Economic Development- Skills required for an Entrepreneur - Barriers to Entrepreneurship - Stages in Entrepreneurial Process.

UNIT-II

PROJECT FORMULATION AND IDENTIFICATION

5

Identification of business opportunities -Project formulation- Project Classification and Identification - Project Objectives - Technical Analysis, Financial Analysis – Environmental Appraisal of Project - EDP Phases - Project Report Preparation.

UNIT-III

START UP OPPORTUNITIES AND FINANCE

5

The New Industrial Revolution- Business Start-up - Rise of the startup Economy- Government Initiatives - Government schemes and incentives - Institutional service to entrepreneur - Sources of Finance.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

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

- CO1:** Enhanced the knowledge of entrepreneurship qualities and skills to startup a business.
- CO2:** Understand the project classification and prepare a feasibility report.
- CO3:** Provide vision for the own Start-up and its importance for economic development.

TEXT BOOKS:

1. Gupta C.B and Srinivasan N.P- Entrepreneurial development-Sultan Chand and Sons- Latest edition.
2. Khanka S.S.-Entrepreneurial Development-S.Chand& Co, RamNagar, New Delhi, Latest edition.

REFERENCE BOOKS:

1. Vasant Desai-Project Management and Entrepreneurship-Himalaya Publishing House,2023
2. P.Narayana Reddy – Entrepreneurship Text and Cases- cengage learning.2022.
3. Prasanna Chandra- Projects planning, analysis, selection, implementation and review Tata McGraw-Hill Publishing Co, Latest edition.
4. Donald F.Kuratko- Entrepreneurship theory, process & practice-9th Edition-Cengage Learning,2022.

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E-RESOURCES:

1. http://nptel.ac.in/courses/122106032/Pdf/7_2.pdf, "Business Plan", Dr.T. J.Kamalanabhan, Indian Institute of Technology Madras.
2. <http://www.nptel.ac.in/syllabus/110104049/>, "Entrepreneurial Finance", Dr. B.V. Phani, IIT Kanpur.
3. http://nptel.ac.in/noc20_mg35/ Entrepreneurship and Start up

CO, PO & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	1	-	-	-	-	-	-	-	3	2	2
CO2	2	3	1	3	-	-	-	-	-	-	-	-	2	1	2
CO3	1	-	3	2	2	-	-	-	-	-	-	-	1	3	2
Avg	2	2	2	1.6	1	-	-	-	-	-	-	-	2	2	2

1-low, 2-medium, 3- high, '-'-no correction

23PTL31

MICROBIOLOGY LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To practically demonstrate various experimental techniques to identify the morphology, culture characteristics, propagation and control of microbes and industrial applications of microbes

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

COURSE OUTCOMES:

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

- C01:** Understand the advanced technical information pertaining to laboratory bio-safety and preventive measures from pathogenic microorganism
- C02:** Develop the minimum skills to work on several important techniques using equipment for the study of microorganisms. Microscopically examine living microorganisms
- C03:** Familiar with the types of laboratory equipment and culture media needed to develop and maintain pure cultures
- C04:** Carry out the technique for aseptic removal and transfer of microorganisms for subculturing
- C05:** Determine the cultural characteristics of microorganisms as an aid in identifying and classifying organisms into taxonomic groups

REFERENCE BOOK:

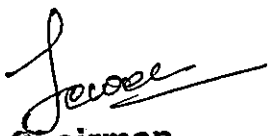
- 1. SVHEC - Microbiology Laboratory Manual


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jCO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	-	-	-	2	-	2	-	-	-	-	-	-	-	3	2
C02	-	3	-	3	2	3	-	-	-	-	-	-	-	3	2	-
C03	-	-	3	3	2	-	1	-	-	-	-	-	2	-	-	-
C04	3	3	-	-	-	-	2	-	-	2	-	-	-	3	-	-
C05	-	-	3	3	-	-	2	-	-	2	-	2	-	-	3	-

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTL32

BIOCHEMISTRY AND PHYSIOLOGY LABORATORY

L	T	P	C
0	0	3	1.5

COURSE 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 (reducing & non-reducing, keto/aldo sugars) and Quantitative (benedict's) analysis of carbohydrates.
2. Quantitative method for amino acid estimation using ninhydrin–distinguishing amino from imino acid.
3. Protein estimation by Lowry's method, Bradford methods.
4. Extraction of lipids and analysis by TLC.
5. Enzymatic assay (amylase/phosphatase, Glucose (GOD-POD)).
6. Estimation of chloride, glucose, ammonia and creatinine in urine.

PHYSIOLOGY

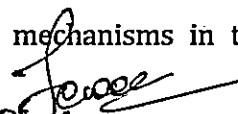
1. Demo of physiology models (axial skeleton, appendicular skeleton, cardiovascular system, respiratory system, digestive system, urinary system, nervous system, special senses, reproductive system)
2. Determination of bleeding, clotting time and blood group determination.
3. Enumeration of RBC & WBC.
4. Estimation of Haemoglobin
5. Determination of Erythrocyte Sedimentation Rate
6. Observation of osmotic fragility of RBCs
7. Determination of packed cell volume and calculation of blood indices
8. Heart rate, blood pressure and ECG recording.
9. Preparation of physiological solution: Ringers' solution, Tyrode solution, Krebs solution, Normal saline.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Apply basic principles of chemistry to biological systems and molecular biology
- CO2 :** Correlate molecular structure and interactions present in proteins, nucleic acids, carbohydrates and lipids
- CO3 :** Perform procedure to characterize the biomolecules using microscopy
- CO4 :** Understand the gross histology, structure and functions of various organs of the human body.
- CO5 :** Implement the physiological tests and appreciate the interlinked mechanisms in the maintenance of normal functioning of human body


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REFERENCE BOOK:

1. SVHEC - Biochemistry and Physiology Laboratory Manual.

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	-	-	-	-	-	-	-	-	-	-	-	3	3	-	2	-
C02	3	2	-	3	-	-	2	-	-	-	-	-	-	3	2	-
C03	3	-	-	3	3	-	-	1	-	-	-	-	-	-	3	-
C04	3	-	-	-	3	-	3	-	-	-	-	-	2	3	-	-
C05	3	2	-	3	2	-	-	-	-	2	-	-	-	-	3	2

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTT41	APPLIED CHEMICAL ENGINEERING THERMODYNAMICS	L	T	P	C
		2	1	0	3

COURSE 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, standard states 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 equilibria in single and multicomponent 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:

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

- CO1 :** Understand the basic concepts, laws and different process related to chemical engineering thermodynamics.
- CO2 :** Identify the laws related to chemical engineering thermodynamics, thermodynamic principles, flow process and its thermodynamic application
- CO3 :** Understand the thermodynamic potential, its correlation and analyze and distinguish between ideal and non-ideal solution
- CO4 :** Understand and demonstrate the activity coefficient and activity property of solution
Demonstrate the Chemical and phase equilibria equations and
- CO5 :** Understand the interrelationships between different thermodynamic properties and become familiar with the Thermodynamic plots

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TEXT BOOKS:

1. Sonntag, Borgnakke, Van Wylen, Fundamentals of Thermodynamics, 7th Edition, Wiley India, 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

REFERENCE BOOKS:

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).

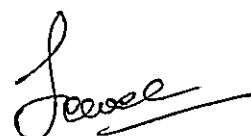
E-RESOURCES:

1. <https://archive.nptel.ac.in/courses/103/103/103103144/>
2. <https://archive.nptel.ac.in/courses/103/103/103103162/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	-	-	-	-	-	-	1	-	-	2	-	-	3	2
CO2	-	3	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	3	2	2	-	-	1	2	-	-	-	3	-	-
CO4	-	3	-	-	3	-	-	-	2	1	-	-	-	3	-	-
CO5	3	-	3	2	-	1	-	-	-	-	-	-	3	-	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation



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23PTT42

FLUID MECHANICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

UNIT-I

FLUID STATICS

9

Introduction: Fluid Properties - Density, Viscosity, Specific gravity, Surface Tension etc. Fluid and Flow Classification – Fluid Statics – Basic Equation Pressure and its Measurement Mano Meter – Types and Application – Differential Analysis of Fluid Motion : Equation of Continuity, Navier – Stokes Equations and Bernouli's Equation – Introduction to Dimensional Analysis - Similitude and Types of Similarity.

UNIT-II

FLOW THROUGH PIPES

9

Flow Through Pipes – Reynolds Number, Pressure Drop Under Laminar and Turbulent Flow Condition. Energy Loss Through Pipes – Minor and Major Losses, Friction Factor, Moody's Diagram and Its Applications. Line sizing introduction to Concept of Boundary Layer.

UNIT-III

FLOW THROUGH IMMERGED DRAG

9

Drag - Drag Coefficient, Drag on Sphere, Form and Pressure Setting Velocity – Terminal and Hindered Setting Velocity, Flow Through Fixed and Fluidizer Bed. Application of fluidizer Bed and Packed in Pharmaceutical Industries.

UNIT-IV

FLOW MEASUREMENT

8

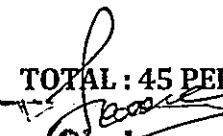
Constant and Variable Head Meters- Velocity Measurement Techniques – Selection and Application of LDA Meter, Ultrasonic, Forced Vortex, Cariolis Flow Meter.

UNIT-V

FLUID MOVERS

10

Pumps – Types and Classification of Pumps – Principle of Centrifugal and Reciprocating Pump, Selection and Application of Pump for Pharma Industries: Peristaltic Pump, Metering Pump, Lift pump, Diapharm Pump, Lope Pump. Classification and application of valves, introduction to fan, blowers and compressors.


TOTAL : 45 PERIODS
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COURSE OUTCOMES:

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

- CO1 :** Understand the fundamental properties of fluids, stress-strain relationship in fluids, and its characteristics under static conditions and establish force balance in static systems.
- CO2 :** Apply Bernoulli principle, Navier - Stokes equation and compute pressure variation in static fluid.
- CO3 :** Use of dimensional analysis to derive relationships among process or system variables. Further they would develop dimensionless groups that help in scale-up studies.
- CO4 :** Understand the different types of flow conditions in fixed bed and fluidized beds.
Describe function of flow metering devices, apply Bernoulli equation to determine the
- CO5 :** performance of flow-metering devices and also analyze the performance aspects of fluid machinery such as pumps, compressors and valves.

TEXT BOOKS:

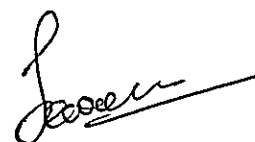
1. Noel de Nevers, "Fluid Mechanics for Chemical Engineers ", Second Edition, McGraw-Hill, (1991).
2. Munson, B. R., Young, D.F., Okiishi, T.H. "Fundamentals of Fluid Mechanics", 5th Edition", John Wiley, 2006.
3. McCabe W.L, Smith, J C and Harriot. P "Unit operations in Chemical Engineering", McGraw Hill, VII Edition, 2017

REFERENCE BOOKS:

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 Hall PTR (International series in Chemical Engineering) (1999)
3. McCabe W.L, Smith, J C and Harriot. P "Unit operations in Chemical Engineering", McGraw Hill, VII Edition, 2005

E-RESOURCES:

1. <https://archive.nptel.ac.in/courses/127/103/127103225/>
2. <https://archive.nptel.ac.in/courses/103/104/103104043/>



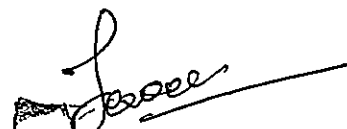
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Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	-	-	3	-	-	-	-	-	-	-	2	-	3	-	-
C02	-	3	-	-	3	-	-	-	-	2	-	-	-	3	-	2
C03	3	-	-	3	-	-	-	-	-	-	-	-	3	-	-	-
C04	-	3	3	-	-	-	1	-	-	-	-	-	-	-	3	-
C05	3	3	-	3	2	-	2	-	1	-	-	-	3	-	-	2

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTT43

CELL AND MOLECULAR BIOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Enable students understand the structure and function of the 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 in biotechnological research.
- Illustrate creative use of modern tools and techniques for sequencing and amplification of DNA.
- Develop students in strategizing research methodologies employing genome analysis.

UNIT-I	CELL STRUCTURE AND FUNCTIONS OF THE ORGANELLES	9
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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	9
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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	9
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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	9
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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	9
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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, RNAi).


TOTAL : 45 PERIODS
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COURSE OUTCOMES:

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

- C01:** Acquire knowledge on the structure and functions of prokaryotic and eukaryotic cells.
- C02:** Illustrate an overview of nucleic acids and the central dogma of life and its significance
- C03:** Employ the knowledge of DNA manipulation techniques in the production of commercially important recombinant proteins
- C04:** Understand the concepts of PCR techniques and genome sequencing techniques in biotechnological applications
- C05:** Apply the knowledge of genome analysis and genomics in disease diagnostics 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 Blackwell Science Publications, 7th edition, 2006.
3. Principles of Genome Analysis and Genomics by S.B. Primrose and R.M. Twyman, Third Edition (Blackwell Publishing), 2003.

REFERENCE BOOKS:

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/102106025>
2. <https://archive.nptel.ac.in/courses/102/106/102106096/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	1	2	1	-	-	1	-	-	-	-	-	1	-	1	-
C02	3	1	2	1	-	-	1	-	-	-	-	-	1	-	1	-
C03	3	3	3	3	2	-	2	1	-	-	-	-	3	-	3	2
C04	3	3	3	2	2	-	2	-	-	-	-	-	-	-	-	2
C05	3	3	3	3	2	-	2	-	-	-	-	1	-	-	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTT44	PHYSICAL PHARMACEUTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT-I	MICROMERITICS AND POWDER RHEOLOGY	9
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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
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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
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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

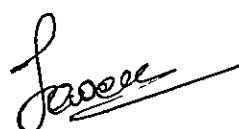
UNIT-IV	DISPERSION SYSTEMS	9
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Colloidal dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy. Suspensions and Emulsions: Interfacial properties of suspended particles, settling in suspension, 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
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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


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COURSE OUTCOMES:

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

- CO1:** Explain the methods used for determining particle size, particle volume and surface area along with the derived properties of powders
- CO2:** Differentiate the surface and interfacial phenomenon,
- CO3:** Distinguish between Newtonian and non-Newtonian system and to identify methods for determining viscosity.
- CO4:** Describe the types and properties of colloidal dispersions, suspensions and emulsions along with its applications
- CO5:** Understand drug reaction kinetics, stabilization of drugs and its accelerated stability testing

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.
3. Hadkar. U. B., Physical Pharmacy, NiraliPrakashan; 12th edition, 2017.

REFERENCE BOOKS:

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 Abinacrea "Physicochemical Basis of Pharmaceuticals" Oxford University Press, 2009.

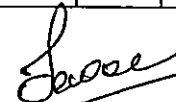
E-RESOURCES:

1. www.digimat.in/nptel/courses/video/104102113/L01.html
2. <https://www.digimat.in/nptel/courses/video/104102009/L01.html>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	-	-	-	1	1	-	-	-	-	1	2	-	1	1
CO2	3	1	-	1	-	-	-	-	-	-	-	1	1	-	3	1
CO3	3	1	-	1	-	-	-	-	-	-	-	1	1	-	3	1
CO4	3	1	-	-	-	-	-	1	-	-	1	1	2	-	2	1
CO5	3	1	-	-	-	-	1	-	-	-	-	1	3	-	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTT45

PHARMACEUTICAL ANALYSIS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- 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 - Polarimetry - 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

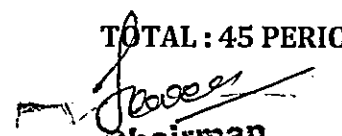
UNIT-V

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


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COURSE OUTCOMES:

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

- CO1 :** Highlight the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals.
- CO2 :** Demonstrate the skills on various types of extraction techniques.
- CO3 :** Develop skills on range of physical analytical methods.
- CO4 :** Determine the chemical properties of pharmaceutical compound.
- CO5 :** Illustrate the methods used for quality control of drug samples and control the errors in the analysis of drug sample.

TEXT BOOKS:

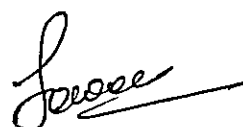
1. Pharmaceutical Analysis P. D. Chaithanya Sudha, Pearson, 2013.
2. Pharmaceutical Drug Analysis, Ashutosh Kar. New Age international Pvt Ltd. 2005.
3. Siddiqui, Anees A. "Pharmaceutical Analysis". Vol. I & II, CBS, 2006
4. A.H. Beckett & J. B. Stenlake, "Practical Pharmaceutical Chemistry", Part II,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

REFERENCE BOOKS:

1. Pharmaceutical Analysis A Textbook for Pharmacy Students and Pharmaceutical Chemists. Third Edition David G. Watson. Churchill 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, Bente Gammelgaard, Trine Grønhaug Halvorsen, Second Edition 2019, Wiley.

E-RESOURCES:

1. <https://nptel.ac.in/courses/103108100>
2. <http://digimat.in/nptel/courses/video/104106106/L01.html>

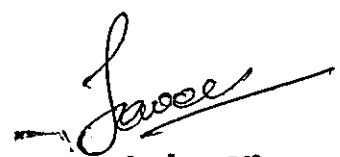


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BoS/Pharma.Tech**

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	3	2	-	3	2	2	-	-	-	1	2	3	-	2	-
C02	3	3	2	-	3	2	2	-	-	-	1	2	3	1	2	-
C03	3	3	2	-	3	2	2	-	-	-	1	2	3	1	2	-
C04	3	3	2	-	3	2	2	-	-	-	1	2	3	1	2	-
C05	3	1	1	-	3	2	2	-	-	-	1	2	3	1	2	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

23CYT41

ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

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

L T P C

2 0 0 2

Course Objectives:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and sustainable practices
- To imbibe awareness on manmade activities and population issues

UNIT-I

ENVIRONMENT AND BIODIVERSITY

6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity – values of biodiversity, India as a mega-diversity nation – threats to biodiversity – conservation of biodiversity. Activity: Documentation of ecosystems/Biodiversity within Campus.

UNIT-II

ENVIRONMENTAL POLLUTION

6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts. Activity: Documentation of pollution issues in Erode district.

UNIT-III

RENEWABLE SOURCES OF ENERGY

6

Energy management and conservation - New Energy Sources: Need and different types of new energy sources. Concept, origin and applications of - Hydrogen energy, Ocean energy, Tidal energy and geothermal energy conversion. Activity: Documentation of available renewable resources in Erode district.

UNIT-IV

SUSTAINABILITY AND MANAGEMENT

6

Development, GDP, Sustainability- concept, needs and challenges - Sustainable Development Goals - Concept of Carbon Credit, Carbon Footprint. Circular economy, ISO 14000 Series, Material Life Cycle Assessment, Environmental Impact Assessment. Green Engineering. Activity: Documentation of sustainable goals of Tamilnadu.

UNIT-V

HUMAN POPULATION AND DISASTER MANAGEMENT

6

Population growth, Population explosion— Family Welfare Program – Environment and human health. Human rights – HIV/AIDS – Women and Child Welfare – Role of Information Technology in environment and human health – Disaster management: Floods, earthquake, cyclone and landslides. Activity: Documentation of women development schemes in Tamilnadu.

TOTAL :30 PERIODS

SVHEC-R2023


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COURSE OUTCOMES:

At the end of the course the students will be able to	
CO1:	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
CO2:	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
CO3:	To identify and apply the understanding of renewable and non-renewable resources
CO4:	To recognize the different goals of sustainable development and sustainability practices and apply them for future development.
CO5:	To aware the population issues and to handle the disaster issues

TEXT BOOKS:

1. Dr. A.Ravikrishnan "Environmental Sciences and Sustainability", 2nd Edition, Sri Krishna Hitech Publishing Company Pvt. Ltd, 2022.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2010.
3. Gilbert M.Masters& Wendell P Ela, 'Introduction to Environmental Engineering and Science', 3rd edition, Prentice- Hall of India Pvt. Ltd, New Delhi, 2008.

REFERENCE BOOKS:

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2009.
2. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2022.
3. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2023.

E- SOURCES:

- Unit 1:<https://www.youtube.com/watch?v=Ar04qG1P8Es> (IIT ROORKEE NPTEL)&<https://www.youtube.com/watch?v=SHxAOoxhKTA> (IIT KANPUR NPTEL)
- Unit 2:<https://www.youtube.com/watch?v=17Z34WU257U> (IIT ROORKEE NPTEL)
- Unit 3:<https://www.youtube.com/watch?v=1kUE0BZtTRc> (NATIONAL GEOGRAPHIC)
- Unit 4:<https://www.youtube.com/watch?v=Crd3CFq5B4s> (IITM NPTEL)
- Unit 5:<https://www.youtube.com/watch?v=sMqtwbKc8EA> (FINANCIAL TIMES)

SVHEC-R2023-24

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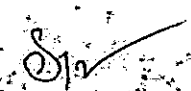
Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

CO's& PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	1	-	-	-	2	3	-	-	-	-	2
C02	3	2	-	-	-	3	3	-	-	-	-	2
C03	3	-	1	-	-	2	2	-	-	-	-	2
C04	3	2	1	1	-	2	2	-	-	-	-	2
C05	3	2	1	-	-	2	2	-	-	-	-	1
AVG	3	2	1	1	-	2	2	-	-	-	-	2

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

SVHEC-R2023


Chairman
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23PTL41

PHARMACEUTICAL CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

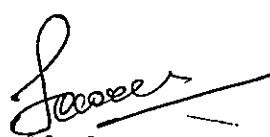
COURSE OBJECTIVES:

- To provide students with the practical laboratory skills of pharmaceutical chemistry
- To demonstrate the effect of the different synthetic methodology.
- 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 NaOH 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:
11. Benzoylation: Benzanilide, Phenyl benzoate, 2-Naphthyl benzoate
12. Acetylation: Aspirin
13. Nitration: Picric acid, p-nitro aniline, m - dinitro benzene
14. Halogenation: p-bromo acetanilide
15. Haloform: Iodoform
16. Synthesis of compounds by naming reaction: 7- hydroxy -4- methyl coumarin (Pechmann reaction), 1- phenyl azo-2-naphthol (Diazotization and Coupling reaction)
17. Synthesis of major industrial compounds: Paracetamol from p-aminophenol, Benzocaine from p-nitro benzoic acid

TOTAL : 45 PERIODS


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COURSE OUTCOMES:

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

- C01:** Apply safe laboratory practices in the preparation of reagents, handling and storage of chemicals.
- C02:** Identify/confirm the unknown organic compounds by melting point determination, pKa, boiling point, Viscosity etc.
- C03:** Carry out quality control tests for fine chemicals and bulk drugs
- C04:** Implement the knowledge of chemistry in designing the synthetic scheme of organic compounds
- C05:** Demonstrate feasible synthesis of some important class of drugs using chemical reactions

REFERENCE BOOK:

1. K.Yogananda Reddy, Dr.K.N.Jayaveera & Dr.S.Subramanyam, Practical Medicinal Chemistry, 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 Organic Chemistry- I, Vallabh Prakashan, 1st edition. 2013.

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	2	3	3	-	2	2	-	-	-	-	2	-	2	-	2
C02	3	1	2	2	-	-	1	-	-	-	-	2	2	2	3	3
C03	3	1	2	2	-	-	1	-	-	-	-	2	3	3	2	-
C04	3	1	2	2	-	-	1	-	-	-	-	2	3	3	2	2
C05	3	1	2	2	-	-	1	-	-	-	-	2	-	-	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTL42

PHYSICAL PHARMACEUTICS LABORATORY

L	T	P	C
0	0	3	1.5

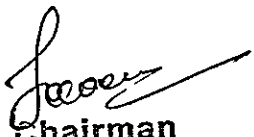
COURSE OBJECTIVES:

- To practice the determination of fundamental properties of dosage forms of powders and dispersions.
- To study the kinetics and stability aspects of pharmaceuticals

LIST OF EXPERIMENTS

1. Determination of particle size, particle size distribution using various methods of particle size analysis.
2. Determination of surface area of powders.
3. Determination of derived properties of powders like density, porosity, compressibility, angle of 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 sedimentation parameters.
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


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COURSE OUTCOMES:

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

- CO1 :** Characterize and evaluate the properties of powders by suitable methods
- CO2 :** Plan and carryout the determination of interfacial property of liquids. .
- CO3 :** Plan and carryout the determination of viscosity,
- CO4 :** Plan and carryout the physical stability study of suspension and emulsion dosage forms.
- CO5 :** Plan and carryout the, preparation of buffer and to determine the buffer capacity and isotonicity of solutions

TEXT BOOKS:

1. C.V.S. Subrahmanyam, Physical pharmaceutics-I, 1st Edn., Vallabhprakashan, 2019.
2. C.V.S. Subrahmanyam, Physical pharmaceutics - II, 1st Edn., Vallabhprakashan, 2019.
3. Manavalan, R. and Ramasamy. C. "Physical Pharmaceutics" 2nd Ed., Vignesh Publishers, 2015.

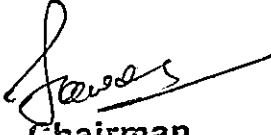
REFERENCE BOOK:

1. Eugene L. Parrott, WitoldSaski, Experimental Pharmaceutics, 4th edn., Burgess Pub. Co., 1977.
2. C.V.S Subrahmanyam & J.ThimmaSetty, Laboratory Manual of Physical Pharmaceutics, 2nd Ed., Vallabh Prakashan, 2014.
3. Dr. U. B. Hadkar, Practical Physical Pharmacy & Physical Pharmaceutics, Nirali Prakashan, Pune, 2008.

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	-	2	-	-	-	-	1	1	-	1	3	1	2	-
CO2	3	3	-	2	-	-	-	-	1	1	-	1	3	1	2	-
CO3	3	3	-	2	-	-	-	-	1	1	-	1	3	1	2	-
CO4	3	3	-	2	-	-	-	-	1	1	-	1	3	1	2	-
CO5	3	3	-	2	-	-	-	-	1	1	-	1	3	1	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation


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BoS/Pharma.Tech

23MDC41

SOFT SKILLS AND ANALYTICAL SKILLS - I

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

L T P C

1 0 0 0

COURSE OBJECTIVES:

- To make the students aware of critical thinking.
- To understand the significance of emotional intelligence in self-growth.
- Basic Knowledge about the Arithmetic Ability.
- Understand the basics of Data Interpretation.
- Basic Knowledge about the Analogy.

UNIT-I

CRITICAL THINKING

3

Active Listening - Analytical Thinking - Open-mindedness - Creative Thinking.

UNIT-II

EMOTIONAL INTELLIGENCE

3

Transactional analysis - Empathy - Sympathy - Conflict management.

UNIT-III

ARITHMETIC ABILITY

3

Vedic maths - BODMAS - Fractions - Divisibility rules - LCM & GCD (HCF).

UNIT-IV

DATA INTERPRETATION

3

Line Graphs - Venn diagrams - Tabulation - Pie Charts.

UNIT-V

ANALOGY

3

Coding & Decoding - Puzzle - Paper Cutting & Folding - Mirror Images.

TOTAL : 15PERIODS

P. Des.

COURSE OUTCOMES:

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

- CO1:** Analyze and evaluate arguments and identify most common fallacies.
- CO2:** Discover personal competence and techniques of building emotional intelligence.
- CO3:** Enhance the Aptitude Round Clearing ability in interview process.
- CO4:** Interrupt the data.
- CO5:** Enhance the Analogy Round Clearing ability in interview process.

