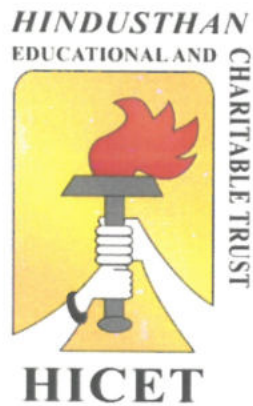*HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY*

(An Autonomous Institution Affiliated to Anna University, Chennai)

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

Coimbatore - 641 032.

B.E. BIOMEDICAL ENGINEERING

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST

HICET

Curriculum & Syllabus

2019-2020

CHOICE BASED CREDIT SYSTEM

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 novelteaching methods.

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

IM3: To produce dedicated professionals with social responsibility.

VISION AND MISSION OF THE DEPARTMENT

VISION

To evolve into a center of excellence in biomedical engineering by nurturing and training interested minds in this diverse technology, thereby striving towards ensuring quality healthcare to the society.

MISSION

M1: To establish the best learning environment that helps the students to face the challenges of Biomedical Engineering field

M2: To inspire the students to drive the next generation innovation to come up with quality solutions to current healthcare needs.

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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO 1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6. **The engineer and society**: Apply reasoning informed by the contextualknowledge to assess societal, health, safety, legal and cultural issues and the   consequent responsibilities relevant to the professionalengineering practice.

PO 7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmentalcontexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. **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 anddesign 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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Biomedical Engineering Graduates will have ability to:

PSO1: Design and develop biomedical devices to meet the needs of people by applying the Fundamentals of Biomedical Engineering.

PSO2. Understand and implement various software skills for accurate diagnostic and Therapeutic applications.

PSO3. Innovate new ideas and solutions for the healthcare field by integrating various Biomedical Technology.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1. To create a strong foundation in engineering and biology for solving the existing Challenges in the healthcare sector.

PEO2. To acquire knowledge in the cutting edge technologies of Biomedical Engineering field and an ability to identify, analyze and solve problems in the field.

PEO3. To instill ethical values, communicative skills, teamwork and leadership skills necessary to function productively and professionally.

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CURRICULUM

Hindusthan College of Engineering and Technology

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Coimbatore, Tamil Nadu.

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DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. BIOMEDICAL ENGINEERING (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	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1103	Calculus and DifferentialEquations	BS	3	1	0	4	25	75	100
THEORY WITH LAB COMPONENT										
3	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
6	19EE1155	Basics of Electrical Engineering	ES	2	0	2	3	50	50	100
PRACTICAL										
7	19HE1071	Value Added Course I : Language Competency Enhancement Course - I	HS	0	0	2	1	0	100	100
			Total:	13	2	10	20	250	450	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	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2102	Complex Variables andTransform Calculus	BS	3	1	0	4	25	75	100
THEORY WITH LAB COMPONENT										

3	19PH2151	Material Science	BS	2	0	2	3	50	50	100
4	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
5	19CS2152	Essentials of C & C++Programming	ES	2	0	2	3	50	50	100
6	19ME2154	Engineering Graphics	ES	1	0	4	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		12	2	16	22	400	400	800

REGULATION-2016

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

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA3111	Fourier Analysis and Z Transforms	3	1	0	4	25	75	100
2	16BM3201	Sensors and Measurement	3	1	0	4	25	75	100
3	16BM3202	Human Anatomy and Physiology	3	0	0	3	25	75	100
4	16BM3203	Bioelectric Phenomena	3	0	0	3	25	75	100
5	16BM3204	Medical Biochemistry	3	0	0	3	25	75	100
6	16CS3232	Fundamentals of Data structures in C	3	0	0	3	25	75	100
PRACTICAL									
7	16BM3001	Biochemistry Lab	0	0	4	2	50	50	100
8	16CS3032	Data structures Lab	0	0	4	2	50	50	100
		Total Credits	18	2	8	24	250	550	800

SEMESTER IV

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	16MA4112	Applied Statistics & Numerical Methods	3	0	2	4	25	75	100
2	16BM4201	Pathology and Microbiology	3	0	0	3	25	75	100
3	16BM4202	Linear Integrated Circuits	3	0	0	3	25	75	100
4	16BM4203	Digital Electronics	3	0	0	3	25	75	100
5	16EE4231	Basics of Electrical Engineering	3	0	0	3	25	75	100
6	16HE4103	Professional Ethics in Engineering	3	0	0	3	25	75	100
PRACTICAL										
7	16BM4001	Human Physiology Laboratory	0	0	4	2	50	50	100
8	16BM4002	Linear Integrated Circuits Lab	0	0	4	2	50	50	100
		Total Credits	18	0	10	23	250	550	800

Credit Distribution R2016

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	24	23	23	25	22	18	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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COIMBATORE - 641 032

SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE1101	TECHNICAL ENGLISH	2	1	0	3

Course Objective
- ✓ Train to maintain coherence in formal communication.
- ✓ Provide Practice to create and interpret descriptive communication.
- ✓ Introduce the professional protocol.
- ✓ Acquire different types of communication and professional etiquette.
- ✓ Educate to improve interpersonal and intrapersonal skills.

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 abouttechnical 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**- Proposalwriting, Writing definitions, **Grammar and Vocabulary**- Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs.	9
	Total Instructional Hours	45

Course Outcome
CO1- To gain knowledge about basic grammar and elements of professional communication.
CO2- To understand formal and technical communication.
CO3- To apply the basic elements of grammar and communication in professional situation.
CO4- To analyse and interpret different styles of correspondence.
CO5- To compose official letters and technical proposals and make presentations.

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", OxfordUniversity Press, 2009.
R2- Raymond Murphy, "English Grammar in Use"-4th editionCambridge University Press, 2004.
R3- KamaleshSadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan,2010.

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Programme B.E.	Course Code 19MA1103	Name of the Course CALCULUS AND DIFFERENTIAL EQUATIONS	L 3	T 1	P 0	C 4

Course Objective	1. Understand the concept of differentiation.
	2. Compute the functions of several variables which are needed in many branches ofengineering.
	3. Understand the concept of double integrals.
	4. Understand the concept of triple integrals.
	5. Solve ordinary differential equations of certain types using Wronskian technique.

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)** Total derivatives - Jacobians – Maxima, Minima and Saddle points - Lagrange's method of undetermined multipliers – Gradient, divergence, curl and derivatives.	12
III	**DOUBLE INTEGRATION** Double integrals in Cartesian coordinates– 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** Triple integrals 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	**ORDINARYDIFFERENTIALEQUATIONS** Ordinary differential equations of second order - Second Order linear differential equations with constant coefficients – Cauchy – Euler's Equation - Cauchy – Legendre's Equation - Method of variation of parameters.	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 the area of plane curves.CO4: Evaluation of triple integrals to compute volume of solids.
	CO5: Develop sound knowledge of techniques in solving ordinary differential equations that model engineering problems

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, NewDelhi.

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 B.E.	Course Code 19PH1151	Name of the Course APPLIED PHYSICS	L 2	T 0	P 2	C 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. Determination of Young's modulus by uniform bending method	6 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. Determination of Rigidity modulus – Torsion pendulum	6 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 criterionof resolution power - resolving power of grating. Determination of wavelength of mercury spectrum – spectrometer gratingDetermination of thickness of a thin wire – Air wedge method	6 3 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 CO2 laser- Laser Applications – Holography – Construction and reconstruction of images. Determination of Wavelength and particl size using Laser	6 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

After completion of the course the learner will be able to

Course Outcome

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 EngineeringCO5: Develop the technology of fiber optical communication in engineering field

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, Newi, 2017.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8thedition, Dhanpat Rai Publications (P) Ltd., Newi, 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 Companyltd., 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.E.	19CY1151	CHEMISTRY FOR ENGINEERS	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 andcomposites.
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, windmills 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 – 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 – principles – 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 itssignificance 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 ofcorrosion, its consequences to minimize corrosion to improve industrial design.

