HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)

Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST

HICET

CHOICE BASED CREDIT SYSTEM

Curriculum & Syllabus

2019-2020

VISION AND MISSION OF THE INSTITUTION

VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

MISSION

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.

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VISION AND MISSION OF THE DEPARTMENT

VISION

To be an excellent Department in training students to become professional Food Technologist who is technically capable of working in food operations sector and discovering licensed food products which could benefit the Eco-friendly society.

MISSION

M1. To impart students with a vibrant technical and analytical skills.

M2. To provide students with leadership quality and also the knowledge to handle all the problems relating Food Industry.

M3. To develop the research and development activities of students to explore the quality food products.

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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **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.

PO3. **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.

PO4. **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.

PO5. **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.

PO6. **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.

PO7. **Environment and sustainability**: Understand the impact of the professional

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engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **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.

PO11. **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.

PO12. **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.

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PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1. Ensure food safety and quality by using the technical skills and other emerging techniques.

PSO 2. Design and develop the safest food products and equipments needed for the eco-friendly society.

PSO 3. Integrate various concepts of food processing operations and come out with the best solution for the complex issues in food sector.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1. Utilize the principles of food science and Engineering to face various professional career challenges.

PEO 2. Analyze and create new food products and process for real world application with technical feasibility.

PEO 3. Exhibit professional and managerial capabilities with ethical conduct for continuous learning.

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CURRICULUM

Hindusthan College of Engineering and Technology
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Approved by AICTE, New Delhi& Accredited by NAAC with 'A' Grade)
Valley Campus, Pollachi Highway, Coimbatore, Tamil Nadu.

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DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)
REGULATION 2016 & 2019
REGULATION-2019

For the students admitted during the academic year 2019-2020 and onwards

SEMESTER I

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
		THEORY								
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100
3	19ME1101	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
		THEORY & LAB COMPONENT								
4	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
5	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
6	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
		PRACTICAL								
7	19HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100
			Total:	14	2	8	20	325	375	700

As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course

SEMESTER II

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
		THEORY								
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
3	19FT2105	Principles of Microbiology	PC	3	0	0	3	25	75	100
		THEORY & LAB COMPONENT								
4	19IT2151	Programming in C	ES	2	0	2	3	50	50	100
5	19PH2151	Material Science	BS	2	0	2	3	50	50	100
6	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
		PRACTICAL								
7	19ME2001	Engineering Practices Laboratory	ES	0	0	4	2	50	50	100
8	19HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
			Total:	14	2	12	22	375	425	800

For the students admitted during the academic year 2018-2019 and onwards

SEMESTER III

S.No.	COURSE CODE	COURSE TITLE	Course Category	L	T	P	C	CIA	ESE
1	16MA3111	Fourier Analysis and Z Transform	BS	3	1	0	4	25	75
2	16FT3201	Fluid Mechanics	PC	3	1	0	4	25	75
3	16FT3202	Food Process Calculations	PC	3	1	0	4	25	75
4	16FT3203	Food Microbiology	PC	3	0	0	3	25	75
5	16FT3204	Food Chemistry	PC	3	0	0	3	25	75
6	16FT3205	Applied Thermodynamics	PC	3	0	0	3	25	75
7	16FT3001	Food Microbiology Lab	PC	0	0	4	2	50	50
8	16FT3002	Food Chemistry Lab	PC	0	0	4	2	50	50
			TOTAL	18	3	8	25	250	550

SEMESTER IV

S.No.	COURSE CODE	COURSE TITLE	Course Category	L	T	P	C	CIA	ESE
1	16MA4112	Applied Statistics & Numerical Methods	BS	3	0	2	4	25	75
2	16FT4201	Engineering Properties of Food Materials	PC	3	0	0	3	25	75
3	16FT4202	Fundamentals of Heat and Mass Transfer	PC	3	1	0	4	25	75
4	16FT4203	Food Process Engineering - I	PC	3	1	0	4	25	75
5	16FT4204	Food Analysis	PC	3	0	0	3	25	75
6	16HE4101	Total Quality Management	HS	3	0	0	3	25	75
7	16FT4001	Food Analysis Laboratory	PC	0	0	4	2	50	50
8	16FT4002	Heat and Mass transfer Laboratory	PC	0	0	4	2	50	50
			TOTAL	18	2	10	25	250	550

(L – Lecture, T –Tutorial, P – Practical, C – Credit, CIA – Continuous Internal

Assessments, ESE – End Semester Examinations)

 # Continuous Internal Assessment (CIA) only.

**NCM (Non Credit Mandatory Course)

$ Audit Course

@@ MOOC Course (Credit Transfer Course if any approved by Dean Office) -Minimum of 45 Hours from recognized MOOC portal like SWAYAM. Assessment with Score/Credit and Certificate is mandatory.

Colour:

1. HS subjects
2. BS Subject
3. ES Subject
4. PC Subject
5. PE Subject
6. OE Subject
7. VA/EEC Subjects

Credit Distribution R2016

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	25	25	23	24	22	16	187

Credit Distribution R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	22	22	20	18	165

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19HE1101	TECHNICAL ENGLISH (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objective

✓ To facilitate students to communicate effectively with coherence.
✓ To train the learners in descriptive communication.
✓ To introduce professional communication.
✓ To enhance knowledge and to provide the information on corporate environment.
✓ To equip the trainers with the necessary skills on critical thinking.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Listening and Speaking** – Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) **Reading** – Reading articles from newspaper, Reading comprehension **Writing** Chart analysis, process description, Writing instructions **Grammar and Vocabulary**- Tenses, Regular and irregular verb, technical vocabulary.	9
II	**Listening and Speaking**- listening to product description, equipment & work place (purpose, appearance, function) **Reading**- Reading technical articles **Writing**- Letter phrases, writing personal letters, **Grammar and Vocabulary**-articles, Cause & effect, Prepositions.	9
III	**Listening and Speaking**- - listening to announcements **Reading**- Reading about technical inventions, research and development **Writing**- Letter inviting a candidate for interview, Job application and resume preparation **Grammar and Vocabulary**- Homophones and Homonyms.	9
IV	**Listening and Speaking**- - Practice telephone skills and telephone etiquette (listening and responding, asking questions).**Reading**- Reading short texts and memos **Writing**- invitation letters, accepting an invitation and declining an invitation **Grammar and Vocabulary**- Modal verbs, Collocation, Conditionals, Subject verb agreement and Pronoun-Antecedent agreement.	9
V	**Listening and Speaking**- listening to technical group discussions and participating in GDs **Reading**- reading biographical writing - **Writing**- Proposal writing, Writing definitions, **Grammar and Vocabulary**- Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs.	9

	Total Instructional Hours	45

Course Outcome

CO1- Trained to maintain coherence and communicate effectively.
CO2- Practiced to create and interpret descriptive communication.
CO3- Introduced to gain information of the professional world.
CO4- acquired various types of communication and etiquette.
CO5- Taught to improve interpersonal and intrapersonal skills.

TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.
T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

REFERENCE BOOKS :

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.
R2- Raymond Murphy, "English Grammar in Use"- 4th editionCambridge University Press, 2004.
R3- Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19MA1102	CALCULUS AND LINEAR ALGEBRA	3	1	0	4

Course Objective	1. Understand the concept of differentiation. 2. Evaluate the functions of several variables which are needed in many branches of engineering. 3. Understand the concept of double integrals. 4. Understand the concept of triple integrals. 5. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.

Unit	Description	Instructional Hours
I	**DIFFERENTIAL CALCULUS** Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima – Taylor's and Maclaurin's Theorem.	12
II	**MULTIVARIATE CALCULUS (DIFFERENTIATION)** Totalderivatives - Jacobians – Maxima, M inima and Saddle points - Lagrange's method ofundeterminedmultipliers – Gradient, divergence, curl and derivatives.	12
III	**DOUBLE INTEGRATION** DoubleintegralsinCartesiancoordinates– Area enclosed by the plane curves (excluding surface area)– Green's Theorem (Simple Application) - Stoke's Theorem – Simple Application involving cubes and rectangular parellopiped.	12
IV	**TRIPLE INTEGRATION** Tripleintegrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parellopiped.	12
V	**MATRICES** Eigen valuesand Eigen vectors – PropertiesofEigenvaluesandEigenvectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	12
	Total Instructional Hours	60

Course Outcome	CO1: Apply the concept of differentiation in any curve. CO2: Identify the maximum and minimum values of surfaces. CO3: Apply double integrals to compute area of plane curves. CO4: Evaluation of triple integrals to compute volume of solids. CO5: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibrational modes.

TEXT BOOKS:

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.
T2 - Veerarajan T. "Engineering Mathematics ", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS :

R1- Thomas & Finney " Calculus and Analytic Geometry" , Sixth Edition,,Narosa Publishing House, New Delhi.
R2 – Weir,M.D and Joel Hass, ' Thomas Calculus" 12thEdition,Pearson India 2016.
R3 - Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19ME1101	BASIC CIVIL AND MECHANICAL ENGINEERING	3	0	0	3

COURSE OBJECTIVES

- To learn about the working principles of IC engines and detailed explanation of components of power plant units.
- To study Refrigeration and Air Conditioning system.
- To impart basic knowledge on Civil and Mechanical Engineering.
- To study materials used for the construction of civil structures.
- To gain knowledge on the fundamentals of construction of structure.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**A – MECHANICAL ENGINEERING** **IC ENGINES** Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.	9
II	**POWER PLANT ENGINEERING** Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits –Prime movers and Power Transmission systems- Pumps– working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.	9
III	**REFRIGERATION AND AIR CONDITIONING SYSTEM** Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.	9
IV	**B – CIVIL ENGINEERING** **SURVEYING AND CIVIL ENGINEERING MATERIALS** **Surveying:** Objects – types – classification – principles – measurements of distances **Civil Engineering Materials:** Bricks – stones – sand – cement – concrete – steel sections-Woods-Plastics.	9
V	**BUILDING COMPONENTS AND STRUCTURES** **Foundations:** Types, Bearing capacity – Requirement of good foundations. **Superstructure:** Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Types of Bridges and Dams.	9
	TOTAL INSTRUCTIONAL HOURS.	45

COURSE OUTCOMES

CO1: Apply the concept of differentiation in any curve.
CO2: Identify the maximum and minimum values of surfaces.
CO3: Apply double integrals to compute area of plane curves.
CO4: Evaluation of triple integrals to compute volume of solids.
CO5: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibrational modes.

TEXT BOOKS:

1. Venugopal K. and Prabhu Raja V., ―Basic Mechanical Engineering‖, Anuradha Publishers, Kumbakonam, 2000.
2. Shanmugam G and Palanichamy M S, ―Basic Civil and Mechanical Engineering‖, Tata McGraw Hill Publishing Co., New Delhi, 1996.