TEXT BOOKS:

1. Soft Skills: an Integrated Approach to Maximise Personality, Gajendra S. Chauhan, Sangeeta Sharma, Wiley India.
2. Quantitative Aptitude for Competitive Examination by R.S. Agrawal, S.Chand Publications.

REFERENCE BOOKS:

1. Personality Development and Soft Skills, Barun K. Mitra, Oxford Press
2. Communication Skills for Engineers and Scientists, Sharma, Sangeeta & Binod Mishra, PHI India. (2 nd edition).
3. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Ramnagar, New Delhi-110055.
4. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
5. Quantitative Aptitude for Competitive Examination by AbhijitGuha, Tata Mc Graw Hill Publications.

E – RESOURCES:

1. <https://infotricks1on1.blogspot.com>
2. <https://www.ambitionbox.com>

**SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE****(Autonomous)****Gobichettipalayam, Erode -638455****Regulation 2023 (UG)****Curriculum and Syllabus****B.Tech. Pharmaceutical Technology****SEMESTER V**

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23PTT51	Pharmaceutical Dosage Forms	PC	3	0	0	3	3	40	60	100
2.	23PTT52	Unit Operations in Process Industries	PC	3	1	0	4	4	40	60	100
3.	23PTT53	Pharmacology	PC	3	0	0	3	3	40	60	100
4.		Professional Elective I*	PE	3	0	0	3	3	40	60	100
5.		Professional Elective II*	PE	3	0	0	3	3	40	60	100
6.		Professional Elective III*	PE	3	0	0	3	3	40	60	100
Practicals											
7.	23PTL51	Dosage Forms Laboratory	PC	0	0	3	3	1.5	60	40	100
8.	23PTL52	Pharmacology Laboratory	PC	0	0	3	3	1.5	60	40	100
9.	23PTL53	Industrial Training/Internship I@	EEC	0	0	0	0	2	100	-	100
Mandatory Courses											
10.		Mandatory Course – II&	MC	3	0	0	3	0	100	-	100
11.	23MDC51	Soft and Analytical Skills – II&&	MC	1	0	0	1	0	-	-	-
Total				21	1	6	28	24			


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23PTT51

PHARMACEUTICAL DOSAGE FORMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To acquaint the concepts of pharmaceutical dosage forms in respect of their formulation and development

UNIT-I**POWDERS AND GRANULES****9**

Introduction of powders and granules, Advantages and disadvantages of powdered and granulated products, Mixing and dividing of powders, problems in manufacturing powders, Reasons for Granulation, Granulation mechanisms, Granulation methods, pharmaceutical granulation equipments.

UNIT-II**TABLETS AND CAPSULES****11**

Definition, Types of tablets, formulation, manufacturing of tablets, Tableting problems, Evaluation of Tablets, Tablet coating, Film coating, Sugar Coating, Enteric coating, Evaluation of coated tablets, Application, Large Scale Manufacture.

ADVANCES IN TABLETING TECHNIQUES

Defintion, Buccal tablets - Chewable Tablets -- Inlay-tablets, Layer tablets, Mouth dissolving tablet, Tablets in tablets -- Compression coating, Defintion, classification of Capsules -- Gelatin and Non-gelatin Capsules - Hard gelatin capsules, Composition and size, Materials and Methods for production of hard gelatin capsule, Formulation and filling of capsules, Soft gelatin capsules, Rationale, Manufacturing and Formulation of soft gelatin capsules, Evaluation of capsules.

UNIT-III**LIQUIDS****9**

Definition, classification of liquid dosage forms, preparation, Formulation, Evaluation of Liquids, Emulsion and Suspension types of liquids, preparation, Formulation and Evaluation. Sterile liquids, sterile liquids, sterility, formulation and evaluation. Storage of liquid dosage forms.

UNIT-IV**SEMISOLID FORMULATIONS****9**

Ointments - materials for preparation - manufacturing method. Compendial Requirements for ointments - characterization, applications - pastes - gels - creams - suppositories formulation and characterization.

UNIT-V**HERBAL FORMULATION****7**

Sources and description of raw materials of herbal origin used via, Fixed oil, waxes, gums, colour, perfumes, protective agents, Antioxidants, herbal excipients, production techniques of convensional herbal preparation like syrubb, mixture.


Chairman
BoS/Pharma.Tech**TOTAL : 45 PERIODS**

COURSE OUTCOMES:

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

- CO1 :** Comprehend the factors influencing the development of various solid dosage forms.
- CO2 :** Recognize the formulation concepts and evaluate solid dosage forms to meet out the compendial requirements.
- CO3 :** Execute and involve in the manufacturing process for the tablet and capsule dosage forms.
- CO4 :** Design and preparation techniques in the liquid dosage forms
- CO5 :** Apprehend the herbal formulations

TEXT BOOKS:

1. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems, 8th Edition, CBS Publishers, New Delhi, 2008.
2. Aulton, M.E., "Pharmaceutics – The Science of Dosage form/Design", 2nd Edition, ELBS Publications, 2002.
3. Cooper and Gunn's "Dispensing for Pharmaceutical Students", Edited by S J Carter, CBS Publishers, New Delhi, 2008

REFERENCE BOOKS:

1. Gennaro, A.R., "Remington: The Science and Practice of Pharmacy", Vol. I and II, 21st Edition, Lippincott Williams and Wilkins, 2005.
2. Banker, G.S. and Rhodes, C.T., "Modern Pharmaceutics", 4th Edition, Informa Health Care, 2002.
3. Liberman, H.A., Lachman, L. and Schwartz, J.B., "Pharmaceutical Dosage Form: Tablets", 2nd Edition, Volume II, Mercel Dekker, 1999.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_bt23
2. <https://archive.nptel.ac.in/courses/103/105/103105209/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	3	-	3	3	-	2	-	-	-	-	-	-	-	2	3
CO4	-	-	3	2	2	-	-	2	-	-	-	-	-	-	-	2
CO5	3	-	-	-	2	-	-	2	-	-	-	-	3	-	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Signature
Chairman

BoS/Pharma.Tech
Page 3 of 98

23PTT52

UNIT OPERATIONS IN PROCESS INDUSTRIES

L	T	P	C
3	1	0	4

COURSE 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**SIZE REDUCTION AND SEPARATION**

12

Unit Operations and unit process: classification and applications in process industries. Properties and characterization of particulate solids - Analytical methods for size determination of powders - Size reduction- Mechanism- equipment - Size separation -mechanism -equipment

UNIT-II

12

Drying - Principles and applications. Theory and selection of dryers. Industrial dryers - Rotary, spray, fluid-bed and vacuum dryers. Principle and applications

UNIT-III

12

Crystallization - Principles and applications. Theory and selection of crystallizers. Industrial crystallizers - Swenson Walker crystallizer and vacuum crystallizer

UNIT-IV

12

Filtration: Theory and applications. Types, selection and applications of filters. Factors affecting filtration- Filter aids, Filter media- Industrial filters-Plate and frame filter press, Rotary drum filter, Edge filter, vacuum filters. Centrifugation-Types and applications. industrial centrifugal filters -sedimentation centrifuges.

UNIT-V**MIXING**

12

Mixing and agitation: Principle and applications. Types of mixing: solid-liquid(suspension), gas-liquid(dispersion), Liquid-liquid (emulsion and blending). Mixing of solids and powders. Types and selection of mixers. Mechanism of mixing. Power number and its application in agitated vessel.

TOTAL : 60 PERIODS


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COURSE OUTCOMES:

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

- CO1 :** Recognize the properties of particulate matter and size reduction and separation equipment.
- CO2 :** Elucidate the various drying process and dryers for pharmaceutical industries
- CO3 :** Describe the properties of crystals and working of crystallisers.
- CO4 :** Appreciate the theory of filtration and centrifugation and the equipment used for these unit operations
- CO5 :** Define the principle of mixing and the working of mixers in pharma industries.

TEXT BOOKS:

- 1.W.L. McCabe, J.C. Smith, P. Harriott, "Unit-operations of Chemical Engineering", 7th Edition, McGraw-Hill, 2017
2. Brown G.G, UNIT OPERATIONS, 2005, CBS
3. L. BRYCE ANDERSEN ALAN S. FOUST, Principles Of Unit Operations 2nd Ed, CBS

REFERENCE BOOKS:

1. Coulson And Richardsons Chemical Engineering, Volume 2, 5Th Edition: Particle Technology And Separation Processes, Elsevier Exclusive
2. Badger W.L and Banchero, J. T "Introduction to Chemical Engineering" Tata McGraw Hill, 2002

E-RESOURCES:

3. <https://archive.nptel.ac.in/courses/102/103/102103015/>
4. <https://archive.nptel.ac.in/courses/103/103/103103155/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	-	3	2	2	-	-	-	1	2	3	-	2	-
CO2	3	3	2	-	3	2	2	-	-	-	1	2	3	1	2	-
CO3	3	3	2	-	3	2	2	-	-	-	1	2	3	1	2	-
CO4	3	3	2	-	3	2	2	-	-	-	1	2	3	1	2	-
CO5	3	1	1	-	3	2	2	-	-	-	1	2	3	1	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

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23PTT53

PHARMACOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide general pharmacological principles.
- To make understand the pharmacology of different types of drugs acting on various physiological system

UNIT-I**INTRODUCTION TO PHARMACOLOGY****9**

Drugs, routes of drug administration, factors modifying drug action, tolerance and dependence, Pharmacodynamics and pharmacokinetics, Adverse drug reactions, Drug interactions, Overview of drug discovery and development.

UNIT-II**DRUGS ACTING ON NERVOUS SYSTEM****9**

Pharmacology of parasympathomimetics, parasympatholytics, sympathomimetics, sympatholytics, general anaesthetics-isoflurane & propofol, sedatives & hypnotics-Primidone & Triazolam, antipyretic-Aspirin, ibuprofen, analgesic-Acetaminophen, anti-inflammatory (NSAIDS)-diclofenac & fenoprofen and CNS stimulants-Modafinil & Prilocaine.

UNIT-III**DRUGS ACTING ON CARDIOVASCULAR SYSTEM****9**

Pharmacology of cardiac glycosides and other drugs for congestive heart failure-enalapril, losartan, carvedilol, furosemide. Antiarrhythmic-Procaainamide, propranolol, sotalol, diltiazem. Antifungal - Nitroglycerin, ranolazine. Antihypertensive-lisinopril & hydralazine.

UNIT-IV**DRUGS ACTING ON GASTROINTESTINAL SYSTEM****9**

Antacids-Aluminium hydroxide & magnesium hydroxide, anti-secretory- omeprazole & ranitidine and anti-ulcer drugs-carafate & bismuth subsalicylate, Laxatives-methyl-cellulose & bisacodyl and Anti-diarrhoeal drugs-loperamide & racecadotril, Appetite stimulants-Marinol & periatin and suppressants-phentermine & lorcaserin, Emetics-ipeac syrup & apomorphine and anti-emetics-ondansetron & metoclopramide.

UNIT-V**CHEMOTHERAPY OF MICROBIAL DISEASES****9**

General principles of chemotherapy; Inhibitors of cell wall synthesis- penicillins, Protein synthesis inhibitors - aminoglycosides, chloramphenicol, Chemotherapy of tuberculosis and malaria.

TOTAL : 45 PERIODS


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COURSE OUTCOMES:

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

- C01 :** Realize the various principles of general pharmacology
- C02 :** Comprehend the Mechanism of action of different types of drugs acting on various nervous systems.
- C03 :** Know the pharmacology of various categories of drugs acting on cardiovascular systems.
- C04 :** Understand the mechanism of action of drugs acting on gastrointestinal system.
- C05 :** Understand the pharmacology of antimicrobial agents and chemotherapy.

TEXT BOOKS:

1. RS Satoskar, Nirmala N Rege, SD Bhandarkar. Pharmacology and Therapeutics. 24th Ed, 2015, Elsevier.
2. Tripathi, K.D. Medical Pharmacology. 8th Edition, 2018, Jaypee Brothers Medical Publications.
3. Basic Concepts in Pharmacology: What You Need to Know for Each Drug Class, Sixth Edition 6th Edition By Janet L. Stringer © 2022.
4. Casarett & Doull's Essentials of Toxicology, Fourth Edition 4th Edition By Curtis D.
5. Klaassen, John B. Watkins © 2021 | Published: February 2, 2021.

REFERENCE BOOKS:

1. Goodman and Gilman's The Pharmacological Basis of Therapeutics, 14th Edition 14th Edition By Laurence Brunton, Bjorn Knollmann © 2023.
2. Rang & Dale's Pharmacology, James Ritter, Rod Flower, Graeme Henderson, Yoon Kong Loke, David MacEwan, Humphrey Rang. 2019.
3. Basic & Clinical Pharmacology, 14th Edition, Bertram G. Katzung, Mc Graw Hill Publishers.
4. Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy, David E. Golan MD PhD, 2016, LWW.

E-RESOURCES:

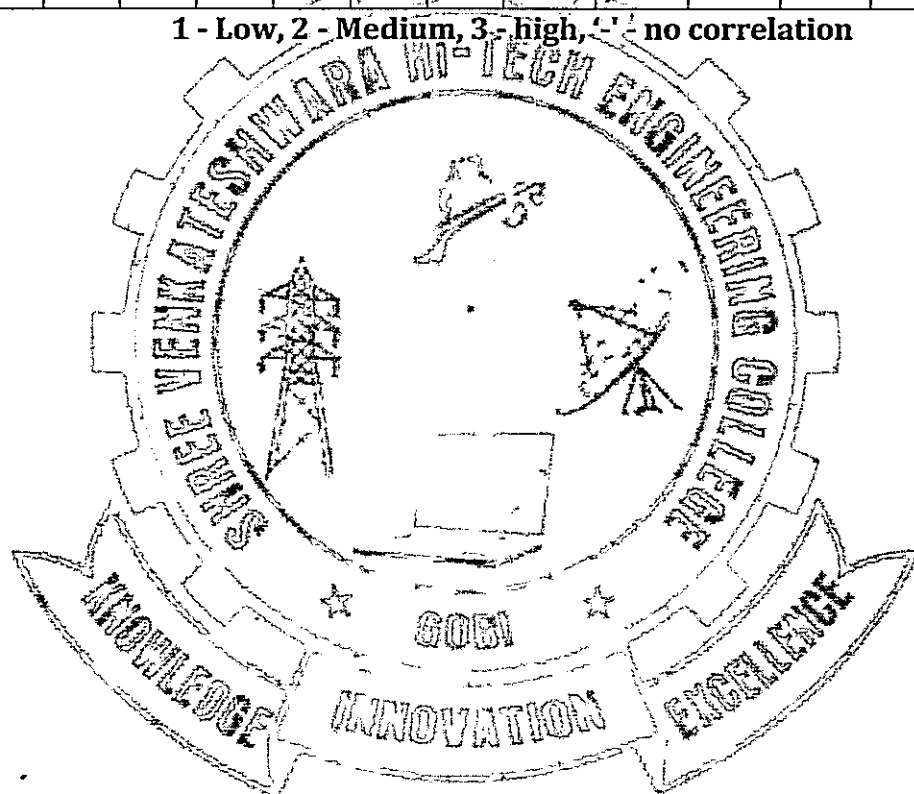
1. <https://dth.ac.in/medical/courses/pharmacology/1/8/index.php>
2. <https://fdspharmacy.in/pharmacology/>


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CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	-	3	-	2	-	-	2	-	-	-	3	3	2	-	-
CO2	3	3	-	2	-	3	-	-	-	-	-	2	-	3	2	-
CO3	-	-	-	3	2	3	-	-	-	-	-	-	-	-	3	2
CO4	3	2	-	-	2	-	3	-	3	-	-	-	2	-	-	-
CO5	2	-	2	-	1	-	-	-	-	-	-	3	-	2	3	-

1 - Low, 2 - Medium, 3 - high, - no correlation



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25 100 100

23PTL51

DOSAGE FORMS LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To study, the basic principles in formulating liquid, semisolid, solid and parenteral dosage forms and their evaluations.

LIST OF EXPERIMENTS

1. Preparation of solutions
2. Preparation of creams
3. Evaluation of creams
4. Preparation of ointments
5. Evaluation of ointments
6. Preparation of suppositories
7. Evaluation of suppositories
8. Preformulation studies on prepared granules
9. Manufacture and evaluation of granules - wet granulation and dry granulation methods
10. Formulation and evaluation of Effervescent granules
11. Preparation of tablets
 - a. Tablets prepared from wet and dry granules
 - b. Tablets prepared by direct compression
12. Formulation and filling of hard gelatin capsules
13. Preparation and evaluation of parenterals - Injections.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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

- CO1 :** Acquire knowledge to prepare and evaluate various liquid, semi-solid dosage forms
- CO2 :** Acquire knowledge to prepare and evaluate solid dosage forms and parenteral dosage forms
- CO3 :** Experiment and interpret the granule manufacturing process
- CO4 :** Demonstrate the concepts in formulation and evaluation of capsules
- CO5 :** Apply the knowledge to formulate new dosage forms

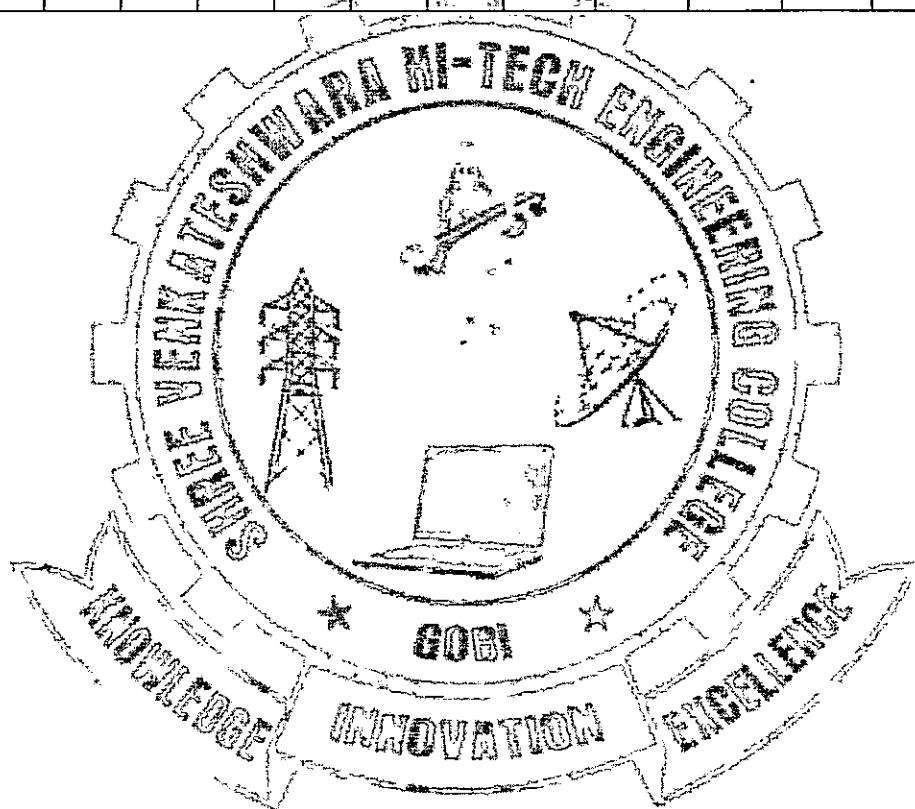
REFERENCE BOOK:

1. SVHEC - Dosage Forms Laboratory Manual

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CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	-	-	-	2	-	-	-	2	-	-	-	3	-	-	-
C02	-	-	-	-	2	-	-	-	2	-	-	-	-	3	-	-
C03	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
C04	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C05	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-



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23PTL52

PHARMACOLOGY LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To instill the knowledge of various pharmacological experiments for better understanding the drug action in various systems.

LIST OF EXPERIMENTS

1. Practical &/ Online demonstration of laboratory animals handling and various routes of drug administration.
2. Virtual study of use of anaesthetics in various laboratory animals.
3. Virtual demonstration of determination of toxicity LD50.
4. To demonstrate the bioassay of Ach using isolated ileum /rectus abdominis muscle preparation using online videos.
5. Bioassay of 5-HT using rat fundus strip or Bioassay of oxytocin using rat uterus using simulation software's / online gadgets.
6. Computer assisted demonstration of estimation of pA₂ value on isolated tissues.
7. Study of alternative methods for drug evaluation.
8. Computational identification of biomarker genes for lung cancer/ prostate cancer/ Diabetes etc.,
9. Insilico ADMET analysis by mol inspiration software
10. Determination of drug likeness properties using SWISSADME

BASIC READING

1. Study of common laboratory animals and handling of lab animals (demonstration).
2. CPCSEA guidelines for laboratory animal facility.
3. Study of different routes of drug-administration.
4. Study of commonly used instruments in experimental pharmacology and its uses

TOTAL : 45 PERIODS**Equipments / Infrastructure requirements**

1. Valid CPCSEA registered airconditioned animal house facility for housing experimental animals and its maintenance furnished as per the CPCSEA norms.
2. Computers (Atleast 10 Nos with a network printer) and multiuser software license e.g., Expharm or other equivalent simulation softwares for teaching.
3. Pharmacology experiment kit (animal cages, dissection kit, animal feed, bed materials autoclave, incinerator, dissection table, standard drugs, anesthetic drugs, minor consumables and gadgets, personnel protective equipments,)

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COURSE OUTCOMES:

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

CO1 : Acquire knowledge on handling of Laboratory animals.

CO2 : Implement the physiological tests and appreciate the interlinked mechanisms in the maintenance of normal functioning of human body

CO3 : Perform basic physiological and pharmacological experiments and to record and interpret the results for its clinical significance.

CO4 : Demonstrate laboratory procedures used to examine anatomical structures and evaluate physiological functions of each organ system

CO5 : Interpret graphs of anatomical and physiological data.

REFERENCE BOOK:

- SVHEC - Pharmacology Laboratory Manual

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	-	-	-	-	-	-	-	-	-	-	-	3	-	2	-
CO2	3	2	-	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	-	3	3	-	1	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	3	-	-	-	2	-	-	-	-	-	-	3	2

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23PTL53

Industrial Training/Internship I

L	T	P	C
0	0	0	2

COURSE OBJECTIVES:

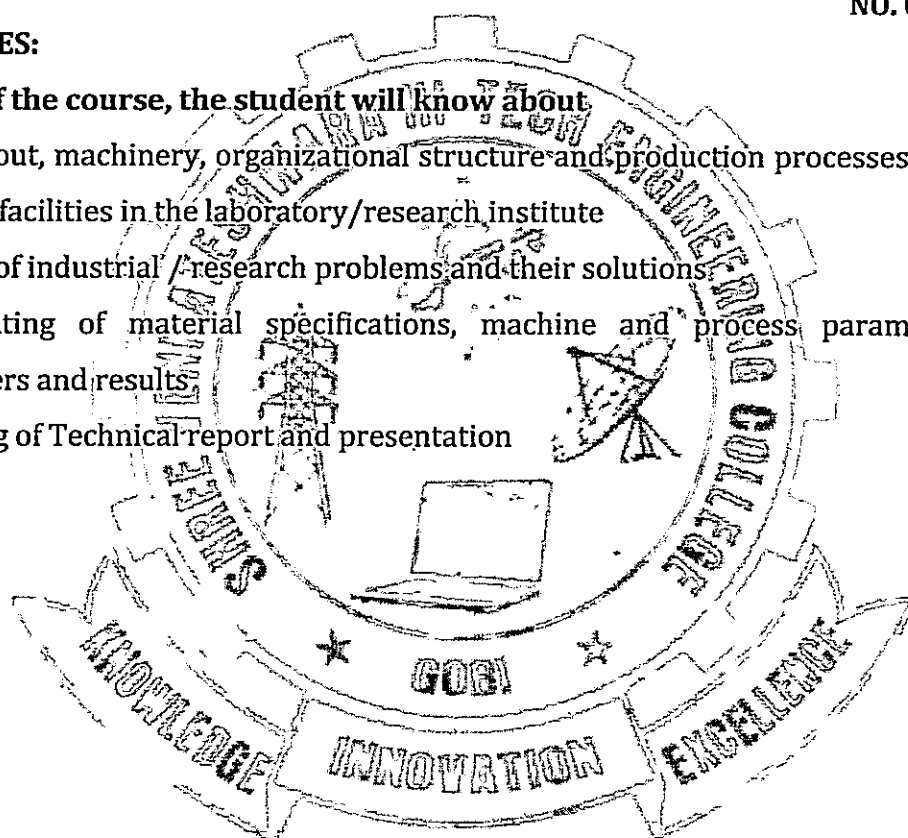
To enable students to

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

The students individually undergo training in reputed firms/ research institutes / laboratories for the specified 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**COURSE OUTCOMES:****On completion of the course, the student will know about**

- CO1:** Plant layout, machinery, organizational structure and production processes in the firm or research facilities in the laboratory/research institute
- CO2:** Analysis of industrial /research problems and their solutions
- CO3:** Documenting of material specifications, machine and process parameters, testing parameters and results
- CO4:** Preparing of Technical report and presentation



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23MDC51

SOFT SKILLS AND ANALYTICAL SKILLS - II

L	T	P	C
1	0	0	0

COURSE OBJECTIVES:

- ☐ To enhance the collaboration and cooperation between individuals towards a common goal.
- ☐ To provide a critical perspective on the socialization of men and women.
- ☐ Basic Knowledge about the Verbal Reasoning.
- ☐ To solve the problems in Quantitative Aptitude.
- ☐ Understand the basics of Data Interpretation

UNIT-I

TEAM SKILLS

3

Trust and collaboration - Team building - Shouldering responsibilities

UNIT-II

GENDER SENSITIZATION

3

Media and the Social Context - Social Networks - Gender Sensitization

UNIT-III

VERBAL REASONING

3

Verbal Reasoning: Syllogism, Blood relationship

UNIT-IV

QUANTITATIVE APTITUDE

3

Ratio and proportion, Problems on ages, Partnership.

UNIT-V

DATA INTERPRETATION

3

Tabulation - Profit & loss, Percentage.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

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

- CO1:** Share and exchange knowledge and ideas, clarify doubts, and arrive at a collective decision or understanding.
- CO2:** Meet the needs of an increasingly ethnically and gender-diverse workplace.
- CO3:** Enhance the Aptitude Round Clearing ability in interview process
- CO4:** Solve problems pertaining to quantitative ability.
- CO5:** Interpret the data.