CO4: Develop knowledge about the renewable energy resources and batteries along with the need ofnew 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/ Sem	Course Code	Name of the Course	L	T	P	C
B.E.	19CS1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3

Course Objectives
1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs
3. To develop Python programs with conditionals and loops and to define Python functions and call them
4. To use Python data structures –- lists, tuples, dictionaries
5. 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 and methods; 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

Course Outcomes	CO1:	Develop algorithmic solutions to simple computational problems
	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:

T1 - Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2017.
T2 - S.Annadurai, S.Shankar, I.Jasmine Selvakumari Jeya, M.Revathi, Fundamentals of Python Programming, McGraw Hill Publications, 2021.
REFERENCE BOOKS:

R1 - Charles Dierbach, ―Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
R2 - Timothy A. Budd, ―Exploring Pythonǁ, Mc-Graw Hill Education (India) Private Ltd., 2015
R3 - Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EE1155	BASICS OF ELECTRICAL ENGINEERING	2	0	2	3

Course Objective

1. To introduce the fundamental concepts of electrical circuits and theorems.
2. To understand the basic theory, operational characteristics of AC and DC machines.
3. To study the operating principles of measuring instrument.
4. To observe the electrical power supply sources and understand electrical wiring basics.
5. To create awareness on the methods for electrical safety and protection.

Unit	Description	Instructional Hours
I	**UNIT I : ELECTRICAL CIRCUITS AND ANALYSIS** Ohm's law, DC and AC circuits fundamentals, Kirchhoff's laws, Mesh andNodal analysis- Theorems and simple problems: Superposition, Thevenins, Maximum power transfer theorem- Experimental analysis of super positiontheorem.	6+3
II	**UNIT II : ELECTRICAL MACHINES** DC Machines: D.C generators & D.C motors: Principle of operation, constructions, types, Applications - A.C Motors: -Single Phase induction motors: principle of operation, Types and Applications-Single phase Transformers: Principles of operation, Constructional Details, Types and Applications- Implementation of no load test on single phase induction motor and Transformer.	6+3
III	**UNIT III : BASIC ELECTRICAL INSTRUMENTATION** Introduction, classification of instruments, operating principles, essential features of measuring instruments (elementary Treatment only) - Moving coil, permanent magnet (PMMC) instruments, Moving Iron of Ammeters and Voltmeters - Energy meter- Experimental measurement of voltage, current and power in single phase circuit.	6+3
IV	**UNIT IV : BASICS OF POWER SUPPLY AND ELECTRICAL WIRING** Introduction to Power supply circuits: Half wave, Full wave Rectifier – SMPS, UPS (online & offline). Wiring types and applications. Service mains, meter board and distribution board - Brief discussion on concealed conduit wiring. One way and two way control- implementation of simple wiring circuit for a household appliance.	6+3
V	**UNIT V: ELECTRICAL SAFETY** Need for Electrical safety - Electric shock, precautions against shock - Elementary discussion on Circuit protective devices: fuse and Miniature Circuit Breaker (MCB's). Objectives for Neutral and Earthing, types of earthing; pipe and plate earthing, Residual current circuit breaker- Experimental measurement of insulation resistance of electrical equipment.	6+3
	Total Instructional Hours	45

Course Outcome

CO1: Understand the fundamental concepts of electrical circuits and theorems.
CO2: Understand the basic theory, operational characteristics of AC and DC machines
CO3: Understand the operating principles of measuring instrument.
CO4: Understand the electrical power supply sources and electrical wiring basics
CO5: Understand the importance for electrical safety and protection.

TEXT BOOKS:

T1   Dr. D P Kothari, Prof I J Nagrath, "Basic Electrical Engineering", 3rd Edition, Tata McGraw-Hill, 2009.

T2   K. S. Dhogal "Basic Practical In Electrical Engineering", 2nd, Reprint 2017, Standard Publishers Distributors

REFERENCE BOOKS:

R1   P.C. Sen, "Principles of Electrical Machines and Power Electronics", Wiley, 2016(Reprint)

R2   Vijay kumar Garg, "Basic Electrical Engineering (A complete Solution)", Wiley Reprint2015.

R3   Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE1071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- I	0	0	2	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.E.	19HE2101	BUSINESS ENGLISH FOR ENGINEERS	2	1	0	3

<table>
<tr><td rowspan="1">Course Objective</td><td>
1. Introduce business communication.
2. Train to respond different professional situations.
3. Make the learnersfamiliar with the managerial skills
4. Empower the trainee in business writing skills.
5. Educate to interpret and expertisedifferent business content.
</td></tr>
</table>

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, Congratulatingsomeone 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 wri ting(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

<table>
<tr><td>Course Outcome</td><td>
CO1- To know different modes of business communication
CO2- To understand managerial techniques.
CO3- To apply the rules of grammar and vocabulary ineffective business communication.
CO4- To analyse and interpret business documents.
CO5- To draft business reports
</td></tr>
</table>

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.E.	19MA2102	COMPLEX VARIABLES ANDTRANSFORM CALCULUS	3	1	0	4

Course Objective

1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2. Identify effective mathematical tools for the solutions of partial differential equations.
3. Describe the construction of analytic functions and conformal mapping.
4. Illustrate Cauchy's integral theorem and calculus of residues.
5. Analyze the techniques of Laplace and Inverse laplace transform.

Unit	Description	Instructional Hours
I	**MATRICES** Eigen values and Eigen vectors of a real matrix– Properties of Eigenvalues and Eigenvectors (without proof)Cayley - Hamilton Theorem (excluding proof) - Orthogonal matrices–Definition – Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	**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
III	**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
IV	**COMPLEX INTEGRATION** Cauchy's integral theorem – Cauchy's integral formula –Taylor's andLaurent's series (statement only) –Residues - Cauchy's Residue theorem.	12
V	**TRANSFORM CALCULUS** Laplace transform–Basic properties – Transforms of derivatives and integrals of functions-Transform of periodic functions - Inverse Laplace transform-Convolution theorem (without proof) –Solution of linear ODE of second order with constant coefficients using Laplace transforms..	12

	Total Instructional Hours	60

Course Outcome

CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies.
CO2: Solve Partial Differential Equations using various methods.
CO3: Infer the knowledge of construction of analytic functions and conformal mapping.
CO4: Evaluate real and complex integrals over suitable closed paths or contours.
CO5: Apply Laplace transform and its properties to solve certain linear differential equations.

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- BaliN.P &ManishGoyal,"ATextbookofEngineeringMathematics",8th Edition, Laxmi Pub. Pvt. Ltd.2011.