REFERENCES:

1. Ramamrutham S., ― Basic Civil Engineering‖, Dhanpat Rai Publishing Co. (P) Ltd.1999.
2. Seetharaman S., ― Basic Civil Engineering‖, Anuradha Agencies, 2005.
3. Shantha Kumar S R J., ― Basic Mechanical Engineering‖, Hi-tech Publications, Mayiladuthurai.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19PH1151	APPLIED PHYSICS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective	1. Enhance the fundamental knowledge in properties of matter 2. Analysis the oscillatory motions of particles 3. Extend the knowledge about wave optics 4. Gain knowledge about laser and their applications 5. Conversant with principles of optical fiber, types and applications of optical fiber

Unit	Description	Instructional Hours
I	**PROPERTIES OF MATTER** Elasticity – Hooke's law – Stress-strain diagram - Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment.	6
	Determination of Young's modulus by uniform bending method	3
II	**OSCILLATONS** Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment.	6
	Determination of Rigidity modulus – Torsion pendulum	3
III	**WAVE OPTICS** Conditions for sustained Interference – air wedge and it's applications - Diffraction of light –Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating.	6
	Determination of wavelength of mercury spectrum – spectrometer grating	3
	Determination of thickness of a thin wire – Air wedge method	3
IV	**LASER AND APPLICATIONS** Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Type of lasers – Nd:YAG laser and CO_2 laser- Laser Applications – Holography – Construction and reconstruction of images.	6
	Determination of Wavelength and particl size using Laser	3
V	**FIBER OPTICS AND APPLICATIONS** Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Fiber optical communication link – Fiber optic sensors – Temperature and displacement sensors.	6
	Total Instructional Hours	**45**

Course Outcome	After completion of the course the learner will be able to CO1: Illustrate the fundamental properties of matter CO2: Discuss the Oscillatory motions of particles CO3: Analyze the wavelength of different colors CO4: Understand the advanced technology of LASER in the field of Engineering CO5: Develop the technology of fiber optical communication in engineering field

TEXT BOOKS: T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015

R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016

R3 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2016

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19CY1151	CHEMISTRY FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective	1. The boiler feed water requirements, related problems and water treatment techniques. 2. The principles of polymer chemistry and engineering applications of polymers and composites. 3. The principles of electrochemistry and with the mechanism of corrosion and its control. 4. The principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells. 5. The important concepts of spectroscopy and its applications.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**WATER TECHNOLOGY** Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process - desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. **Estimation of total, permanent and temporary hardness of water by EDTA**	6 +3=9
II	**POLYMER & COMPOSITES** Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, Polymerization – types Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) –FRP	6
III	**ELECTROCHEMISTRY AND CORROSION** Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods - protective coatings – paints – constituents and functions. **Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4. Estimation of Ferrous iron by Potentiometry.**	6+9 =15
IV	**ENERGY SOURCES AND STORAGE DEVICES** Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.	6
V	**ANALYTICAL TECHNIQUES** Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principle – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. **Determination of iron content of the water sample using spectrophotometer. (1,10 phenanthroline / thiocyanate method).**	6+3

| | Total Instructional Hours | 45 |

Course Outcome	CO1: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life CO2: Acquire the basic knowledge of polymers, composites and FRP and their significance. CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design. CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities. CO5: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

TEXT BOOKS

T1 - P. N. Madudeswaran and B.Jeyagowri, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd,Chennai

T2 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

REFERENCES

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).

R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co. Ltd., New Delhi (2017).

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19CS1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3

Course Objectives	• To know the basics of algorithmic problem solving.
	• To read and write simple Python programs.
	• To develop Python programs with conditionals and loops and to define Python functions and call them.
	• To use Python data structures – lists, tuples, dictionaries.
	• To do input/output with files in Python.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**ALGORITHMIC PROBLEM SOLVING**	9
	Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategiesfor developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert acard in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.	
II	**DATA, EXPRESSIONS, STATEMENTS**	7+2
	Python interpreter and interactive mode; values and types: int, float, boolean, string, and list;variables, expressions, statements, tuple assignment, precedence of operators, comments;modules and functions, function definition and use, flow of execution, parameters and arguments. **Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.**	
III	**CONTROL FLOW, FUNCTIONS**	5+4
	Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: returnvalues, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. **Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.**	
IV	**LISTS, TUPLES, DICTIONARIES**	3+6
	Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; **Illustrative programs: selection sort, insertion sort, merge sort, histogram.**	
V	**FILES, MODULES, PACKAGES**	5+4
	Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages. **Illustrative programs: word count, copying file contents.**	
	Total Instructional Hours	45

Upon completion of the course, students can be able to

CO1: Develop algorithmic solutions to simple computational problems.

Course Outcomes

CO2: Read, write, execute by hand simple Python programs.

CO3: Structure simple Python programs for solving problems and decompose a Python program into functions.

CO4: Represent compound data using Python lists, tuples, dictionaries.

CO5: Read and write data from/to files in Python Programs.

TEXT BOOKS:

1. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised andupdated for Python 3.6.2, Shroff Publishers, First edition (2017).
2. S. Annadurai, S.Shankar, I.Jasmine, M.Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019.

REFERENCE BOOKS:

1. Charles Dierbach, —Introduction to Computer Science using Python: A ComputationalProblem-Solving Focus, Wiley India Edition, 2013.
2. Timothy A. Budd, —Exploring Pythonl, Mc-Graw Hill Education (India) Private Ltd., 2015.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming inPython: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

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Programme B.TECH.	Course Code 19HE1071	Name of the Course LANGUAGE COMPETENCY ENHANCEMENT COURSE- I	L 0	T 0	P 2	C 1

Course Objective	✓ To enhance student language competency ✓ To train the students in LSRW skills ✓ To develop student communication skills ✓ To empower the trainee in business writing skills. ✓ To train the students to react to different professional situations

Unit	Description	Instructional Hours
I	**LISTENING** Listening to technical group discussions and participating in GDs. listening to TED talks. Listen to Interviews & mock interview. Listening short texts and memos.	3
II	**READING** Reading articles from newspaper, magazine. Reading comprehension. Reading about technical inventions, research and development. Reading short texts and memos.	3
III	**WRITING** E-mail writing: Create and send email writing (to enquire about some details, to convey important message to all, to place an order, to share your joy and sad moment). Reply for an email writing.	3
IV	**SPEAKING** To present a seminar in a specific topic (what is important while choosing or deciding something to do). To respond or answer for general questions (answer for your personal details, about your family, education, your hobbies, your aim etc.,).	3
V	**SPEAKING** Participate in discussion or interactions (agree or disagree express your statement with a valid reason, involve in discussion to express your perspective on a particular topics).	3
	Total Instructional Hours	15

Course Outcome	CO1- Trained to maintain coherence and communicate effectively. CO2- Practiced to create and interpret descriptive communication. CO3- Introduced to gain information of the professional world. CO4- Acquired various types of communication and etiquette. CO5- Taught to improve interpersonal and intrapersonal skills.

TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.

T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press. 2019.

REFERENCE BOOKS :

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19HE2101	BUSINESS ENGLISH FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objective	1. Introduce business communication. 2. Train to respond different professional situations. 3. Make the learners familiar with the managerial skills 4. Empower the trainee in business writing skills. 5. Educate to interpret and expertise different business content.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement **Reading** –reading auto biographies of successful personalities **Writing** Formal & informal email writing, Recommendations **Grammar and Vocabulary-** Business vocabulary, Adjectives & adverbs.	9
II	**Listening and Speaking-** listening to TED talks **Reading-**Making and interpretation of posters**Writing-** Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success"**Grammar and Vocabulary-** Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	9
III	**Listening and Speaking-**travel arrangements and experience **Reading-** travel reviews **Writing-** Business letters (Placing an order, making clarification & complaint letters). **Grammar and Vocabulary-** Direct and Indirect speech.	9
IV	**Listening and Speaking-** Role play- **Reading-** Sequencing of sentence **Writing-** Business report writing (marketing, investigating) **Grammar and Vocabulary-** Connectors, Gerund & infinitive.	9
V	**Listening and Speaking-** Listen to Interviews & mock interview **Reading-** Reading short stories, reading profile of a company - **Writing-** Descriptive writing (describing one's own experience) **Grammar and Vocabulary-** Editing a passage(punctuation, spelling& number rules).	9
	Total Instructional Hours	45

Course Outcome	CO1- To know different modes of business communication CO2- To understand managerial techniques CO3- To apply the rules of grammar and vocabulary in effective business communication CO4- To analyze and interpret business documents CO5-To draft business reports

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.

T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS:

R1 -Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.

R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.

R3-Frederick T. Wood, "Remedial English Grammar for Foreign Students", Macmillan publishers, 2001.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19MA2101	DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES	3	1	0	4

Course Objective

1. Describe some methods to solve different types of first order differential equations.
2. Solve ordinary differential equations of certain types using Wronskian technique
3. Use the effective mathematical tools for the solutions of partial differential equations.
4. Describe the construction of analytic functions and conformal mapping.
5. Illustrate Cauchy's integral theorem and calculus of residues

Unit	Description	Instructional Hours
I	**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS** Solutions of Equations of the first order and of the first degree – Variable seperable method- Homogeneous equations – Exact differential equations (Excluding non Exact differential Equations) – Linear equations – Equations reducible to the linear form – Bernoulli's equation	12
II	**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER** Second order linear differential equations with constant and variable co-efficients – Cauchy – Euler equations – Cauchy – Legendre equation – Method of variation of paramers. Solution of ODE related to electric circuits, bending of beams.	12
III	**PARTIAL DIFFERENTIAL EQUATIONS** Formation of partial differential equations by the elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations of the form $f(p,q)=0$, Clairaut's type : $z = px+qy +f(p,q)$ – Lagrange's linear equation.	12
IV	**COMPLEX DIFFERENTIATION** Functions of complex variables – Analytic functions – Cauchy's – Riemann's equations and sufficient conditions (excluding proof) – Construction of analytic functions – Milne – Thomson's method – Conformal mapping $w = A+z$, Az, $1/z$ and bilinear transformations.	12
V	**COMPLEX INTEGRATION** Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series (statement only) –Residues - Cauchy's Residue theorem.	12
	Total Instructional Hours	60

Course Outcome

CO1: Apply few methods to solve different types of first order differential equations.
CO2: Develop sound knowledge of techniques in solving ordinary differential equations
CO3 Solve Partial Differential Equations using various methods.
CO4: Infer the knowledge of construction of analytic functions and conformal mapping.
CO5: Evaluate real and complex integrals over suitable closed paths or contours.

TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineering Mathematics", McGraw Hill education (India) Private Ltd., Chennai,2017
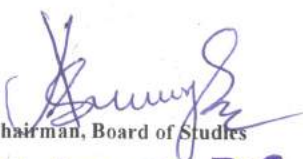
T2- Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.

REFERENCE BOOKS :

R1- Veerarajan T, "Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016
R2- Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.

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Programme B.TECH.	Course code 19FT2105	Name of the course PRINCIPLES OF MICROBIOLOGY	L 3	T 0	P 0	C 3

COURSE OBJECTIVES
- Understand the history of microbiology.
- Understand the structure and classification of microorganisms.
- Understand the techniques to detect the microbes.
- Understand the conditions for the growth of microorganisms.
- Understand the isolation and control techniques.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Introduction:** Development and Scope of Microbiology, History of Microbiology - Spontaneous generation theory, Biogenesis, Germ theory of diseases. Contributions by Anton Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Joseph Lister, Edward Jenner, Alexander Fleming and Waksman.	9
II	**Classification and Structure of Microorganisms:** Classification and Groups of microorganisms - Prokaryotes and Eukaryotes. Whittaker's five kingdom and three kingdom concept of living organisms. Microbial cell: Bacteria, Virus, Algae, Fungi- structure, reproduction and economic importance. Bacteriophage – structure, importance and life cycle (lytic and lysogenic cycle).	9
III	**Microscopy and Staining Techniques-** Principle, resolution, numerical aperture, magnification. Different types of microscopes – Light, UV, dark field, phase contrast and Electron microscope (Scanning and Transmission type). Stains – Auxochrome, chromophores, acidic and basic dyes. Staining techniques – Simple staining, Gram's staining, acid fast staining, endospore staining, capsule staining and flagella staining.	9
IV	**Microbial Nutrition and Growth:** Primary nutritional requirements and nutritional classification – Phototrophs, autotrophs, organotrophs, lithotrophs, chemotrophs. Culture Media – components of media, design and preparation of media using common ingredients. Types of media - natural, synthetic, complex, selective, differential, enriched, assay, enumeration, transport and enrichment media. Growth curve – batch culture, continuous culture, synchronous culture. Physical factors influencing the growth – Temperature, pH, osmotic pressure and salt concentration.	9
V	**Isolation and Control of Microbes:** Pure culture technique – Serial dilution and plating methods; cultivation, maintenance and preservation of pure cultures. Control of microorganisms: Physical agents – heat, radiation and filtration; Chemical agents and their mode of action – Aldehydes, halogens, Quaternary ammonium compounds, phenol and phenolic compounds, heavy metals, alcohol, detergents and surfactants; Antibiotics and their mode of action – Pencillin, streptomycin, tetracycline and chloramphenicol.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

COURSE OUTCOMES
CO1 - Acquire knowledge on historical developments in microbiology.
CO2 - Classify and identify the structure of microorganisms
CO3 – Interpret the different types of microscopes and staining techniques
CO4 - Formulate media for microbial growth
CO5 - Identify the technique used for isolation and control of microorganisms

TEXT BOOKS:
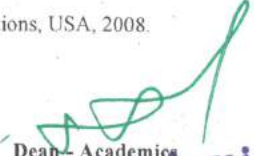
1.Pelczar M.J., Chan E.C.S. and Krieg N.R., ―Microbiology‖, McGraw Hill, New York, 2004.
2.Powar C.B. and Daginawala H.F., ―General Microbiology‖, Volume I and II, Himalaya Publishing House, New Delhi, 2005.