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TEXT BOOKS:

1. Quantitative Aptitude for Competitive Examination by R.S. Agrawal, S.Chand Publications.
2. Soft Skills: an Integrated Approach to Maximise Personality, Gajendra S. Chauhan, Sangeeta Sharma, Wiley India

REFERENCE BOOKS:

1. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Raminagar, New Delhi-110055
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw Hill Publications.
4. Personality Development and Soft Skills, Barun K. Mitra, Oxford Press
5. Cornerstone: Developing Soft Skills, Sherfield, Pearson India

**SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE**

(Autonomous)

Gobichettipalayam, Erode -638455

Regulation 2023 (UG)

Curriculum and Syllabus

B.Tech. Pharmaceutical Technology

SEMESTER VI

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23PTT61	Heat and Mass Transfer Operations	PC	3	1	0	4	4	40	60	100
2.	23PTT62	Instrumental Techniques in Drug Analysis	PC	3	0	0	3	3	40	60	100
3.		Open Elective - I**	OE				-	3	40	60	100
4.		Professional Elective IV *	PE	3	0	0	3	3	40	60	100
5.		Professional Elective V *	PE	3	0	0	3	3	40	60	100
6.		Professional Elective VI *	PE	3	0	0	3	3	40	60	100
Practicals											
7.	23PTL61	Heat and Mass Transfer Operations Laboratory	PC	0	0	3	3	1.5	60	40	100
8.	23PTL62	Instrumental Techniques In-Drug Analysis Laboratory	PC	0	0	3	3	1.5	60	40	100
Mandatory Courses											
9.		Mandatory Course-III& IV	MC	3	0	0	3	0	100	-	100
Total				-	-	-	-	22			

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23PTT61

HEAT AND MASS TRANSFER OPERATIONS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To recognize the principles and applications of heat transfer
- To understand the principles of mass transfer operations.

UNIT-I

FUNDAMENTAL CONCEPTS AND CONDUCTIVE HEAT TRANSFER

9

Introduction to heat transfer processes – modes of heat transfer- steady state heat conduction – Fourier's equation – thermal conductivity and thermal resistance. Heat transfer through homogenous wall, hollow cylinders and sphere. Extended surfaces –Types and its application- conductors and insulators and its applications. Solving problems in heat transfer by conduction.

UNIT-II

HEAT TRANSFER: CONVECTION

9

Types of convection - dimensional analysis and its application- factors affecting the heat transfer coefficient in free and forced convection – overall heat transfer coefficient. Heat exchanger- types and its application. Evaporator-Types and applications- solving problems in heat transfer by convection.

UNIT-III

HEAT TRANSFER: RADIATION

9

Radiation heat transfer – concept of black and grey body - monochromatic total emissive power – Laws of radiation- Kirchhoff's law – Planck's law - Stefan-Boltzmann's law – heat exchange through non-absorbing media - solving problems in heat transfer by radiation.

UNIT-IV

MASS TRANSFER DIFFUSION, EXTRACTION AND ABSORPTION

9

Introduction to Mass transfer- Fick's law for molecular diffusion - molecular diffusion in gases, liquids and solids - Introduction to Absorption- Equilibrium in gas liquid system- Minimum Liquid rate- Height equivalent to theoretical plate. Liquid-liquid extraction - solvent characteristics

UNIT-V

DISTILLATION AND ADSORPTION

9

Concept of distillation, Vapour liquid equilibria, Henry's Law, Raoult's Law -Volatility- relative volatility. Methods of distillation- Simple or Differential distillation, Rayleigh's equation - Steam distillation. Adsorption - Types of adsorption, nature of adsorbents, adsorption equilibria, adsorption isotherms

TOTAL : 60 PERIODS

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COURSE OUTCOMES:

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

- CO1:** Elucidate the theory behind conduction mode of heat transfer and solving problems related to it.
- CO2:** Recognize the theory behind convection mode of heat transfer and solving problems related to it.
- CO3:** Acquire the basics of radiation mode of heat transfer and its theory and problem solving related to radiation.
- CO4:** Appreciate the principles of mass transfer operations.
- CO5:** Understand the theory of distillation and absorption.

TEXT BOOKS:

1. Theodore L. Bergman et. al., Fundamentals of Heat and Mass Transfer, 7th edition, Wiley Publishers, NJ, 2011
2. Cengel, Y. A., & Ghajar, A. J. (2014). Heat and Mass Transfer Fundamental and Applications, 5th Edition 2017.
3. Coulson, J.M. and et al. "Coulson & Richardson's Chemical Engineering, 6th Edition, Vol.1, Elsevier Butterworth - Heinemann, MA, 2005"

REFERENCE BOOKS:

1. Holman J. P., Heat Transfer (SI Units), 10th Edition, McGraw-Hill Inc., US
2. Robert E. Treybal., "Mass Transfer Operations". Mc Graw - Hill Publishers, New York i, 2017

E-RESOURCES:

3. <https://archive.nptel.ac.in/courses/112/108/112108149/>
4. <https://nptel.ac.in/courses/112101097>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
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CO3	3	3	3	2	2	-	2	-	-	-	-	2	-	3	2	1
CO4	3	3	3	2	3	-	2	-	-	-	-	2	-	3	2	1
CO5	3	1	1	1	2	-	2	-	-	-	-	2	-	3	2	1

1 - low, 2 - medium, 3 - high, -/- no correlation

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23PTT62

INSTRUMENTAL TECHNIQUES IN DRUG ANALYSIS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To facilitate students to acquire knowledge about the principles and operations of various modern analytical instruments.

UNIT-I

UV-VISIBLE SPECTROSCOPY

9

Theory of atomic and molecular spectra, Electronic transitions, Beer and Lambert's law, Derivation and deviations, Chromophores, Auxochromes, Spectral shifts, Solvent effect on absorption spectra. Instrumentation - Sources of radiation, wavelength selectors, sample cells, Detectors- Barrier layer cell, Photo tube, PMT, PDA detectors; Applications in pharmaceuticals.

UNIT-II

ATOMIC ABSORPTION SPECTROSCOPY

9

Principles, Instrumentation, Operation - single and double beam spectroscopy; sampling technique - Detection limit, Difference between Atomic absorption spectroscopy and Flame spectroscopy; Applications in pharmaceuticals.

UNIT-III

INFRARED AND NMR SPECTROSCOPY

9

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

UNIT-IV

MASS SPECTROMETRY

9

Basic principles, instrumentation and ionization methods; atmospheric pressure ionization (API), chemical ionization (CI), electron impact ionization (EI), fast atom bombardment (FAB), matrix assisted laser desorption ionization (MALDI-TOF); Applications in pharmaceuticals.

UNIT-V

CHROMATOGRAPHIC METHODS

9

History, origin and classification of chromatography; Column Chromatography: principle, theory, column operations, instrumentation, derivatization methods and applications; High Performance Liquid Chromatography: Principle, instrumentation, solvents, system, packing materials and applications; Thin Layer Chromatography: Principle, instrumentation, solvents, packing materials and applications in pharmaceuticals.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1: Discuss the principle, theory and instrumentation of UV/Visible spectroscopy; Applications in pharmaceuticals.
- CO2: Describe the principle, instrumentation and operation of AAS; Difference between AAS and FES; Applications in pharmaceuticals.
- CO3: Illustrate the principle and instrumentation of IR and NMR spectroscopy; Applications in pharmaceuticals.

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- Discuss the basic principle, instrumentation and ionization methods of Mass spectroscopy;
- CO4:** Applications in pharmaceuticals.
- Describe the principle, instrumentation, solvents and packing materials of CC, TLC and
- CO5:** HPLC; Applications in pharmaceuticals.

TEXT BOOKS:

1. A. H. Beckett & J. B. Stenlake, "Practical Pharmaceutical Chemistry", Part II, 4th Edition, Bloomsbury Academic, 2001.
2. Hobert H. Willard, "Instrumental Methods of Analysis", 7th Edition, CBS Publishers & Distributors, 2004.
3. B.K. Sharma, "Instrumental Method of Chemical Analysis", Krishna's Education Publishers, 2014.
4. P. D. Sethi, "HPTLC: High Performance Thin Layer Chromatography: Quantitative Analysis of Pharmaceutical Formulations", 1st edition, CBS, 2013.

REFERENCE BOOKS:

1. Robert M. Silverstein, Francis X. Webster, David J. Kiemle, David L. Bryce, "Spectroscopic Identification of Organic Compounds", 8th Edition, Wiley, 2014.
2. Mendham J, "Vogel's Text Book of Quantitative Chemical Analysis", 6th Edition, Pearson Education 2009.
3. Douglas A. Skoog, F. James Holler, Stanley R. Crouch, "Principles of Instrumental Analysis", 7th Edition, Brooks Cole, 2017.
4. William Kemp, "Organic Spectroscopy" W.H. Freeman, New York, 3rd Edition, 2011.

E-RESOURCES:

3. <https://fdspharmacy.in/instrumental-analysis>
4. <https://nptel.ac.in/courses/112101097>

CO's - PO's & PSO's MAPPING

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CO2	3	-	2	2	3	-	2	-	-	-	-	-	1	2	1	2
CO3	3	-	2	2	3	-	2	-	-	-	-	-	1	2	1	2
CO4	3	-	2	2	3	-	2	-	-	-	-	-	1	2	1	2
CO5	3	-	2	2	3	-	2	-	-	-	-	-	1	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

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23PTL61	HEAT AND MASS TRANSFER OPERATIONS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- To provide basic understanding of chemical engineering principles and operations
- To train the students to work on different types of Heat transfer equipment.
- To train the students to develop sound working knowledge on different types of mass transfer equipment.

LIST OF EXPERIMENTS

1. To determine the Thermal Conductivity of metal rod.
2. To determine individual heat transfer film coefficient in forced convection.
3. Heat transfer studies in Stefan - Boltzmann apparatus.
4. To determine overall heat transfer coefficient of double pipe heat exchanger by parallel flow.
5. To determine overall heat transfer coefficient of double pipe heat exchanger by counter flow.
6. To determine overall heat transfer coefficient of shell and tube heat exchanger.
7. Determination of diffusivity of acetone in air
8. Determination of mass transfer coefficient for steady state surface evaporation of water at different temperature.
9. Conduction of liquid - liquid extraction studies
10. Conduction of Adsorption studies
11. Separation of binary mixture using Simple distillation
12. Separation of binary mixture using Steam distillation

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 : Determine heat transfer coefficient.
- CO2 : Apprehend the conduction parameters.
- CO3 : Determine heat transfer film coefficient.
- CO4 : Demonstrate the separation of Binary mixtures
- CO5 : Determine diffusivity and Drying characteristics

REFERENCE BOOK:

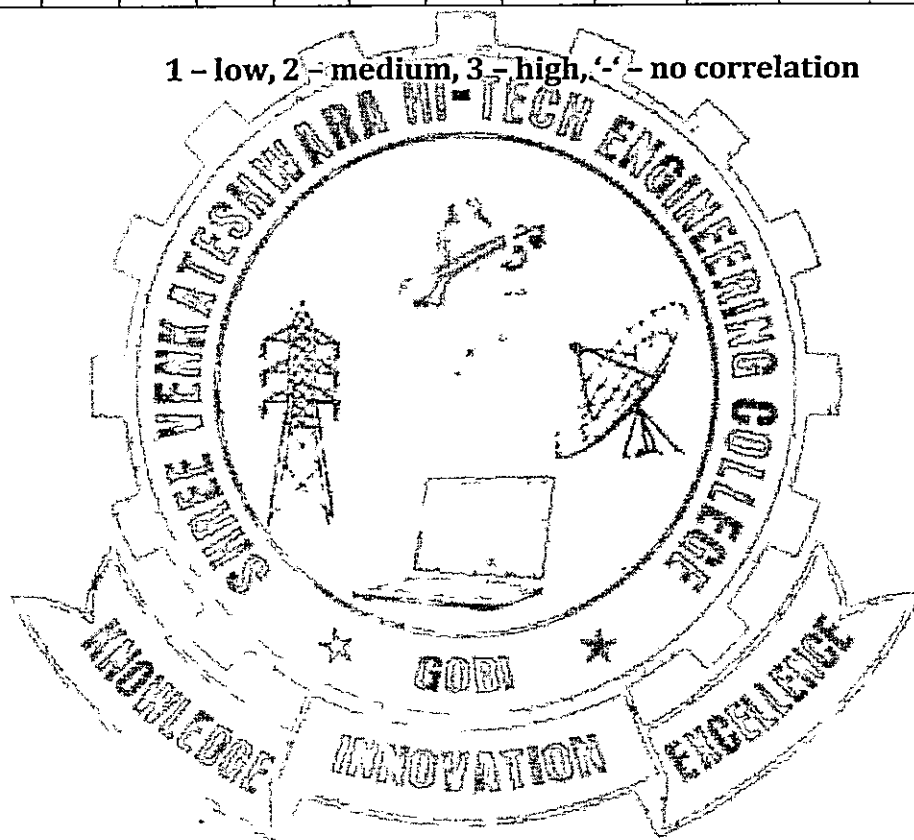
1. SVHEC – Heat and Mass Transfer Operations Laboratory Manual


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CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	2	2	-	-	2	-	-	-	-	3	2	-	2
CO2	3	3	2	2	2	-	-	2	-	-	-	-	3	2	1	2
CO3	3	3	2	2	2	-	-	2	-	-	-	-	3	2	1	2
CO4	3	3	2	2	3	-	-	2	-	-	-	-	3	2	1	2
CO5	3	1	1	1	2	-	-	2	-	-	-	-	3	2	1	2

1 - low, 2 - medium, 3 - high, - - no correlation



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23PTL62

INSTRUMENTAL TECHNIQUES IN DRUG ANALYSIS LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To carry out analytical experiments related to spectroscopic and chromatographic techniques.

LIST OF EXPERIMENTS

1. Calibration of volumetric glasswares.
2. Establishing standard operating procedure (SOP) and Calibration records for analytical balance, pH meter and UV/Vis spectroscopy.
3. Determination of λ_{max} .
4. Quantitative analysis by titrimetric methods.
5. Effect of change in physio-chemical parameters on absorbance spectrum of a drug molecule.
6. Quantitative and qualitative analysis of drug molecule using standard comparison method by UV/Vis spectroscopy.
7. Quantitative analysis of drug molecule using calibration graph method by UV/Vis Spectroscopy.
8. Quantitative analysis of drug molecule using $E1\%1\text{cm}$ method by UV/Vis spectroscopy.
9. Simultaneous analysis of drug molecules using UV/Vis Spectroscopy.
10. Separation and identification of mixtures of drugs by TLC.
11. Separation and identification of amino acids by paper chromatography.
12. Identification of functional group of a drug molecule by IR spectroscopy.
13. Quantitative and qualitative analysis of drug molecule using standard comparison method by HPLC.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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

- CO1 :** Discuss the principle, theory and instrumentation of UV/Visible spectroscopy; Applications in pharmaceuticals.
- CO2 :** Describe the principle, instrumentation and operation of AAS; Difference between AAS and FES; Applications in pharmaceuticals.
- CO3 :** Illustrate the principle and instrumentation of IR and NMR spectroscopy; Applications in pharmaceuticals.
- CO4 :** Discuss the basic principle, instrumentation and ionization methods of Mass spectroscopy; Applications in pharmaceuticals.
- CO5 :** Describe the principle, instrumentation, solvents and packing materials of CC, TLC and HPLC; Applications in pharmaceuticals.

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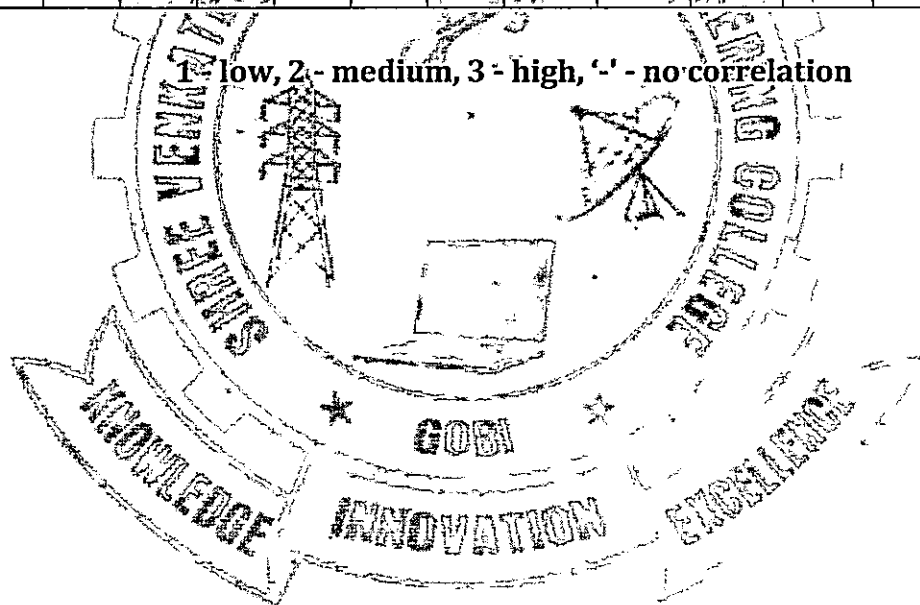
REFERENCE BOOK:

- SVHEC – Instrumental Techniques in Drug Analysis Laboratory Manual.

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	-	3	3	2	-	-	-	-	-	-	-	-	3	-	-
C02	-	-	3	3	2	2	-	-	-	-	-	-	3	-	-	2
C03	-	-	-	3	3	-	2	-	-	-	-	-	2	-	3	-
C04	3	3	-	2	2	-	-	-	-	-	-	2	3	3	-	-
C05	3	3	-	-	2	-	-	-	-	-	-	2	-	3	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation



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MANDATORY COURSES II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23MDC51	Introduction to Women and Gender Studies	MC	3	0	0	3	0	100	-	100
2.	23MDC52	Elements of Literature	MC	3	0	0	3	0	100	-	100
3.	23MDC53	Film Appreciation	MC	3	0	0	3	0	100	-	100
4.	23MDC54	Disaster Risk Reduction and Management	MC	3	0	0	3	0	100	-	100

MANDATORY COURSES III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23MDC61	Well Being with Traditional Practices Yoga, Ayurveda and Siddha	MC	3	0	0	3	0	100	-	100
2.	23MDC62	History of Science and Technology in India	MC	3	0	0	3	0	100	-	100
3.	23MDC63	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0	100	-	100
4.	23MDC64	State, Nation Building and Politics in India	MC	3	0	0	3	0	100	-	100
5.	23MDC65	Industrial Safety	MC	3	0	0	3	0	100	-	100

ELECTIVE - MANAGEMENT COURSES

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23MSE71	Principles of Management	HSS	3	0	0	3	3	40	60	100
2.	23MSE72	Total Quality Management	HSS	3	0	0	3	3	40	60	100
3.	23MSE73	Engineering Economics and Financial Accounting	HSS	3	0	0	3	3	40	60	100
4.	23MSE74	Human Resource Management	HSS	3	0	0	3	3	40	60	100
5.	23MSE75	Knowledge Management	HSS	3	0	0	3	3	40	60	100
6.	23MSE76	Industrial Management	HSS	3	0	0	3	3	40	60	100


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PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Drug Design & Development	Vertical II Drug Manufacturing Technologies	Vertical III Quality Control and Quality Assurance	Vertical IV Pharmaceutical Industrial Management
Medicinal Chemistry	Technology of Fine Chemicals and Bulk drugs	Biological spectroscopic techniques	Pharmaceutical Production Management
Bioinformatics and Cheminformatics	Pre formulation Technology	Quality Assurance in Pharmaceutical Industries	Pharmaceutical Supply Chain Management
Protein Structure and Function	Manufacturing Technology of Dosage Forms	Audits and regulatory compliance	Safety and Disaster Management
Computer Aided Drug Design	Industrial Process and Scale up Techniques	Validation in Pharmaceutical Industries	Management Information System
Regulatory Toxicology	Novel Drug Delivery Systems	Quality Management system	Industrial Psychology And Human Resource Management
Clinical Research and Pharmacovigilance	Pharmaceutical Packaging Technology	Product development and technology transfer	Project Management for Pharmaceutical Technology
Chemistry of Natural Products	Chemical Reaction Engineering	Instrumentation and Process Control	Biosafety
Molecular Modeling and Drug Design	Immunology	Experimental Design and Biostatistics	Regulatory Issues in Pharmaceutical Industry


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PROFESSIONAL ELECTIVE COURSES: VERTICALS**VERTICAL I: DRUG DESIGN & DEVELOPMENT**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23PTE11	Medicinal Chemistry	PE	3	0	0	3	3	40	60	100
2.	23PTE12	Bioinformatics and Cheminformatics	PE	3	0	0	3	3	40	60	100
3.	23PTE13	Protein Structure and Function	PE	3	0	0	3	3	40	60	100
4.	23PTE14	Computer Aided Drug Design	PE	3	0	0	3	3	40	60	100
5.	23PTE15	Regulatory Toxicology	PE	3	0	0	3	3	40	60	100
6.	23PTE16	Clinical Research and Pharmacovigilance	PE	3	0	0	3	3	40	60	100
7.	23PTE17	Chemistry of Natural Products	PE	3	0	0	3	3	40	60	100
8.	23PTE18	Molecular Modeling and Drug Design	PE	3	0	0	3	3	40	60	100

VERTICAL II: DRUG MANUFACTURING TECHNOLOGIES

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23PTE21	Technology of Fine Chemicals and Bulk drugs	PE	3	0	0	3	3	40	60	100
2.	23PTE22	Pre formulation Technology	PE	3	0	0	3	3	40	60	100
3.	23PTE23	Manufacturing Technology of Dosage Forms	PE	3	0	0	3	3	40	60	100
4.	23PTE24	Industrial Process and Scale up Techniques	PE	3	0	0	3	3	40	60	100
5.	23PTE25	Novel Drug Delivery Systems	PE	3	0	0	3	3	40	60	100
6.	23PTE26	Pharmaceutical Packaging Technology	PE	3	0	0	3	3	40	60	100
7.	23PTE27	Chemical Reaction Engineering	PE	3	0	0	3	3	40	60	100
8.	23PTE28	Immunology	PE	3	0	0	3	3	40	60	100

VERTICAL III: QUALITY CONTROL AND QUALITY ASSURANCE

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23PTE31	Biological Spectroscopic Techniques	PE	3	0	0	3	3	40	60	100
2.	23PTE32	Quality Assurance in Pharmaceutical Industries	PE	3	0	0	3	3	40	60	100
3.	23PTE33	Audits and regulatory compliance	PE	3	0	0	3	3	40	60	100
4.	23PTE34	Validation in Pharmaceutical Industries	PE	3	0	0	3	3	40	60	100
5.	23PTE35	Quality Management systems	PE	3	0	0	3	3	40	60	100
6.	23PTE36	Product Development and Technology Transfer	PE	3	0	0	3	3	40	60	100
7.	23PTE37	Instrumentation and Process Control	PE	3	0	0	3	3	40	60	100
8.	23PTE38	Experimental Design and Biostatistics	PE	3	0	0	3	3	40	60	100

VERTICAL IV: PHARMACEUTICAL INDUSTRIAL MANAGEMENT

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23PTE41	Pharmaceutical Production Management	PE	3	0	0	3	3	40	60	100
2.	23PTE42	Pharmaceutical Supply Chain Management	PE	3	0	0	3	3	40	60	100
3.	23PTE43	Safety and Disaster Management	PE	3	0	0	3	3	40	60	100
4.	23PTE44	Management Information System	PE	3	0	0	3	3	40	60	100
5.	23PTE45	Industrial Psychology And Human Resource Management	PE	3	0	0	3	3	40	60	100
6.	23PTE46	Project Management for Pharmaceutical Technology	PE	3	0	0	3	3	40	60	100
7.	23PTE47	Biosafety	PE	3	0	0	3	3	40	60	100
8.	23PTE48	Regulatory Issues in Pharmaceutical Industry	PE	3	0	0	3	3	40	60	100


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VERTICAL 1 : DRUG DESIGN & DEVELOPMENT

23PTE11

MEDICINAL CHEMISTRY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart comprehensive understanding of the physicochemical basis of drug action including steric and stereoisomerism.
- To provide knowledge on the classification, chemical nomenclature, generic names and synthesis of various categories of medicinal drugs.
- To enable the students to learn and understand the structure activity relationship, biochemical/molecular basis of mechanism of action and uses of different classifications of drugs.

UNIT-I

PRINCIPLES OF MEDICINAL CHEMISTRY

9

Introduction and history and development of medicinal chemistry physico chemical properties of medicinal chemistry, Metabolism: phase I and phase II, protein binding, receptors, prodrug.

UNIT-II

DRUGS ACTING ON AUTONOMIC NERVOUS SYSTEM

9

DRUGS ACTING ON CENTRAL NERVOUS SYSTEM

Drugs acting on Adrenergic nervous system: Adrenergic receptors, adrenomimetic agents*(SAR), biosynthesis(catecholamine), adrenolytic agents*(SAR)

Drugs Acting On Cholinergic Nervous System: Cholinergic receptors, biosynthesis (Ach) cholinomimetic agents*(SAR), cholinolytic agents*(SAR)

DRUGS ACTING ON CENTRAL NERVOUS SYSTEM

Antipsychotics (chlorpromazine, haloperidol), antidepressants (Amitryptalline, Imipramine), anti-convulsants (*Phenytoin, Gabapentin), sedative and hypnotics (Alprazolam, Diazepam)

UNIT-III

DRUGS ACTING ON CARDIOVASCULAR SYSTEM

9

Diuretics (*Furosemide, Spironolactone), Calcium Channel Blocker (Verapamil, Diltiazem), Antihypertensive Agents (Propranolol, Atenolol), Congestive Heart Failure (Digitoxin, Digoxin), Antianginal Drugs (Glyceryl Trinitrite, Isosorbide Dinitrite)

UNIT-IV

ANTIBIOTICS

9

History and Development Of Penicillin, Classification, Mechanism Of Action, SAR Of penicillin, Cephalosporin, Tetracycline, Macrolide Antibiotics (Erythromycin, Azithromycin) B-Lactamase Inhibitor (Clavulanic Acid), Urinary Tract Anti Infective Agents (Norfloxacin, Ciprofloxacin), Antiviral Agents (Zidovudine)

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UNIT-V**MISCELLANEOUS AGENTS****9**

Antineoplastic Agents (Mercaptopurine, Cyclophosphamide), Antidiabetic Agents (Metformin, Glimepride) Prostaglandins and Eicosanoids, Antihistaminic Agents, H1blocker (Diphenhydramine, Dimenhydrinate), H2blocker (Ranitidine, Cimetidine) Gastric Proton Pump Inhibitors (Omeprazole, Rabeprazole), NSAIDS (Paracetamol, Aceclofenac), Opioid Analgesic (Morphine, Codeine), QSAR and Docking, Molecular Modelling.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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

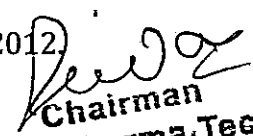
- CO1 :** Correlate the relationship between the physicochemical properties, steric properties and structural features of the drugs with its biological action.
- CO2 :** Explain the biochemical/molecular mechanism of action, Structure Activity Relationship, therapeutic use and depict the synthesis of drugs acting on nervous system.
- CO3 :** Describe the molecular basis of mechanism of action, therapeutic use, Structure Activity Relationship and synthesis of drugs acting on cardiovascular system.
- CO4 :** Illustrate the mechanism of action, therapeutic use and synthesis of antibiotic drugs.
Outline the chemical structure, mechanism of action, Structure Activity Relationship and
- CO5 :** therapeutic uses of miscellaneous agents such as antineoplastic, eicosanoids, eicosanoid blocking, analgesic and NSAIDS.

TEXT BOOKS:

1. Ashutosh Kar, Medicinal Chemistry, 6th Edition, New Age International (P) Ltd. Publishers, New Delhi 2015.
2. Graham L. Patrick, An introduction to Medicinal Chemistry, 6th Edition, Oxford University Press, 2017.
3. Ilango, K. and Valentina, P., "Text book of Medicinal Chemistry", Vol.1 & 2, 1st & 2 nd edition, Keerthi Publishers, 2017.