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	Course Code	Name of the Course	L	T	P	C
B.E.	19PH2151	MATERIAL SCIENCE	2	0	2	*3

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

Unit	Description	Instructional Hours
I	**SEMICONDUCTING MATERIALS**	
	Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct andindirect 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
	B – H curve by Magnetic hysteresis experiment	3
III	**SUPERCONDUCTING 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 velocityusing acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrialapplications – 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., NewDelhi   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.E.	19CY2151	ENVIRONMENTAL STUDIES	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
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+9=15
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: Realize 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 – ErachBharucha, "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	Course Code	Name of the Course	L	T	P	C
B.E.	19CS2152	ESSENTIAL OF C AND C++ PROGRAMMING	2	0	2	3

Course Objective	1. To Learn and develop basics of C programming. 2. To understand Object Oriented Programming concepts and basic characteristics of C++. 3. Be familiar with the constructors and operator overloading. 4. To understand the concepts of inheritance, polymorphism and virtual function. 5. To learn and define concept of templates and exception handling.

Unit	Description	Instructional Hours
I	**BASICS OF 'C' PROGRAMMING** Fundamentals of ' C' programming – Structure of a 'C' program – Constants - Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations-Branching and Looping - Arrays – One dimensional and Two dimensional arrays. **Programs: 1. Write a C program to calculate sum of individual digits of a given number.** **2. Write a C program to count no. of positive numbers, negative numbers and zeros in the array. 3. Write a C program to find sum of two numbers using functions with arguments and without return type.**	3+6
II	**BASICS OF 'C++' PROGRAMMING** Introduction to C++ – structures and unions- Object oriented programming concepts–Defining a Class – creating objects - access specifiers – Function in C++ - function and data members default arguments – function overloading – Inline functions - friend functions – constant with class – static member of a class – nested classes – local classes. **Program: Write a C++ program to accept the student detail such as name and 3 differentmarks by get_data() method and display the name and average of marks using display() method. Define a friend class for calculating the average of marks using the method mark_avg().**	6+3
III	**CONSTRUCTOR AND OPERATOR OVERLOADING** Constructors - Default, Copy, Parameterized, Dynamic constructors, Default argument – Destructor. - Function overloading- Operator overloading-Unary, Binary - Binary operators using friend function. **Program: Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere and hence implement the concept of Function Overloading.**	7+2
IV	**INHERITANCE AND POLYMORPHISM** Inheritance – Public, Private and Protected derivations– Single– Multiple– Multilevel– Hybrid– Hierarchical - Virtual base class – abstract class – composite objects- Runtime polymorphism – virtual functions – pure virtual functions. **Program: Demonstrate Simple Inheritance concept by creating a base class FATHER with data members SurName and BankBalance and creating a derived class SON, which inherits SurName and BankBalance feature from base class but provides its own feature FirstName and DOB. Create and initialize F1 andS1 objects with appropriate constructors and display the Father & Son details. (Hint : While creating S1 object, call Father base class parameterized constructor through derived class by sending values).**	7+2
V	**TEMPLATES AND EXCEPTION HANDLING** Function and class templates - Exception handling – try-catch-throw paradigm – exception specification – terminate and Unexpected functions – Uncaught exception. **Program: Write a C++ program to create a template function for Bubble Sort and demonstrate sorting of integers and doubles.**	7+2
	Total Instructional Hours	45

Course Outcomes	CO1: Develop simple applications in C using basic constructs. CO2: Apply solutions to real world problems using basic characteristics of C++. CO3: Write object-oriented programs using operator overloading, constructors and destructors. CO4: Develop programs with the concepts of inheritance and polymorphism. CO5: Understand and define solutions with C++ advanced features such as templates and exception handling.

TEXT BOOKS:

T1 - E.Balagurusamy, "Programming in ANSI C", 7th Edition, McGraw Hill Publication, 2016.

T2 - E.Balagurusamy, "Object Oriented Programming with C++", 7th Edition, McGraw Hill Publication, 2017.

REFERENCE BOOKS:

R1 - Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

R2 - RohitKhurana, "Object Oriented Programming with C++", Vikas Publishing, 2nd Edition, 2016.

R3 - B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19ME2154	ENGINEERING GRAPHICS	1	0	4	3

Course Objective	1. To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves. 2. To learn about the orthogonal projections of straight lines and planes. 3. To aquire the knowledge of projections of simple solid objects in plan and elevation. 4. To learn about the projection of sections of solids and development of surfaces. 5. To study the isometric projections of different objects.

Unit	Description	Instructional Hours
I	**PLANE CURVES** Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	12
II	**PROJECTIONS OF POINTS, LINES AND PLANE SURFACES** Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
III	**PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
IV	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	12
V	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	12

Total Instructional Hours   60

Course Outcome	CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves. CO2: Draw the orthogonal projections of straight lines and planes. CO3: Interpret the projections of simple solid objects in plan and elevation. CO4: Draw the projections of section of solids and development of surfaces of solids.

CO5: Draw the isometric projections and the perspective views of different objects.

TEXT BOOK:

1. K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5thedition New Age International Publishers, New delhi 2016.

2. K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai 2016.

REFERENCES:

1. Basant Agrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing   company

   Limited,New Delhi 2013.

2. N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University PRESS, India 2015.

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

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

GROUP A (CIVIL & MECHANICAL)
CIVIL AND MECHANICAL ENGINEERING PRACTICES

S.No	Description of the Experiments
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 1 1/2 brick thick wall for right angle corner junction.
3	Arrangement of bricks using English bond for 1brick thick wall and 1 1/2 brick thick wall for T junction.
4	Preparation of arc welding of Butt joints, Lap joints and Tee joints.
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.

Total Practical Hours   45

GROUP B (ELECTRICAL)
ELECTRICAL ENGINEERING PRACTICES

S.No	Description of the Experiments
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 Practical Hours   45

Course Outcome	CO1: Fabricate wooden components and pipe connections including plumbing works.
	CO2: Fabricate simple weld joints.
	CO3: Fabricate different electrical wiring circuits and understand the AC Circuits.

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

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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Programme	Course code	Course title	L	T	P	C
B.E.	19HE2072	**CAREER GUIDANCE LEVEL II** Personality, Aptitude and Career Development	2	0	0	0

Course Objectives:
- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]

Expected Course Outcome:
Enable students to solve questions on Verbal, Logical and Quantitative Aptitude of placement level

Student Learning Outcomes   6, 7, 8
(SLO):

Module:1	**Logical Reasoning**	**8 hours**		SLO:6

Word group categorization questions
Puzzle type class involving students grouping words into right group orders of logical sense

Cryptarithmetic
Data arrangements and Blood relations
- Linear Arrangement
- Circular Arrangement
- Multi-dimensional Arrangement
- Blood Relations

Module:2	**Quantitative Aptitude**	**12 hours**		SLO:7

Ratio and Proportion
- Ratio
- Proportion
- Variation
- Simple equations
- Problems on Ages
- Mixtures and alligations

Percentages, Simple and Compound Interest
- Percentages as Fractions and Decimals
- Percentage Increase / Decrease
- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

Number System
- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

Module:3	**Verbal Ability**	**10hours**		SLO:8

Essential grammar for placements
- Prepositions
- Adjectives and Adverbs
- Tenses
- Forms and Speech and Voice
- Idioms and Phrasal Verbs
- Collocations, Gerund and Infinitives

Reading Comprehension for placements

- Types of questions
- Comprehension strategies
- Practice exercises

Articles, Prepositions and Interrogatives
- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary for placements
- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

Total Lecture hours: 30hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA3111	FOURIER ANALYSIS AND Z TRANSFORMS	3	1	0	4

Course Objective

1. Analyze 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. Apply Fourier transform techniques in wide variety situations.
5. Analyze 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 semicircular 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: Apply Fourier series in solving the boundary value problems.
CO3: Understand Fourier series in solving the two dimensional heat equations.
CO4: Summarize the knowledge of Fourier transform techniques which extend its applications.
CO5: Illustratethe 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	Course Code	Name of the Course	L	T	P	C
B.E.	16BM3201	SENSORS AND MEASUREMENT	3	1	0	4

Course Objective

The student should be conversant with
1. Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
2. Know the principle of transduction, classifications and the characteristics of different transducers
3. Understand the principle of photoelectric and piezoelectric sensors.
4. Know the different bridges for measurement.
5. Know the different display and recording devices.