REFERENCE BOOKS:

1.Wiley J., Sherwood L., and Woolverton C., ―Prescott's Microbiology‖, McGraw Hill, New York, 2013.
2.Harvey R.A., Cornelissen C.N. and Fisher B.D., ―Microbiology‖, 3rd Edition, Lippincott Williams & Wlakins, Philidelphia, 2013.
3.Black J.G., ―Microbiology – Principles and Explorations‖, Wiley Publications, USA, 2008.

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Programme B.TECH.	Course code 19IT2151	Name of the course PROGRAMMING IN C	L T P C 2 0 2 3

COURSE OBJECTIVES
- To develop C Programs using Basic programming constructs
- To develop C programs using Arrays and Strings
- To develop applications in C using Functions , Pointers and Structures
- To do Input / Output and File handling in C
- To develop C Programs using Basic programming constructs

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Basics of C Programming** Structure of C program - C programming: Data Types –Keywords – Variables - Operators: Precedence and Associativity - Expressions – Input / Output statements Decision making statements - Looping statements – Pre-processor directives - Compilation process *Programs using decision - making and Looping Constructs.*	5+4(P)
II	**Arrays And Strings** Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – String operations and String functions *Programs Using Arrays and string functions.*	5+4(P)
III	**Functions And Pointers** Introduction to functions: Function prototype, function definition, function call - Parameter passing: Pass by value, Pass by reference – Recursion – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers — Pointer to pointers – pointer to strings *Programs Using Functions and Pointers*	5+4(P)
IV	**Structures and Unions** Structure - Nested structures – Pointer to Structures – Array of structures – Self-referential structures – Dynamic memory allocation – Typedef-Unions – Union of Structures *Programs Using Structures and Unions.*	7+2(P)
V	**File Processing** Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file – Command line arguments *Programs Using File concepts*	7+2(P)
	TOTAL INSTRUCTIONAL HOURS	45

COURSE OUTCOMES
CO1 - Select appropriate data types and control structures for solving a given problem.
CO2 - Develop applications using arrays and strings
CO3 - Understand the importance of functions, pointers and dynamic memory allocation.
CO4 - Understand the Concepts of structures to develop applications in C
CO5 – Applying the concepts of files in programming

TEXT BOOKS:
1. E. Balagurusamy – "Programming in ANSI C", Tata McGraw Hill, 7th Edition,201. ISBN 13: 9789339219666
2. Reema Thareja, — "Programming in C", Oxford University Press, Second Edition, 2016. ISBN 9780199456147
REFERENCES:
1. Ashok.N.Kamthane, Raj Kamal ," Computer Programming and IT", Pearson Education (India),2012. ISBN -9788131799604
2. Paul Deitel and Harvey Deitel, —"C How to Program", Eighth edition,2012, Pearson Publication ISBN– 9780132990448
3. Kernighan, B.W and Ritchie,D.M, —The C Programming language, Second Edition, Pearson Education, 2012 ISBN 13: 9789332549449
4. Yashavant P. Kane tkar. " Let Us C", BPB Publications, 15th Edition , July 201. ISBN-13:978-8183331630

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19PH2151	MATERIAL SCIENCE (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective	1. Acquire fundamental knowledge of semiconducting materials which is related to the 2. engineering program 3. Extend the knowledge about the magnetic materials 4. Explore the behavior of super conducting materials 5. Gain knowledge about Crystal systems **6.** 5. Understand the importance of ultrasonic waves

Unit	Description	Instructional Hours
I	**SEMICONDUCTING MATERIALS** Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber(Qualitative).	6
	Determination of band gap of a semiconductor	3
	Determination of acceptance angle and numerical aperature in an optical fiber	3
II	**MAGNETIC MATERIALS** Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications.	6
		3
	B – H curve by Magnetic hysteresis experiment	
III	**PERCONDUCTING MATERIALS** Superconductivity: properties (Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.	6
IV	**CRYSTAL PHYSICS** Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
V	**ULTRASONICS** Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrial applications – Drilling and welding – Non destructive testing – Ultrasonic pulse echo system.	6
	Determination of velocity of sound and compressibility of liquid – Ultrasonic wave	3
	Determination of Coefficient of viscosity of a liquid –Poiseuille's method	3
	Total Instructional Hours	**45**

Course Outcome	CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday CO3: Discuss the behavior of super conducting materials CO4: Illustrate the types and importance of crystal systems CO5: Evaluate the production of ultrasonics and its applications in NDT

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015
R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016
R3 - Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2016

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19CY2151	ENVIRONMENTAL STUDIES (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. The importance of environmental education, ecosystem and biodiversity.
2. The knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. The natural resources, exploitation and its conservation
4. Scientific, technological, economic and political solutions to environmental problems.
5. An awareness of the national and international concern for environment and its protection.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Main objectives and scope of environmental studies-Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – food chain, food web and ecological pyramids - energy flow in the ecosystem – ecological succession processes - Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	6
II	**NATURAL RESOURCES** Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non-renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	6+9=15
III	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- nuclear hazards – role of an individual in prevention of pollution. **Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by indicator method. Determination of chloride content of water sample by argentometric method.**	6
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12. Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones. **Determination of pH in beverages.**	6+3=9
V	**HUMAN POPULATION AND THE ENVIRONMENT** Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health. **Estimation of heavy metal ion (copper) in effluents by EDTA.**	6+3=9

	Total Instructional Hours	45

Course Outcome

CO1: Realise the importance of ecosystem and biodiversity for maintaining ecological balance.
CO2: Understand the causes of environmental pollution and hazards due to manmade activities.
CO3: Develop an understanding of different natural resources including renewable resources.
CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.
CO5: Gain knowledge about the importance of women and child education and know about the existing technology to protect environment

TEXT BOOKS:

T1- S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2020

T2 – Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.

REFERENCES:

R1 – Erach Bharucha, "Textbook of environmental studies" University Press (I) Pvt.ltd, Hyderabad, 2015

R2 - G.Tyler Miller, Jr and Scott E. Spoolman"Environmental Science" Thirteenth Edition, Cengage Learning, 2010.

R3 - Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.

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Programme B.TECH.	Course Code 19ME2001	Name of the Course ENGINEERING PRACTICES LABORATORY	L 0	T 0	P 4	C 2

Course Objectives	• To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

S.No.   DESCRIPTION
GROUP A (CIVIL & MECHANICAL)

1. Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.

2. Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for right angle corner junction.

3. Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for T junction.

4. Preparation of arc welding of Butt joints, Lap joints and Tee joints. structures.

5. Practice on sheet metal Models– Trays and funnels

6. Hands-on-exercise in wood work, joints by sawing, planning and cutting.

7. Practice on simple step turning, taper turning and drilling.

8. Demonstration on Smithy operation.

9. Demonstration on Foundry operation.

10. Demonstration on Power tools.

S.No.   DESCRIPTION
GROUP B (ELECTRICAL)

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.

2. Fluorescent lamp wiring.

3. Stair case wiring.

4. Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.

5. Measurement of energy using single phase energy meter.

6. Soldering practice using general purpose PCB.

7. Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.

8. Study of Energy Efficient Equipment's and Measuring Instruments.

Total Instructional Hours   **45**

Course Outcomes	Upon completion of the course, students can be able to • Fabricate wooden components and pipe connections including plumbing works. • Fabricate simple weld joints. • Fabricate different electrical wiring circuits and understand the AC Circuits. • Demonstration of different welding operations like Butt joints, Tee Joints and Lap Joints. • Demonstration on smithy, foundry and power tools.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19HE2071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- II	0	0	2	1

(COMMON TO ALL BRANCHES)

Course Objective	✓ To introduce to business communication. ✓ To train the students to react to different professional situations. ✓ To make the learner familiar with the managerial skills ✓ To empower the trainee in business writing skills. ✓ To learn to interpret and expertise different content.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement **Reading** –reading auto biographies of successful personalities **Writing** Formal & informal email writing, Recommendations **Grammar and Vocabulary**- Business vocabulary, Adjectives & adverbs.	3
II	**Listening and Speaking**- listening to TED talks **Reading**- Making and interpretation of posters **Writing**- Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success" **Grammar and Vocabulary**- Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	3
III	**Listening and Speaking**-travel arrangements and experience **Reading**- travel reviews **Writing**- Business letters (Placing an order, making clarification & complaint letters). **Grammar and Vocabulary**- Direct and Indirect speech.	3
IV	**Listening and Speaking**- Role play - **Reading**- Sequencing of sentence **Writing**- Business report writing (marketing, investigating) **Grammar and Vocabulary**- Connectors, Gerund & infinitive.	3
V	**Listening and Speaking**- Listen to Interviews & mock interview **Reading**- Reading short stories, reading profile of a company - **Writing**- Descriptive writing (describing one's own experience) **Grammar and Vocabulary**- Editing a passage(punctuation, spelling & number rules).	3
	Total Instructional Hours	15

Course Outcome	CO1- Introduced to different modes and types of business communication. CO2- Practiced to face and react to various professional situations efficiently. CO3- Learnt to practice managerial skills. CO4- Familiarized with proper guidance to business writing. CO5- Trained to analyze and respond to different types of communication.

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.

T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS :

R1 - Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.

R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.

R3- Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001.

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16MA3111	FOURIER ANALYSIS AND Z TRANSFORMS (AGRI, BIO MEDICAL & FOOD TECHNOLOGY)	3	1	0	4

Course Objective	1. Introduce Fourier series which is central to many applications in engineering. 2. Apply the effective tools for the solutions of one dimensional boundary value problems. 3. Apply the effective tools for the solutions of two dimensional heat equations. 4. Acquaint with Fourier transform techniques used in wide variety of situations. 5. Develop Z transform techniques for discrete time systems.

Unit	Description	Instructional Hours
I	**FOURIER SERIES** Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis.	12
II	**BOUNDARY VALUE PROBLEMS** Classification of PDE - Solutions of one dimensional wave equation - One dimensional equation of heat conduction (excluding insulated edges).	12
III	**TWO DIMENSIONAL HEAT EQUATIONS** Steady state solution of two dimensional equation of heat conduction in infinite plate and semi circular plate.	12
IV	**FOURIER TRANSFORMS** Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem – Parseval's identity.	12
V	**Z - TRANSFORMS AND DIFFERENCE EQUATIONS** Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem (excluding proof)– Solution of difference equations using Z – transform.	12
	Total Instructional Hours	60

Course Outcome	CO1: Understand the principles of Fourier series which helps them to solve physical problems of engineering. CO2: Obtain the knowledge of Fourier series in solving the boundary value problems. CO3: Familiar with the application of Fourier series in solving the two dimensional heat equations. CO4: Acquire the knowledge of Fourier transform techniques which extend its applications. CO5: Illustrate the Z- transforms for analyzing discrete-time signals and systems.

TEXT BOOKS

T1 - Veerarajan. T.,"Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.

T2 - Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007

REFERENCE BOOKS

R1 - C.Roy Wylie " Advance Engineering Mathematics" Louis C. Barret, 6th Edition, Mc Graw Hill Education India Private Limited, New Delhi 2003.

R2 - Kandasamy P., Thilagavathy K. and Gunavathy K.,"Engineering Mathematics Volume III", S.Chand & Company Ltd., New Delhi, 1996.