REFERENCE BOOKS:

1. Donald J. Abraham, Burger's Medicinal Chemistry and Drug Discovery, Vol 1-8, 8th Edition, Donald J. Abraham, Michael Myers, Wiley, 2021.
2. Wilson and Gisvold's Textbook of Organic, Medicinal and Pharmaceutical Chemistry, Editors -John M Beale and John Block, 12th Edition, Lippincott Williams & Wilkins, 2010.
3. William O Foye, Thomas L Lemke, David A Williams Foye's Principles of Medicinal Chemistry, 7th Edition, Wolters Kluwer Health Adis (ESP) Publisher, 2012


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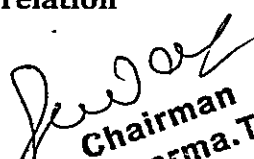
E-RESOURCES:

1. <https://fdspharmacy.in/medicinal chemistry>
2. https://onlinecourses.nptel.ac.in/noc20_cy16/

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	2	3	3	-	2	2	-	-	-	-	2	3	-	3	1
C02	3	1	2	2	-	-	1	-	-	-	-	2	2	-	2	-
C03	3	1	2	2	-	-	1	-	-	-	-	2	2	-	2	-
C04	3	1	2	2	-	-	1	-	-	-	-	2	2	-	2	-
C05	3	1	2	2	-	-	1	-	-	-	-	2	3	-	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTE12	BIOINFORMATICS AND CHEMINFORMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- This course is to provide an introduction to cheminformatics - an interdisciplinary area on the interface of chemistry, informatics and biology.
- The student will be able to learn and understand the fundamentals of cheminformatics and its applications.

UNIT-I	INTRODUCTION TO CHEMINFORMATICS AND DRUG DISCOVERY	9
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Introduction to cheminformatics and its role in drug discovery, Overview of drug discovery process, Molecular databases and molecular mining techniques, Introduction to computational chemistry tools and techniques.

UNIT-II	CHEMICAL DATA ANALYSIS AND VISUALIZATION	9
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Overview data representation and molecular descriptors, Chemical structure drawing and molecular visualization tools, Exploratory data analysis and statistical methods, Cheminformatics in property prediction and SAR analysis, Tools and databases in ADME- Toxicity prediction, AI/ML models for effective drug toxicity and safety assessment.

UNIT-III	STRUCTURE ACTIVITY RELATIONSHIP MODELLING	9
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Protein-ligand interactions, docking techniques and scoring functions, Pharmacophore modeling and visual screening. Quantitative structure activity relationship (SAR) analysis, Molecular mechanics and molecular dynamics simulations, Quantum chemistry methods and calculations.

UNIT-IV	HIGH-THROUGHPUT VIRTUAL SCREENING STRATEGIES	8
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Introduction to high-throughput Virtual screening (HTVS) strategies, Risks/ challenges in HTVS prediction, Ligand-based and structure-based drug screening approaches. Integration of cheminformatics with experimental high-throughput screening (HTS) Automation, Hit lead identification and optimization strategies.

UNIT-V	CASE STUDIES AND APPLICATIONS	10
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Case studies on successful drug discovery projects, Case studies of successful applications in industry and academia. Application of cheminformatics in lead optimization and drug repurposing,

Future trends and emerging technologies in cheminformatics.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Have the knowledge of the basic ligand/structure based drug design approaches.
- CO2 :** Understand the basic chemical data and visualization tools.
- CO3 :** Understand the importance of structure activity relationship and modeling tools.
- CO4 :** Understand and gain knowledge about high throughput screening and their strategies.
- CO5 :** Identify the cheminformatics case studies and their applications

TEXT BOOKS:

1. Introduction to Bioinformatics by Lesk, Arthur M., Oxford University Press
2. Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press.
3. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by Durbin, S.Eddy, A.Krogh, G.Mitchison.
4. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press. Media.
5. Thomas Engel , Johann Gasteiger, Chemoinformatics: Basic Concepts and Methods, ISBN: 978-3-527-33109-3
6. Andrew R Leach and Valerie J. Gillet. (2007). Introduction to Chemoinformatics. Springer publications

REFERENCE BOOKS:

1. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition (2005) Andreas D. Baxevanis Francis Ouellette ISBN: 978-0-471-47878-2
2. Bioinformatics For Dummies, 2nd Edition (2006) Jean-Michel Claverie Cedric Notredame ISBN: 978-0-470-08985-9
3. The Bioinformatics Machine Learning Approach by Pierre Baldi and Soren Brunak. 2nd Edition, MIT Press 2001.
4. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall, O'Reilly
5. Navneet Sharma, Himanshu Ojha, Pawan Raghav and Ramesh Goyal, "Chemoinformatics and Bioinformatics in the Pharmaceutical Sciences, 1st Edition, Academic Press 2021, Paperback ISBN: 9780128217481, eBook ISBN: 9780128217474
6. [https://chem.libretexts.org/Courses/Intercollegiate_Courses/Cheminformatics_OLCC_\(2019\)](https://chem.libretexts.org/Courses/Intercollegiate_Courses/Cheminformatics_OLCC_(2019))

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_bt06/
2. https://onlinecourses.swayam2.ac.in/cec21_bt04/

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	2	2	2	2	2	2	-	-	-	-	2	3	-	-	2
C02	3	2	2	2	2	2	2	-	-	-	-	-	-	3	-	-
C03	2	2	-	1	-	-	-	-	-	-	-	2	-	-	3	-
C04	3	-	-	-	3	-	3	-	-	-	-	-	3	3	-	-
C05	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTE13

PROTEIN STRUCTURE AND FUNCTION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To provide fundamental knowledge on the existence of various structures of proteins.
- To impart knowledge on how these structures relate to their functions.

UNIT-I**BONDS, ENERGIES, BUILDING BLOCKS OF PROTEINS****9**

Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vanderwaals interactions in protein structure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray) and elucidation of protein structure. Amino acids (letter codes) and their molecular properties (size, solubility, charge, pKa), Chemical reactivity in relation to post-translational modification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups)

UNIT-II**PROTEIN ARCHITECTURE****9**

Primary structure, peptide mapping, protein sequencing – automated Edman method & mass-spec High-throughput protein sequencing setup Secondary structure. Alpha, Beta and loop structures and methods to determine Super-secondary structure; Alpha-turn-Alpha, Beta-trn-Beta(hairpin), beta-sheets, alpha-beta-alpha, topology diagrams, up and down & TIM barrel structures nucleotide binding folds, prediction of substrate binding sites.

UNIT-III**TERITARY STRUCTURE****9**

Tertiary structure: Domains, folding, denaturation and renaturation, overview of methods to determine 3D structures. Quaternary structure: Molecular nature, formation of complexes. Computer exercise on the above aspects.

UNIT-IV**STRUCTURE -FUNCTION RELATIONSHIP****9**

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding. Trip repressor, Eukaryotic transcription factors, Zn fingers, Helix-turn-Helix motifs in homeodomin, Leucine zippers, Membrane proteins: General chjaracteristics, Transmembrane segments, prediction, bacteriorhodopsin and photosynthetic reaction center. Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes and enzymes. Serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase, substrate – assised catalysis other commercial applications.

UNIT-V**PROTEOMICS****9**

Introduction to the concept of proteome, components of proteomics, proteomic analysis, importance of proteomics in biological functions, protein arrays, cross linking methods, affinity methods, yeast hybrid systems and protein arrays.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Acquire basic knowledge about bonds, energies, and building blocks of proteins.
- CO2 :** Explain the protein architecture such as peptide mapping, structure and sites for binding.
- CO3 :** Describe the domains, folding and renaturation and denaturation of tertiary and quaternary structure.
- CO4 :** Have a foundational level of understanding of the principles of protein structure-function relations.
- CO5 :** Understand selective pressure at the level of protein structure and dynamics in the evolution of new functions.

TEXT BOOKS:

1. Branden C. and Tooze J., "Introduction to Protein Structures" 2nd Edition, Garland Publishing, 1999'
2. Creighton T.E. "Proteins" 2nd Edition. W.H. Freeman, 1993.
3. Pennington, S.R and M.J. Dunn, "Proteomics: Protein Sequence to Function". VivaBooks, 2002.
4. Peptides and Proteins, RSC - ROYAL SOCIETY OF CHEMISTRY, SHAWN DOONAN
5. Proteins Biochemistry and Biotechnology Second Edition Gary Walsh Wiley Blackwell.
6. Recent review articles from peer reviewed journals.

REFERENCE BOOKS:

1. Liebler, "Introduction to Proteomics" Humana Press, 2002.
2. David Whitford, "Proteins: Structure and Function" John Wiley & Sons Ltd, 2005.
3. Introduction to Proteins Structure, Function, and Motion, Second Edition By Amit Kessel, Nir Ben-Tal Copyright Year 2018 ISBN 9781498747172 Published May 17, 2018 by Chapman and Hall/CRC.
4. Flatt, P.M. (2019) Biochemistry – Defining Life at the Molecular Level. Published by Western

Oregon University, Monmouth. (e-book)

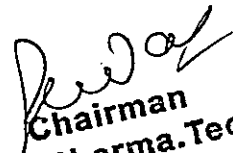
E-RESOURCES:

1. <https://archive.nptel.ac.in/courses/102/103/102103017/>
2. <https://archive.nptel.ac.in/courses/102101007/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	2	3	3	2	-	-	-	-	-	-	2	-	3	2
CO2	2	2	2	3	3	2	-	2	2	-	-	-	-	-	2	-
CO3	3	3	-	3	3	-	2	-	-	-	-	-	-	-	3	-
CO4	3	3	3	3	3	-	-	-	-	-	-	2	-	3	3	-
CO5	2	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation


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23PTE14

COMPUTER AIDED DRUG DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of this course is to

- Find a chemical compound that can fit to a specific cavity on a protein target both geometrically and chemically.
- To know the informatics approaches to the prediction of chemical properties of new drugs
- To present the appropriate tools for such a modelling, ranging from electronic Structure
- Methods, Molecular modelling, Structure Activity Relationships in drug design, QSAR,
- Molecular docking and Molecular dynamics

UNIT-I

ELECTRONIC STRUCTURE METHODS

9

Quantum chemical methods semi-empirical and ab initio methods. Conformational analysis, energy minimization, predicting the mechanism of organic reactions using electronic structure

Methods

UNIT-II

MOLECULAR MODELING

9

Bioactive vs. global minimum conformations. Automated methods of conformational search. Advantages and limitations of available software. Molecular graphics. Computer methodologies behind molecular modeling including artificial intelligence methods.

UNIT-III

STRUCTURE ACTIVITY RELATIONSHIPS IN DRUG DESIGN

9

Qualitative versus quantitative approaches advantages and disadvantages. Random screening, Non-random screening, rational approaches to lead discovery. Homologation, chain branching, ring-chain transformations. Insights into molecular recognition phenomenon. Structure based drug design, ligand based drug design.

UNIT-IV

QSAR: ELECTRONIC EFFECTS

9

Hammett equation, lipophilicity effects. Hansch equation, steric effects. Taft equation. Experimental and theoretical approaches for the determination of physicochemical parameters, parameter inter-dependence: Regression analysis, Descriptor calculation. The importance of biological data in the correct form; 2D QSAR; 3D-QSAR examples of CoMFA and CoMSIA.

UNIT-V

MOLECULAR DOCKING

9

Rigid docking, flexible docking, manual docking. Advantages and disadvantages of Flex-X, Flex-

S, Autodock and Dock softwares, Autodock Vina and large scale screening softwares. Dynamics of drugs, biomolecules, drug receptor complexes, Monte Carlo simulations and Molecular dynamics in performing conformational search and docking.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Gain knowledge about fundamental concepts, challenges, and rich opportunities in developing and applying algorithms for structural bioinformatics and healthcare.
- CO2 :** Interpret and practice the fundamental concepts of Molecular Modeling and Computer aided Drug Design.
- CO3 :** Develop practical skills in computational approaches to analyse, predict, and engineer biomolecules and biomolecular systems.
- CO4 :** Find a chemical compound that can fit to a specific cavity on a protein target both geometrically and chemically.
- CO5 :** Present the appropriate tools for such a modelling, ranging from electronic Structure methods, Molecular modelling, Structure Activity Relationships in drug design, QSAR, Molecular docking and Molecular dynamics

TEXT BOOKS:

1. Andrew R. Leach, Molecular Modelling Principle and Application, 2nd Edition, Prentice Hall, England, 2001.
2. Richard B. Silverman, Mark W. Holladay, Organic Chemistry of Drug Design and Drug Action, 3rd Edition, Academic Press, USA, 2014.
3. Paul S. Charifson, Practical Applications of computer aided drug design, 1st Edition, Marcel Dekker, New York, 1997.
4. J. M. Goodman, Chemical Applications of Molecular Modelling, The Royal Society of Chemistry, Cambridge, 1998.

REFERENCE BOOKS:

1. Donald J. Abraham, Burger's Medicinal Chemistry and Drug Discovery, Vol V, 6th Edition, John Wiley and Sons, Inc., 2003.
2. John B. Taylor and David J. Triggle, Comprehensive Medicinal Chemistry II, Vol IV, Elsevier Science, 2006.
3. Graham L. Patrick, An Introduction to Medicinal Chemistry, 5th Edition, Oxford University Press, UK, 2013.

4. David. C. Young, Computational Drug Design – A Guide for Computational and Medicinal Chemists, John Wiley and Sons Ltd, Hoboken, United States, 2009.
5. Alan Hinchliffe, Molecular Modelling for Beginners, 2nd Edition, Wiley, United University of California, 2008.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_bt29/
2. <https://archive.nptel.ac.in/courses/102/106/102106070/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	2	3	-	3	3	-	-	-	-	1	3	3	2	-	-
C02	3	3	2	2	-	3	-	-	-	-	1	3	2	3	-	-
C03	3	3	2	3	-	1	-	1	-	-	-	2	-	3	2	-
C04	3	2	1	2	-	2	-	-	-	-	1	3	2	-	3	-
C05	3	2	3	3	3	-	1	-	-	-	2	3	-	3	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation


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		L	T	P	C
23PTE15	REGULATORY TOXICOLOGY	3	0	0	3
UNIT-I	INTRODUCTION TO REGULATORY ASPECTS				9
Regulatory aspects and strategy in medical device and biomaterials safety evaluation. Regulations affecting cosmetic and over-the-counter drug products.					
UNIT-II	REGULATIONS GOVERNING TOXICOLOGY				9
Aim and mission, working areas, regulatory process in toxicology, quality assurance in regulatory toxicology, toxicological risk assessment.					
UNIT-III	TOXICOLOGY AND DRUG PRODUCT REGULATIONS				9
Introduction, aspects of the IND / NDA process, toxicology and other issues, paediatric drug products, drug combinations, excipients and reformulations, conclusions.					
UNIT-IV	TOXICOGENOMICS, GENETIC TOXICOLOGY AND REGULATORY POLICY				9
Microarrays in toxicology, proteomics and metabolomics, case examples, toxicogenomics in regulatory environment. Initiation of genetic toxicology testing, ICPEMC, NTP, Genetic toxicology technologies and concepts. Influence of genetic toxicology research on regulatory policy, future role in safety testing strategies.					
UNIT-V	ETHICAL TOXICOLOGY				9
Introduction, Societal need for information about toxic chemicals, evolution of alternatives in toxicology, humane science and animal welfare, assessing alternatives, challenges and future.					
TOTAL : 45 PERIODS					

COURSE OUTCOMES:

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

- CO1 :** Describe the general principles in toxicological risk assessment
- CO2 :** Apprehend both ecotoxicology, human toxicology, and Quality Assurance
- CO3 :** Understand the basic principles of and have current, cutting-edge knowledge in IND/NDA regulatory process.
- CO4 :** Demonstrate an understanding of Toxicogenomics
- CO5 :** Describe the Genetic Toxicology and ethical considerations relating to toxicology within the broader societal context


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TEXT BOOKS:

1. Regulatory Toxicology. Eds. Franz Xaver Reichl and Michael Schwenk. Springer, 2014.
2. Shayne C. Gad, Regulatory Toxicology, Second Edition,, CRC Press, 2001.
3. Toxicology and Regulatory Process. Sidney Green, CRC Press, 2006.

REFERENCE BOOKS:

1. Regulatory Toxicology in the European Union, Ian Dewhurst, Royal Society of Chemistry, 2017
2. Regulatory Toxicology: Essentially Practical Aspects, Renuka Sengupta, Narosa Publishing House, 2015

E-RESOURCES:

1. <https://archive.nptel.ac.in/courses/103/107/103107156/>
2. <https://fdspharmacy.in/regulatory-toxicology/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	3	2	-	-	2	-	-	-	-	2	2	-	-	2
CO2	3	-	3	2	-	-	2	-	-	-	-	2	2	-	1	2
CO3	3	-	3	2	-	-	2	-	-	-	-	2	2	-	1	2
CO4	3	-	3	2	-	-	2	-	-	-	-	2	2	-	1	2
CO5	3	-	1	2	-	-	2	-	-	-	-	2	2	-	1	2

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE16

CLINICAL RESEARCH AND PHARMACOVIGILANCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- give an opportunity to learn the different types and designs of clinical trials, requirements for conducting clinical trials, an opportunity to conceptualize, conduct, manage and report clinical trials
- teach the students on conceptualizing, designing, conducting, managing, and reporting of clinical trials.
- focus on global scenario of pharmacovigilance in different methods that can be used to generate safety data.
- teach the students in developing drug safety data in pre-clinical, clinical phases of drug development and post market surveillance

UNIT-I

REGULATORY PERSPECTIVES OF CLINICAL TRIALS

9

Origin and Principles of International Conference on Harmonization – Good Clinical Practice (ICH-GCP) guidelines; Ethical Committee: Institutional Review Board, Ethical Guidelines for Biomedical Research and Human Participant-Schedule Y, ICMR, the Informed Consent Process: Structure and content of an Informed Consent Process, Ethical principles governing informed consent process.

UNIT-II

CLINICAL TRIALS- TYPES AND DESIGN

9

Experimental Study- Randomised Clinical Trials and Non Randomised Clinical Trials, Observation Study: Cohort, Case Control, Cross sectional; Roles and responsibilities of Clinical Trial Personnel: Investigator, Study Coordinator, Sponsor, Contract Research Organization and its management.

UNIT-III

CLINICAL TRIAL DOCUMENTATION

9

Guidelines to the preparation of documents, Preparation of protocol, Investigator Brochure, Case Report Forms, Clinical Study Report, Clinical Trial Monitoring - Safety Monitoring in CT, Adverse Drug Reactions: Definition and types. Detection and reporting methods. Severity and seriousness assessment, predictability and preventability assessment. Management of adverse drug reactions.

UNIT-IV

BASIC ASPECTS AND TERMINOLOGIES OF PHARMACOVIGILANCE

9

History and progress of pharmacovigilance, Significance of safety monitoring, Pharmacovigilance in India and international aspects, WHO international drug monitoring programme, WHO and

Regulatory terminologies of Adverse Drug Reactions, evaluation of medication safety, Establishing pharmacovigilance centres in Hospitals, Industry and National programmes related to pharmacovigilance.

UNIT-V METHODS, ADR REPORTING, TOOLS FOR PHARMACOVIGILANCE

9

International classification of diseases, International Non-proprietary names for drugs, Passive and Active surveillance, Comparative observational studies, targeted clinical investigations and Vaccine safety surveillance. Spontaneous reporting system and Reporting to regulatory authorities, Guidelines for ADRs reporting. Argus, Aris G Pharmacovigilance, VigiFlow, Statistical methods for evaluating medication safety Data.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Apply the knowledge of the regulatory requirements for conducting clinical trials.
- CO2 :** Apply the knowledge of different clinical trial designs in conducting clinical trials.
- CO3 :** Explain the responsibilities of key players involved in clinical trials and execute safety monitoring, reporting, close-out activities etc.
- CO4 :** Elucidate the principles of pharmacovigilance and detect new adverse drug reactions and their assessment.
- CO5 :** Comprehend the various pharmacovigilance methods and reporting systems.

TEXT BOOKS:

1. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, 2nd edition, 2006, John Wiley and Sons.
2. A textbook of Clinical Pharmacy Practice: Essential Concepts and Skills. Second Edition, 2012, University Press
3. Central Drugs Standard Control Organization- Good Clinical Practices, Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.
4. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice. E6(R2); NOV 2016
5. Ethical Guidelines for Biomedical Research on Human Subjects 2006 (Revised). Indian Council of Medical Research, New Delhi.
6. Textbook of Pharmacovigilance: Concept and Practice. G. P. Mohanta and P. K. Manna. 2016, Pharma Med Press.


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REFERENCE BOOKS:

1. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
2. Handbook of Clinical Research. Julia Lloyd and Ann Raven Ed.,1994 Churchill Livingstone.
3. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes,2001
4. Blaisdell, Peter, "Twenty – First Century Pharmaceutical Development", Interpharm Press, 2001.
5. Gad, Shayne C. "Drug Safety Evaluation", John – Wiley & Sons, 2016.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ge14/
2. <https://nptel.ac.in/courses/127106009>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	1	2	2	2	2	1	3	2	-	-	1	2	1	-	2
CO2	2	2	2	2	1	1	1	1	2	-	2	1	2	-	-	2
CO3	-	1	1	1	-	1	1	3	2	-	2	2	1	-	-	2
CO4	2	2	2	2	1	2	2	2	-	-	-	2	2	-	-	2
CO5	1	1	1	1	2	1	1	-	-	-	-	1	1	-	-	1

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE17

CHEMISTRY OF NATURAL PRODUCTS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- learn, classify and understand the chemistry and structural aspects of medicinal compounds from various natural sources
- understand the structural elucidation principles of compounds from natural sources and relate their therapeutic applications

UNIT-I

STRUCTURAL BASIS OF NATURAL PRODUCTS

9

Chemical and spectral approaches to simple molecules of natural origin. identification of natural products by chromatographic and spectroscopic methods and application of I.R., N.M.R. and Mass spectroscopy in the structural elucidation of organic compounds. Concept of stereoisomerism taking examples of natural products Eg. citral, menthol, camphor, ephedrine, atropine etc.; standardization of traditional drug formulations, chromatographic study of some herbal constituents

UNIT-II

GLYCOSIDES

9

Classification, biosynthetic studies and basic metabolic pathways, introduction to biogenesis of secondary metabolites, chemistry, general methods of extraction, isolation, chemical tests, isolation, medicinal properties and structural elucidation of sennosides, cardenolides and bufadienolides, digoxin and digitoxin, introduction to scillaren A and ouabain.

UNIT-III

ALKALOIDS

9

Classification, biosynthetic studies and basic metabolic pathways, introduction to biogenesis of secondary metabolites, chemistry, general methods of extraction, isolation, chemical tests, isolation and structural elucidation of Pyridine alkaloids, Tropane alkaloids, Quinoline and Isoquinoline alkaloids, Phenanthrene alkaloids, Indole alkaloids, Imidazole alkaloids, Alkaloid amines, Glycoalkaloid, Xanthine alkaloid

UNIT-IV

TERPENES AND FLAVONOIDS

9

Classification, biosynthetic studies and basic metabolic pathways, introduction to biogenesis of secondary metabolites, chemistry, general methods of extraction, isolation, chemical tests, isolation, medicinal properties and structural elucidation, flavonoids, quercetin; Terpenes- special

isoprene rule, mono, diterpenes, triterpenoids and sesquiterpenes, and structural elucidation of citral, carvone, menthol and camphor; Steroids – cholesterol, colour reactions, reactions of steroids, stigmasterol, β -Sitosterol, bile acids, ergosterol, diosgenin, solasodine, hecogenin

UNIT-V

STUDY OF TRADITIONAL DRUGS

9

Classification of indigenous drugs traditional drugs, common vernacular names, botanical source, chemical constituents, uses and marketed formulations with ingredients like – Amla, Shatavari, Bhilwua, bael, bach, rasna, punarnava, gokhru, shankhapushpi, brahmi adusa, arjuna, lahsun, guggul, gymnema, neem, tulsi, Shilajit and Spirulina

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

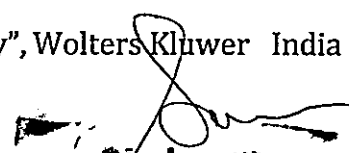
- CO1 :** Apply chromatographic and spectroscopic techniques (I.R., N.M.R., Mass Spectroscopy) to analyze and elucidate the structures of natural products.
- CO2 :** Explain the classification, biogenesis, extraction methods, and structural elucidation of glycosides and their medicinal importance.
- CO3 :** Classify alkaloids, describe their biosynthesis, and elucidate their structures with an emphasis on their pharmacological significance.
- CO4 :** Analyze the structural and medicinal properties of terpenes, flavonoids, and steroids, including their isolation techniques and biogenesis.
- CO5 :** Evaluate the chemical, therapeutic properties, and formulations of traditional drugs, identifying their botanical sources and marketed forms.

TEXT BOOKS:

1. O.P. Agarwal, "Chemistry of Organic Natural Products: Volume I & II", Goel Publishing House, 1980.
2. Gurdeep R. Chatwal, "Organic Chemistry of Natural Products: volume I & II", edited by Arora M, Himalaya publishing house, 2014.
3. I.L. Finar, "Organic Chemistry: Stereochemistry and the Chemistry Natural Products", Volume II, V edition, 2002.

REFERENCE BOOKS:

1. James E Robbers, Varro E Tyler and Lynn R Brady, "Pharmacognosy", Wolters Kluwer India Pvt. Ltd., Ninth edition, 2011.


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2. William C. Evans "Trease and Evans Pharmacognosy", Elsevier Health, UK, 16th edition, 2009.

E-RESOURCES:

3. https://onlinecourses.nptel.ac.in/noc24_ge14/
4. <https://nptel.ac.in/courses/12710456009>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	3	2	1	1	2	2	3	2	2	3	3	2	3
CO2	3	3	3	2	2	1	1	2	2	2	2	2	3	3	3	2
CO3	3	3	3	2	3	2	2	2	2	3	2	3	3	3	3	3
CO4	2	3	3	2	3	2	1	2	2	3	2	2	3	3	3	3
CO5	3	3	2	3	3	3	3	3	2	2	3	3	3	3	2	3

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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2000-2001
2000-2001

23PTE18	MOLECULAR MODELING AND DRUG DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- learn the principles of computer aided bio-molecular docking and simulation.
- plan and select in-silico approaches and tools.
- execute and analyse the results of *in-silico* molecular dynamics simulation and docking experiments for research in drug development.

UNIT-I	INTRODUCTION TO THE DRUG DISCOVERY/DEVELOPMENT	9
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Definition and introduction to Drug Discovery, Stages of Drug Discovery, Strategic Issues in drug discovery and Development, Ligand sources – Natural, synthetic and semi – synthetics, Protein Structure Basics, Protein Databases, Structure file formats, Cheminformatics databases, Graphical and structure viewers.

UNIT-II	CRYSTALLOGRAPHY METHODS OF MODEL DEVELOPMENT	9
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Introduction to Crystallography, Protein crystals, Collecting X-ray Data, Diffraction, Coordinate systems in crystallography, Electron Density maps, Obtaining a model, Judging the molecular models, Other diffraction methods for model building, Tools for studying macromolecules.