Unit	Description	Instructional Hours
I	**SCIENCE OF MEASUREMENT** Measurement System – Instrumentation - Classification and Characteristics of Transducers - Static and Dynamic - Errors in Measurements and their statistical analysis – Calibration - Primary and secondary standards.	12
II	**DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS** Strain Gauge: Gauge factor, sensing elements, configuration, and unbounded strain gage. Capacitive transducer - various arrangements, Inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, Active type: Thermocouple - characteristics.	12
III	**PHOTOELECTRIC AND PIEZO ELECTRIC SENSORS** Phototube, scintillation counter, photo multiplier tube (PMT), photovoltaic, photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers. Optical displacement sensors and optical encoders. Piezoelectric active transducer- Equivalent circuit and its characteristics.	12
IV	**SIGNAL CONDITIONING CIRCUITS** Functions of signal conditioning circuits, Preamplifiers, Concepts of passive filters, Impedance matching circuits, AC and DC Bridges - wheat stone bridge, Kelvin, Maxwell, Hay, Schering	12
V	**DISPLAY AND RECORDING DEVICES** Digital voltmeter – Multi meter – CRO – block diagram, CRT – vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, Inkjet recorder, thermal recorder	12
	Total Instructional Hours	60

Course Outcome

After the completion of the course, the learner will be able to
CO1: Measure various electrical parameters with accuracy, precision, resolution.
CO2: Select appropriate passive or active transducers for measurement of physical phenomenon.
CO3: Select appropriate light sensors for measurement of physical phenomenon.
CO4: Use AC and DC bridges for relevant parameter measurement.
CO5: Employ Multimeter, CRO and different types of recorders for appropriate measurement.

TEXT BOOKS:

1. A.K.Sawhney, ―Electrical & Electronics Measurement and Instrumentation‖,10th edition, DhanpatRai& Co, New Delhi, 19th Revised edition 2011, Reprint 2014.
2. John G. Webster, ―Medical Instrumentation Application and Design‖, 4th edition, Wiley India Pvt Ltd,New Delhi, 2015.

REFERENCES:

1. Ernest O Doebelin and Dhanesh N Manik, Measurement systems, Application and design, 6th edition, McGraw-Hill, 2012.
2. Khandpur R.S, ―Handbook of Biomedical Instrumentation‖, 3rdedition,Tata McGraw-Hill, New Delhi, 2014.
3. Leslie Cromwell, ―Biomedical Instrumentation and measurement‖, 2nd edition, Prentice hall of India, New Delhi, 2015.
4. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques‖, Prentice Hall of India, 1stedition, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16BM3202	HUMAN ANATOMY AND PHYSIOLOGY	3	0	0	3

Course Objective

1: To identify all the organelles of an animal cell and their function.
2: To understand structure and functions of the skeletal, muscular and respiratory systems.
3: To understand structure and functions of the cardiovascular and lymphatic systems.
4: To understand structure and functions nervous and endocrine systems.
5: To understand structure and functions of the digestive and urinary systems.

Unit	Description	Instructional Hours
I	**CELL AND TISSUE STRUCTURE** Structure of Cell – structure and functions of sub organelles – Cell Membrane –Transport of Across Cell Membrane - Action Potential – Cell to Cell Signaling – Cell Division. Types of Specialized tissues – Functions	9
II	**SKELETAL, MUSCULAR AND RESPIRATORY SYSTEMS** **Skeletal:**:Types of Bone and function – Physiology of Bone formation – Division of Skeleton – Types of joints and function – Types of cartilage and function. **Muscular:** Parts of Muscle – Movements. **Respiratory:** Parts of Respiratory Systems – Types of respiration - Mechanisms of Breathing – Regulation of Respiration	9
III	**CARDIOVASCULAR AND LYMPHATIC SYSTEMS** **Cardiovascular:** Components of Blood and functions.- Blood Groups and importance – Structure of Heart – Conducting System of Heart – Properties of Cardiac Muscle - Cardiac Cycle - Heart Beat – Types of Blood vessel – Regulation of Heart rate and Blood pressure. **Lymphatic:** Parts and Functions of Lymphatic systems – Types of Lymphatic organs and vessels	9
IV	**NERVOUS AND ENDOCRINE SYSTEMS AND SENSE ORGANS** **Nervous:** Cells of Nervous systems – Types of Neuron and Synapses – Mechanisms of Nerve impulse – Brain : Parts of Brain – Spinal Cord – Tract and Pathways of Spines – Reflex Mechanism – Classification of Nerves - Autonomic Nervous systems and its functions. **Endocrine - Pituitary** and thyroid gland, Sense Organs: Eye and Ear	9
V	**DIGESTIVE AND URINARY SYSTEMS** Digestive: Organs of Digestive system – Digestion and Absorption. Urinary: Structure of Kidney and Nephron – Mechanisms of Urine formation – Regulation of Blood pressure by Urinary System – Urinary reflex.	9
	Total Instructional Hours	45

Course Outcome

After the completion of the course, the learner will be able to
CO1: Explain the basic structure and functions of cell
CO2: Learn about the structure and functions of the skeletal, muscular and respiratory systems
CO3: Understand about the cardiovascular and lymphatic systems
CO4: Learn about the nervous and endocrine systems.
CO5: Explain about the structure and functions of the digestive and urinary systems

TEXT BOOKS:

1. Prabhjot Kaur. Text Book of Anatomy and Physiology. Lotus Publsihers. 2014
2. Elaine.N. Marieb , —Essential of Human Anatomy and Physiologyǀ, Ninth Edition, Pearson Education, New Delhi, 2016.

REFERENCES:

1. Frederic H. Martini, Judi L. Nath, Edwin F. Bartholomew, Fundamentals of Anatomy and Physiology. Eleventh edition, Pearson Publishers, 2017
2. Gillian Pocock, Christopher D. Richards, The human Body – An introduction for Biomedical and Health Sciences, Oxford University Press, USA, 2013
3. William F.Ganong, —Review of Medical Physiologyǀ, 22nd Edition, Mc Graw Hill, New Delhi, 2010
4. Eldra Pearl Solomon, —Introduction to Human Anatomy and Physiologyǀ, W.B. Saunders Company, 2015
5. Guyton & Hall, —Medical Physiologyǀ, 13th Edition, Elsevier Saunders, 2015.

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Programme B.E.	Course Code 16BM3203	Name of the Course BIOELECTRIC PHENOMENA	L 3	T 0	P 0	C 3

Course Objective	1: To study about cell membrane and the mode of transport across the cell membrane
	2: To understand the electrical activity of heart
	3: To analyse the electrical activity of brain.
	4: To understand the electrical activity of muscles.
	5: To study the principles of measuring the bio potentials and the type of electrodes used.