R3 - Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi,2018.

R4 - Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.

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Programme B.TECH.	Course code 16FT3201	Name of the course FLUID MECHANICS	L	T	P	C
			3	1	0	4

UNIT	DESCRIPTION	INTRUCTIONAL HOURS
I	**Fluid Statics and Dimensional Analysis:** Nature of fluids – physical properties of fluids. Compressible and incompressible. Types of fluids – Newtonian and Non – Newtonian fluids. Fluid static: Hydrostatic equilibrium. Application of fluid statics: manometers, continuous gravity decanter. Basics of dimensional analysis: Rayleigh's method and Buckingham's method.	12
II	**Basic Equations of Fluid Flow:** Bernoulli equation. Correction of Bernoulli equation for fluid friction. Application of Bernoulli equation for pump work. Shear stress and skin friction in pipes. Laminar and turbulent flow of fluids through closed conduits. Velocity profiles and friction factor for smooth and rough pipes. Friction loss due to sudden enlargement, contraction. Friction loss in fittings valves and coils.	12
III	**Flow Past Immersed Bodies:** Pressure drop for flow of liquids through porous media. Motion of particles through fluids: Equation for one dimensional motion of spherical particle through fluid, terminal velocity. Hindered settling. **Agitation of liquids:** Types of impellers, Flow pattern in agitated vessel. Power consumption in agitated vessels, blending and mixing.	12
IV	**Transportation of Fluids:** Fluid moving machinery. Performance – selection and specification. Positive displacement, centrifugal pump - characteristics. Gear pump, diaphragm pumps, vacuum pump, metering pump, peristaltic pump –working principle and application. Fans, blowers and compressors – Selection, types and applications.	12
V	**Metering of Fluids:** Variable head meter: Orifice meter, Venturimeter, Pitot tube. Variable area meter: Rota meter. Calibration of flow meters. Principles and applications of Doppler Effect in flow measurement. Principle of Magnetic flow meters, V-Notch, Turbine flow meters, and Thermal flow meters. Valves – Types, applications.	12
	TOTAL INTRUCTIONAL HOURS	60

COURSE OUTCOMES

➢ Classify fluids, apply hydrostatic equilibrium and dimensional analysis in fluid flow behaviour
➢ Derive and apply basic equations of fluid flow
➢ Analyze fluid flow through porous media and select suitable mixing equipment used in food industries
➢ Select and evaluate the performance of pumps
➢ Illustrate the principle and application of different flow measuring devices and valves

TEXT BOOKS

1. McCabe W.L., Smith J.C. and Harriot P., ―Unit Operations of Chemical Engineering‖, 7th Edition, McGraw Hill, New York, 2017.
2. Gavhane K.A., ―Unit Operations – I, 8th Edition, NiraliPrakashan Publications, Pune, 2017.

REFERENCE BOOKS

1. Coulson & Richardson's Chemical Engineering. 5th edition, vol. 2. Elsevier, 2006.
2. Mott, Robert L., and Joseph A. Untener. Applied fluid mechanics. Pearson, 2015.
3. Cengel, Yunus and Cimbala John M., ―Fluid Mechanics Fundamentals and Applications‖, 4th Edition, Tata McGraw Hill Publishing Company, 2017.

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Programme B.TECH.	Course code 16FT3202	Name of the course FOOD PROCESS CALCULATIONS	L 3	T 1	P 0	C 4

UNIT	DESCRIPTION	INTRUCTIONAL HOURS
I	**Units and Dimensions, Fundamental Calculations:** Basic and derived units, unit conversions, use of model units in calculations, methods of expression, compositions of mixture and solutions. Ideal and real gas laws – gas constant - calculations of pressure, volume and temperature using ideal gas law, Use of partial pressure and pure component volume in gas calculations, applications of real gas relationship in gas calculation.	12
II	**Material Balance and Stoichiometry:** Stoichiometric principles, Importance of material balance and energy balance in a process Industry, material balance with chemical reaction and without chemical reaction- application of material balance to unit operations like distillation, evaporation, crystallization, drying and extraction.	12
III	**Recycle Operations:** Recycle stream, block diagram, purging operations, purge ratio, recycle ratio and purge stream. **Humidity and Saturation:** Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity, wet and dry bulb temperature, dew point - Humidity chart usage.	12
IV	**Energy Balance:** Heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats, evaluation of enthalpy. Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heat of reaction - Effect of pressure and temperature on heat of reaction - Energy balance for systems without chemical reaction.	12
V	**Combustion:** Combustion of solids, liquid and gas, determination of NHV and GHV. Determination of composition by Orsat analysis - Calculation of excess air, theoretical oxygen requirement	12
	TOTAL INTRUCTIONAL HOURS	60

COURSE OUTCOMES	➢ Apply different systems of units and dimensions, estimate compositions of mixtures and solutions ➢ Apply material balance for different unit operations ➢ Apply material balance for recycle operations and perform humidification calculations ➢ Perform energy balance calculations ➢ Determine the GHV, NHV and composition of fuels

TEXT BOOKS

1. Gavhane K.A., ―Introduction to Process Calculations (Stoichiometery), 1st Edition, NiraliPrakashan Publications, 2016.
2. Venkataramani V. and Anantharaman N., ―Process Calculations, 2nd edition, Prentice Hall of India, 2011.

REFERENCE BOOKS

1. Bhatt B.L. and Vora S.M., ―Stoichiometry, 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2004.
2. Himmelblau D.M., ―Basic Principles and Calculations in Chemical Engineering, 8th Edition, Prentice Hall of India, New Delhi, 2012.
3. Narayanan K.V. and Lakshmikutty B., ―Stoichiometry and Process Calculations, 2nd revised edition, Prentice Hall of India, New Delhi, 2016.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	16FT3203	FOOD MICROBIOLOGY	3	0	0	3

UNIT	DESCRIPTION	INTRUCTIONAL HOURS
I	**Classification and Structure of Microorganisms:** Classification and Groups of microorganisms - Prokaryotes and Eukaryotes. Whittaker's five kingdom and three kingdom concept of living organisms. Microbial cell: Bacteria, Virus, Algae, Fungi- structure, reproduction and economic importance. Bacteriophage – structure, importance and life cycle (lytic and lysogenic cycle).	9
II	**Microscopy and Staining Techniques-** Principle, resolution, numerical aperture, magnification. Different types of microscopes – Light, UV, dark field, phase contrast and Electron microscope (Scanning and Transmission type). Stains – Auxochrome, chromophores, acidic and basic dyes. Staining techniques – Simple staining, Gram's staining, acid fast staining, endospore staining, capsule staining and flagella staining.	9
III	**Microbial Nutrition and Growth:** Primary nutritional requirements and nutritional classification – Phototrophs, autotrophs, organotrophs, lithotrophs, chemotrophs. Culture Media – components of media, design and preparation of media using common ingredients. Types of media - natural, synthetic, complex, selective, differential, enriched, assay, enumeration, transport and enrichment media. Growth curve – batch culture, continuous culture, synchronous culture. Physical factors influencing the growth – Temperature, pH, osmotic pressure and salt concentration.	9
IV	**Incidence of Microorganisms in Food:** Importance of microorganisms in food, primary sources of microorganisms in food, Intrinsic and Extrinsic parameters of food affecting / influencing microbial growth. Types of microorganisms in foods like meats, poultry, seafood, vegetables, dairy products, fruits and vegetables. **Microbial Load Assessment:** Sampling methods, SPC, MPN, spiral platter, DEFT, microcolonyHGMF, DMC, Dye reduction, swab/swab-rinse method, impedance, microcalorimetry, flow cytometry, ATP measurement, PCR, Fluorescent antibody, RIA, ELISA.	9
V	**Microbial Examination Of Foods:** Detection & Enumeration of microbes in foods; Indicator organisms and microbiological criteria;Rapid and automated microbial methods - development and impact on the detection of food bornepathogens; Applications of immunological, techniques to food industry; Detection methods for E.coli, Staphylococci, Yersinia, Campylobacter, B. cereus, Cl. Botulin0.1um& Salmonella, Listeriamonocytogenes Norwalk virus, Rotavirus, Hepatitis A virus from food samples.	9
	TOTAL INTRUCTIONAL HOURS	45

COURSE OUTCOMES	➢ Classify and identify the structure of microorganisms ➢ Interpret the different types of microscopes and staining techniques ➢ Formulate media for microbial growth ➢ Recognize the sources and factors influencing the microbial growth and identify the techniques used to assess the microbial load ➢ Examine the microorganism in food

TEXT BOOKS

1. Pelczar M.J., Chan E.C.S. and Krieg N.R., ―Microbiology, McGraw Hill, New York, 2004.
2. Powar C.B. and Daginawala H.F., ―General Microbiology, Volume I and II, 2nd edition, Himalaya Publishing House, New Delhi, 2010.

REFERENCE BOOKS

1. Wiley J., Sherwood L., and Woolverton C., ―Prescott's Microbiology, McGraw Hill, New York, 2013.
2. Harvey R.A., Cornelissen C.N. and Fisher B.D., ―Microbiology, 3rd Edition, Lippincott Williams & Wlakins, Philidelphia, 2013.
3. Black J.G., ―Microbiology – Principles and Explorations, 9th edition, John Wiley and sons Publications, USA, 2015.

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Programme B.TECH.	Course code 16FT3204	Name of the course FOOD CHEMISTRY	L	T	P	C
			3	0	0	3

UNIT	DESCRIPTION	INTRUCTIONAL HOURS
I	**Food Groups:** Definition. Major food groups (basic 4, 5, 7) and their characterization. Food as a source of energy. Energy value of foods, energy requirement of the body - estimation. Water balance and recommended intakes; fluid/electrolyte balance, acid-base balance; Concept of water activity – Water binding in foods. **Nutrition:** Definitions – Malnutrition, obesity, balanced diets, Recommended Dietary Allowances (RDA).	9
II	**Minerals:** Major minerals – Calcium, Potassium, Sodium, Phosphorus. Minor minerals – Iron, Zinc, Iodine, Copper, Selenium. Functional role and deficiency. **Vitamins:** Definition, water soluble and fat soluble vitamins, sources, functions and deficiency symptoms.	9
III	**Changes during Cooking:** Cooking – objectives, methods – moist heat, dry heat and combination. Loss of nutrients and prevention, biochemical changes in carbohydrates - Gelatinization and retro gradation of starch, proteins and lipids; parboiling of rice; enzymatic browning reactions; non enzymatic browning reactions - caramelization, Maillard reaction.	9
IV	**Modification of Biomolecules:** Modified starches, resistant starch. Starch hydrolysates – Maltodextrins and dextrins. Modification of proteins – chemical and enzymatic methods. Modification of fats - Hydrogenation - cis and trans isomers, interesterification, winterization. Biochemical changes during processing of foods - pickling, malting, drying and baking.	9
V	**Food Preservation:** principles of food preservation. Preservation by high temperature – sterilization, pasteurization, blanching. Preservation by low temperature – Refrigeration and freezing – factors affecting the process and characteristics of foods. Preservation by irradiation, drying and chemicals. Biochemical changes during preservation.	9
	TOTAL INTRUCTIONAL HOURS	45

COURSE OUTCOMES

➤ Interpret the nutritional importance of foods and water
➤ Summarize the nutritional importance of vitamins and minerals
➤ Recognize the changes in food components during cooking, processing and storage
➤ Modify the carbohydrates, proteins and fats based on its functional properties
➤ Apply the different methods of food preservation

TEXT BOOKS

1. Belitz H.D., Grosch W. and Schieberle P., ―Food Chemistry, 4th revised and extended Edition, Springer, 2009.
2. Sivasankar B., ―Food Processing and Preservation, Prentice Hall of India, New Delhi, 2005.