UNIT-III	MOLECULAR MODELING AND MOLECULAR MECHANICS	9
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Introduction to Molecular Modelling, Protein Secondary and Tertiary structure elements, Homology Modelling - steps to get a model, Refinement of the model, Empirical Force Fields for Molecular Mechanics: bond stretching, angle bending, torsion, improper torsion, Lennard-Jones potential and van der waals interactions.

UNIT-IV	COMPUTER SIMULATION METHODS	9
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Introduction to Molecular Dynamics Simulation and Monte Carlo Simulation Methods, History of Molecular Dynamics, Calculation of thermodynamic properties, System Preparation, Energy Minimisation, Periodic Boundary conditions, Hydrogen Bonding, Running Molecular Dynamics Simulation of a Protein, Analysis of Molecular Dynamics Simulation.

UNIT-V	MOLECULAR DOCKING METHODS	9
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Introduction to Molecular docking, Structure Based methods to identify lead components, Denovo

ligand design, Simulation and docking case studies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Explain the stages, strategies, and resources (natural, synthetic, and semi-synthetic ligands) involved in drug discovery and development.
- CO2 :** Apply crystallographic methods to develop, evaluate, and refine molecular models using protein structure data and electron density maps.
- CO3 :** Construct and optimize molecular models using homology modeling and molecular mechanics principles, including empirical force fields.
- CO4 :** Utilize computer simulation methods like molecular dynamics and Monte Carlo simulations to study and analyze biomolecular systems.
- CO5 :** Perform molecular docking studies to identify and optimize lead compounds using structure-based methods and simulation tools.

TEXT BOOKS:

1. Andrew R. Leach "Molecular Modeling Principles and Applications", 2nd Ed., Prentice Hall, 2009
2. J.M. Haile, "Molecular Dynamics Simulation Elementary Methods", John Wiley and Sons, 1997.
3. Gale Rhodes, "Crystallography made crystal clear", Academic Press Inc. 2012.

REFERENCE BOOKS:

1. Jan H Jensen, "Molecular Modeling Basics", CRC Press, 2010.
2. Visualisation Tools : PyMol or VMD Manual, <https://pymol.org>
3. GROMACS Manual, <https://manual.gromacs.org>
4. AUTODOCK Manual, autodock.scripps.edu

E-RESOURCES:

1. <https://pymol.org>
2. <https://manual.gromacs.org>
3. autodock.scripps.edu


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CO's – PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	3	2	2	1	2	1	2	2	3	2	3	3	2	3	2
C02	3	3	3	3	2	2	1	3	2	2	2	3	3	3	3	2
C03	3	3	3	3	3	2	1	3	2	3	2	3	3	3	3	3
C04	3	3	3	3	3	2	2	2	2	3	2	3	3	3	3	3
C05	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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[illegible]

VERTICAL II: DRUG MANUFACTURING TECHNOLOGIES

23PTE21

TECHNOLOGY OF FINE CHEMICALS AND BULK DRUGS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- Understand the basic concept of bulk drug and their intermediates involved in the manufacture.
- Understand the diverse aspects in bulk drug industry like unit processes, equipments used and process optimization.
- Acquire the knowledge on plant design, process development and chemical hazards in fine chemical and bulk drug industry.

UNIT-I

INTRODUCTION OF FINE CHEMICALS AND BULK DRUGS

9

Concept of fine and Bulk drugs and their salient features – Evolution of process – Process chemistry – Research and development strategies in pharmaceutical industries, Chemical process life cycle, Legislative requirements for safe process development and scale up.

UNIT-II

PRODUCTION, PLANNING AND CONTROL

9

Flow sheets – Types of flow sheets – Flow symbols – Line symbols – Concept of all purpose and multipurpose plants – Plant design – Layout -- Process economics – Materials of construction – Effluent minimization and control and solvent recovery for fine chemicals and bulk drugs.

UNIT-III

PROCESS DEVELOPMENT AND HAZARDS

9

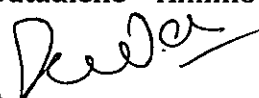
Developing the best synthetic route; Selection of the best route for scale-up, Choice of raw materials and reagents, Development techniques for safe process design, Effect of process variables on yield and quality of products, Unit operations posing particular hazards during development, Strategies for chemical hazards assessment, Hazards of gas and vapor generation, Identification of highly-energetic materials.

UNIT-IV

**BASE CHEMICALS, DRUG INTERMEDIATES AND FINE CHEMICAL
PRODUCTION**

9

Manufacture of following chemicals and their applications – Sulphuric acid – Caustic soda – Ammonia – Phenol – Industrial alcohol – Urea – Acrylonitrile – Ethyl acetate – Butadiene – Aniline – Titanium dioxide – Vanillin.


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UNIT-V**BULK DRUGS PRODUCTION****9**

Raw Materials – Production Techniques – Reaction Flow Sheet – Equipments Utilities for the production of drugs below – Paracetamol – Aspirin – Ibuprofen – Diazepam, Vitamin C – Salbutamol – Ranitidine – Sulphamethoxazole – Cephalosporins – Erythromycin, Chloramphenicol, Sulfathiazole.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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

- CO1 :** Apply legislative requirements and obtain official approval of the regulatory authorities for safe process development and scale up of fine chemicals and bulk drugs industries.
- CO2 :** Demonstrate the importance of flow sheets, flow symbols, plant design, layout and plant construction materials for the production of bulk drugs and fine chemicals and to implement the concept of effluent treatment and solvent recovery in pharmaceutical industries
- CO3 :** Develop and optimize the best synthetic scheme and pilot plant procedure to manufacture compounds and to insist development techniques for safe process considering the hazard assessment
- CO4 :** Apply the knowledge of process chemistry in the production techniques of fine chemicals.
- CO5 :** Analyze the different process involved in bulk drug manufacturing chemical and manufacturing processes associated with the production of small molecule drugs.

TEXT BOOKS:

1. Gopal Rao, M. and Sittig, M., "Dryden's Outlines of Chemical Technology", 3rd Edition, Affiliated East West Press Pvt. Ltd., 2001.
2. Austin, G.T., "Shreve's Chemical Process Industries", 5th Edition, McGraw Hill Book Company, 2012.
3. Pandey, G.N., "A Text Book of Chemical Technology", Vol. II, Vikas Publishing House (P) Ltd., 2000.

REFERENCE BOOKS:

1. A. Cybulski, "Fine Chemicals Manufacture- Technology and Engineering Elsevier Publication, 2000
2. Stanley Nusim, "Active Pharmaceutical Ingredients" Informa Healthcare, 2009


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E-RESOURCES:

1. <https://fdspharmacy.in/fine-chemicals-bulk-drugs/>
2. <https://nptel.ac.in/courses/103106108>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
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CO3	3	2	3	3	3	2	2	2	2	-	-	2	3	2	-	2
CO4	3	2	3	3	3	2	2	2	-	-	2	2	3	2	2	-
CO5	3	2	2	3	3	2	2	2	-	-	2	2	3	2	-	2

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE22

PRE FORMULATION TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To recognize the principles of preformulation
- To understand the role of preformulation in drug and formulation development.

UNIT-I**FUNDAMENTALS OF PREFORMULATION****9**

Preformulation studies of drug substances, proteins and peptides- Fundamental and derived properties in preformulation profiling -Preformulation worksheet.

UNIT-II**ROLE OF PREFORMULATION IN FORMULATION DEVELOPMENT****9**

Preformulation as a support for formulation development- identification of 'developmental challenges' during pharmaceutical development - dosage form specific studies.

UNIT-III**SALT SELECTION****9**

Role of salt selection in drug discovery and development - theoretical concepts for selection of counter ions for salt formation- 'pKa rule' for salt formation- decision tree for salt selection- appropriate case studies.

UNIT-IV**SOLUBILIZATION****9**

Solubility and solubilization of non-electrolyte- drug solubilization in surfactant systems -use of co-solvents for development of liquid formulations-solid state manipulations including use of metastable solid forms like amorphous state.

UNIT-V**OPTIMIZATION TECHNIQUES IN PHARMACEUTICAL FORMULATION****9****AND PROCESSING**

Introduction- optimization parameters- statistical design-response surface method, contour diagrams, factorial design, partial factorial design, simplex methods, mixture designs, and Box Benken method- applications in pharmaceutical formulation.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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


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- CO1 :** Apprehend the principles of preformulation
CO2 : Demonstrate the role of preformulation in Formulation
CO3 : Comprehend the strategy of salt selection of drugs
CO4 : Understand the solubilisation role in preformulation
CO5 : Know the optimization techniques

TEXT BOOKS:

1. Mark Gibson, Pharmaceutical Preformulation and Formulation, A Practical Guide from Candidate Drug Selection to Commercial Dosage Form, 2nd Edition, CRC Press, 2009
2. James I. Wells. Ellis Horwood, Pharmaceutical preformulation: The physicochemical properties of drug substances.
3. Aulton's Pharmaceuticals, The Design and manufacture of Medicines, Churchill Livingstone Elsevier, 2013.

REFERENCE BOOKS:

1. Ram I. Mahato, Ajit S. Narang, Pharmaceutical Dosage Forms and Drug Delivery, CRC Press, 2007
2. Simon Gaisford, Mark Saunders, Essentials of Pharmaceutical Preformulation, John Wiley & Sons, 2012

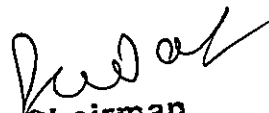
E-RESOURCES:

1. <https://nptel.ac.in/courses/104102113>
2. <https://fdspharmacy.in/pre-formulations/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	3	2	-	-	2	-	-	-	-	2	2	-	-	2
CO2	3	-	3	2	-	-	2	-	-	-	-	2	2	-	1	2
CO3	3	-	3	2	-	-	2	-	-	-	-	2	2	-	1	2
CO4	3	-	3	2	-	-	2	-	-	-	-	2	2	-	1	2
CO5	3	-	1	2	-	-	2	-	-	-	-	2	2	-	1	2

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE23	MANUFACTURING TECHNOLOGY OF DOSAGE FORMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- Impart the knowledge of the various types and stages of process of dosage forms and sterile pharmaceutical products.
- Understand the principles of formulating Parenterals and ophthalmics.

UNIT-I	INTRODUCTION TO DOSAGE FORMS TECHNOLOGIES	9
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Introduction to dosage forms, classifications, definitions, advantages and disadvantages of different dosage forms, applications.

UNIT-II	SOLIDS DOSAGE FORMS	9
----------------	----------------------------	----------

Tablets : Introduction, ideal properties, Excipients, granulation methods, Equipments and Tablet Tooling, compression and processing problems of tablet

Capsules:

Hard gelatin capsule: production of hard gelatin capsule. Size of capsule, filling, finishing and special Techniques of formulation of hard gelatin capsule, manufacturing defects.

Soft gelatin capsule: production of soft gelatin capsule. Size of capsule, Importance of base adsorption and minim / gram factor, different techniques, manufacturing defects.

UNIT-III	LIQUIDS DOSAGE FORMS	9
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Monophasic liquids : Definitions and preparation of Gargles, Mouthwashes, Throat paint, Eardrops, nasal drops, syrups, Elixirs, Liniments and Lotions.

Biphasic liquids:

Suspensions : Definition, Ideal properties, Excipients, preparation of suspension, Flocculated suspension and deflocculated suspensions and stability problems and methods to overcome.

Emulsion : Defintion, Ideal properties, Excipients, Method of preparation and stability and problems and methods to overcome.

UNIT-IV	STERILE DOSAGE FORMS AND PREPARATION	9
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Parenteral products : Defintion, types, production procedure, production facilities, and controles, aseptic processing.

Formulation of injections, sterile powders, large volume parenterals. Quality control test for

parenterals

Ophthalmic preparation : Definition, absorption of drugs in the eye, raw materials, ocular penetration enhancers, general safety consideration. Formulation of eye drops, eye ointment, eye lotions with their characterization.

UNIT-V

COSMETIC PREPARATION

9

Formulation and production techniques of the following cosmetic preparation; lipsticks, shampoos, cold cream, vanishing creams, tooth paste, hair dyes, sunscreens.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Acquire the concepts of dosage form technologies
- CO2 :** Attain the knowledge of solid dosage form manufacturing technologies
- CO3 :** Acquire the concepts in the formulation of liquids
- CO4 :** Get the knowledge of sterilisation process for the sterile products
- CO5 :** Know the technology used in the formulations of cosmetic products

TEXT BOOKS:

1. Loyd V. Allen, Howard C. Ansel, Pharmaceutical Dosage Forms and Drug Delivery Systems, 10th Edition, Wolters Kluwer Health 2013.
2. Roop K. Khar, SP. Vyas "Lachman/Liebermans: The Theory and Practice of Industrial Pharmacy", 4th Edition, CBS Publishers and Distributors 2013.

REFERENCE BOOKS:

1. James Swarbrick "Encyclopedia of Pharmaceutical Science and echnology", 4th Edition, CRC Press, 2012.
2. Sandeep Nema, Nema Sandeep, John D "Pharmaceutical Dosage Forms: Parenteral Medications", 3rd Edition, Informa Healthcare 2010.
3. David B. Troy, Paul Beringer, Remington: The science and practice of pharmacy, 21st Edition, Lippincott Williams and Wilkins, 2006

E-RESOURCES:

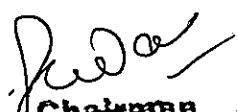
1. https://onlinecourses.nptel.ac.in/noc19_bt23/
2. <https://fdspharmacy.in/dosage-forms/>


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CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	1	-	-	-	-	1	-	-	-	-	-	1	-	-	-
C02	3	1	-	-	-	-	1	-	-	-	-	-	1	-	-	-
C03	3	1	-	-	-	-	1	-	-	-	-	-	1	-	-	-
C04	3	1	-	-	-	1	1	-	-	-	-	-	1	-	-	-
C05	3	1	-	-	-	-	1	-	-	-	-	-	1	-	-	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE24	INDUSTRIAL PROCESS AND SCALE UP TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To develop the concepts of pilot plant and scale-up techniques in industrial processes
- To know the principle, design, methods, and equipment involved in scale – up processes

UNIT-I PILOT PLANT AND SCALE-UP TECHNIQUES 9

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

UNIT-II PRINCIPLE OF SIMILARITY AND DIMENSIONAL ANALYSIS 9

Principle of similarity –Pi- theorem and its applications. Dimensional analysis – Scale up equations – Extrapolations – Analog models. Similitude : types and applications in scale up.

UNIT III SCALEUP OF MIXING PROCESS 9

Pilot plant scale up of flow through ducts and mixing process: packed and fluidized bed

UNIT-IV SCALUP METHODS FOR HEAT AND MASS TRANFER 9

Design and scale up methods for shell and tube heat exchangers and evaporators. Fundamental considerations scale up procedure for distillation column and absorption unit

UNIT-V SCALEUP OF SEPARATION PROCESS EQUIPMENTS 9

Scale up methods for plate and frame filters and cyclone separators

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- C01 :** Acquire the knowledge of pilot plant scale-up techniques for pharmaceutical products
- C02 :** Describe the principle of similarity and similitude in scale –up process
- C03 :** Explains pilot plant design for mixing process equipments
- C04 :** Attain the knowledge of design methods for heat and mass transfer equipments.
- C05 :** Acquire the knowledge of separation process equipments.

TEXT BOOKS:


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

REFERENCE BOOKS:

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

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ch52/
2. <https://archive.nptel.ac.in/courses/112/107/112107219/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	1	-	2	-	-	1	1	-	-	-	-	-	2	1	-	-
C02	3	-	2	-	-	1	1	-	-	-	-	-	2	1	-	-
C03	3	-	2	-	-	1	1	-	-	-	-	-	2	1	-	-
C04	3	-	2	-	-	1	1	-	-	-	-	-	2	1	-	-
C05	3	-	2	-	-	1	1	-	-	-	-	-	2	1	-	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE25

NOVEL DRUG DELIVERY SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- Understand the properties of polymer and its significance in drug delivery systems.
- Interpret physicochemical properties of the drug with the drug delivery system modules.
- Apply the concepts of newer method of drug delivery systems involved in the pharmaceutical sciences and relevance of their drug delivery strategies.

UNIT-I

POLYMERS

9

Polymers used in controlled drug delivery modules – Classification – Advantages and disadvantages of polymers – Polymer Characterisation - Various classes of controlled release systems.

UNIT-II

CONTROLLED RELEASE FORMULATIONS

9

Introduction, concept, advantages and disadvantages. Physicochemical and physiological properties of drugs influencing design of oral controlled drug delivery systems.

UNIT-III

TRANSDERMAL DRUG DELIVERY SYSTEMS

9

Permeation through skin – factors affecting permeation – basic components of TDDS – permeation enhancers – formulation approaches used in development of TDDS and their evaluation

UNIT-IV

TARGETED DRUG DELIVERY SYSTEMS

9

Concepts – Advantages and disadvantages – Nanoparticles – Liposomes – Dendrimers – Magnetically modulated drug delivery.

UNIT-V

DRUG DELIVERY LARGE MOLECULES

9

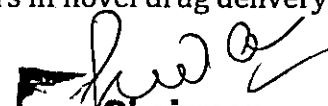
Delivery system for Peptides and Proteins – Delivery strategies of nucleic acids – Antibodies and siRNA.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Understands the properties, importance and influence of polymers in novel drug delivery systems.


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CO2 : Gains the importance of various physicochemical and biological properties of the drug with the controlled release drug delivery systems.

CO3 : Discuss the concepts of transdermal drug delivery systems.

CO4 : Relate the importance of various targeted drug delivery systems.

CO5 : Illustrate the concepts of large molecules based delivery systems.

TEXT BOOKS:

1. Controlled drug delivery Concepts and Advances. Vyas SP, Rook K Khar, First edition, 2002, Vallabh Prakashan, New Delhi.
2. Vyas S.P., Khar R.K, "Targeted & Controlled Drug Delivery: Novel Carrier Systems", CBSPD, 2006.
3. Controlled and Novel Drug Delivery, Jain N.K. 2019. CBS Publishers, New

REFERENCE BOOKS:

1. Vasant Ranade, Mannfred A Hollinger "Drug delivery systems" II ed , CRC Press.
2. Novel Drug Delivery Systems, 2nd Yie. W. Chien. CRC Press.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_bt23/
2. <https://fdspharmacy.in/drug-delivery/>

CO's - PO' & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	3	3	-	-	-	-	-	-	-	-	-	3	-	2	-
CO2	3	-	-	2	-	-	-	1	1	1	-	-	-	2	-	-
CO3	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	2	-	2	-	2	-	-	-	-	-	-	-	-	-
CO5	-	2	-	-	-	-	-	2	-	-	-	-	3	3	-	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE26

PHARMACEUTICAL PACKAGING TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To instill the cognizant of packaging technology and its requirements in pharmaceutical products.

UNIT-I**PHARMACEUTICAL PACKAGING AND LABELLING****9**

Introduction of packaging - classification of packaging - packaging essential requirements functions of packaging - importance / significance of pharma packaging - main packaging materials - ideal package material properties - Label functions - types - label substrate materials - legal requirements of labels-types of closures

UNIT-II**PRIMARY PACKAGING MATERIAL****9**

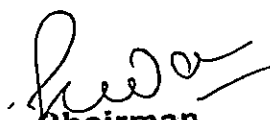
Glass containers- introduction - selection of glass as packaging materials for the pharmaceutical products - properties of glass - production of glass - types of glass - test for glass containers advantages and disadvantages of glass containers. Metals containers- aluminium - aluminium foil - collapsible tubes and stainless steel. Polymers -and plastics- introduction to plastics - raw materials of plastics - types of plastics - resin identification code - plastics and packaging and testing of plastic containers.

UNIT-III**SOLID DOSAGE FORM PACKAGING****9**

Blister package- introduction to blister package - types of blisters - advantages and disadvantages of blister packaging - types of problems/ defects. Strip package- strip Packaging Process - packaging materials - child-resistant and multi-dose strip packaging - tamper evident packaging- intelligent packaging.

UNIT-IV**LIQUID FORMULATION AND STERILE PRODUCT PACKAGING****9**

Liquid Formulation - Factors influencing selection of liquid filling machinery - balanced and unbalanced constant level filling - volumetric - gravimetric - level sensing - time fill - peristaltic and overflow liquid filling machinery. Sterile product packaging- various types of containers used for sterile products like ampoules - vials - bottles for I.V. fluid, etc. Types of closures used for the sterile products. Sterile product filling and sealing machinery i.e. ampoule filling and sealing machine.


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UNIT-V**QUALITYCONTROL AND REGULATIONS OF PACKAGING****9**

Specifications–quality control tests–methods and evaluation of packaging of materials– stability of packaging materials–law and regulations governing packaging.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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

- C01 :** Understand the various categories of packaging materials used in pharmaceutical industry.
- C02 :** Differentiate proper packaging materials for different pharmaceutical dosage forms.
- C03 :** Select and evaluate the appropriate packaging materials for the different dosage forms.
- C04 :** Recognize the factors influencing the packaging of liquid and sterile products.
- C05 :** Understand the regulations of the packaging materials.

TEXT BOOKS:

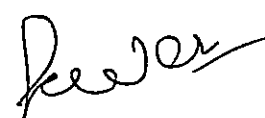
1. Textbook of Pharmaceutical Packaging Technology. Kaushik A.Chaurasia B. Dakar V. First Edition. CBS Publishers New Delhi. 2019
2. D.A. Dean, E.R. Evans, I.H. Hall, "Pharmaceutical Packaging Technology", Taylor and Francis,2000.
3. Edward J. Bauer, Pharmaceutical Packaging Handbook. CRC Press, 2009.

REFERENCE BOOKS:

1. Anonymous,"Quality Assurance of Pharmaceuticals:A Compendium of Guidelines and Related Materials",2nd Edition, World Health Organization,2004.
2. U.K. Jain, D.C. Goupale, S. Nayak, "Pharmaceutical Packaging Technology", 2nd ed., Pharma Med Press, Hyderabad, 2008.
3. Remington: The Science and Practice of Pharmacy. 21st edition, 2005.
4. James Swarbrick, "Encyclopedia of Pharmaceutical Science and Technology", 4th edition, CRC Press, 2013.

E-RESOURCES:

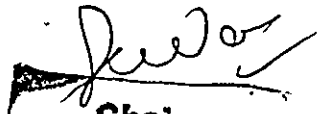
1. <https://nptel.ac.in/courses/127106237>
2. <https://fdspharmacy.in/packaging/>


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CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	2	2
CO3	-	-	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO4	-	-	2	2	2	-	-	-	-	-	-	-	-	2	-	2
CO5	3	-	-	-	-	-	2	-	-	-	-	-	-	-	-	1

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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-- multiple reactions.

CO3 : Evaluate reactor performance under non-ideal flow conditions using RTD and non-ideal flow models.

CO4 : Apply the principles of resistances and rate equations in gas-solid and gas-liquid reactions with heterogeneous catalysis.

CO5 : Design and analyze the performance of fixed bed and fluidized bed reactors for gas-liquid and fluid-fluid reactions.

TEXT BOOKS:

1. Levenspiel O. "Chemical Reaction Engineering", III edition, John Wiley, 2012.
2. Fogler H.S. "Elements Of Chemical Reaction Engineering", IV edition, Pearson Education India, 2015.

REFERENCE BOOKS:

1. Missen R.W., Mims C.A., and Saville B.A. "Introduction to Chemical Reaction Engineering and Kinetics", John Wiley & sons, 1999.
2. Dawande, S.D., "Principles of Reaction Engineering", I edition, Central Techno Publications, 2001.
3. Richardson, J.F. and Peacock, D.G., "Coulson & Richardson's Chemical Engineering, Vol. III", III edition, Butterworth- Heinemann- Elsevier, 2014.

E-RESOURCES:

1. <https://nptel.ac.in/courses/125498237>
2. <https://fdspharmacy.in/chemical-reactors/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	3	3	2	1	1	2	2	3	2	3	3	3	2	3
CO2	3	3	3	3	2	2	1	2	2	3	2	3	3	3	3	2
CO3	3	3	3	3	3	2	2	2	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	2	2	2	2	3	2	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3

1 - Low, 2 - Medium, 3 - high, '-' - no correlation

23PTE28

IMMUNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- Discuss the structure, functions and integration of the immune system.
- Explain the antigen-antibody interactions and how the immune system is protecting the body from foreign pathogens/germs.
- Explain various techniques of monoclonal and engineered antibodies (important therapeutic molecules) production, for treating most of the human diseases.

UNIT-I

INTRODUCTION TO IMMUNE SYSTEM

9

Organisation and classification of immune system – immune cells and organs; innate and acquired immunity; Toll receptors and responses, classification of antigens – chemical and molecular nature; haptens, adjuvants; cytokines; complement pathway, antigen presenting cells; major histocompatibility complex.

UNIT-II

HUMORAL AND CELLULAR IMMUNITY

9

Development, maturation, activation, regulation, differentiation and classification of T-cells and B-cells, antigen processing and presentation, theory of clonal selection, TCR; antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions: precipitation, Agglutination, complement fixation, IFT, RIA, ELISA.

UNIT-III

IMMUNITY AGAINST PATHOGENS AND TUMORS

9

Inflammation; protective immune responses to viruses, bacteria, fungi and parasites; tumor antigens, tumor immune response, tumor diagnosis, tumor immunotherapy

UNIT-IV

IMMUNE TOLERANCE AND HYPERSENSITIVITY

9

Immune tolerance, Immunodeficiencies; Transplantation – genetics of transplantation; laws of transplantation; Allergy and hypersensitivity – Types of hypersensitivity, Autoimmunity, Autoimmune disorders and diagnosis.

UNIT-V

APPLIED IMMUNOLOGY

9

Monoclonal antibodies, engineering of antibodies; Classification of Vaccines, methods of vaccine development, immunodiagnostic methods (Immunodiffusion ELISA, FACS), immunomodulatory drugs.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand about immune system, its structure and functions.

CO2 : Gain knowledge on various concepts of antibodies

CO3 : Learn about immune responses to various pathogens.

CO4 : Understand the principles behind the production of therapeutic /diagnostic molecules.

CO5 : Understand the various methods of vaccine development

TEXT BOOKS:

1. Roitt I, Male, Brostoff. Immunology, Mosby Publications, XII edition, 2011.
2. Kuby J, Immunology, WH Freeman & Co., VII edition, 2012.
3. Ashim K. Chakravarthy, Immunology, Tata McGraw-Hill, 2006.

REFERENCE BOOKS:

1. Coico, Richard, "Immunology: A Short Course", VI Edition, John Wiley, 2008.
2. Khan, Fahim Halim, "Elements of Immunology", Pearson Education, 2009.
3. Abbas, Lichtman and Shiv Pillai, "Cellular and Molecular Immunology", VI edition, Elsevier, 2017

E-RESOURCES:

3. <https://fdspharmacy.in/immunity/>
4. <https://nptel.ac.in/courses/346788>

CO's – PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	1	1	1	-	1	1	1	-	-	-	2	2	2	2	-
CO2	2	2	3	2	2	1	2	1	-	-	-	2	2	2	3	-
CO3	2	2	2	2	2	-	1	-	-	-	-	3	3	2	2	-
CO4	3	2	2	2	2	1	1	2	-	2	-	3	3	2	3	-
CO5	2	2	2	2	2	1	2	2	-	2	-	2	2	2	3	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation

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CO3 : Describe the theory and operation of X-ray diffraction; Determination of crystal structure of drug molecule.