Unit	Description	Instructional Hours
I	**CELL MEMRANE** Structure, Excitable cells, Nernst potential, Resting membrane potential, Polarised state, Goldman Hodgkin Katz equation, Action potential – Features, ionic basis, depolarization, re-polarization and hyper polarization- Propagation of nerve impulses – length constant, time constant, passive decay, Refractory period – absolute, relative, mono-phasic and bi-phasic recordings - Hodgkin Huxley model of squid gait axon membranes, Modes of transport of substances across the cell membranes	9
II	**ELECTRICAL ACTIVITY OF THE HEART** Cardiac muscle, Action potentials in cardiac muscle, SA node, Origin and propagation of rhythmical excitation & contraction, refractoriness, regular and ectopic pace makers, electrocardiogram – lead systems - waveforms and their significance – ECG in diagnosis – Arrhythmias, abnormal rhythms, heart blocks, premature contractions, flutter, fibrillation, vulnerable period.	9
III	**ELECTRICAL ACTIVITY OF THE BRAIN** *Electrical activity of brain* – Sleep stages, Brain waves, waveforms & measurements, 10-20 electrode system – montage - Evoked potentials – visual, auditory and somatosensory EPs, *Magnetoencephalogram, Electrogastrogram, Electroretinogram, Electroocculogram.*	9
IV	**ELECTRICAL ACTIVITY OF THE MUSCLES** neuromuscular junction, synaptic potentials, motor unit, motor unit action potentials, Electromyogram, *Electroneurogram* – nerve conduction studies	9
V	**ELECTRODES FOR MEASUREMENT OF BIOPOTENTIALS** Types, Recording and stimulating electrodes, electrode-tissue interfaces – electrode-electrolyte and electrolyte-skin interfaces, Polarizable and non-polarizable electrodes - Silver-silver chloride electrodes, skin contact impedance	9
	Total Instructional Hours	45

Course Outcome	CO1: Analyze the nature of various potentials generated in the body.
	CO2: Discuss the activity of heart.
	CO3: Understand the activity of brain.
	CO4: Learn the activity of muscle.
	CO5: Explain the methods for measuring the potentials.

TEXTBOOKS

1. Arthur C. Guyton : Textbook of Medical Physiology, Prism Books (Pvt) Ltd &W.B. Saunders Company.Thirteenth Edition, 2015

2. D.J. Aidley: The Physiology of Excitable cells, 3rd Ed., Cambridge University Press. 1998

REFERENCES

1. John G. Webster: Medical Instrumentation - Application and Design; Fourth Edition, Wiley India Pvt ltd, 2015

2. Richard Aston: Principles of Biomedical Instrumentation and Measurement, Merril Publishing Co., Columbus 1990.

3. Khandpur R S: Handbook of Medical Instrumentation, Tata Mc Graw Hill, New Delhi.2014

4. B. Katz :Nerve, Muscle, and Synapse, Mc-Graw Hill, New York. 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16BM3204	MEDICAL BIOCHEMISTRY	3	0	0	3

Course Objective	1. To study the basic fundamentals of biochemistry 2. To study structural and functional properties of carbohydrates 3. To study structural and functional properties of lipids. 4. To study structural and functional properties of proteins, and nucleic acids 5. To emphasize the role of enzymes in human body.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO BIOCHEMISTRY** Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Handerson - Hasselbalch equation, physiological buffers in living systems, Energy in living organism. Properties of water and their applications in biological systems. Introduction to Biomolecules, Biological membrane, Clinical application of Electrolytes and radioisotopes.	9
II	**CARBOHYDRATES** Classification of carbohydrates - mono, di, oligo and polysaccharides. Structure, physical and chemical properties of carbohydrates Isomerism, racemisation and mutarotation. Digestion and absorption of carbohydrates. Metabolic pathways and bioenergetics – Glycolysis, glycogenesis, glycogenolysis and its hormonal regulation. TCA cycle and electron transport chain. Oxidative phosphorylation. Biochemical aspect of Diabetes mellitus and Glycogen storage Disease.	9
III	**LIPIDS** Classification of lipids- simple, compound and derived lipids. Nomenclature of fatty acid, physical and chemical properties of fat..Metabolic pathways: synthesis and degradation of fatty acid (beta oxidation), hormonal regulation of fatty acid metabolism, ketogenesis, Biosynthesis of Cholesterol. Disorders of lipid metabolism	9
IV	**NUCLEICACID&PROTEIN** Structure of purines and pyrimidines, nucleoside, nucleotide. DNA act as a genetic material, chargoffs rule. Watson and crick model of DNA. Structure of RNA and its type. Metabolism and Disorder of purines and pyrimidines nucleotide Classification, structure and properties of proteins, structural organization of proteins, classification and properties of amino acids. Separation of protein, Inborn Metabolic error of amino acid metabolism	9
V	**ENZYME AND ITS CLINICAL APPLICATION** Classification of enzymes, apoenzyme, coenzyme, holoenzyme and cofactors. Kinetics of enzymes - Michaelis-Menten equation.Factors affecting enzymatic activity: temperature, pH, substrate concentration and enzyme concentration. Inhibitors of enzyme action: Competitive, non-competitive, irreversible.	6
	Total Instructional Hours	45

After the completion of the course, the learner will be able to

Course Outcome	CO1: Explain the fundamentals of biochemistry CO2: Explain structural and functional properties of carbohydrates CO3: Explain structural and functional properties of lipids. CO4: Explain structural and functional properties of proteins, and nucleic acids CO5: Discuss the role of enzymes in human body.

TEXT BOOKS:

1. RAFI MD ―Text book of biochemistry for Medical Studentl Second Edition, University Press, 2014.
2. Victor. W.Rodwell, David A Bender et al ―Harper's Illustrated Biochemistry, 31st edition, LANGE Medical Publications,2018.

REFERENCES:

1. Keith Wilson & John Walker, ―Practical Biochemistry - Principles & Techniquesl, Seventn Edition, Oxford University Press, 2010.
2. Pamela.C.Champe & Richard.A.Harvey, ―Lippincott Biochemistry Lippincott's Illustrated Reviewsl, Raven publishers,1994

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CS3232	FUNDAMENTALS OF DATA STRUCTURES IN C	3	0	0	3

Course Objective	
	1. Understand the fundamental concepts of C Programming.
	2. Understand the concept of various linear data structures like list, stack and queue.
	3. Understand the various non-linear data structures like binary tree, binary search tree, AVL,B-Tree.
	4. Understand the graph algorithms such as shortest path and minimum spanning tree.
	5. Understand the concepts of Sorting, Searching and Hashing techniques.

Unit	Description	Instructional Hours
I	**FUNDAMENTAL CONCEPTS OF C PROGRAMMING** Fundamentals of ' C' programming – Structure of a 'C' program – Constants - Variables – Data Types –Branching and Looping - Arrays – One dimensional and Two dimensional arrays. Pointers – Definition – Initialization – Pointers arithmetic. Structures– definition – Structure within a structure – Programs using structures- Pre-processor directives.	9
II	**LINEAR DATA STRUCTURES-LIST,STACK,QUEUE** List ADT-Single Linked List-Doubly Linked List-Circular Linked List-Polynomial Addition. Stack ADT-Array Based Implementation-Linked List Implementation-Applications of Stack-Infix to Postfix Conversion, Postfix Evaluation. Queue ADT- Array Based Implementation-Linked List Implementation-Double Ended Queue.	9
III	**NON-LINEAR DATA STRUCTURES -TREES** Tree ADT-Binary Tree- Search Tree: Binary Search Tree-AVL Tree-B trees- Tree Traversal Algorithms-Expression Tree- Priority Queues- Binary Heap.	9
IV	**NON-LINEAR DATA STRUCTURES -GRAPHS** Graph ADT- Representation of Graphs-Graph Traversals-Topological Sort- Shortest Paths- Dijkstra's Algorithm- Minimum Spanning Trees- Prims-Algorithm- Kruskal's Algorithm-Biconnectivity-Euler Circuits.	9
V	**SORTING , SEARCHING AND HASHING** **Sorting Algorithms**-Insertion Sort, Bubble Sort, Merge Sort-Quick Sort- **Searching Algorithm**: Linear Search-Binary Search. **Hashing**- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.	9
	Total Instructional Hours	45

Course Outcome		
	CO1	Develop applications in C using pointers and structures.
	CO2	Acquire knowledge the most common abstractions for data collections (e.g., stacks, queues, lists).
	CO3	Use non linear data structures such as trees to solve problems. .
	CO4	Apply Graph algorithms to find the shortest path cost
	CO5	Apply Algorithms for solving problems like sorting and searching.