REFERENCE BOOKS

1. Fennema, Owen R., Srinivasan Damodaran, and Kirk L. Parkin. "In Fennema's Food Chemistry", Fifth Edition, CRC Press, 2017.
2. Sri lLakshmi B., ―Nutrition Science, 6th Edition, New Age International Ltd., New Delhi, 2017.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	16FT3205	APPLIED THERMODYNAMICS	3	0	0	3

UNIT	DESCRIPTION	INTRUCTIONAL HOURS
I	**Basic Concepts and First Law:** Fundamental concepts of thermodynamics- microscopic and macroscopic approach – systems, properties, process, functions, units, energy, heat and work, zeroth law. First law - statement of first law for flow and non - flow process, internal energy, enthalpy, heat capacities (CV and CP) – steady state flow processes with reference to various thermal equipments - nozzle, throat, throttling process and compressors.	9
II	**Second Law:** Second Law of thermodynamics: Kelvin-Plank, Clausius statements and its equivalence, reversible cycle – Carnot cycle and theorem – thermodynamic temperature scale. Entropy, Clausius theorem, Clausius inequality, Entropy changes during processes – available and unavailable energies.	9
III	**PVT Behavior of Pure Fluids:** PVT surfaces: P-V, P-T, T-S and H-S Diagrams. Equation of state and the concept of ideal gas - Process involving ideal gases: constant volume, constant pressure, constant temperature, adiabatic and polytrophic process. Equation of state for real gases – Vander Waals equation, RedllichKwong equation, Virial equation of state. Principle of corresponding states – generalized compressibility charts.	9
IV	**Steam Properties:** Properties of steam, usage of steam tables. Determination of dryness fraction of steam. Calorimeters – Tank or barrel type, throttling, separating, separating and throttling. Steam distribution. systems. Types of steam traps and their characteristics. Application of steam in food process industries.	9
V	**Boilers:** Types and classification of boilers - Cochran Boiler, Lancashire boiler, Locomotive Boiler, Fluidized Bed Boiler. Boiler mountings and Accessories. Performance and energy efficiency of boilers. Simple calculation of Boiler efficiency. Importance of boiler water treatment and blow down.	9
	TOTAL INTRUCTIONAL HOURS	45

COURSE OUTCOMES

➤ Outline the basic concepts and apply the first law of thermodynamics in selected processes

➤ Understand the principle of second law of thermodynamics and concepts of Carnot cycle

➤ Interpret the second law of thermodynamics and relate the properties of pure substance

➤ Estimate the properties of steam and measurement of quality of steam using calorimeters

➤ Integrate the use of simple calculation in gaining the working knowledge of different boilers

TEXT BOOKS

1. Narayanan K.V., ―A Text Book of Chemical Engineering Thermodynamic, 2nd revised edition, Prentice Hall of India, New Delhi, 2013.
2. Reeve Sidney Armor., ―"Thermodynamics of Heat Engines", Wentworth press 2019.

REFERENCE BOOKS

1. Smith J.M., Van Ness H.C. and Abbott M.M., ―Introduction to Chemical Engineering Thermodynamics, 7th Edition, McGraw Hill, New York, 2005.
2. Rao Y.V.C., ―An Introduction to Thermodynamics, Universities Press, 2004.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	16FT3001	FOOD MICROBIOLOGY LAB	0	0	4	2

Experiments:

1. Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques; Culture Media-Types and Use; Preparation of Nutrient broth and agar
2. Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid: Pour plates, streak plates, slants, stabs
3. Microscopy – Working and care of Microscope; Microscopic Methods in the Study of Microorganisms; Staining Techniques- Simple, Differential- Gram's Staining
4. Quantification of Microbes: Sampling and Serial Dilution; Bacterial count in food products TVC
5. Microbiological Quality of Water (MPN)
6. Microbiological quality of milk
7. Enumeration of Lactic acid bacteria from fermented foods
8. Yeast &Mould count from fruits
9. Enumeration of spores from pepper
10. Inhibitory effect of spices on microbial load in fish & flesh foods
11. Enumeration & Isolation of E. colifrom processed meat/chicken
12. Thermal destruction of microbes: TDT & TDP
13. Enumeration & Isolation of Staphylococci from ready to eat street foods
14. Effect of cleaning and disinfection on microbial load

Total Practical Hours 45

COURSE OUTCOMES	➢ Complete understanding of isolation, characterization of various microbes associated withfoods and food groups.
	➢ Familiarize with microbiological techniques for the study of foods.
	➢ Better understanding of methods to detect pathogens in foods.

REFERENCES

1. Yousef A.E. and Carlstrom C., —Food Microbiology: A Laboratory Manual, Wiley Inter science Publications, 2003.
2. McLandsborough L., —Food Microbiology Laboratory, CRC Press, 2004.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	16FT3002	FOOD CHEMISTRY LAB	0	0	4	2

Experiments:

1. Qualitative tests for monosaccharide, disaccharides, polysaccharides
2. Estimation of reducing sugar by dinitrosalicylic acid method
3. Estimation of starch by anthrone method
4. Estimation of amylase
5. Estimation of non-enzymatic browning in foods
6. Extraction and estimation of oil content
7. Determination of peroxide value and TBA value of oil
8. Isolation of protein from milk and egg
9. Estimation of moisture content, total ash and acid insoluble ash
10. Estimation of vitamins
11. Estimation of crude fibre
12. Extraction of natural colours - chlorophyll, lycopene and carotenoids.

Total Practical Hours: 45

COURSE OUTCOMES

➤ Estimate the biomolecules in food samples
➤ Interpret the changes during storage of oil
➤ Extract and estimate pigments and bioactive compounds
➤ Analyzing the chemical components of food materials
➤ Identifying the major and minor components of cereals, pulses and oilseeds

REFERENCES

1. Manickam A., ―Biochemical Methods, New Age International, New Delhi, 2010.
2. Ranganna S., ―Handbook of Analysis and Quality Control for Fruit and Vegetable Products, 2nd Edition, Tata McGraw Hill, New Delhi, 2017.

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IV SEMESTER

Programme B.TECH.	Course code 16MA4112	Name of the course APPLIED STATISTICS AND NUMERICAL METHODS	L T P C 3 0 2 4

UNIT	DESCRIPTION	INTRUCTIONAL HOURS
I	**MEASURE OF CENTRAL TENDENCY AND DISPERSION** Measure of central tendency – mean, median, mode –Measure of dispersion – range – Quartile deviation – Standard deviation – Coefficient of Variation.Introduction to R programming, **Application of descriptive statistics – Mean, Median, Mode, variance**	9+3
II	**HYPOTHESIS TESTING** Large sample test based on Normal distribution – test of significance for single mean and difference of means –Small sample test – t test for single mean and difference of mean - F distribution for variance, Chi – Square test for independence of attributes – Goodness of fit. **Application of Student t- test, Application of Chi – square test**	9+6
III	**ANALYSIS OF VARIANCE** Introduction, assumptions of analysis of variance, Completely randomized design, Randomized block design, Latin square design. **ANOVA – completely randomized design ,ANOVA – randomized block design**	9+6
IV	**INTERPOLATION** Interpolation: Newton's forward and backward difference formulae Lagrangian interpolation for unequal intervals – Divided difference for unequal intervals : Newton's divided difference formula.	9
V	**NUMERICAL DIFFERENTIATION AND INTEGRATION** Differentiation using interpolation formula – Newton's forward and backward interpolation formulae for equal intervals – Newton's divided difference formula for unequal intervals - Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules.	9
	TOTAL INTRUCTIONAL HOURS	60

COURSE OUTCOMES

- Familiar with Measures of Central Tendency and Measures of Dispersion.
- Understand the concepts of statistical methods for testing the hypothesis.
- Apply Design of Experiment techniques to solve various engineering problems
- Understand the concept of interpolation in both cases of equal and unequal intervals.
- Identify various methods to perform numerical differentiation and integration.

TEXT BOOKS

1. Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons,   Reprint 2011.
2. M.K.Jain,S.R.K.Iyengar, R.K.Jain "Numerical methods for Scientific and Computation", Fifth Edition, New Age International publishers 2010.

REFERENCE BOOKS

1. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
2. Grewal B.S. and Grewal J.S. " Numerical Methods in Engineering and Science ", 6th Edition , Khanna publishers, New Delhi 2014.
3. S.K.Gupta, Numerical Methods for Engineers" , New Age International Pvt. Ltd Publishers,2015.

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Programme B.TECH.	Course code 16FT4201	Name of the course ENGINEERING PROPERTIES OF FOOD MATERIALS	L	T	P	C
			3	0	0	3

UNIT	DESCRIPTION	INTRUCTIONAL HOURS
I	**Physical Properties:** Physical properties of food materials- size, shape, density, porosity and surface area – definitions and measurements, moisture content and its determination, direct and indirect methods, units, Frictional properties –friction – types, coefficient of friction, angle of repose – types and its determination.	9
II	**Thermal Properties:** Thermal properties, Definition of specific heat, enthalpy, conductivity and diffusivity, surface heat transfer coefficient. Measurement of specific heat, thermal conductivity, thermal diffusivity. Cryogenics, Calorific value of food, Bomb calorimeter. Applications of thermal properties.	9
III	**Optical Properties:** Refractive index of food items, Abbe_srefractometer, Sorting of food material using optical properties , Optical activity, Polarimeter, Spectrophotometer, Gloss, color, translucency – Definitions, measurement and applications. **Electromagnetic Properties:** Electrical properties, dielectric heating, electrical conductivity, dielectric measurements, microwave heating and other Applications.	9
IV	**Rheological Properties:** Stress Strain behavior of Newtonian and Non-Newtonian fluids- Bingham and Non Bingham. Stress-strain relationships in solids, liquids and viscoelastic behavior- stress relaxation test, creep test and dynamic test, stress-strain diagrams, Emulsions and Colloids. Viscosity – Principle, Types- Capillary, Orifice, Falling and Rotational viscometers.	9
V	**Textural Properties:** Types of food textures, Texture measuring instruments- Compression, Snap Bending, Cutting Shear, Puncture, Penetration and TPA, Properties of food powders. **Colour:** Interaction of object with light, Colorimeter- Color order systems- Munsel color system, CIE color system, Hunter lab color space, Loviebond system.	9
	TOTAL INTRUCTIONAL HOURS	45

COURSE OUTCOMES
- ➤ Interpret the physical properties of agricultural materials
- ➤ Elaborate the thermal properties and its application
- ➤ Outline the optical and electromagnetic properties
- ➤ Recognize the rheological properties of food materials
- ➤ Infer textural properties and color measurements of food materials

TEXT BOOKS
1. Rao, M. Anandha, Syed SH Rizvi, Ashim K. Datta, and Jasim Ahmed. *Engineering properties of foods*. CRC press, 2014.
2. Heldman, Dennis R., Daryl B. Lund, and Cristina Sabliov, eds. *Handbook of food engineering*. CRC press, 2018.