CO4 : Understand and demonstrate the key steps in analytical method development and validation.

CO5 : Apply the techniques in material science for research, quality control and analysis

TEXT BOOKS:

1. Banwell, Colin N. and E.M. McCash. "Fundamentals of Molecular Spectroscopy" IVth Edition, Tata McGraw-Hill, 2017.
2. Aruldas, G. "Molecular Structure and Spectroscopy". IInd Edition, Prentice Hall of India, 2007.
3. G.R. Naik. Applied biological engineering principles and practice. InTech, Croatia, 2012.
4. Williams, Dudley H. and Ian Fleming. "Spectroscopic Methods in Organic Chemistry". VIth Edition, Tata McGraw-Hill, 2007.

REFERENCE BOOKS:

1. ICH Harmonized Guideline BIOANALYTICAL METHOD VALIDATION M10.
2. Hammes, Gordon G. "Spectroscopy for the Biological Sciences". John Wiley, 2005. 80
3. Hobert H. Willard, "Instrumental Methods of Analysis", 7th Edition, CBS Publishers & Distributors, 2004.
4. Atkins P.W., "Physical Chemistry ", 10th Edition, Oxford University Press India

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cy59/
2. <http://fdspharmacy.in/spectroscopy/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	2	2	3	-	2	-	2	-	-	1	1	2	1	2
CO2	3	3	2	2	3	-	2	-	2	-	-	1	1	2	1	2
CO3	3	-	2	2	3	-	2	-	-	-	-	-	1	2	1	2
CO4	3	3	2	2	3	-	2	-	2	-	-	1	1	2	1	2
CO5	3	-	2	2	3	-	2	-	-	-	-	-	1	2	1	2

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE32	QUALITY ASSURANCE IN PHARMACEUTICAL INDUSTRIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To understand the importance of cGMP aspects in a pharmaceutical industry.
- To understand the responsibilities of QA and QC departments.

UNIT-I GOOD LABORATORY PRACTICE 9

Concept and evolution and scopes of Quality Control and Quality Assurance. Good Laboratory Practices: Scope of GLP, The principles of good laboratory practice, Test facility management, Quality assurance programme, protocol for conduct of non-clinical testing

UNIT-II ANALYSIS OF RAW MATERIAL 9

Developing specification for new drug substances, new drug products and impurities as per ICH Q6 and Q3.

UNIT-III IN-PROCESS QUALITY CONTROL 9

Laboratory control, testing and release for distribution, in-process control, water for pharmaceutical use, aseptic process control, deviation procedure, stability testing.

UNIT-IV QUALITY ASSURANCE 9

Quality assurance of finished products - tablets, capsules, ointments, parenteral, creams according to Indian Pharmacopoeias.

UNIT-V GUIDANCE FOR INDUSTRY PAT 9

Guidance development process and scope, process understanding-principles and tools – PAT tools- Risk based approach-Integrated systems approach-Real time release – strategy for implementation- PAT regulatory approach.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Apply GLP regulation in pharmaceutical manufacturing.

CO2 : Perform an experiment using modern equipment's in identifying the drug substance, drug


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products and impurities.

CO3 :

Design and develop process to ensure the critical systems in pharmaceutical industries and products by In-process control.

CO4 :

Demonstrate the different assessments involved in the finished products

CO5 :

Understand the principle and process involved in the process analytical technology

TEXT BOOKS:

1. The Quality Management Sourcebook: An International Guide to Materials and Resources By Christine Avery; Diane Zabel, Routledge, 1997.
2. The Quality Toolbox, Second Edition, Nancy R. Tague, ASQ Publications.
3. Juran's Quality Handbook, Sixth Edition, Joseph M. Juran and Joseph A. De Feo, ASQ Publications.

REFERENCE BOOKS:

1. Root Cause Analysis, The Core of Problem Solving and Corrective Action, Duke Okes, 2009, ASQ Publications.
2. Good laboratory Practice Regulations – Allen F. Hirsch, Volume 38, Marcel Dekker Series, 1989.
3. The drugs and cosmetics act 1940 – Deshpande, Nilesh Gandhi, 4 th edition, Susmit Publishers, 2006.
4. Sarker DK. Quality Systems and Controls for Pharmaceuticals

E-RESOURCES:

1. <https://fdsparmacy.in/quality-assurance/>
2. <http://digimat.in/nptel/courses/video/104106106/L01.html>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	-	-	-	-	-	-	2	-	-	-	3	3	2	2
CO2	-	-	3	3	2	-	-	-	-	-	-	1	-	3	3	2
CO3	3	3	-	-	3	2	-	-	2	2	-	2	-	-	3	2
CO4	3	-	3	3	3	2	2	-	2	2	-	2	2	3	3	2
CO5	3	3	3	3	3	2	2	-	2	2	-	2	3	3	3	2

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE33	AUDITS AND REGULATORY COMPLIANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To understand the importance and methodology of auditing.
- To prepare check list for audit process, audit report and regulatory compliance.

UNIT-I	INTRODUCTION – AUDIT	9
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Objectives, Management of audit, Responsibilities, Audit checklist for drug industries, factory acceptance test (FAT), site acceptance test.

UNIT-II	VENDOR AUDIT & PRE-APPROVAL INSPECTIONS/INVESTIGATIONS	9
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Vendor certification- Objectives, vendor appraisal, Vendor rating, Assessment of new vendor, vendor preferences, rewards system. Pre-Approval Inspections- Facility cGMP compliance and the capability to produce the product, Data accuracy and completeness, Laboratory methodology, manufacturing changes to approved drugs.

UNIT-III	AUDITING OF MICROBIOLOGICAL LABORATORY	9
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Auditing the process, Product and process information, General areas of interest in the building raw materials, Water, Packaging materials.

UNIT-IV	AUDITING OF QUALITY ASSURANCE AND ENGINEERING	9
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Quality Assurance Maintenance, Critical systems: HVAC – Purpose, life cycle, control during routine operation, Required Quality for Water for Pharmaceutical Purposes, Selection of Water for Pharmaceutical Purposes, Equipment and Components for Water System - Purposes of an Air Handling System, verification of air quality Cleanliness.

UNIT-V	QUALITY AUDIT AND REGULATORY COMPLIANCE	9
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Scope, objective, quality audit, periodic evaluation, self-inspection, quality audit – internal audit, external audit, regulatory audit, role of GMP audits in QC and QA, benefits of GMP audits, elements of a systemic audit.

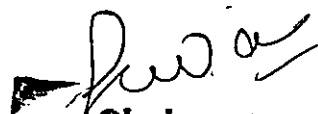
TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Perform the auditing in pharmaceutical industries.

CO2 : Design and develop the check list for vendor auditing and inspection of the pharmaceutical industries.


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CO3 : Design and develop process in checking the microbial laboratory facility.

CO4 : Perform and verify the critical engineering systems in pharmaceutical manufacturing area.

CO5 : Demonstrate the different auditing process and prepare the compliance report for approval pharmaceutical products.

TEXT BOOKS:

1. Compliance Auditing for Pharmaceutical Manufacturers: A Practical Guide to In-Depth Systems Auditing by Karen Ginsbury, Gil Bismuth, CRC Press BSP Books, 2018.
2. Pharmaceutical Manufacturing Handbook, Regulations and Quality by Shayne Cox Gad. Wiley Interscience, A John Wiley and sons, Inc., Publications. 2008.
3. Handbook of microbiological Quality control. Rosamund M. Baird, Norman A. Hodges, Stephen P. Denyar. CRC Press. 2000.

REFERENCE BOOKS:

1. Laboratory auditing for quality and regulatory compliance. Donald C. Singer, Raluca-loana Stefan, Jacobus F. Van Staden. CRC Press (2008).
2. Pharmaceutical Process validation by Robert A. Nash, Alfred H. Wachter, Marcel Dekker Inc, 2003.
3. Pharmaceutical Vendors Approval Manual A Comprehensive Quality Manual for API and Packaging Material Approval by Erfan Syed Asif, CRC Press, 2021.

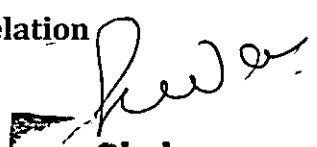
E-RESOURCES:

1. <https://fdspharmacy.in/quality-audit/>
2. <http://digimat.in/nptel/courses/video/104106106/L01.html>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	3	-	-	-	-	-	2	2	-	2	-	3	-	2
CO2	-	-	3	3	2	-	-	-	2	2	-	2	-	-	3	2
CO3	3	3	3	3	-	2	2	-	2	2	-	2	-	3	3	2
CO4	-	3	3	3	3	-	-	-	2	2	-	2	-	-	3	2
CO5	3	3	3	3	3	-	2	-	2	2	-	2	-	3	3	2

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE34	VALIDATION IN PHARMACEUTICAL INDUSTRIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

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

UNIT-I CONCEPTS OF VALIDATION 9

Introduction – Regulatory basis for process validation – Total approach to pharmaceutical process validation – Pilot- scale up and process validation – Process validation order of priority – Process characterization and optimization techniques – Process validation as a quality assurance tool.

UNIT-II EQUIPMENT VALIDATION 9

Introduction – Project Scope- Prequalification – Installation Qualification –Operation Qualification – Process qualification – Equipment Approval – change Control.

UNIT-III CLEANING VALIDATION 9

Regulatory requirements– Multiplevs dedicated equipment– Uniquenatureof API–Multiple level approach to cleaning–Natureofcontaminants–Selectionofa worstcase–Cleaning techniques – Sampling – Analytical methods – Limits and acceptance criteria, documentation.

UNIT-IV ANALYTICAL METHOD VALIDATION 9

Introduction –Premarketing activities in assay validation methods development- Validation on analytical procedures(Q2A) - Validation for a NDA, ANDA – Validation in the quality control laboratory and transfer of methods from one laboratory to another.

UNIT-V PROCESS VALIDATION 9

Process validation as a quality assurance tool-General QA tools, purpose of process validation, Qualification activities, Process validation activities. Prospective process validation-Organization, documentation, product development, development of manufacturing capability, full scale production development, defining experimental programs, experimental design and analysis.

TOTAL : 45 PERIODS


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COURSE OUTCOMES:

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

- CO1 :** Understand about the validation approach in pharmaceutical industries.
- CO2 :** Perform the different equipment validation process for successful installation of equipment.
- CO3 :** Design and develop process in cleaning the equipment based on cleaning validation in pharmaceutical industries.
- CO4 :** Design, develop an experiment process using modern equipment tools in identifying the drug substances and products.
- CO5 :** Demonstrate the different process and activities involved in the new product development.

TEXT BOOKS:

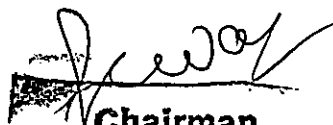
1. R.A. Nash, A.H. Wachter, "Pharmaceutical Process Validation", 3rd ed., CRC Press, Taylor & Francis Group, 2003.
2. Y. Anjaneyulu, R.Maraya, "Quality Assurance and Quality Management in Pharmaceutical Industry", Pharma Book Syndicate, 2005.
3. J. P. Agalloco, F.J. Carleton, "Validation of Pharmaceutical Processes", 3rd ed., Informa Healthcare, NY, USA, 2007.

REFERENCE BOOKS:

1. Michael Levin, Pharmaceutical Process Scale-Up||, Drugs and Pharm. Sci. Series, Vol. 157,2nd Ed., Marcel Dekker Inc., N.Y.
2. Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook, Phillip A. Cloud, Interpharm Press
3. Analytical Method validation and Instrument Performance Verification by Churg Chan, Heiman Lam, Y.C. Lee, Yue. Zhang, Wiley Inter Science.

E-RESOURCES:

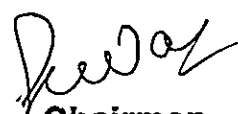
1. <https://nptel.ac.in/courses/165108102>
2. <http://fdspharmacy.in/validation/>


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CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	3	-	-	-	-	-	-	2	-	-	-	-	-	3	2
C02	-	-	3	3	2	-	-	-	-	-	-	1	-	3	-	-
C03	-	-	3	-	3	2	1	-	-	-	-	-	3	3	2	-
C04	-	-	3	3	3	-	-	-	2	1	-	2	-	3	3	-
C05	-	-	3	3	-	-	-	-	2	-	-	1	3	-	3	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE35

QUALITY MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To provide the basic fundamental knowledge and importance of quality in pharmaceutical products.
- Analysis the issues in quality and provides tools for quality improvement.

UNIT-I**QUALITY MANAGEMENT****9**

Basics of Quality Management, Total Quality Management (TQM), Principles of Six sigma, ISO 9001 and ISO 14000, Pharmaceutical Quality Management – ICH Q10.

UNIT-II**QUALITY SYSTEMS****9**

Personal hygiene, sanitation, training, calibration, cleaning and monitoring of equipment, packaging and labeling, product coding, documentation, inventory control, ware housing.

UNIT-III**QUALITY SYSTEM INSPECTION****9**

Out of Specifications (OOS), Out of Trend (OOT), Complaints and evaluation of complaints, handling of returned goods and its disposal, product recalls, rejects and scrap disposal, annual product reviews, batch review and batch release, area clearance, line clearance.

UNIT-IV**QUALITY RISK ASSESSMENT****9**

Quality risk management - Introduction, risk assessment, risk control, risk review, risk management tools, HACCP, risk ranking and filtering according to ICH Q9 guideline.

UNIT-V**QUALITY CULTURE DEVELOPMENT****9**

Quality by design – Definition, overview, elements of QbD program tools according to ICH Q8 (R2) guideline, measuring process control and quality improvement. Product life cycle management – corrective preventive action process.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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

CO1 : Understand and develop different standards for the quality management.

CO2 : Understand, design, develop and implement the systems in pharmaceutical industries.

- CO3 :** Demonstrate and verify the process to ensure the product quality and quality systems.
- CO4 :** Verify and assess the quality risk process and manage to ensure the products quality in the manufacturing.
- CO5 :** Develop the quality culture by adopting new strategies for improving the process and quality of the product.

TEXT BOOKS:

1. Good manufacturing procedure for Pharmaceuticals by Joseph D. Nally. Informa Health Care, NY, USA, 2007.
2. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control by Sidney H. Wiliig, James R. Stoker, Dekker Series, 1997
3. Understanding, Managing and Implementing Quality Frameworks, Techniques and Cases, By Jiju Antony; David Preece, Routledge, 2002.

REFERENCE BOOKS:

1. cGMP Current Good Manufacturing Practices for Pharmaceuticals by Manohar A. Potdar and Ramkumar Dubey, Pharmamed Press / BSP Books, 2018.
2. ISO 9001, ISO 14001, and New Management Standards, by Inaki Heras-Saizarbitoria, Springer, 2018.
3. Good Manufacturing Practices for Pharmaceuticals by Graham P. Bunn, CRC Press, 2018.

E-RESOURCES:

1. <https://nptel.ac.in/courses/165108102>
2. <http://fdspharmacy.in/quality-assurance/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	3	-	-	-	-	-	2	2	-	2	3	-	3	2
CO2	3	-	3	3	2	-	-	-	2	2	-	2	3	-	3	2
CO3	-	3	3	3	2	2	2	-	2	2	-	2	-	3	3	2
CO4	3	-	3	3	3	2	2	-	2	2	-	2	-	3	3	2
CO5	3	3	3	3	3	2	2	-	2	2	-	2	3	3	3	2
CO6	3	3	3	3	2	2	2	-	2	2	-	2	3	3	3	2

1 - Low, 2 - Medium, 3 - high, '-' - no correlation

23PTE36	PRODUCT DEVELOPMENT AND TECHNOLOGY TRANSFER	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To understand the new drug substance development process.
- To understand the information to pilot plant scale up and technology transfer from R& D to manufacturing premises.

UNIT-I	PRINCIPLES OF DRUG DISCOVERY AND DEVELOPMENT	9
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Development and informational content for Investigational New Drugs Application (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Supplemental New Drug Application (SNDA), Scale Up Post Approval Changes (SUPAC), Post marketing surveillance, Product registration.

UNIT-II	PRE-FORMULATION STUDIES	9
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Introduction/concept, organoleptic properties, purity, impurity profiles, particle size, shape and surface area. Solubility, Methods to improve solubility of Drugs: Surfactants & its importance, co-solvency. Techniques for the study of Crystal properties and polymorphism.

UNIT-III	PHARMACEUTICAL PACKAGING	9
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Pharmaceutical packaging: Pharmaceutical dosage form and their packaging requirements, Pharmaceutical packaging materials, enteral Packaging, aseptic packaging systems, container closure systems, selection and evaluation of Pharmaceutical packaging materials.

UNIT-IV	PILOT PLANT SCALE TECHNIQUES	9
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Concept, significance, pilot plant scale up activities – general consideration for solids, semisolids, liquid, its relevant documentation and contract manufacturing.

UNIT-V	TECHNOLOGY TRANSFER	9
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Scope, organization and management, production, quality control, premises and equipment, documentation, qualification and validation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand the process in developing new drug substances.

CO2 : Perform an experiment using modern equipment to investigate the physicochemical properties of the drug substances.


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CO3 : Design, develop and perform an experiment using modern equipment to evaluate the packing materials.

CO4 : Demonstrate the different process and activities involved in the pilot plant scale up of the products.

CO5 : Design and develop the process for successful transfer of the developed product.

TEXT BOOKS:

1. Computer Applications in Drug Discovery and Development by A. Puratchikody, S. Lakshmana Prabu, A. Umamaheswari, IGI Global Medical Information Science Reference, USA, 2018.
2. The process of new drug discovery and development. I and II Edition (2006) by Charles G. Smith, James T and O. Donnell. CRC Press, Group of Taylor and Francis.
3. Pharmaceutical product development. Vandana V. Patrevalle. John I. Disouza. MaharukhT.Rustomji. CRC Press, Group of Taylor and Francis.

REFERENCE BOOKS:

1. Remingtons Pharmaceutical Sciences, by Alfonso & Gennaro, 19th Edn.(1995)002C Lippincott; Williams and Wilkins A Wolters Kluwer Company, Philadelphia.
2. The Pharmaceutical Sciences; the Pharma Path way 'Pure and applied Pharmacy' by D. A Sawant, Pragathi Books Pvt.Juran's Quality Handbook, Sixth Edition, Joseph M. Juran and Joseph A. De Feo, ASQ Publications.
3. Pharmaceutical Packaging technology, by D.A. Dean. E.R. Evans, I.H. Hall. 1 st Edition (Reprint 2006). Taylor and Francis. London and New York.

E-RESOURCES:

1. <https://nptel.ac.in/courses/16558102>
2. <http://fdspharmacy.in/technology-transfer/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	3	-	-	-	-	-	2	2	-	1	3	2	-	2
CO2	-	3	3	3	2	-	-	-	-	-	-	1	-	3	3	2
CO3	-	-	3	3	3	2	-	-	2	-	-	1	-	-	3	2
CO4	-	-	3	3	3	2	-	-	2	2	-	2	3	-	3	2
CO5	-	-	3	3	3	2	-	-	2	2	-	2	3	-	3	2

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE37

INSTRUMENTATION AND PROCESS CONTROL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- Familiarize the students about concepts of process dynamics and control leading to control system design.
- Introduce dynamic response of open and closed loop systems, control loop components and stability of control systems along with instrumentation.

UNIT-I**INSTRUMENTATION****9**

Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, Volumetric Flow Rate and mass flow rate (for liquids and solids), viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

UNIT-II**OPEN LOOP SYSTEMS****9**

Laplace transformation, application to solve ODEs. Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.

UNIT-III**CLOSED LOOP SYSTEMS****9**

Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability

UNIT-IV**FREQUENCY RESPONSE****9**

Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controller settings

UNIT-V**ADVANCED CONTROL SYSTEMS****9**

Introduction to advanced control systems, cascade control, feed forward control, Smith predictor controller, control of distillation towers and heat exchangers, introduction to computer control of chemical processes

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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

CO1 : Understand the principles of process instrumentation and the measurement of various

physical and chemical parameters in industrial systems.

CO2 : Analyze open-loop systems using Laplace transformation, first- and second-order system dynamics, and linearization techniques.

CO3 : Develop block diagrams and transfer functions for closed-loop control systems and evaluate their stability and transient response.

CO4 : Design and analyze control systems using frequency response techniques, including Bode diagrams and controller tuning.

CO5 : Explore advanced control systems, such as cascade and feedforward control, and apply them to chemical processes like distillation and heat exchange.

TEXT BOOKS:

1. Stephanopoulos, G., "Chemical Process Control", Pearson Education India, 2015.
2. Coughanowr, D., LeBlanc, S., " Process Systems Analysis and Control ", 3rd edition., McGraw Hill, New Delhi, 2017.
3. Coughanowr, D., " Process Systems Analysis and Control ", 2nd edition., McGraw Hill, New York, 1991.

REFERENCE BOOKS:

1. Marlin, T. E., " Process Control ", 2nd edition, McGraw Hill, New York, 2000.
2. Smith, C. A. and Corripio, A. B., "Principles and Practice of Automatic Process Control", 3rd edition., John Wiley, New York, 2015.

E-RESOURCES:

1. <https://nptel.ac.in/courses/16558802>
2. <http://fdspharmacy.in/process-control/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	2	2	1	1	2	1	3	2	3	3	2	2	2
CO2	3	3	3	2	2	2	1	2	1	3	2	3	3	3	2	2
CO3	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1 - Low, 2 - Medium, 3 - high, '-' - no correlation

SVHEC
SVHEC - R2023


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23PTE38

EXPERIMENTAL DESIGN AND BIOSTATISTICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To understand the new drug substance development process.
- To understand the information to pilot plant scale up and technology transfer from R&D to manufacturing premises.

UNIT-I**FUNDAMENTALS OF STATISTICS**

9

Define Statistics, intuitive biostatistics, relevance to research, preparation of data, analysis of data, frequency tables, graphical techniques, measuring variability, identify measure central tendency and variability, probability, tools in statistics, selection of various statistics tools

UNIT-II**PRINCIPLES OF EXPERIMENTAL DESIGN**

9

Designing an experiment, controlled experiments, natural and quasi-experiments, population definitions, sampling unit, types of variables, treatment structure, design structure, collecting and analyzing data, types of effects, randomization, replication, blocking, orthogonality, factorial design, completely randomized design, randomized complete block design

UNIT-III**CORRELATION AND REGRESSION**

9

Correlation and regression: Graphical presentation of two continuous variables; Pearson's product moment correlation coefficient; its statistical significance; Multiple and partial correlations; Linear regression; Regression line; Coefficient of determination; Interval estimation and hypothesis testing for population slope; Introduction to multiple linear regression models; Probit and logit transformations.

UNIT-IV**PARAMETRIC TESTS**

9

Estimation and Hypothesis testing: Point and interval estimation including fiducial limits; Concepts of hypothesis testing and types of errors; Student-t and Chi square tests; Sample size and power; Experimental design and analysis of variance: Completely randomized, randomized blocks; Latin square and factorial designs; Post- hoc procedures

UNIT-V**NON-PARAMETRIC TESTS**

9

Non-parametric tests: Sign; Mann-Whitney U; Wilcoxon matched pair; Kruskal wallis and Friedman two way anova tests. Spearman rank correlation; Statistical techniques in pharmaceuticals: Experimental design in clinical trials; Parallel and crossover designs; Statistical test for bioequivalence; Dose response studies; Statistical quality control.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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

- CO1:** Understand the fundamentals of statistics, including data preparation, analysis, central tendency, variability, and probability.
- CO2:** Apply principles of experimental design, including randomization, replication, blocking, and factorial design.
- CO3:** Analyze relationships between variables using correlation, regression, and transformation techniques.
- CO4:** Perform parametric tests for hypothesis testing and ANOVA to draw meaningful conclusions.
- CO5:** Utilize non-parametric tests and advanced statistical techniques in clinical and pharmaceutical research.

TEXT BOOKS:

1. Gupta S.P, Statistical Methods, Sultan Chand & Sons, New Delhi, 2005.
2. P.S.S. Sundar Rao, P.H.Richard, J.Richard, An introduction to Biostatistics, Prentice Hall of India(P) Ltd., New Delhi, 2003.

REFERENCE BOOKS:

1. Jerrold H. Zar, Bio Statistical Analysis, Tan Prints(I) Pvt. Ltd., New Delhi, 2003.
2. Goulden, Methods of Statistical Analysis, Asia Publishing Co., New Delhi, 1962.
3. Intuitive Biostatistics by Harvey Motulsky. Copyright,1995 Oxford University Press Inc.

E-RESOURCES:

1. <https://nptel.ac.in/courses/1076558102>
2. <http://fdspharmacy.in/plant design/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	3	2	1	2	1	2	2	2	3	3	2	2	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1 - Low, 2 - Medium, 3 - high, '-' - no correlation

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VERTICAL IV: PHARMACEUTICAL INDUSTRIAL MANAGEMENT

23PTE41	PHARMACEUTICAL PRODUCTION MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To make understand the process involved in the pharmaceutical industries and its management.

UNIT-I PILOT PLANT AND SCALE-UP TECHNIQUES 9

Pharmaceutical Pilot plant – Pilot plant Design – Theories of similarities – General considerations of pilot plant scaleup – Case studies for tablets – Capsules – Liquid orals – Parenterals – Sustained release preparation – Semi-solid preparation.

UNIT-II FORMULATION PRODUCTION MANAGEMENT 9

Plant site selection and layout – Plant Material handling for various pharmaceutical products – Functions – Selection – Maintenance – Types – Different categories of Pharmaceutical Plant maintenance – Replacement analysis – Group and individual replacement.

UNIT-III PRODUCTION, PLANNING, SCHEDULING AND FORECASTING 9

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

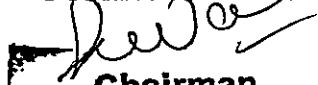
UNIT-IV MATERIAL MANAGEMENT 9

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

UNIT-V HUMAN RESOURCE MANAGEMENT 9

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

TOTAL : 45 PERIODS


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COURSE OUTCOMES:

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

- CO1 :** Illustrate the general considerations of pilot plant scaleup
- CO2 :** Identify the various factors influencing for choosing a suitable location for pharmaceutical plant and its construction
- CO3 :** Analyse the different categories of Pharmaceutical Plant maintenance
- CO4 :** Handle and execute various process of pharmaceutical product manufacturing and manage the materials and human resources.
- CO5 :** Measure performance in inventory management

TEXT BOOKS:

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

REFERENCE BOOKS:

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

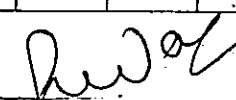
E-RESOURCES:

1. <https://nptel.ac.in/courses/157398102>
2. <http://fdspharmacy.in/product-management/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	-	-	-	-	3	3	3	2	3	3	2	1	-	3	-
CO2	2	1	-	-	-	3	3	3	3	3	1	3	2	2	2	-
CO3	2	1	2	2	3	3	3	3	3	2	3	3	2	3	3	-
CO4	-	2	3	2	3	3	3	3	3	3	3	1	2	3	2	-
CO5	-	-	2	2	3	3	3	3	3	3	2	3	1	3	3	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE42	PHARMACEUTICAL SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To develop an understanding of basic concepts and role of Logistics and supply chain management in business.
- To understand how supply chain drivers play an important role in redefining value chain excellence of Firms.
- To develop analytical and critical understanding & skills for planning, designing and operations of supply chain.
- To understand, appraise and integrate various supply chain strategies.