TEXT BOOKS:

T1 - Reema Thareja, ―Programming in C, Oxford University Press, Second Edition, 2016.

T2 - Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997.

REFERENCE BOOKS:

R1 - Aaron M. Tenenbaum, Yeedidyah Langsam, Moshe J. Augenstein, 'Data structures using C', Pearson Education, 2008.

R2 - Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.

R3 - Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.

R4 - Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16BM3001	**BIOCHEMISTRY LAB**	0	0	4	2

Description of the Experiments

1. General guidelines for working and functional component of biochemistry lab
2. Units of volume, weight, density and concentration measurements ad their range in biological measurements. Demonstration of proper use of volume and weight measurement devices.
3. Preparation of buffer-titration of a weak acid and a weak base..
4. Qualitatitive tests for carbohydrates-distinguishing reducing from non-reducing sugras and keto from aldo sugars
5. Spectroscopy: Determination of absorption maxima (λmax) of a given solution
6. Estimation of blood glucose.
7. Estimation of Haemoglobin
8. Estimation of creatinine.
9. Estimation of urea.
10. Estimation of cholesterol.
11. Preparation of serum and plasma from blood.
12. Separation of proteins by SDS electrophoresis(Demo)
13. Separation of amino acids by thin layer chromatography (Demo).

Total Practical Hours: 45

	CO1:	Understand the Biochemistry laboratory functional components
Course Outcome	CO2:	Understand the basics knowledge of Biochemical parameter and their interpretation in Blood sample.
	CO3:	Understand the basics principle of preparation of buffers

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CS3032	DATA STRUCTURES LAB	0	0	4	2

Course Objective

1. To learn the methodical way of solving problem.
2. To comprehend the different methods of organizing large amount of data.
3. To efficiently implement the different data structures.

S. No.	Description Of The Experiments
1	a) Write a C program to create a singly linked list, insert items into a list at three levels (beginning, middle, last), delete the given element from the list; display all the elements after deletion.
	b) Write a C program to create a doubly linked list, insert items into a list, delete the given element from the list and display all the elements after deletion.
2	a) Implementation of Stack using linked list.
	b) Implementation of Queue using linked list.
3	a) Write a C program that uses stack operations to convert a given infix expression into its postfix Equivalent.
	b) Implementation of deque using linked lists.
4	Implementation of binary search tree and traverse the tree in inorder, postorder and preorder.
5	Implementation of AVL tree.
6	Implementation of heaps using priority queues.
	Implementation of the following graph traversal algorithms:
7	a) Depth first traversal
	b) Breadth first traversal
8	Implementation of minimum spanning tree using prim's and kruskal's algorithm.
	Implement the following sorting algorithms
9	a) Merge Sort
	b) Quick Sort
10	Implementation of hashing.

Total Practical Hours: 45

Course Outcome

CO1: Understand the appropriate data structure for a given problem.
CO2: Understand different data structures for implementing solutions to practical problems.
CO3: Understand various tree operations.
CO4: Apply data set to solve problems using graphs
CO5: Apply the concepts of sorting, searching and hashing techniques to solve the problems

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SEMESTER IV

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA4112	APPLIED STATISTICS & NUMERICAL METHODS	3	0	2	4

Course Objective
1. Determine the measures of central tendency and dispersion along with R studio.
2. Employ some basic concepts of statistical methods for testing the hypothesis together with R studio.
3. Analyze the design of experiment techniques to solve various engineering problems accompanying with R studio.
4. Apply various methods to find the intermediate values for the given numerical data.
5. Explain concepts of numerical differentiation and numerical integration of the unknown functions.

Unit	Description	Instructional 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		45+15=60

Course Outcome
CO1: Familiar with Measures of Central Tendency and Measures of Dispersion.
CO2: Understand the concepts of statistical methods for testing the hypothesis.
CO3: Apply Design of Experiment techniques to solve various engineering problems
CO4: Understand the concept of interpolation in both cases of equal and unequal intervals.
CO5: Identify various methods to perform numerical differentiation and integration.

TEXT BOOKS:
T1- Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons Reprint 2014.
T2 - 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:
R1 - 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.
R2 - Grewal B.S. and Grewal J.S. "Numerical Methods in Engineering and Science ", 6th Edition, Khanna publishers, New Delhi 2014.
R3 - S.K.Gupta, Numerical Methods for Engineers", New Age Internationalm Pvt.Ltd Publishers,2015

Theory: 45   Practical: 15   Total: 60 Hour

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16BM4201	PATHOLOGY AND MICROBIOLOGY	3	0	0	3

Course Objective	1. Gain a knowledge on the structural and functional aspects of living organisms. 2. Know the etiology and remedy in treating the pathological diseases. 3. To study the structure of disease causing organisms. 4. To study about the working of microscope. 5. Empower the importance of public health.

Unit	Description	Instructional Hours
I	**CELL DEGENERATION, REPAIR AND NEOPLASIA** Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification- Dystrophic and Metastatic. cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.	9
II	**FLUID AND HEMODYNAMIC DERANGEMENTS** Edema, Hyperemia/Ischemia, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, Chronic venous congestion. Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas Haemorrhage. .	9
III	**MICROBIOLOGY** Structure of Bacteria and Virus. Routes of infection and spread; endogenous and exogenous infections, Morphological features and structural organization of bacteria and virus, growth curve, identification of bacteria , culture media and its types , culture techniques and observation of culture. Disease caused by bacteria, fungi, protozoal, virus and helminthes	9
IV	**MICROSCOPES** Light microscope – bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM & SEM). Preparation of samples for electron microscope. Staining methods – simple, gram staining and AFB staining.	9
V	**IMMUNOPATHOLOGY** Natural and artificial immunity, types of Hypersensitivity, antibody and cell mediated tissue injury: opsonization, phagocytosis, inflammation, Secondary immunodeficiency including HIV infection. Auto-immune disorders: Basic concepts and classification, SLE.Antibodies and its types, antigen and antibody reactions, immunological techniques: immune diffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies	9
	Total Instructional Hours	45

Course Outcome	CO1: Analyze structural and functional aspects of living organisms. CO2: Analyze the structure of disease causing organism. CO3: Describe methods involved in treating the pathological diseases. CO4: Explain the function of microscope CO5: Discuss the importance of public health.