REFERENCE BOOKS
1. Stroshine R., ―Physical Properties of Agricultural Materials and Food Products, West Lafayette, IN., Purdue University, 2000.
2. De Podesta, Michael. Understanding the properties of matter. CRC Press, 2002.
3. Singh R. Paul and Heldman Dennis R., ―Introduction to Food Engineering, 5th Edition, Gulf Publishing USA, 2013.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	16FT4202	FUNDAMENTALS OF HEAT AND MASS TRANSFER	3	1	0	4

UNIT	DESCRIPTION	INTRUCTIONAL HOURS
I	**Heat Transfer – Conduction :** Basic transfer processes – heat, mass and momentum – heat transfer process - conductors and insulators - conduction – Fourier's fundamental equation – thermal conductivity and thermal resistance - linear heat flow – heat transfer through homogenous wall, composite walls, radial heat flow through cylinders and sphere – extended surfaces (fins) — solving problems in heat transfer by conduction.	12
II	**Heat Transfer – Convection :** NewtonRikhman's law – film coefficient of heat transfer - convection – free and forced convection - dimensional analysis and its application – factors affecting the heat transfer coefficient in free and forced convection heat transfer – overall heat transfer coefficient - solving problems in heat transfer by convection.	12
III	**Heat Transfer – Heat Exchanger :** Heat exchangers – parallel, counter and cross flow – evaporator and condensers – Logarithmic Mean Temperature Difference – overall coefficient of heat transfer – tube in tube heat exchanger, shell and tube heat exchanger, plate heat exchanger – applications of heat exchangers – solving problems in heat exchangers.	12
IV	**Heat Transfer: Radiation** Radiation heat transfer – concept of black and grey body - monochromatic total emissive power – Kirchoff's law – Planck's law - Stefan-Boltzman's law – heat exchange through non-absorbing media - solving problems in heat transfer by radiation.	12
V	**Mass Transfer:** Mass transfer – introduction – Fick's law for molecular diffusion - molecular diffusion in gases –equimolar counters diffusion in gases and diffusion of gas A through non diffusing or stagnant B - diffusion through a varying cross sectional area and diffusion coefficients for gases – molecular diffusion in liquids, biological solutions and gels.	12
	TOTAL INTRUCTIONAL HOURS	60

COURSE OUTCOMES	
	➢ To understand and apply the principles in heat transfer phenomena
	➢ To understand and apply the principles in mass transfer phenomena
	➢ To design heat and mass transfer equipments
	➢ Understand and apply the concepts of radiation and Stephan boltzman's law
	➢ Understand the mass transfer phenomena using Fick's law of molecular diffusion

TEXT BOOKS

1. Bellaney, P.L. "Thermal Engineering". Khanna Publishers, New Delhi, 2001
2. Pyle, D. Leo, Peter J. Fryer, and Chris D. Reilly. Chemical engineering for the food industry. Springer Science & Business Media, 2012.

REFERENCES

1. Holman, E.P. "Heat Transfer". McGraw-Hill Publishing Co. New Delhi, 2001
2. Coulson, J.M. and etal. "Coulson & Richardson's Chemical Engineering", 6th Edition, Vol. I& II, Butterworth – Heinman (an imprint of Elsevier), 2004
3. McCabe, W.L., J.C. Smith and P.Harriot "Unit Operations of Chemical Engineering", 6th Edition, McGraw Hill, 2003.

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Programme B.TECH. UNIT	Course code 16FT4203	Name of the course FOOD PROCESS ENGINEERING– I DESCRIPTION	L T P C 3 1 0 4 INTRUCTIONAL HOURS
I		**Processing Operations:** Post-harvest losses in field crops – Cleaning - Wet and Dry cleaning, Screen Cleaners, Air Screen Cleaners. Peeling - Flash steam, Knife, Abrasion, Caustic and Flame peeling. Grading and Sorting - Principles, types and equipments. Moisture content – free moisture, bound and unbound moisture. Equilibrium moisture content - determination methods, models, Importance and hysteresis effect. Water activity and its importance.	12
II		**Drying:** Theory and mechanism of drying - Drying characteristics of materials. Psychrometric chart – applications. Thin layer and deep bed drying. Methods of drying agricultural materials - batch and continuous drying. Drying equipment design and performance of various drying equipments.	12
III		**Types of Dryers:** Tunnel Dryer, Belt Dryer, Drum Dryer, Spray Dryer, Fluidized Bed Dryer, Spouted bed dryer, Pneumatic Dryer, Rotary Dryer, Vacuum Drying, Freeze Drying, Heat Pump drying, Di-electric drying and Micro wave drying.	12
IV		**Preservation by Heating:** Methods of applying heat to food - Blanching, Pasteurization, Sterilization. Thermal death time relationships (D, Z and F values). Process calculations: General method, Ball's formula method. Sterilization – methods and equipments. UHT sterilization.	12
V		**Preservation by Cooling:** Chilling - Equipments, Cold storage. Freezing - Thermodynamics of food freezing, Phase diagrams, Ice crystals formation, Properties of frozen foods. Freezing time calculations, Freezing equipments. Freeze concentration.	12
		TOTAL INTRUCTIONAL HOURS	60

<table>
<tr><td rowspan="5">COURSE
OUTCOMES</td><td>➤ Adapt specific pre-processing operations and estimate the moisture content of food materials</td></tr>
<tr><td>➤ Infer the concepts of food drying</td></tr>
<tr><td>➤ Classify the dryers and illustrate the working of dryers</td></tr>
<tr><td>➤ Appraise the techniques of preservation by heating</td></tr>
<tr><td>➤ Elaborate the techniques of preservation by cooling</td></tr>
</table>

TEXT BOOKS

1. Fellows P.J., ―Food processing Technology: Principles and Practice‖, 3rd Edition, Wood Head Publishing Limited, New Delhi, 2009.
2. Sahay K.M. and Singh K. K., ―Unit Operations of Agricultural Processing‖, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.

REFERENCE BOOKS

1. Earle R.L., ―Unit Operations in Food Processing‖, Web Edition, Pergamon Press, U.K., 2004.
2. Paul Singh R. and Dennis R. Heldman, ―Introduction to Food Process Engineering‖, 5th Edition, Academic Press, USA, 2014.
3. James G Brennan, ―Food Processing Handbook‖, 2nd Edition, Wiley VCH, Weinheim, 2011.

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Programme B.TECH.	Course code 16FT4204	Name of the course FOOD ANALYSIS	L T P C 3 0 0 3

UNIT	DESCRIPTION	INTRUCTIONAL HOURS
I	**INTRODUCTION-** Introduction, food regulations and standards; sampling methods, and sample preparation foranalysis; statistical evaluation of analytical data. General methods of food analysis- Moisture determination by different methods; ash analysis-different methods; titrable acidity in foods;determination of crude fiber and dietary fibre.	9
II	**LIPIDS, PROTEINS AND CARBOHYDRATE ANALYSIS -** Analysis of oils and fats for physical and chemical parameters and quality standards, protein analysis by different techniques; analysis of carbohydrates by different techniques	9
III	**SPECTROSCOPIC TECHNIQUES -** Basic principles; application of UV-Visible spectrophotometer in the analysis of food additives; IR Spectroscopy in online determination of components of food- FT-IR tintometer in colorintensitydetermination; application of Atomic Absorption Spectrophotometer and ICP-AES in analysis of mineral elements and fluorimeter in vitamin analysis.	9
IV	**CHROMATOGRAPHIC TECHNIQUES -** Basic principles; application of paper chromatography and TLC in food analysis; detection ofadulterants in foods; Column chromatography for purification analysis- Ion exchange and affinitychromatography; HPLC and GC in food analysis; Significance of MS detectors in HPLC and GC;FAME analysis in oils and fats.	9
V	**ELECTROPHORESIS, REFRACTOMETRY AND POLARIMETRY** - Basic principles; application of the electrophoresis in food analysis; Brixs value of fruit juices; totalsoluble solids in fruit products; Refractive indices of oils and fats; specific rotations of sugars;Estimation of simple sugars and disaccharides by polarimeter.	9

TOTAL INTRUCTIONAL HOURS	45

COURSE OUTCOMES

- ➢ Understand the principles behind analytical techniques in food analysis.
- ➢ Know the methods of selecting appropriate techniques in the analysis of food products.
- ➢ Realize the role of food analysis in food standards and regulations for the manufacture and the sale of food products and food quality control in food industries.
- ➢ Familiarize with the current state of knowledge in food analysis.
- ➢ Understand the principles behind electrophoresis, refractometry and polarimetry in food analysis.

TEXT BOOKS

1. Pomeranz, Yeshajahu. "Food Analysis: Theory and Practice". 3rd Edition. AspenPublishers / Springer, 2000.
2. Nielsen, S. Suzanne. "Food Analysis". 3rd Edition. Springer, 2003.

REFERENCES

1. Otles, Semih. "Methods of Analysis of Food Components and Additives". CRC Press, 2005.
2. Nollet, Leo M.L. "Hand Book of Food Analysis" II Rev. Edition. Vol. I, II & III, Marcel &Dekker, 2004.
3. Nollet, Leo M.L. " Food Analysis by HPLC". II Rev. Edition, Marcel & Dekker, 2000
4. Otles, Semih. "Handbook of Food Analysis Instruments". CRC Press, 2009.

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Programme B.TECH.	Course code 16HE4101	Name of the course TOTAL QUALITY MANAGEMENT	L 3	T 0	P 0	C 3

UNIT	DESCRIPTION	INTRUCTIONAL HOURS
I	**Introduction :**Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of productand service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction,Customer complaints, Customer retention.	9
II	**TQM Principles :**Leadership - Quality Statements, Strategic quality planning, Quality Councils – Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward,Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen – Supplier partnership - Partnering, Supplier selection, Supplier Rating.	9
III	**TQM Tools And Techniques I :**The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking – Reason to bench mark, Bench marking process - FMEA - Stages, Types.	9
IV	**TQM Tools And Techniques II :**Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.	9
V	**Quality Management System :**Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**Environmental Management System:**Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO14001—Benefits of EMS.	9
	TOTAL INTRUCTIONAL HOURS	45

COURSE OUTCOMES	➤ To apply the tools and techniques of quality management ➤ To manufacturing and services processes ➤ Apply the tools and techniques of quality management to manufacturing and service processes ➤ Predict the improvement necessary for the better performance ➤ Implement quality management system

TEXT BOOK

1. Dale H.Besterfiled, Carol B. Michna, Glen H. Besterfield, Mary B. Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall(India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.

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Programme B.TECH.	Course code 16FT4001	Name of the course FOOD ANALYSIS LABORATORY	L 0	T 0	P 4	C 2

EXPERIMENTS:

1. Determination of moisture in spices powder by distillation method and Hot air oven method.
2. Determination of total fat, protein in milk and milk products.
3. Rancidity test for fried foods to assess primary and secondary oxidative products.
4. Detection and estimation of additives in food materials
5. Determination of pectin present in the given sample
6. Determination of Iron content in foods.
7. Determination of Iodine content in iodized salt.
8. Determination of viscosity of food samples
9. Estimation of saccharin present in the given sample
10. Detection of anti oxidant, polyphenols and flavonoids in foods.
11. Determination of soluble and insoluble fibre in foods.
12. Detection of adulterants in food materials.
13. Familiarization on working of analytical instruments like HPLC, UV visible spectrophotometer, flame photometer

Total Practical Hours 45

COURSE OUTCOMES

➢ Better understanding in analysis of foods and food products for chemical components.
➢ Knowing standards for food products.
➢ Obtain knowledge of adulterants in foods.
➢ Determination of bioactive compounds present in food samples
➢ Understanding the working principles of analytical instruments like HPLC, UV etc.

REFERENCE BOOKS:

1. Nielsen, S. Suzanne, ed. *Food analysis*. New York: Springer, 2010.
2. Huber, Ludwig. *Validation and qualification in analytical laboratories*. CRC Press, 2007.
3. Pomeranz, Yeshajahu, ed. *Food analysis: theory and practice*. Springer Science & Business Media, 2013.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	16FT4002	HEAT AND MASS TRANSFER LABORATORY	0	0	4	2

Experiments:

1. Flow measurement a) Orifice meter b) Venturimeter c) Coils
2. Flow through square duct, annular and circular pipes
3. Pressure drop studies in packed bed
4. Flow through fluidized bed, valves and pipe fittings
5. Calibration of V-notch
6. Solving problems on single and multiple effect evaporator
7. Determination the efficiency of heat transfer in agitated vessel.
8. DetermSination of efficiency of liquid solid separation by filtration.
9. Determination of absorption efficiency in a packing tower
10. Heat transfer in natural convection/ forced convection
11. Determination of the activity coefficients by vapor liquid equilibrium
12. Determination of vaporization efficiency (Ev) and thermal efficiency (Et) of the given system using steam distillation setup. Also verify with Raleigh's equation
13. Studying the theoretical and actual recovery of solvent using leaching

Total Practical Hours 45

COURSE OUTCOMES

➢ Evaluate the process/performance parameters for mass transfer operations (distillation column, leaching)
➢ Determine diffusivity and Stefan Boltzman constant using fundamental principles
➢ Calculate the individual and overall heat transfer coefficient of heat exchangers
➢ Determine the discharge coefficient using variable area flow meters and variable head flow meters
➢ Assess the flow of fluids through closed conduits, open channels, valves and pipe fitting

REFERENCES:

1. McCabe W.L., Smith J.C. and Harriot P., ―Unit Operations of Chemical Engineering‖, 7th Edition, McGraw Hill, New York, 2005.
2. Perry Robert, ―Perry's Chemical Engineers Hand Book‖, 8th Edition, McGraw Hill, New York, 2007.