UNIT-I DEVELOPMENT OF SCM CONCEPTS 9

Concept of supply chain management, scope of SCM in Pharma Sector -Key decision areas – strategic. Supply Chain Management and Key components, External Drivers of Change. Dimensions of Logistics – The Macro perspective and the macro dimension – Logistic system analysis.

UNIT-II SOURCING STRATEGY 9

Manufacturing management – make or buy decision – capacity management – Materials Management – choice of sources – procurement planning. Key Drivers and enablers in Supply Chain Management, Supply chain components, SC Strategy, Measures of Supply Chain Performance

UNIT-III DISTRIBUTION STRATEGY 9

Choice of Market – network design – warehouse designed operation and distribution planning – transportation – packaging.

UNIT-IV INVENTORY STRATEGY AND CHANNELS OF DISTRIBUTION 9

Demand forecasting – inventory planning – planning of stocking facilities – warehouse location allocation. Warehouse design and operations – inventory norms. Customer Service Strategy: Identification of Service needs, cost of services – revenue Management

UNIT-V LOGISTICS IN SUPPLY CHAIN 9

Reverse Logistics, Networks in Reverse Logistics, Decision options in Reverse Logistics, Entities in Reverse Logistics, Small Intermediate logistics, Clinical trial Logistics

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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


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- CO1 :** Understand the fundamentals of elements and functions of supply chain, role of drivers and demand forecasting.
- CO2 :** Apply various techniques of inventory management and their practical situations.
- CO3 :** Analyze how supply chain decisions related to facility location can be applied to various industries and designing the supply chain.
- CO4 :** Describe warehousing management system and transportation practiced in various industries
- CO5 :** Analyse logistics and supply chain strategies to create value generation and utilise IT applications

TEXT BOOKS:

1. Supply Chain Management in the Drug Industry Delivering Patient Value for Pharmaceuticals and Biologics by Hedley Rees • 2011.
2. The Supply Chain Management Casebook: Comprehensive Coverage by Chuck Munson 2013.

REFERENCE BOOKS:

1. Supply Chain Management: A Global Perspective by Nada R. Sanders • 2011
2. Supply Chain Science books by Wallace J. Hopp • 2011

E-RESOURCES:

1. <https://nptel.ac.in/courses/5687602>
2. <http://fdspharmacy.in/supplychain/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	-	-	-	-	3	3	3	2	3	3	3	1	-	2	-
CO2	2	2	2	1	1	3	3	3	3	3	2	3	2	2	1	-
CO3	1	1	3	2	3	3	3	3	3	2	2	3	1	3	3	-
CO4	-	2	2	2	3	3	3	3	3	3	2	1	2	3	2	-
CO5	-	1	2	2	3	3	3	3	3	3	2	3	1	3	2	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE43

SAFETY AND DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To provide comprehensive knowledge about the safety management, safety procedures and handling techniques of the chemicals in Industry
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT-I

INDUSTRIAL SAFETY

9

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

UNIT-II

HAZARD IDENTIFICATION AND CONTROL

9

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

UNIT-III

RISK MANAGEMENT

9

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

UNIT-IV

TYPES OF DISASTERS

9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social,economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters,pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT-V

DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND

9

FIELD WORKS


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Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, ManMade disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Illustrate the various aspects of industrial safety, hazard identification and control
- CO2 :** Highlight the various risk management systems in chemical industry.
- CO3 :** Describe safety procedure and handling of chemicals used in the various process.
- CO4 :** Differentiate the types of disasters, causes and their impact on environment and society
- CO5 :** Assess vulnerability and various methods of risk reduction measures as well as mitigation.

TEXT BOOKS:

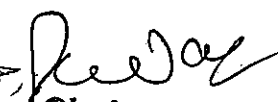
1. J Maiti, Pradip Kumar Ray (Editor)., "Industrial Safety Management: 21st Century Perspectives of Asia, Kindle edition, Springer, 2019
2. Lees, F.P., "Loss Prevention in Process Industries", 4th Edition, Butterworth Heinemann, 2012.
3. Harsh K.Gupta Disaster Management, University Press, 2020

REFERENCE BOOKS:

1. Geoff Wells, Hazard Identification and Risk Assessment, Butterworth-Heinemann, 1996
2. L. M. Deshmukh, Industrial Safety Management: Hazard Identification and Risk Control, 1st Edition, McGraw Hill Education (India) Private Limited, 2005
3. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.
4. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

E-RESOURCES:

1. <https://nptel.ac.in/courses/16516259>
2. <http://fdspharmacy.in/safety/>


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CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	-	-	-	2	3	3	3	2	3	3	3	1	-	2	-
CO2	1	2	2	3	2	3	3	3	3	3	2	3	2	2	1	-
CO3	3	1	3	2	2	3	3	3	3	3	3	2	1	3	3	-
CO4	3	2	2	3	-	3	3	3	3	2	3	3	2	3	2	-
CO5	3	1	2	1	-	3	3	3	3	3	2	3	1	3	2	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE44

MANAGEMENT INFORMATION SYSTEM

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To describe the role of information technology and decision support systems in business and record the current issues with those of the firm to solve business problems.
- To introduce the fundamental principles of computer-based information systems analysis and design and develop an understanding of the principles and techniques used.
- To enable students understand the various knowledge representation methods and different expert system structures as strategic weapons to counter the threats to business and make business more competitive.

UNIT-I

INTRODUCTION TO INFORMATION TECHNOLOGY

9

Digital Transformation Disrupts companies , Competition and Careers - Doing business in the on demand and sharing Economies. IT Business Objective, Business process improvement and Competition, Social-Mobile-Analytics-Cloud (SAMC) model. IT and You- On-Demand 'Gig' workers, Changes in work status, IT adds value to your performance and career, Becoming an informed IT user.

Case study :- Enabling digital technology for sustainable pharma manufacturing and growth in India from The Indian Pharmaceutical Alliance (IPA) .

UNIT-II

INFORMATION SYSTEMS, IT INFRASTRUCTURE AND THE CLOUD

9

IS Concepts and Classification- Six components of an IS, Types of Information system. IT infrastructure, IT architecture, and Enterprise architecture (EA) - Adding value with an EA, Measuring EA success, Components of an EA. Cloud Infrastructure - Moving workload from the Enterprise to the cloud, XaaS mode - SaaS, PaaS, IaaS, DaaS.

Case study : Explore the open source Cloud service providers in the market.

UNIT-III

DATA MANAGEMENT, DATA WAREHOUSES AND DATA GOVERNANCE

9

Database technologies, Centralized databases, distributed databases, ACID tests. DBMS - elements of a DBMS, benefits of a DBMS, vendor rankings. Data warehouse - introduction, database to a data warehouse. Data governance - Master data and Master Data Management (MDM)

Network fundamentals - Business function supported by computer networks, type of networks - LAN, WAN, VPN, Wireless network technologies , IP, TCP/IP , API.

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Practice : Open source database - Create, Insert, Update and delete tables.

UNIT-IV

ENTERPRISE SYSTEMS

9

Introduction- six types of enterprise systems, Integrating Legacy systems. ERP modules, IT Infrastructure. Knowledge management (KM), Koenig's three stages of KM - benefits of enterprise knowledge management systems, managing knowledge in group work.

Case study: Online Mindmapping Tools

UNIT-V

IT SOURCING STRATEGIES , SERVICE MANAGEMENT AND CYBER SECURITY

9

Introduction - IT offshoring, IT onshoring, Cloud Services, Cloud strategy challenges, outsourcing and its risks. Cyber security - Defence strategies, managing risk, backup and recovery, continuity planning, disaster recovery services. Regulatory control, Frameworks and models - general, application defence control, auditing information systems and government regulations.

TOTAL : 45 PERIODS

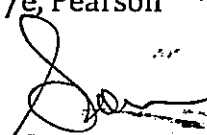
COURSE OUTCOMES:

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

- CO1 :** Relate the basic concepts and technologies used in the field of management information systems
- CO2 :** Compare the processes of developing and implementing information systems.
- CO3 :** Outline the role of the ethical, social, and security issues of information systems.
- CO4 :** Translate the role of information systems in organizations, the strategic management processes, with the implications for the management.
- CO5 :** Apply the understanding of how various information systems like DBMS work together to accomplish the information objectives of an organization.

TEXT BOOKS:

1. Efraim Turban, et al., (2022), Information Technology Management, 12th edition, Wiley, New Delhi.
2. Jawadekar, W.S., "Management Information Systems", Tata McGraw Hill Private Limited, New Delhi, 6e, 2020.
3. Kenneth C. Laudon and Jane P. Laudon: "Management Information Systems" 17/e, Pearson Education, New Delhi.


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REFERENCE BOOKS:

1. Alex Leon and Mathew Leon: "Data Base Management Systems", Vikas Publishing House, New Delhi.
2. Goyal, D.P.: "Management Information System", MACMILLAN India Limited, New Delhi, 2008.
3. James A. O'Brien et al.,(2013), Management Information System, McGraw Hill Education India.

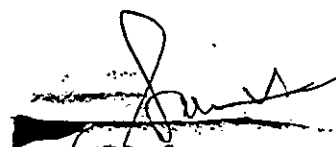
E-RESOURCES:

1. <https://nptel.ac.in/courses/100108102>
2. <http://fdspharmacy.in/pharma management/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	-	-	-	2	3	3	3	3	3	3	3	1	-	2	1
CO2	3	2	1	3	2	3	3	3	3	3	3	3	1	2	1	2
CO3	2	1	3	2	2	3	3	3	3	3	2	2	-	3	3	1
CO4	2	2	3	2	-	3	3	3	3	1	3	3	1	3	2	2
CO5	1	1	3	1	-	3	3	3	3	3	2	3	1	3	2	1

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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1600473
1600473

23PTE45	INDUSTRIAL PSYCHOLOGY AND HUMAN RESOURCE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- This course equips students with human resource management skills
- To be able to function effectively in their professional careers.
- To develop their soft skills for organizational culture.

UNIT-I INTRODUCTION AND OVERVIEW OF HUMAN RESOURCE MANAGEMENT 9

Introduction and Overview, Management Theories- Taylor, Fayol, Weber, Hawthorne; Basic types of structures; Span of Control, Delegation, Authority, Responsibility, Recruitment- Philosophies, Different methods of attracting candidates, Selection- Application blanks, Interviews, Induction

UNIT-II PERFORMANCE MANAGEMENT, TRAINING AND DEVELOPMENT 9

Performance management -Goal setting process, Performance appraisal methods, Appraisal interviews, Rating errors, Training & Development- Identifying training needs, Training methods (on the job and off the job techniques), Evaluation of training, Change Management- Types of change, Theories of change management, Hurdles to change, Olmosk change strategies

UNIT-III KNOWLEDGE MANAGEMENT AND MOTIVATION 9

Knowledge management -Innovation, Importance and benefits of Knowledge Management, Framework, Motivation Theories-Classification of motives, Various theories (Maslow, Herzberg, ERG, Vroom, Equity and Nohria's 4 drive model)

UNIT-IV LEADERSHIP AND ORGANIZATIONAL CULTURE 9

Leadership Theories- Blake Mouton model, Hersey Blanchard Model, Michigan Model, Organizational Culture-Types of cultures, Understanding and influencing cultures, Conflict Management- Stages of conflict, Types of conflict and sources of conflicts, Conflict resolution

UNIT-V POWER, POLITICS, PERSONALITY AND PERCEPTION 9

Power & Politics- Bases of power, Politicking strategies, Personality- Theories of personality, Behaviour and personality styles, Perception- Perception versus sensation, Perceptual process, Perceptual errors


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TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Explain the fundamental concepts of industrial psychology and human resource management
- CO2 :** Analyze practical solutions
- CO3 :** Provide applicable solutions
- CO4 :** Provide leadership qualities
- CO5 :** Enhance their Entrepreneurship skills

TEXT BOOKS:

1. C.B Gupta, Management Theory & Practice, Sultan Chand & Sons, 19th Edition, 2017.
2. L.M Prasad, Principles and Practices in Management, Sultan Chand & Sons, 2015.
3. Harold Koontz, Cyril O' Donnell & Heinz Weihrich, Essentials of Management, McGraw Hill, Inc, 5th Edition, 2017.

REFERENCE BOOKS:

1. Innovation and Entrepreneurship, Peter Drucker, ASIN: 0060851139, Publisher: Harper Business; Reprint edition (9 May 2006), ISBN-13:978-0060851132.
2. Essentials of organizational Behaviour, Stephen P. Robbins, Publisher: Pearson; 14th edition (30 March 2017), ISBN-13: 978-0134523859.

E-RESOURCES:

1. <https://nptel.ac.in/courses/48761141/>
2. <https://nptel.ac.in/courses/109103142>

CO's - PO's & PSO's MAPPING

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CO2	3	3	1	3	2	3	2	3	3	3	1	2	2	3	-	-
CO3	3	3	2	3	2	3	3	3	3	3	3	2	3	2	1	-
CO4	2	-	-	-	-	3	3	3	3	3	3	2	3	3	2	-
CO5	-	-	-	-	-	2	3	3	3	3	3	1	3	3	3	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation



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23PTE46	PROJECT MANAGEMENT FOR PHARMACEUTICAL TECHNOLOGY	L T P C 3 0 0 3
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COURSE OBJECTIVES:

The objective of the course is to

- To understand the concepts of project management.
- To understand the tools and techniques for project management.

UNIT-I	CONCEPTS OF PROJECT MANAGEMENT	9
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Concepts of projects, characteristics of project, Phases of project life cycle, Tools and techniques for project management, Computer based project management. Project planning and estimating: Feasibility report, Preparation of cost estimation, Evaluation of the project profitability.

UNIT-II	TECHNICAL ANALYSIS	9
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Study of material inputs and utilities, manufacturing process and technology, product mix, plant capacity, location and site, project charts and layouts, work schedule financial analysis: Estimation of cost of project and means of financing, estimates of sales and production, cost of production, working capital requirement and its financing. Estimates of working results, breakeven point. Project cash flows. Time value of money. Cost of capital appraisal criteria: Net present value. Benefit cost ratio. Internal rate of return, payback period. Accounting rate of return, Investment appraisal in practice.

UNIT-III	TOOLS AND TECHNIQUES OF PROJECT MANAGEMENT	9
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Bar (GANTT) chart, Networks – PERT and CPM, Applications, Basic steps in PERT/CPM, Rules for drawing network diagram, Labelling, Time estimates, Critical Path Method, Project Evaluation and Review Technique (PERT).

UNIT-IV	PERFORMANCE MEASURES IN PROJECT MANAGEMENT	9
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Performance indicators, Performance Improvement, Project management and environment. Risk Analysis: Sources, measures and perspectives on risk, sensitivity analysis, scenario analysis, breakeven analysis, Hiller model, simulation analysis, decision tree analysis, managing risk, project selection under risk.

UNIT-V	FINANCING OF PROJECTS	9
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Capital structure, menu of financing, equity capital, internal accruals, term loans, debentures, working capital advance, miscellaneous sources, raising of venture capital, raising capital in international markets

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

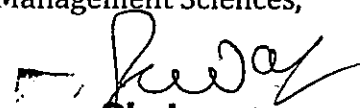
- CO1 :** Identify characteristics of project and formulate Phases of project life cycle
- CO2 :** Estimate cost of project and means of financing
- CO3 :** Select, and apply the tools and techniques for project management
- CO4 :** Measure the risk involved in a project and analyse the sensitivity, scenario of market using Information technology tools.
- CO5 :** Estimate of cost of project and means of financing, sales and production, cost of production, working capital requirement and its financing.

TEXT BOOKS:

1. Project Management: Choudhry S., Tata McGraw-Hill, 2010
2. Projects: Planning, Analysis, Financing, Implementation, and Review- Prasanna Chandra, 5th edition, Tata McGraw-Hill publishing company limited, 2005.
3. Operations Research- N V R Naidu, G. Rajendra, T Krishna kumar, I K international Publishing house, Pvt. Ltd. 2011.
4. Operations Research and Engineering Management, S. D. Sharma, Kedar Nath Ram Nath & Co., 2010
5. Bhavesh M. Patel, Project Management: Strategic Financial Planning, Evaluation and Control Patel Sangam Books Ltd, 2000.

REFERENCE BOOKS:

1. A Guide to the Project Management Body of knowledge PMBOK Guide 6th Edition, Project Management Institute 2017.
2. Project management a system approach to planning scheduling and controlling- Harold Kerzner, CBS Publisher and distributors, 2002.
3. A management guide to PERT and CPM- WEIST and LEVY Eastern Economy of PH 2002.
4. T R Banga, N K Agarwal and S C Sharma -Industrial engineering and Management Sciences, Khanna Publishers.


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23PTE47

BIOSAFETY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- create awareness about biosafety and containment guidelines
- assess the risk analysis and the stringency requirements

UNIT-I

NEED FOR BIOSAFETY

9

Introduction; the history and incidence of laboratory-acquired infections (LAI) ,incidents of secondary transmission from the laboratory, Outline the types of laboratory accidents leading to LAIs, Explain the role of aerosols in LAIs, Illustrate the importance of biosafety and biocontainment in minimizing the risk of LAIs

UNIT-II

BIOLOGICAL SAFETY CABINETS

9

Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; recommended Biosafety Levels for Infectious Agents and Infected Animals, The classes and types of biological safety cabinets (BSC), Understand the principles of HEPA filtration, Explain the practices for safely working in a BSC , Identify other laminar flow devices and their limitations for use with microorganisms . Outline the certification process for BSCs

UNIT-III

BIOSAFETY GUIDELINES

9

Biosafety guidelines - Government of India; Definition of GMOs and LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMO

UNIT-IV

GENETICALLY MODIFIED ORGANISMS AND REGULATIONS

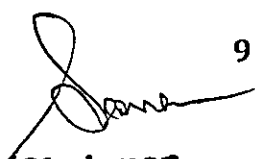
9

Biosafety for human health and environment. - Global scenario of transgenic microorganisms and plants. Ecological risk of engineered microorganisms/plants and remedial measure . Components of a risk assessment for microorganisms Outline factors affecting risk assessment (agent, host, environment, behavioural). Risk Assessment; Risk Analysis; Risk management and communication; Overview of National Regulations and relevant International Agreements including Cartagena Protocol

UNIT-V

BIOCONTAINMENT AND CERTIFICATION

9


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Describe the progression of building a new biocontainment laboratory from conceptualization through to certification. Outline the concepts to be addressed during the laboratory programming phase, architectural and engineering biocontainment features, key security features and control systems, commissioning and certification process and understand the difference between them.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Explain the need for biosafety and its role in minimizing laboratory-acquired infections.
- CO2 :** Demonstrate knowledge of Biological Safety Cabinets, including their types, principles, and certification.
- CO3 :** Interpret biosafety guidelines, regulatory frameworks, and roles of committees in GMO applications.
- CO4 :** Evaluate risks associated with genetically modified organisms and recommend measures for biosafety.
- CO5 :** Plan and understand biocontainment laboratory design and certification processes.

TEXT BOOKS:

1. Biosafety in Microbiological and Biomedical Laboratories, 5th ed., 2009.
2. Diane O. Fleming & Debra A. Hunt, "Biological Safety, Principles and Practices", 4th ed., ASM Press, 2006.
3. Guide for the care and use of laboratory animals, 8th ed., (National Research Council), National Academies Press, 2011.
4. Control of communicable diseases manual, 20th ed. (Heymann), 2014.
5. NIH guidelines for research involving recombinant or synthetic nucleic acid molecules, 2013.

REFERENCE BOOKS:

1. Collins, C.H., and Kennedy, D.A. Laboratory-acquired infections. In: Laboratory acquired infections: history, incidence, causes and preventions. Oxford, UK: Butterworth-Heinemann, 1999;
2. Harding, A.L., and Brandt Byers, K. Epidemiology of laboratory-associated infections. In: Fleming, D.O., and Hunt, D.L. Biological safety: principles and practices. Washington, DC: ASM Press, 2000.

E-RESOURCES:

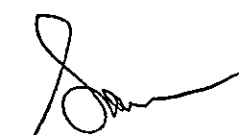
1. <https://nptel.ac.in/courses/60354537>
2. <https://nptel.ac.in/biosafety/103142>


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CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	3	3	2	2	2	3	2	3	2	2	2	3	3	2	2	2
C02	3	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3
C03	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
C04	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
C05	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PTE48	REGULATORY ISSUES IN PHARMACEUTICAL INDUSTRY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- Understanding and process for auditing in pharmaceutical industries.
- Understanding the methodology involved in the auditing process of different in pharmaceutical industries.

UNIT-I	INTRODUCTION	9
---------------	---------------------	----------

Objectives, Management of audit, Responsibilities, Planning process, information gathering, administration, Classifications of deficiencies.

UNIT-II	ROLE OF QUALITY SYSTEMS AND AUDITS IN PHARMACEUTICAL MANUFACTURING ENVIRONMENT	9
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cGMP Regulations, Quality assurance functions, Quality systems approach, Management responsibilities, Resource, Manufacturing operations, Evaluation activities, Transitioning to quality system approach, Audit check list for drug industries.

UNIT-III	AUDITING OF VENDORS AND PRODUCTION DEPARTMENT	9
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Bulk Pharmaceutical Chemicals and packaging material Vendor audit, Warehouse and weighing, Dry Production: Granulation, tableting, coating, capsules, sterile production and packaging.

UNIT-IV	AUDITING OF MICROBIOLOGICAL LABORATORY	9
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Auditing the manufacturing process, Product and process information, General areas of interest in the building raw materials, Water, Packaging materials.

UNIT-V	AUDITING OF QUALITY ASSURANCE AND ENGINEERING DEPARTMENT	9
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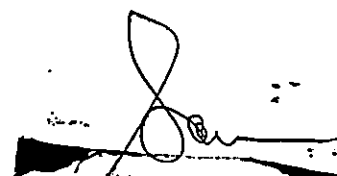
Quality Assurance Maintenance, Critical systems: HVAC, Water for Injection systems, ETP

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** understand the importance of auditing
- CO2 :** understand the methodology of auditing
- CO3 :** carry out audit process


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CO4: prepare the auditing report

CO5: prepare the check list for auditing

TEXT BOOKS:

1. Compliance auditing for Pharmaceutical Manufacturers. Karen Ginsbury and Gil Bismuth, Interpharm/CRC, Boca Raton, London New York, Washington D.C.
2. Pharmaceutical Manufacturing Handbook, Regulations and Quality by Shayne Cox Gad. Wiley, Interscience, A John Wiley and sons, Inc., Publications.

REFERENCE BOOKS:

1. Handbook of microbiological Quality control. Rosamund M. Baird, Norman A. Hodges, Stephen P. Denyar. CRC Press. 2000.
2. Laboratory auditing for quality and regulatory compliance. Donald C. Singer, Raluca Ioana Stefan, Jacobus F. Van Staden. Taylor and Francis 2005.

E-RESOURCES:

1. <https://nptel.ac.in/courses/12658950>
2. <https://nptel.ac.in/courses/29825598>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	2	3	1	-	-	-	2	-	1	3	3	1	3	-
CO2	3	2	2	2	2	-	-	-	1	-	1	2	3	1	3	-
CO3	2	1	2	1	3	-	-	-	1	-	2	1	3	1	3	-
CO4	3	1	2	3	3	-	-	-	3	-	2	1	3	1	3	-
CO5	3	2	2	2	3	-	-	-	2	-	2	1	3	1	3	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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OPEN ELECTIVES - OFFERED BY DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	Max.Marks		
				L	T	P			CA	ES	TM
1.	23PT011	Nutraceuticals	OE	3	0	0	3	3	40	60	100
2.	23PT012	IPR for Pharma Industry	OE	3	0	0	3	3	40	60	100
3.	23PT013	Pharmaceutical Nanotechnology	OE	3	0	0	3	3	40	60	100
4.	23PT014	Basics of Human Anatomy and physiology	OE	3	0	0	3	3	40	60	100


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OPEN ELECTIVES - OFFERED BY DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY

23PTO11	NUTRACEUTICALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
- To understand the role of Nutraceuticals and functional food in health and disease

UNIT-I INTRODUCTION AND SIGNIFICANCE 9

Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoochemicals and microbes in food, plants, animals and microbes

UNIT-II ANALYSIS OF PHYTOCHEMICALS 9

Qualitative and quantitative methods: phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, Chitin; Carotenoids - Factors affecting bioavailability, chemical and histochemical characterization of cell wall polysaccharides in almond seed in relation to lipid bioavailability.

UNIT-III ASSESSMENT OF ANTIOXIDANT ACTIVITY 9

In vitro and In vivo methods for the assessment of antioxidant activity, Comparison of different In Vitro methods to evaluate the antioxidant, Prediction of the antioxidant activity of natural phenolics from electrotopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources

UNIT-IV ROLE IN HEALTH AND DISEASE 9

Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus, HIV and Dental disease; Importance and function of probiotic, prebiotic and synbiotic and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders.

UNIT-V SAFETY ISSUES 9

Health Claims, Adverse effects and toxicity of nutraceuticals, regulations and safety issues- International and national.

TOTAL : 45 PERIODS


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COURSE OUTCOMES:

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

- CO1 :** Discuss about Nutraceuticals in different food sources
- CO2 :** Illustrate about their significances in treating the infectious diseases.
- CO3 :** Demonstrate about the adverse effects of antioxidants -
- CO4 :** Examine the mechanism of action of some important phytochemicals and zoochemicals as nutraceuticals and their role in health and diseases.
- CO5 :** Develop the compounds with pharmacological, toxicological properties and regulatory requirements.

TEXT BOOKS:

1. Bisset, Normal Grainger and Max WichH "Herbal Drugs and Phytopharmaceuticals", 2nd Edition, CRC, 2001.
2. Handbook of Nutraceuticals and Functional Foods: Robert Wildman, CRC , Publications. 2006
3. WEBB, PP, Dietary Supplements and Functional Foods Blackwell Publishing Ltd (United Kingdom), 2006
4. Ikan, Raphael "Natural Products : A Laboratory Guide", 2nd Edition, Academic Press / Elsevier, 2005.
5. Tipnis, H.P. "Bioavailability and Bioequivalence : An Update" New Age International.

REFERENCE BOOKS:

1. Asian Functional Foods (Nutraceutical Science and Technology) by John Shi (Editor), Fereidoon Shahidi (Editor), Chi-Tang Ho (Editor), CRC Publications, Taylor & Francis, 2007
2. Functional Foods and Nutraceuticals in Cancer Prevention by Ronald Ross Watso (Author), Blackwell Publishing, 2007
3. Marketing Nutrition: Soy, Functional Foods, Biotechnology, and Obesity by Brian Wansink (Author).
4. Functional foods: Concept to Product: Edited by G R Gibson and C M Williams, Woodhead Publ., 2000
5. Hanson, James R. "Natural Products : The Secondary Metabolites", Royal Society of Chemistry, 2003.