TEXT BOOKS:

T1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, ―Pathologic Basis of Diseases‖, 7th edition,WB Saunders Co. 2005 (Units I & II).
T2. Ananthanarayanan & Panicker, ―Microbiology‖ Orientblackswan, 2017 10th edition. (Units III,IV and V).
REFERENCES:

R1. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 3rd edition, 2000.
R2. Dubey RC and Maheswari DK. ―A Text Book of Microbiology‖ Chand & Company Ltd, 2007
R3. Prescott, Harley and Klein, ―Microbiology‖, 10th edition, McGraw Hill, 2017

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16BM4202	LINEAR INTEGRATED CIRCUITS	3	0	0	3

Course Objective	CO1. To introduce the basic concepts of OPAMP.
	CO2. To impart knowledge on various applications of OPAMP.
	CO3. To understand the working of comparators and wave form generators.
	CO4. To learn the design concepts of ADC and DAC.
	CO5. To understand the working of PLL and voltage regulators.

Unit	Description	Instructional Hours
I	**BASICSOF OPERATIONAL AMPLIFIERS**	9
	Basic information about op-amps–Ideal Operational Amplifier-General operational amplifier stages, DC and AC performance characteristics, slewrate, Open and closed loop configurations.	
II	**APPLICATIONS OF OPERATIONAL AMPLIFIERS**	9
	Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.	
III	**COMPARATORS AND WAVEFORM GENERATORS**	9
	Comparators, Schmitt trigger, Sine-wave generators, Multivibrators , Triangular wave generator, Saw-tooth wave generator, Frequency to Voltage and Voltage to Frequency converters.	
IV	**ANALOG TO DIGITALAND DIGITALTO ANALOG CONVERTERS**	9
	Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode -R - 2R Ladder types - switches for D/A converters, high speed sample and hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type.	
V	**SPECIALISED ICs AND APPLICATIONS**	9
	IC regulators - 723 (block diagram, typical low voltage regulator circuit), 78XX, 79XX, 317 - applications. Timers - 555 – Functional block diagram- Astable and monostable multivibrators using 555 - applications. VCO – 566. PLL - Block diagram and derivation of capture range, lock range and pull in time capture and lock range - 565 – applications purposeregulator- SMPS.	

Total Instructional Hours	45

Course Outcome	CO1. To analyse the characteristics of opamp.
	CO2. To design various applications of opamp.
	CO3. To design various wave generating and shaping circuits.
	CO4. To select ADC and DAC for various applications.
	CO5. To design PLL and voltage regulators.

TEXT BOOKS:

T1 - D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 4th Edition ,New Age International Pvt. Ltd., 2010.

T2 - Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Pearson Education, 2015 .

REFERENCE BOOKS :

R1 - S.Salivahanan & V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", 2nd edition McGraw Hill, 2014.

R2 - Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tata Mc Graw-Hill, 2007.

R3 - Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, 2001

Chairman   BoS
BME - HiCET

Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16BM4203	DIGITAL ELECTRONICS	3	0	0	3

Course Objective	1. To understand different methods used for the simplification of Boolean functions. 2. To study combinational circuits. 3. To learn synchronous sequential circuits. 4. To understand asynchronous sequential circuits. 5. To study the fundamentals of HDL.

Unit	Description	Instructional Hours
I	**MINIMIZATION TECHNIQUES** Number systems: Decimal, Binary, Octal, Hexadecimal-Number-Base conversion-Complements of Numbers: 1's and 2's complements- Boolean algebra and laws-De-Morgan's Theorem-Principle of Duality-Minimization of Boolean expressions – Minterm – Maxterm – Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions (2variable,3variable&4-variable)-Tabulation method.	6
II	**COMBINATIONAL CIRCUITS** Circuits for arithmetic operations: adder: Half adder, Full adder, subtractor: Half subtractor, Fullsubtractor-BCD adder-Magnitude comparator-Encoders, Decoders-Multiplexers, Demultiplexers, Code converters: Binary to Gray, Gray to Binary	9+6(P)
III	**SYNCHRONOUS SEQUENTIAL CIRCUITS** Flip flops:SR,JK,D,T - Design of synchronous sequential circuits: State diagram - State table – State minimization - State assignment. Shift registers:SISO,SIPO,PIPO,PISO –Counters:BCD,Up down counter.	6+3(P)
IV	**ASYNCHRONOUS SEQUENTIAL CIRCUITS** Analysis and design of asynchronous sequential circuits-Reduction of state and flow tables– Race-free state assignment–Hazards.	6
V	**MEMORY DEVICES AND HDL** ROM-PROM-EPROM-EEPROM-RAM-FPGA-Programmable Logic Device-Introduction to Hardware Description Language (HDL)- HDL for combinational circuits- Half adder, Full adder, Multiplexer, De-multiplexer, Counters	6+3(P)
	Total Instructional Hours	45

Course Outcome	CO1: Simplify Boolean functions using different methods. CO2: Analyze, design and implement combinational logic circuits. CO3: Analyze, design and implement Synchronous sequential logic circuits. CO4: Analyze, design and implement Asynchronous sequential logic circuits CO5: Simulate and implement combinational and sequential circuits using HDL.

TEXT BOOKS:

T1 Morris Mano M. and Michael D. Ciletti, "Digital Design with an Introduction to the Verilog HDL", V Edition, Pearson Education, 2013.ISBN-13: 978-0-13-277420-8

REFERENCE BOOKS :

R1-.S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design",FourthEdition, Vikas Publishing House Pvt. Ltd, New Delhi, 2012.ISBN: 978-93-259-6041-1

R2-.Thomas L. Floyd, "Digital Fundamentals", Pearson Education, Inc, New Delhi, 2013 ISBN: 978-1-292-07598-3.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16HE4103	PROFESSIONAL ETHICS IN ENGINEERING	3	0	0	3

Course Objective
1. To expose the students to the basic human value and their impotence.
2. To understand the importance of Engineering ethics and moral autonomy.
3. To understand the various ethics of Social experimentation.
4. To make them understand the rights, risk and responsibilities in Engineering
5. To enable the students to face the Global issues in the present scenario

Unit	Description	Instructional Hours
I	**HUMAN VALUES** Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation –Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.	10
II	**ENGINEERING ETHICS** Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories	9
III	**ENGINEERING AS SOCIAL EXPERIMENTATION** Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	9
IV	**SAFETY, RESPONSIBILITIES AND RIGHTS** Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime –Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination	9
V	**GLOBAL ISSUES** Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors –Moral Leadership –Code of Conduct – Corporate Social Responsibility	8
	Total Instructional Hours	45

Course Outcome

CO1: Students should be able to describe the basic human value and their impotence
CO2:Students will have a better understanding the importance of Engineering ethics and moral autonomy
CO3: Students will be in a position to follow the various ethics of Social experimentation
CO4: Students will understand and handle the risk and responsibilities in Engineering field
CO5: Students will understand and handle the Global issues in the present scenario

TEXT BOOKS:

T1- R S Nagarajan, A Textbook on Professional Ethics and Human Values, New Age International, 2018
T2- M P Ragavan, Professional Ethics and Human Values, Scitech Publications, 8th edition, 2018.

REFERENCE BOOKS:

R1- Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2017
R2 - Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", engage Learning, 2018
R3- World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2016

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE4231	BASICS OF ELECTRICAL ENGINEERING	3	0	0	3

Course Objective	1. To introduce the fundamental concepts of electrical circuits and theorems. 2. To understand the construction, operational characteristics of AC and DC machines. 3. To study the operating principles measuring instrument for V, I, energy, power. 4. To create awareness on the methods for electrical safety, load protection basics. 5. To observe the electricity supply sources based on classical and standalone systems.