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CO'S, PO'S & PSO'S MAPPING (R2016)

Semester – III

16MA3111 Fourier Analysis and Z Transform

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	1
CO2	3	3	3	2	1	-	-	-	-	-	-	3	2	3
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	1	2	2	-	-	-	-	-	2	2	2
CO5	3	3	3	2	1	1	-	-	-	-	-	2	2	3
Avg	3	2.8	3	1.4	1.4	2	-	-	-	-	-	2.2	2.2	2.2

16FT3201 Fluid Mechanics

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1										1	1	1
CO2	2	2	1									1	1	1
CO3	3	2	1	1		1						1	1	1
CO4	3	2	1	2		1						1	1	1
CO5	3	2	1	1		1						1	1	1
Avg	2.8	1.8	1	1.3		1						1	1	1

16FT3202 Food Process Calculations

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2										2	1	1
CO2	2	2	1									2	2	1

CO3	3	2	3	1		1						1	2	1
CO4	3	2	2	2		1						1	1	1
CO5	3	2	1	1		1						1	1	1
Avg	2.8	1.8	1	1.3		1						1	1	1

16FT3203 Food Microbiology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2												1	1
CO2		2											1	1
CO3		2	2	2	2								1	1
CO4			2	2									1	1
CO5		2	2	2	2								1	1
Avg	2.8	1.8	1	1.3		1						1	1	1

16FT3204 Food Chemistry

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		2			3	2	3				3		2	3
CO2	3	2		2	3		2							3
CO3	2	1	3	2			2						1	3
CO4	3	2	1	2									1	3
CO5	2	3	3				1							2
Avg	2.5	2	2.3	2	3	2	2				3		1.3	2.8

16FT3205 Thermodynamics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO	PSO

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		2			3	2	3				3		2	3
CO2	3	2		2	3		2							3
CO3	2	1	3	2			2						1	3
CO4	3	2	1	2									1	3
CO5	2	3	3				1							2
Avg	2.5	2	2.3	2	3	2	2				3		1.3	2.8

16FT3001   Food Microbiology Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	2		2						2	2
CO2	2	2	2	2	2		2						2	2
CO3	2	1	2	2	2		2						2	2
Avg	2	1.7	1.7	2	2		2						2	2

16FT3001   Food Production Analysis Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	2	2	-	1	1	-	2	3	1
CO2	2	1	1	1	2	2	2	-	1	1	-	2	2	1
CO3	2	2	1	1	2	2	2	-	1	1	-	2	1	-
Avg	2	1	1	1	2	2	2	-	1	1	-	2	1.2	0.4

16FT3002   Food Chemistry Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	2	2	-	1	1	-	2	3	1
CO2	2	1	1	1	2	2	2	-	1	1	-	2	2	1

PO& PSO														
CO3	2	2	1	1	2	2	2	-	1	1	-	2	1	-
Avg	2	1	1	1	2	2	2	-	1	1	-	2	1.2	0.4

SEMESTER IV

16MA4112   Applied Statistics & Numerical Methods

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1		1	1	1				1			2	1	2
CO2	1	2	2	1	1							1		2
CO3	1	1		1	1							2		3
CO4	1	1	1	1	1							1		2
CO5	1	1	3	1								2		3
Avg	1	1.25	1.75	1	4				1			1.6	1	2.4

16FT4201   Engineering Properties of Food Materials

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1		1	1	1				2			2	3	2
CO2	1	2	2	2	1							3		3
CO3	1	1		2	3							3		3
CO4	1	1	2	2	1							1		2
CO5	1	1	3	1								2		3
Avg	1	1.25	2	1.6	1.5				2			2.2	3	2.6

16FT4202   Fundamentals of Heat and Mass Transfer

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										3	2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO2	3		2			2							3	2
CO3		1	2	2										3
CO4	3		2									2		3
CO5	1	3	3	3								2		3
Avg	2	1.2	2.2	2.5		2						2	3	2.6

16FT4203   Food Process Engineering - I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	1		1	1	2				1	1	2
CO2	2	1	2	2		1	1					2	1	2
CO3	3	3	2	3		1	1	1				2	1	2
CO4	2	3	2	1		1	1					2	1	2
CO5	2	1	2	3		1	1	3			1	3	1	2
Avg	2.8	1.8	1	1.3		1						1	1	1

16FT4204   Food Analysis

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	1	-	-	-	-	-	-	3	2	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3		-	-	-	-	-	2	2	2
CO5	3	3	3	3	3		-	-	-	-	-	2	2	2
Avg	3	2.8	3	2	2							2.2	2.2	2

16HE4101   Total Quality Management

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	1	-	-	-	-	-	-	3	2	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3		-	-	-	-	-	2	2	2
CO5	3	3	3	3	3		-	-	-	-	-	2	2	2
Avg	**3**	**2.8**	**3**	**2**	**2**							**2.2**	**2.2**	**2**

16FT4001   Food Analysis Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2		1					3			2		
CO2	1		2						3			2		
CO3	1		3	2	2				2			2		
CO4	2				2				2			3	2	
CO5	2	1		2					3			3	2	
Avg	**1.6**	**1.5**	**2.5**	**1.7**	**2**				**2.6**			**2.4**	**2**	

16FT4002   Heat and Mass transfer Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3							3			3		3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2	2		2					3			2		3
CO3	2		2					3			2		3
Avg	**2.33**	**3**	**2**					**3**			**2.3**		**3**

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
I	I	16MA1101 Engineering Mathematics – I(Matrices and calculus)	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2
		16PH1101 Engineering Physics	3	3	3	2.6	2.8	-	-	-	-	-	-	2
		16CY1101 Engineering Chemistry	3	2.2	2	1.6	2	1.3	-	-	-	-	-	1
		16HE1101 English for Engineers – I	3	2	2	2	2	1	1	-	-	-	-	1
		16GE1103 Problem Solving and Python Programming	3	1	1	-	-	1	-	-	-	-	-	1
		16GE1102 Engineering Graphics	2	3	3	-	2	-	-	-	2	-	-	2
		16PS1001 Physical Sciences Lab – I	2.8	3	2.6	1	1	2	1	-	-	1	1	1
		16GE1004 Problem Solving and Python Programming Lab	3	3	3	2.6	2.8	-	-	-	-	-	-	2
		16GE1002 Engineering Practices Lab												
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
I	II	16MA2101 Engineering Mathematics – II	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8
		16PH2102 Physics of Materials	3	3	3	2.4	2.4	-	-	-	-	-	-	2
		16FT2101 Fundamentals of Biochemistry	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1
		16HE2102 Essential English for Engineers - II	2	1	1.7	-	-	1	2	3	2	-	-	2
		16GE2101 Engineering Mechanics	1	2	1				1			1		1
		16CY2102 Environmental Science	2	3	3.0	-	2	-	-	-	-	-	-	2

Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
16PS2001 Physical Sciences Laboratory – II	3		3		3					1				
16FT200 Biochemistry Lab														

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
II	III	16MA3111 Fourier Analysis and Z Transforms	3	2.8	3	1.4	1.4	2	-	-	-	-	-	2.2	2.2	2.2
		16FT3201 Fluid Mechanics	2.8	1.8	1	1.3		1						1	1	1
		16FT3202 Food Process Calculations	2.8	1.8	1	1.3		1						1	1	1
		16FT3203 Food Microbiology	2.8	1.8	1	1.3		1						1	1	1
		16FT3204 Food Chemistry	2.5	2	2.3	2	3	2	2				3		1.3	2.8
		16FT3001 Food Microbiology Laboratory	2	1.7	1.7	2	2		2					2	2	2
		16FT3002 Food Production Analysis Laboratory	2	1	1	1	2	2	2	-	1	1	-	2	1.2	0.4

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
II	IV	16MA4112 Applied Statistics & Numerical Methods	1	1.25	1.75	1	4				1			1.6	1	2.4
		16FT4201 Engineering Properties of Food Materials	1	1.25	2	1.6	1.5				2			2.2	3	2.6
		16FT4202 Fundamentals of Heat and Mass Transfer materials	2	1.2	2.2	2.5		2						2	3	2.6
		16FT4203 Food Process Engineering - I	2.8	1.8	1	1.3		2.2	2.8	1.6	2.2	2	2.6	1.4		2
		16FT4204 Food Analysis	3	2.8	3	2	2							2.2	2.2	2
		16HE4101 Total Quality Management	1.6	1.5	2.5	1.7	2				2.6			2.4	2	
		16FT4001 Food Analysis Laboratory	2.25	2.75	2.5	1.66	3		1.6						1	2.75
		16FT4001 Food Analysis Laboratory	1	1.25	1.75	1	1				1			1.6	1	2.4

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
II	V	16FT5201 Food Process Engineering - II	3	2	3	1	2	2	1.25				1.75	1	1	2
		16FT5202 Food Quality Assurance and Control	1		2.8			2	1	1				1	2.2	1
		16FT5203 Baking and Confectionery Technology	2.25	2.75	2.5	1.66	3		1.6						1	2.75
		16FT5204	2.5	1.75	2.2	2.5	0	2						1	3	1.8
		16FT5205 Unit Operations in Food Processing	1	1.25	1.75	1	1				1			1.6	1	2.4
		16FT5306 Milling Technology for Food Materials	1	2	1.2				1.25			1		1	1.6	
		16FT5001 Baking and Confectionery Technology Laboratory	2.25	2	2	2.25		1	1	2			1	2.25	1.5	2.25
		16FT5002 Food Process Engineering Laboratory	2.5	1.75	2.2	2.5								1	3	1.8
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
III	VI	16FT6201 Dairy Engineering	3	2	3	1	2	2	1.25				1.75	1	1	2
		16FT6202 Food Packaging	3	1	2	2		2						2	3	2.6
		16FT6203 Poultry, Meat and Fish Process Technology	2.5	1.75	2.2	2.5		2						1	3	1.8
		16FT6204 Refrigeration and Cold chain Management	2.3	2	2.25	2.5		2						2	3	2.75
		16FT6301 Beverage Technology	1	2	1.2				1.25			1		1	1.4	
		16FT6401 Traditional Foods	2.2	2.0	1.8	2	-	1	1	2	-	-	1	2	1.4	3
		16FT6001 Food Packaging and Fruits & Vegetable	1.5	1.75	1.75	1	1	1	1		1	1		1	1.25	2

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		Processing Laboratory														
		16FT6002 Dairy Engineering Laboratory	2	1.5	2	2	2		2					2	2.5	2
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
IV	VII	16HE7101 Professional Ethics	2.2	2.8	1.6	2.2	2	2.6	1.4		2	1.8	1	3	3	1.8
		16FT7201 Food Additives	2.2	2.8	1.6	2.2	2	2.6	1.4		2	1.8	1	3	3	
		16FT7202 Plantation crops & Spices Product Technology	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2
		16FT7306 Technology of Snacks and Extruded Foods	2.2	2.8	1.6	2.2	2	2.6	1.4		2	1.8	1	3	3	1.8
		16FT7308 Food Process Plant Layout and safety	2.5	1.75	2.4	2.5		2							3	1.8
		16FT7401 Food Product Development	2.8	2.2	1.8	1.8	1.4	2.2	1.4		2	1		3	3	2
		16FT7001 Food Process Equipment Design Laboratory	1.6	1.5	2.5	1.7	2	-	-	-	2.6	-	-	2.4	2	2
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
IV	VIII	16FT8306 Waste Management and By-product Utilization in Food Industries	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1
		16FT8308 Emerging Non-Thermal Processing of Foods	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