E-RESOURCES:

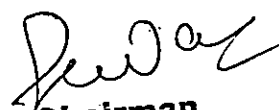
1. <https://nptel.ac.in/courses/103556100>
2. <http://digimat.in/nptel/courses/video/10410875>


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CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	2	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-
C02	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C03	2	2	-	2	-	-	3	-	-	-	-	-	-	-	-	-
C04	1	2	1	-	-	-	-	-	2	-	-	-	-	-	-	-
C05	1	2	2	1	-	-	-	-	-	-	-	1	-	-	-	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation


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23PT012

IPR FOR PHARMA INDUSTRY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To provide the basic fundamental knowledge of different forms of Intellectual Property Rights in national and international level.
- To provide the significance of the Intellectual Property Rights about the patents, copyrights, industrial design, plant and geographical indications.
- This paper is to study significance of the amended patent act on pharma industry

UNIT-I	INTRODUCTION- INTELLECTUAL PROPERTY RIGHTS	9
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Introduction, Types of Intellectual Property Rights -patents, plant varieties protection, geographical indicators, copyright, trademark, trade secrets.

UNIT-II	PATENTS	9
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Patents-Objective, Introduction, Requirement for patenting- Novelty, Inventive step (Nonobviousness) and industrial application (utility), Non-patentable inventions, rights of patent owner, assignment of patent rights, patent specification (provisional and complete), parts of complete specification, claims, procedure for obtaining patents, compulsory license.

UNIT-III	PLANT VARIETY-TRADITIONAL KNOWLEDGE -GEOGRAPHICAL INDICATIONS	9
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Plant variety- Justification, criteria for protection of plant variety and protection in India. Traditional knowledge- Concept of traditional knowledge, protection of traditional knowledge under Intellectual Property frame works in national level and Traditional knowledge digital library (TKDL). Geographical Indications – Justification for protection, National and International position.

UNIT-IV	ENFORCEMENT AND PRACTICAL ASPECTS OF IPR	9
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Introduction – civil remedies – injunction, damage, account of profit – criminal remedies – patent, trademark. Practical aspects – Introduction, benefits of licensing, licensing of basic types of IPR, licensing clauses of IPR. Case studies of patent infringement, compulsory licensing, simple patent license agreements.

UNIT-V	INTERNATIONAL BACKGROUND OF INTELLECTUAL PROPERTY	9
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International Background of Intellectual Property- Paris Convention, Berne convention, World Trade Organization (WTO), World Intellectual Property Organization (WIPO), Trade Related Aspects of Intellectual Property Rights (TRIPS) and Patent Co-operation Treaty (PCT).

COURSE OUTCOMES:

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

CO1: Understand the basic fundamental of Intellectual Property Rights.

CO2: Assess and critique for Patents and Copyrights

CO3: Understand the basic theoretical justifications for the protection of traditional Plant varieties.

CO4: Analyse the laws and enforcement in practical aspects of IPR.

CO5: Analyse the effects of intellectual property rights on International society.

TEXT BOOKS:

1. N. Nagpal, M. Arora, M.R.D. Usman, S. Rahar, "Intellectual Property Rights" Edu creation Publishing, New Delhi, 2017.
2. The Patents Act, 1970 (Bare Act with Short Notes) (New Delhi: Universal Law Publishing Company Pvt. Ltd. 2012.
3. B.S. Rao, P.V. Appaji, "Intellectual Property Rights in Pharmaceutical Industry: Theory and Practice", 2015.

REFERENCE BOOKS:

1. Patents for Chemicals, Pharmaceuticals, & Biotechnology-Fundamentals of Global Law, Practice and Strategy. Philip W. Grubb, Oxford University Press, 2004.
2. Basic Principles of patent law – Basics principles and acquisition of IPR. Ramakrishna T. CIPRA, NLSIU, Bangalore, 2005
3. S. Lakshmana Prabu, TNK. Suriyaprakash, "Intellectual Property Rights", 1st ed., In Tech open access, Croatia, 2017.

E-RESOURCES:

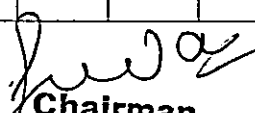
<https://nptel.ac.in/courses/10578429>

<http://digimat.in/nptel/courses/video/1074983/>

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	2	2	3	2	2	1	2	2	1	2	3	2	3	-
CO2	3	3	2	3	3	3	2	1	2	2	1	3	2	3	3	-
CO3	3	2	3	3	3	3	3	2	2	2	1	2	3	3	2	-
CO4	3	3	3	3	3	3	3	2	3	2	2	3	3	3	3	-
CO5	2	3	3	3	2	3	3	2	2	2	2	3	3	3	3	-

1 - Low, 2 - Medium, 3 - high, '-' - no correlation.


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23PTO13	PHARMACEUTICAL NANOTECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- The goal of this course is to provide an insight into the fundamentals of nanotechnology in biomedical and Pharmaceutical research.
- It will also guide the students to understand how nanomaterials can be used for a diversity of analytical and medicinal rationales.

UNIT-I	NANOSTRUCTURES	9
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Preparation, properties and characterization - Self-assembling nanostructure - vesicular and micellar polymerization-nanofilms - Metal Nanoparticles- lipid nanoparticles- nanoemulsion - Molecular nanomaterials: dendrimers, etc.,

UNIT-II	NANOTECHNOLOGY IN BIOMEDICAL INDUSTRY	9
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Reconstructive Intervention and Surgery- Nanomaterials in bone substitutes and dentistry - Implants and Prosthesis -in vivo imaging- genetic defects and other disease states -Nanorobotics in Surgery -Nanocarriers: sustained, controlled, targeted drug delivery systems

UNIT-III	NANOTECHNOLOGY IN CANCER THERAPY	9
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Cancer Cell Targeting and Detection- Polymeric Nanoparticles for cancer treatment - mechanism of drug delivery to tumors -advantages and limitations - Multifunctional Agents - Cancer Imaging - Magnetic Resonance Imaging- Cancer Immunotherapy.

UNIT-IV	NANOTECHNOLOGY IN COSMETICS	9
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Polymers in cosmetics: Film Formers - Thickeners - Hair Colouring - Conditioning Polymers: conditioning, Cleansing - Silicons - Emulsions - Stimuli Responsive Polymeric Systems - Formulation of Nano Gels, Shampoos, Hair-conditioners -Micellar self-assembly Sun-screen dispersions for UV protection - Color cosmetics

UNIT-V	NANOTOXICITY	9
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NanoToxicology- introduction, dose relationship- Hazard Classification-Risk assessment and management - factors affecting nano toxicity- Dermal Effects of Nanomaterials, Pulmonary, Neuro and Cardiovascular effects of Nanoparticles - Gene-Cellular and molecular Interactions of Nanomaterials

TOTAL : 45 PERIODS


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COURSE OUTCOMES:

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

- CO1 :** Comprehend the structural and functional principles of Pharmaceutical nanotechnology.
- CO2 :** Apprehend the biomedical applications of nanotechnology
- CO3 :** Recognize nanomaterials for analysis and sensing techniques along with therapy in Cancer
- CO4 :** Familiarize the use of nanotechnology in cosmetics
- CO5 :** Analyse the effects of nanomaterials and their toxicity.

TEXT BOOKS:

1. Springer Handbook of Nanotechnology- Ed. by B. Bhushan, Springer-Verlag 2004
2. Nanobiotechnology: Concepts, Applications and Perspectives, CM.Niemeyer C A. Mirkin, (Eds) , Wiley, 2004
3. Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, Second Edition, CRC Press, 2013
4. Sarah E. Morgan, Kathleen O. Havelka, Robert Y. Lochhead "Cosmetic Nanotechnology:Polymers and Colloids in Cosmetics", American Chemical Society, 2006.

REFERENCE BOOKS:

1. Nanotechnology in Biology and Medicine: Methods, Devices and Applications, Tuan VoDinh, CRC Press, 2007
2. The Chemistry of Nanomaterials: Synthesis, Properties and Applications, C.N.R. Rao, A. Muller, A. K. Cheetham (Eds), Wiley-VCH Verlag 2004
3. Nanotechnology: Environmental Health and safety, Risks, Regulation and Management, Matthew Hull and Diana Bowman, Elsevier, 2010

E-RESOURCES:

1. <https://nptel.ac.in/courses/10898100>
2. <http://digimat.in/nptel/courses/video/156964001>


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23PT014

BASICS OF HUMAN ANATOMY AND PHYSIOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to

- To develop understanding about the structure (gross and histology) and functions of various organs of the human body;
- describe the various homeostatic mechanisms and their imbalances of various systems;
- identify the various tissues and organs of the different systems of the human body and appreciate coordinated working pattern of different organs of each system

UNIT-I**FOUNDATIONS OF PHYSIOLOGY, HOMEOSTASIS****9**

Organization of the Human Body , Chemical Foundations – Atoms, Ions, Molecules, Bonds, Solutions, Classes of organic molecules; Physical Foundations – Morphology of the cell (plasma membrane, nucleus, cell organelles) Elementary tissues of the human body: epithelial, connective, Muscular and nervous tissues-their sub-types and characteristics, Cellular Transport – Intracellular movement, Intercellular movement, Movement of molecules across the plasma membrane, intercellular communication.

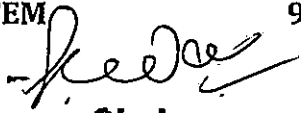
UNIT-II**NERVOUS AND MUSCULO-SKELETON SYSTEM****9**

Anatomy and physiology of brain, blood-brain barrier, spinal cord, structure and types of the neuron, synapses neurotransmitters, organization of spinal and cranial nerves, central and peripheral nervous system, autonomic nervous system, receptors membrane potentials – graded potentials and action potentials, physiology of vision, audition, olfaction, taste and skin; anatomy and physiology of muscular system, types of muscle tissue – skeletal, smooth, cardiac, contraction, muscle fibre regulation, Osseous system - structure, composition and functions of the Skeleton, classification of joints, types of movements of joints and their disorders

UNIT-III**GASTROINTESTINAL AND RENAL SYSTEM****9**

Anatomy and physiology of the gastrointestinal tract (secretion, motility, digestion and absorption), structure and function of the liver, spleen, gall bladder, pancreas; the renal system structure – Anatomy and physiology kidney; structure of the nephron and network of blood capillaries urinary tract, formation of urine, concentration of urine; regulation of acidbase balance; the chemical acid-base buffer systems of body fluids and disease conditions

UNIT-IV**CARDIOVASCULAR AND PULMONARY SYSTEM****9**


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Anatomy and physiology of the heart, lungs, cardiac cycle; circulation of blood, heart rate, blood pressure, ECG and heart sounds, lymphatic vessel, systemic and portal circulation; vascular system – arteries, arterioles, capillaries, venules. Anatomy of respiratory tract, mechanism and dynamics of respiration, lung volumes, transport of oxygen and carbon dioxide, disorders like cyanosis

UNIT-V

ENDOCRINE AND REPRODUCTIVE SYSTEM

9

Anatomy and physiology of Pituitary, thyroid, parathyroid, adrenal and pancreatic hormones and disorders of these glands, endocrine control of growth and metabolism; pineal, thymus, testes, ovaries, structure and physiology of reproductive systems, sex hormones, physiology of fertilization, menstruation, menopause, spermatogenesis and oogenesis, pregnancy and parturition and clinical disorders

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Define various blood cells and its importance.
- CO2 :** Demonstrate the functions of central, peripheral and autonomic nervous system and sense organs.
- CO3 :** Recognize the process of digestion excretion and urine formation.
- CO4 :** Explain mechanism of blood circulation by heart and respiration by lungs.
- CO5 :** Understand significance of endocrine glands & its hormones.

TEXT BOOKS:

1. Guyton, A.C. and Hall, J.E. "Textbook of Medical Physiology", 11th Edition, Saunders, 2006.
2. Ganong, W.F. "Review of Medical Physiology", 22nd Edition (A Lange Medical book series) McGraw – Hill (International Ed.) 2005.
3. Khurana, Indu "A Textbook of Medical Physiology" Elsevier, 2006.
4. Johnson, L.R. "Essential Medical Physiology", 3rd Edition, Academic Press / Elsevier, 2003.

REFERENCE BOOKS:

1. Waugh, Anne and Allison Grant "Ross and Wilson Anatomy and Physiology in Health and Illness", 10th Edition, Churchill – Livingstone / Elsevier, 2006.
2. Carola, R., J.P. Harley and C.R. Noback. "Human Anatomy & Physiology", 2nd Edition, McGraw – Hill, 1992.
3. Vander, A.J., J.H. Sherman and D.S. Luciano "Human Physiology: The Mechanisms of Body Function", 5th Edition, McGraw – Hill, 1990.


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23PTT71	REGULATORY REQUIREMENTS IN PHARMACEUTICAL INDUSTRIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To acquire the knowledge of pharmaceutical industry regulations and research.

UNIT-I**REGULATORY CONCEPTS****9**

Quality assurance – Quality control – Practice of cGMP – WHO Guidelines – Schedule M in Pharma Industries– USFDA-ICH guidelines -Impurities in new drug substances (Q3A(R2)) – Impurities in new drug products(Q3B(R2)) – Validation of analytical procedures text and methodology (Q2 (R1)).

UNIT-II**REGULATORY ASPECTS IN PHARMACEUTICALS****9**

Pharmaceuticals: Bulk drug manufacture; Personnel, Buildings and Facilities, Process Equipment, Documentation and Records, Materials Management, Production and In-Process Controls, Packaging and Identification Labelling of API's and Intermediates, Storage and distribution.

UNIT-III**REGULATORY ASPECTS IN BIOTECHNOLOGY DERIVED PRODUCTS****9**

Biotechnology derived products; Principles, Personnel, Premises and equipments, Animal quarters and care, production, labelling, Lot processing records and distribution records, quality assurance and quality control.

UNIT-IV**REGULATORY AUTHORITIS IN INDIA****9**

Central Drugs Standard Control Organization (CDSCO)- National Accreditation Board for Testing and Calibration Laboratories (NABL)- ISO 9000 & ISO 14000-National Pharmaceutical Pricing Authorities (NPPA)- Bureau of Indian Standards (BIS)

UNIT-V**QUALITY AUDIT AND SELF INSPECTIONS****9**

SOPs – Documentation – Loan license auditing – Common technical documentation (CTD) – Drug master file (DMF) – Batch manufacturing record (BMR)-Quality Audit & documentation, review and reports in Pharma Industries.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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

- CO1 :** Familiarize with the pharmaceutical industry manufacturing practices and regulatory
- CO2 :** Implement and judge the requirements of regulatory agencies for the pharmaceutical
- CO3 :** Understand the regulatory process for biotechnology derived products.
- CO4 :** Know the regulatory authorities in India for pharmaceuticals.
- CO5 :** Aware about the technical process of quality audit and inspections in document preparation for pharmaceutical.

TEXT BOOKS:

Sawar
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1. Sharma, P.P., "How to Practice GMPs", 3rd Edition, Vandana Publications, 2006
2. C.V.Subbrahmanyam & J. Thimmasetty, Pharmaceutical regulatory affairs, 1st Edn., Vallabh Prakashan, New Delhi, 2012.
3. N. Udupa, Krishnamurthy Bhat, A Concise Textbook of Drug Regulatory Affairs, Manipal University Press (MUP); First Edition, 2015.

REFERENCE BOOKS:

1. Ira R. Berry, The Pharmaceutical Regulatory Process, marcel dekker Series: Drugs and the Pharmaceutical Sciences, by CRC Press, New York, 2004.
2. Mindy J. Allport-Settle, Current Good Manufacturing Practices: Pharmaceutical, Biologics, and Medical Device Regulations and Guidance Documents Concise Reference, Pharmalogika Inc., USA, 2009.
3. Willig, H., Tuckeman, M.M. and Hitchings, W.S., "Good Manufacturing Practices for Pharmaceuticals", 5th Edition, Marcel Dekker Drugs and the Pharmaceutical Sciences, by CRC Press, New York, 2000.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_8923
2. <https://archive.nptel.ac.in/courses/103/105/10310138/>

CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	-	-	-	-	3	-	3	-	-	-	-	3	2	-	-
CO2	-	-	-	3	-	-	-	-	2	-	-	-	-	2	-	-
CO3	-	-	-	2	-	3	-	-	-	-	-	-	2	-	-	-
CO4	-	3	3	-	-	-	-	-	-	-	-	-	2	2	-	-
CO5	-	-	-	-	2	-	-	2	2	-	-	-	2	-	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

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23PTT72

BIOPHARMACEUTICS AND PHARMACOKINETICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- learn important parameters involved in drug disposition and its principles in living systems.
- make the students to understand how the drug disposition takes place in the in vitro and in vivo conditions.
- understand the concepts of bioavailability and bioequivalence of drug products and their significance

UNIT-I**DRUG ABSORPTION AND DISTRIBUTION****9**

Mechanisms of drug absorption through GIT, factors influencing drug absorption through GIT, absorption of drug from Non-per oral extravascular routes, Distribution of drugs, Tissue permeability of drugs, binding of drugs, apparent volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs.

UNIT-II**ELIMINATION****9**

Drug metabolism, metabolic pathways, factors affecting metabolism, renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non- renal routes of drug excretion of drugs.

UNIT-III**BIOAVAILABILITY AND BIOEQUIVALENCE****9**

Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, in-vitro drug dissolution models, in-vitro-in-vivo correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

UNIT-IV**PHARMACOKINETICS****9**

Introduction to Pharmacokinetics, Pharmacokinetic models, One compartment open model Intravenous Bolus Injection – Intravenous infusion - Extra vascular administrations.

UNIT-V**MULTIPLE DOSAGE REGIMENS AND NONLINEAR PHARMACOKINETICS****9**

Concept, Accumulation, Persistent and elimination factors. Calculation of dosage regimen following repetitive IV and oral administration. Nonlinear Pharmacokinetics - Introduction, factors causing Non-linearity, Michaelis-menton method of estimating pharmacokinetic parameters..

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Identify the factors affecting the rate of drug absorption.
- CO2 :** Study the various factors influencing the drug disposition, various pharmacokinetic parameters.
- CO3 :** Estimate various pharmacokinetic parameters using plasma and urine drug level data.
- CO4 :** Design and interpret the bioavailability and bioequivalence of dosage forms.
- CO5 :** Predict the effects of dosage form design and routes of drug administration on drug levels in the body.

TEXT BOOKS:

1. Rosenbaum, S. E. "Basic Pharmacokinetics and Pharmacodynamics: An Integrated Textbook and Computer Simulations", 2nd Edition, John Wiley & Sons, 2016.
2. Brahmankar, D.M. and Jaiswal, S.B. "Biopharmaceutics and Pharmacokinetics: a Treatise" , Alig publication, 2019.
3. Sunil Bakliwal and Dr. Anant Paradkar "Biopharmaceutics and Pharmacokinetics" NiraliPrakashan, 2020 ISBN-13978-9389825206
4. Alexander T. Florence; David Attwood "Physicochemical Principles of Pharmacy - In Manufacture, Formulation and Clinical Use", Sixth Edition, Pharmaceutical Press, Royal Pharmaceutical Society, London, UK, 2015, ISBN 978 0 85711 174 6
5. Judith E. Thompson and Lawrence W. Davidow "A Practical Guide to Contemporary Pharmacy Practice", Third Edition, Lippincott Williams & Wilkins ISBN 978-0781-7839-65

REFERENCE BOOKS:

1. Robert E Notari "Biopharmaceutics and Clinical Pharmacokinetics" 2019, Taylor & Francis ISBN - 13 978-0367340797
2. Shargel, L and Andrew, B.C. Yu. "Applied Biopharmaceutics & Pharmacokinetics", 7th Edition, The McGraw-Hill Companies, Inc, 2016.
3. Gibaldi, M. "Biopharmaceutics & Clinical Pharmacokinetics", 4th Edition, Pharma Book Syndicate, 2016.
4. Jambhekar, S.S. and Philip, J. B. "Basic Pharmacokinetics" 2nd Edition, Pharmaceutical Press, 2012

E-RESOURCES:

1. <https://archive.nptel.ac.in/courses/102/103/102103235/>
2. <https://archive.nptel.ac.in/courses/106/103/1031031675>


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CO's - PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
C01	2	2	2	2	2	-	1	-	-	-	-	2	1	1	3	3
C02	2	2	2	2	2	-	1	-	-	-	-	2	1	1	3	3
C03	2	2	1	2	2	-	1	-	-	-	-	2	1	1	3	3
C04	2	2	1	2	2	-	1	-	-	-	-	2	1	1	3	3
C05	2	2	-	-	-	-	-	-	-	-	-	2	1	-	3	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

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23UHV71

UNIVERSAL HUMAN VALUES-2
(Common to all branches)

L	T	P	C
2	1	0	3

Course Objectives:

- Transform the students for the essential complementarity between 'VALUES' and 'SKILLS'.
- Develop students towards life and profession as well as towards happiness and prosperity.
- Exploring the difference of Needs of Self and Body.
- To highlight ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.
- Exploring Humanistic Models in Education.

UNIT-I

Introduction to Value Education

6+3

Lectures - Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations

Tutorials [Practice Session] - *Sharing about Oneself - Exploring Human Consciousness - Exploring Natural Acceptance*

UNIT-II

Harmony in the Human Being

6+3

Lectures - Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body – The Body as an Instrument of the Self - Understanding Harmony in the Self - Harmony of the Self with the Body - Programme to ensure self-regulation and Health

Tutorials [Practice Session] - *Exploring the difference of Needs of Self and Body - Exploring Sources of Imagination in the Self - Exploring Harmony of Self with the Body*

UNIT-III

Harmony in the Family and Society

6+3

Lectures - Harmony in the Family – the Basic Unit of Human Interaction - Values in Human-to-Human Relationship – 'Trust' – the Foundational Value in Relationship - 'Respect' – as the Right Evaluation - Understanding Harmony in the Society - Vision for the Universal Human Order

Tutorials [Practice Session] - *Exploring the Feeling of Trust - Exploring the Feeling of Respect - Exploring Systems to fulfil Human Goal*

UNIT-IV

Harmony in the Nature/Existence

6+3

Lectures - Understanding Harmony in the Nature - Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature – Realizing Existence as Co-existence at All Levels - The Holistic Perception of Harmony in Existence

Tutorials [Practice Session] - *Exploring the Four Orders of Nature - Exploring Co-existence in Existence*

UNIT-V

Implications of the Holistic Understanding

6+3

Lectures - Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct – A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order - Competence in Professional Ethics - Holistic Technologies, Production Systems and Management Models-Typical Case Studies - Strategies for Transition towards Value-based Life and Profession

Tutorials [Practice Session] - Exploring Ethical Human Conduct - Exploring Humanistic Models in Education - Exploring Steps of Transition towards Universal Human Order

Total Hours 45

COURSE OUTCOME

CO's

OUTCOME

- | | |
|------------|---|
| CO1 | • Students are expected to become more aware of themselves, and their surroundings (family, society, nature) |
| CO2 | • Students would become more responsible in life, and in handling problems with sustainable solutions. |
| CO3 | • Students become sensitive to their commitment towards what they have understood (human values, human relationship and human society). |
| CO4 | • Students would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction . |
| CO5 | • Students would have better critical ability. |

Text Books:

- A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
- Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-53-2

Reference Books:

- Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

23PTL71

Mini-Project

L	T	P	C
0	0	0	1

COURSE OBJECTIVES:

To enable students to

- make the students identify project/problems relevant to their field of interest that can be carried out.
- make them equipped to search databases and journals to collect relevant data and learn methods to develop understanding and formulate solutions.
- plan, learn and perform experiments to verify the solutions.

The students individually undergo training in reputed firms/ research institutes / laboratories for the specified 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.

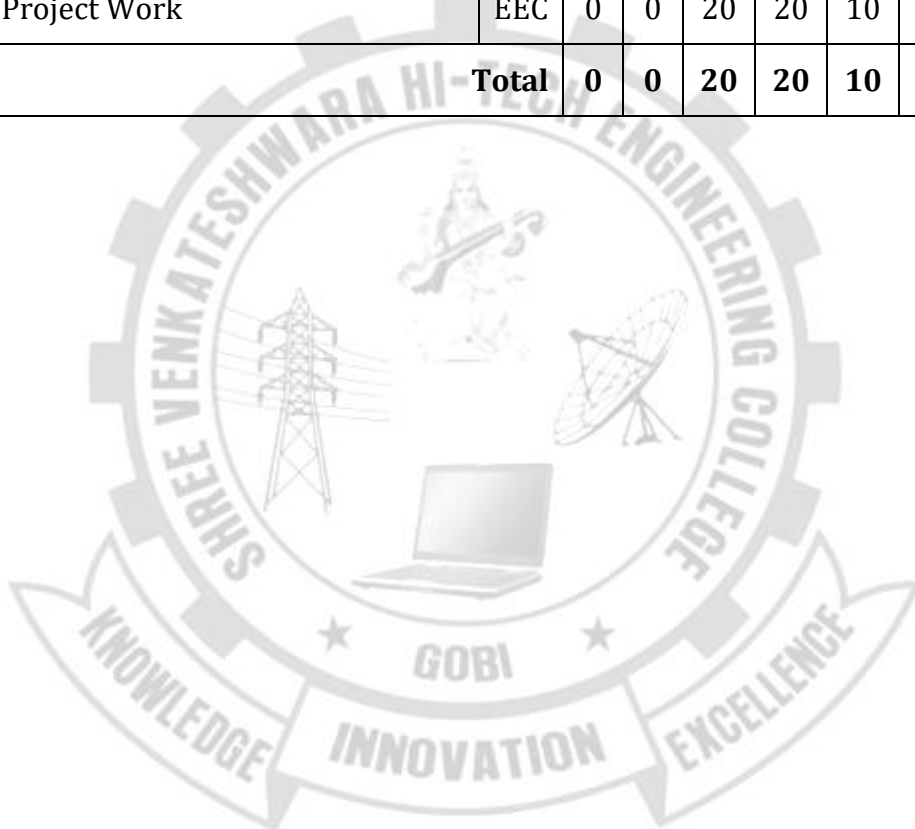
NO. OF. WEEKS: 04**COURSE OUTCOMES:****On completion of the course, the student will know about**

- CO1 :** Gain knowledge in the identification of field of interest.
- CO2 :** Equip the students to search and think about logical solutions.


 Chairman
 BoS/Pharma.Tech


SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)
Gobichettipalayam, Erode -638455
Regulation 2023 (UG)
Curriculum and Syllabus
B.Tech. Pharmaceutical Technology
SEMESTER VIII

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
Practicals											
1.	23PTL81	Project Work	EEC	0	0	20	20	10	60	40	100
Total				0	0	20	20	10			



23PTL81**PROJECT WORK**

L	T	P	C
0	0	20	10

COURSE OBJECTIVES:

To train the students in

- Identifying problem and developing the structured methodology to solve the identified problem in the industry or research problem at research Institution or college.
- Conducting experiments, analyze and discuss the test results, and make conclusions.
- Preparing project reports and presentation

The students shall individually / or as group work on a specific topic approved by the Department. The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL: 300 PERIODS**COURSE OUTCOMES:****On completion of the course, the student will know about**

- CO1 :** Formulate and analyze problem / create a new product/ process.
- CO2 :** Design and conduct experiments to find solution
- CO3 :** Analyze the results and provide solution for the identified problem, prepare project report and make presentation.