CO'S, PO'S & PSO'S MAPPING-(R 2019)

Semester – I

Course Code & Name : 19HE1101/ TECHNICAL ENGLISH

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2

PO& PSO														
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Avg	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

Course Code & Name : 19MA1101/ CALCULUS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO5	3	3	3	2	3	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name : 19MA1102/ CALCULUS AND LINEAR ALGEBRA

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name : 19MA1103/ CALCULUS AND DIFFERENTIAL EQUATIONS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name : 19PH1151/ APPLIED PHYSICS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	1.333333	-	-	-	-	-	1	2.4	2.4

Course Code & Name : 19CY1151/ CHEMISTRY FOR ENGINEERS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	2	1	1	-	-	-	-	1	1	1
CO2	3	2	2	-	2	1	-	-	-	-	-	1	1	-
CO3	3	2	2	-	2	1	1	-	-	-	-	1	1	-
CO4	3	2	2	2	2	1	-	-	-	-	-	1	1	1
CO5	3	2	2	-	2	1	-	-	-	-	-	1	1	1
Avg	3	2	2	2	2	1	1	-	-	-	-	1	1	1

Course Code & Name : 19ME1101/BASICS OF CIVIL AND MECHANICAL ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	1	1	-	-	1	-	-	-	-	-	1	3	3
CO2	3	1	1	-	-	1	-	-	-	-	-	1	3	2
CO3	3	1	1	-	-	1	-	-	-	-	-	1	2	2
CO4	3	1	1	-	-	1	-	-	-	-	-	1	3	2
CO5	3	1	1	-	-	1	-	-	-	-	-	1	3	2
Avg	3	1	1	-	-	1	-	-	-	-	-	1	2.8	2.2

Course Code & Name : 19CS1151/PYTHON PROGRMMING PRACTICES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2

Course Code & Name : 19ME1152/ ENGINEERING DRAWING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12

CO1	2	3	2	-	1	-	1	-	-	1	1	1	1	2
CO2	3	3	2	1	1	-	1	-	-	1	1	1	1	2
CO3	3	3	3	-	1	1	1	-	-	1	1	-	1	1
CO4	3	3	3	1	1	2	1	-	-	1	1	1	1	1
CO5	3	3	3	1	1	3	1	-	-	1	1	1	1	1
Avg	2.8	3	2.6	1	1	2	1	-	-	1	1	1	1	1.4

Course Code & Name : 19EC1153/ ELECTRON DEVICES AND ELECTRIC CIRCUITS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	1	1				1	2	3	3
CO2	3	3	2	2	2	1	1				1	2	3	2
CO3	3	2	3	2	2	1	1				1	2	2	2
CO4	3	3	3	2	2	1	1				1	2	3	2
CO5	3	3	3	2	2	1	1				1	2	3	2
Avg	3	2.8	2.8	2	2	1	1				1	2	2.8	2.2

Course Code & Name : 19EC1154/ BASICS OF ELECTRON DEVICES AND ELECTRIC CIRCUITS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	1	1				1	2	3	3
CO2	3	3	2	2	2	1	1				1	2	3	2
CO3	3	2	3	2	2	1	1				1	2	2	2
CO4	3	3	3	2	2	1	1				1	2	3	2
CO5	3	3	3	2	2	1	1				1	2	3	2
Avg	3	2.8	2.8	2	2	1	1				1	2	2.8	2.2

Course Code & Name : 19EE1155/ BASICS OF ELECTRICAL ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3											3	3
CO2		2											3	0
CO3		1	2	1		2							3	3
CO4									1		1		3	0
CO5			1	1	1								3	0
Avg	3	3											3	3

Semester –II

Course Code & Name : 19HE2101/ BUSINESS   ENGLISH FOR ENGINEERS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Avg	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

Course Code & Name : 19MA2101/ DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.4	2.4	-	-	-	-	-	-	2	2	2

Course Code & Name : 19MA2102/ COMPLEX VARIABLES AND TRANSFORM CALCULUS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	1.8

Course Code & Name : 19MA2103/ LINEAR ALGEBRA, NUMERICAL METHODS AND TRANSFORM CALCULUS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	1
CO2	3	2	3	2	3	-	-	-	-	-	-	2	1	2
CO3	3	2	3	3	3	-	-	-	-	-	-	3	2	3
CO4	3	3	2	2	2	-	-	-	-	-	-	2	1	2
CO5	2	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	2.8	2.6	2.8	2.4	2.6	-	-	-	-	-	-	2.2	1.6	1.8

Course Code & Name : 19MA2104/ DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	2	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.6	2	-	-	-	-	-	-	2	2	2.2

Course Code & Name : 19PH2151/ MATERIAL SCIENCE

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	1	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	1	2	3
CO4	3	3	1	2	2	1	-	-	-	-	-	1	2	2
CO5	3	2	2	3	2	1	2	-	-	-	-	1	2	3
Avg	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2

Course Code & Name : 19CY2151/ ENVIRONMENTAL STUDIES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO2	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO3	2	1	1	-	-	2	3	3	2	-	-	2	-	-
CO4	2	1	2	-	-	2	3	3	2	-	-	2	-	-
CO5	2	1	2	-	-	2	3	3	2	-	-	2	-	-
Avg	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-

Course Code & Name : 19FT2105/ PRINCIPLES OF MICRO BIOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	2	1				1					1	2	
CO2	1	2	1				1			1		1	1	
CO3	1	2	1				1			1		1	1	2
CO4	1	2	1				1			1		1	1	
CO5	1	2	1				1			1		1	3	
Avg	1	2	1				1			1		1	1.6	2

Course Code & Name : 19IT2151/ PROGRAMMING IN C

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12

CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3.0	-	2	-	-	-	-	-	-	2	2	2

Course Code & Name : 19ME2001/ ENGINEERING PRACTICES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	-	3	-	3	-	1	-	1	-	-	-	1	2
CO2														
CO3														
CO4														
CO5														
Avg	3		3		3				1				1	2

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12
I	I	19HE1101/ TECHNICAL ENGLISH	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2
		19MA1102/ CALCULUS AND LINEAR ALGEBRA	3	3	3	2.6	2.8	-	-	-	-	-	-	2
		19PH1151/ APPLIED PHYSICS	3	2.2	2	1.6	2	1.3	-	-	-	-	-	1
		19CY1151/ CHEMISTRY FOR ENGINEERS	3	2	2	2	2	1	1	-	-	-	-	1
		19ME1101/ BASIC OF CIV AND MECHANICAL ENGINEERING	3	1	1	-	-	1	-	-	-	-	-	1
		19CS1151/ PYTHON PROGRMMING PRACTICES	2	3	3	-	2	-	-	-	2	-	-	2
		19ME1152/ ENGINEERING DRAWING	2.8	3	2.6	1	1	2	1	-	-	1	1	1
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12
I	II	19HE2101/ BUSINESS ENGLISH FOR ENGINEERS	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8
		19MA2101/ DIFFERENTIAL EQUATIONS AND	3	3	3	2.4	2.4	-	-	-	-	-	-	2

Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
COMPLEX VARIABLES														
19PH2151/ MATERIAL SCIENCE	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-			1
19CY2151/ ENVIRONMENTAL STUDIES	2	1	1.7	-	-	1	2	3	2	-	-			2
19FT2105/ PRINCIPLES OF MICRO BIOLOGY	1	2	1				1				1			1
19IT2151/ PROGRAMMING IN C	2	3	3.0	-	2	-	-	-	-	-	-			2
ENGINEERING PRACTICES	3		3		3						1			

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
II	III	19MA3102 Fourier Analysis and Transforms	3	2.8	3	1.4	1.4	2	-	-	-	-	-	2.2	2.2	2.2
		19FT3201 Fluid Mechanics	2.8	1.8	1	1.3		1						1	1	1
		19FT3101 Principles of Thermodynamics	2.8	1.8	1	1.3		1						1	1	1
		19FT3202 Food Microbiology	2.8	1.8	1	1.3		1						1	1	1
		19FT3251 Bio Chemistry	2.5	2	2.3	2	3	2	2				3		1.3	2.8
		19FT3001 Food Microbiology Laboratory	2	1.7	1.7	2	2		2					2	2	2
		19FT3002 Food Production Analysis Laboratory	2	1	1	1	2	2	2	-	1	1	-	2	1.2	0.4
		19FT4002 Food Process Equipment Design Laboratory	2.33	3	2						3			2.3		3

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
II	IV	19FT4201 Fundamentals of Heat and Mass Transfer	1	1.25	1.75	1	4				1			1.6	1	2.4
		19FT4202 Food Process Calculations	1	1.25	2	1.6	1.5				2			2.2	3	2.6

Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19FT4203 Engineering properties of food materials	2	1.2	2.2	2.5		2						2	3	2.6
19FT4251 Food Chemistry	2.8	1.8	1	1.3		1						1	1	1
19MA4152 Statistics and Numerical Method	3	2.8	3	2	2							2.2	2.2	2
19FT4001 Unit Operations Laboratory	1.6	1.5	2.5	1.7	2				2.6			2.4	2	

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
II	V	19FT5201 Baking and Confectionery Technology	3	2	3	1	2	2	1.25				1.75	1	1	2
		19FT5202 Food Additives	1		2.8			2	1	1				1	2.2	1
		19FT5203 Poultry, Meat and Fish Process Technology	2.25	2.75	2.5	1.66	3		1.6						1	2.75
		19FT5204 Principles of Food Processing	2.5	1.75	2.2	2.5	0	2						1	3	1.8
		19FT5205 Unit Operations in Food Processing	1	1.25	1.75	1	1				1			1.6	1	2.4
		19FT5306 Milling Technology for Food Materials	1	2	1.2				1.25			1		1	1.6	
		19FT5001 Baking and Confectionery Technology Laboratory	2.25	2	2	2.25		1	1	2			1	2.25	1.5	2.25
		19FT5002 Unit Operations in Food Processing Laboratory	2.5	1.75	2.2	2.5								1	3	1.8

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
III	VI	19FT6201 Dairy Engineering	3	2	3	1	2	2	1.25				1.75	1	1	2
		19FT6202 Plantation crops and Spices	3	1	2	2		2						2	3	2.6

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		Products Technology														
		19FT6203 Fruits and Vegetable Processing Technology	2.5	1.75	2.2	2.5		2						1	3	1.8
		19FT6181 Professional Ethics in Engineering	2.3	2	2.25	2.5		2						2	3	2.75
		19FT6301 Beverage Technology	1	2	1.2				1.25			1		1	1.4	
		19FT6401 Traditional Foods	2.2	2.0	1.8	2	-	1	1	2	-	-	1	2	1.4	3
		19FT6001 Dairy Engineering Laboratory	1.5	1.75	1.75	1	1	1	1		1	1		1	1.25	2
		19FT6002 Fruits and Vegetable Processing Technology Laboratory	2	1.5	2	2	2		2					2	2.5	2
ear	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
IV	VII	19FT7201 Food Analysis and Quality Control	2.2	2.8	1.6	2.2	2	2.6	1.4		2	1.8	1	3	3	1.8
		19FT7202 Food Packaging	2.2	2.8	1.6	2.2	2	2.6	1.4		2	1.8	1	3	3	
		19FT7203 Food Plant Layout and Management	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2
		19FT7307 Emerging Non-Thermal Processing of Foods	2.5	1.75	2.4	2.5		2							3	1.8
		19FT7401 Open Elective – II	2.8	2.2	1.8	1.8	1.4	2.2	1.4		2	1		3	3	2
		19FT7001 Food Packaging Laboratory	1.6	1.5	2.5	1.7	2	-	-	-	2.6	-	-	2.4	2	2
		19FT7002 Food Analysis and Quality Control Laboratory	3	3	2	2	1	1						2	3	3
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

IV	VIII	19FT8312 Total Quality Management	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1
		19FT8308 Emerging Technologies in Food Processing	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1