Unit	Description	Instructional Hours
I	**UNIT I : ELECTRICAL CIRCUITS AND ANALYSIS** Ohm's law, DC and AC circuits fundamentals, Energy sources, Kirchhoff's laws, Mesh and Nodal analysis, Star -delta and Delta -star transformation; theorems and simple problems: Superposition, Thevenins's, Maximum power transfer theorem.	9
II	**UNIT II : ELECTRICAL MACHINES** DC Machines: D.C generators & D.C motors: Principle of operation, constructions, types, Applications -A.C Motors: Types-Single Phase and Three phase induction motors: principle of operation, Types and Applications-Transformers: Principles of operation, Constructional Details, Types and Applications.	9
III	**UNIT III : BASIC ELECTRICAL INSTRUMENTATION** Introduction, classification of instruments, operating principles, essential features of measuring instruments (elementary Treatment only) - Moving coil, permanent magnet (PMMC) instruments, Moving Iron of Ammeters and Voltmeters -Energy meter.	9
IV	**UNIT IV : ELECTRICAL WIRING AND SAFETY** Wiring types and applications: Service mains, meter board and distribution board - Brief discussion on concealed conduit wiring. One way and two way control. Elementary discussion on Circuit protective devices: fuse and Miniature Circuit Breaker (MCB's). Electric shock, precautions against shock, Objectives for Neutral and Earthing, types of earthing; pipe and plate earthing, Residual current circuit breaker.	9
V	**UNIT V : ELECTRICAL POWER SUPPLY AND ITS APPLICATION** Introduction to Power supply circuits –Half wave rectifiers and Full wave rectifiers - SMPS, UPS, Batteries: Types, Principle of operation. Introduction to Smart Grid based on solar PV systems.	9

	Total Instructional Hours	**45**

Course Outcome	CO1: Understand the fundamental concepts of electrical circuits and theorems. CO2: Understand the construction, operational characteristics of AC and DC machines. CO3: Understand the operating principles measuring instrument for V, I, energy, power. CO4: Develop awareness on the methods for electrical safety, load protection basics. CO5: Classify the electricity supply sources based on types and standalone systems.

TEXT BOOKS:

T1   Dr. D P Kothari, Prof I J Nagrath, "Basic Electrical Engineering", 3rd Edition, Tata McGraw-Hill, 2009.

T2   K. S. Dhogal "Basic Practical In Electrical Engineering", 2nd, Reprint 2017, Standard Publishers Distributors

REFERENCE BOOKS:

R1   P.C. Sen, "Principles of Electrical Machines and Power Electronics", Wiley, 2016(Reprint)

R2   Vijay kumar Garg, "Basic Electrical Engineering (A complete Solution)", Wiley Reprint 2015.

R3   Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16BM4001	HUMAN PHYSIOLOGY LABORATORY	0	0	4	2

Description of Experiments

1. Study of parts of compound microscope
2. Microscope with neubauer chamber.
3. Estimation of RBC count.
4. Estimation of WBC count.
5. Estimation of eosinophil count.
6. Estimation of platelet count.
7. Estimation of differential count.
8. Hemoglobin estimation.
9. Packed cell volume/ ESR.
10. Blood grouping/ osmotic fragility.
11. Bleeding time/ clotting time.
12. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
13. Histopathological slides of benign and malignant tumours.
14. Manual paraffin tissue processing and section cutting (demonstration)
15. Cryo processing of tissue and cryosectioning (demonstration)

Total Practical Hours: 45

REFERENCES:

R1. Ghai C L, ―Textbook of Practical Physiology‖, Jaypee Brothers, Medical Publisher's Pvt. Ltd., New York, 2004.
R2. Stuart Ira Fox, ―Laboratory Guide to Human Physiology‖, Tata McGraw Hill, 2002.
R3. Richard G P Flanzer, ―Experimental and Applied Physiology Laboratory Manual‖, Tata McGraw Hill, Columbus, 2005.

Course Outcome	CO1:	Identification and enumeration of blood cells
	CO2:	Enumeration of haematological parameters

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16BM4002	**LINEAR INTEGRATED CIRCUITS LABORATORY**	0	0	4	2

Description of the Experiments

1 Design and Testing of Voltage Follower, Inverting & Non inverting amplifiers using 741 op-amp.

2 Design and Testing of Active low-pass, High-pass and band-pass filters using 741 opamp.

3 Design and Testing of Astable multivibrator , Monostable multivibrator and Schmitt Trigger using 741 op-amp.

4 Design and Testing of Phase shift and Wien bridge oscillators using 741 op-amp.

5 Design and Testing of Astable and Monostable multivibrators using NE555 Timer.

6 Design Function Generator using ICL8038.

7 Simulate Integrator and Differentiator using SPICE.

8 Simulate Astable & Monostable multivibrators with NE555 Timer using SPICE.

9 Simulate Phase shift and Wien bridge oscillators with op-amp using SPICE.

10 Simulate D/A and A/D converters using SPICE.

Total Practical Hours: 45

Course Outcome	CO1: Design oscillators using operational amplifiers.
	CO2: Design amplifiers using operational amplifiers.
	CO3: Design filters using Op-amp and plot frequency response.
	CO4: Analyse the performance of oscillators using SPICE.
	CO5: Analyse the performance of multivibrators using SPICE.

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Course Code & Name:19HE1101& Technical English

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

Course Code & Name:19MA1103 & Calculus and Differential Equations

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

Course Code & Name:19PH1151 &Applied Physics

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

Course Code & Name: 19CY1151&Chemistry for Engineers

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

Course Code & Name: 19CS1151&Python Programming and Practices

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

Course Code & Name:19EE1155&Basics of Electrical Engineering

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

SEMESTER II

Course Code & Name: 19HE2101 & Business English for Engineers

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

Course Code & Name:19MA2102 & Complex Variables And Transform Calculus

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

Course Code & Name:19PH2151&Material Science

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	1	1	-	-	-	-	-	1	2	1	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	2	1

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

Course Code & Name: 19CY2151 Environmental Studies

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

Course Code & Name: 19CS2152 Essentials of C&C++Programming

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

Course Code & Name:19ME2154 Engineering Graphics

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

Course Code & Name:19ME2001 Engineering Practices

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

PO& PSO															PSO 3
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Avg	3	-	3	-	3	-	-	-	1	-	-	-	1	2	1

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<u>Semester – III</u>

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Course Code & Name: 16MA3111   Fourier Analysis and Z Transforms

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

Course Code & Name: 16BM3201 Sensors and Measurement

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	-	-	-	1	1	1		1	1	1	1
CO2	3	-	-	-	-	-	-	1	1	1		1	1	1	1
CO3	3	-	-	-	-	-	-	1	1	1		1	1	1	1
CO4	3	-	-	-	-	-	-	1	1	1		1	1	1	1
CO5	3	-	-	-	-	-	-	1	1	1		1			1
Avg	3	0	-	-	-	-	-	1	1	1		1	1	1	1

Course Code & Name: 16BM3202 Human Anatomy and Physiology

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

Course Code & Name: 16BM3203 Bioelectric Phenomena

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

Course Code & Name: 16BM3204 Fundamentals of Biochemistry

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

													1	2	
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	2	2
CO2	3	-	2		-	2	-	-	-	-	-	-	3	2	1
CO3	-	1	2	2	-	-	-	-	-	-	-	-	-	3	1
CO4	3	-	2		-	-	-	-	-	-	-	2	-	3	1
CO5	1	3	3	3	-	-	-	-	-	-	-	2	-	3	2
Avg	2	1	2	1	-	0	-	-	-	-	-	1	1	3	1

Course Code & Name: 16CS3232 Fundamentals of Data structures in C

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

Course Code & Name: 16BM3001 Biochemistry Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	2	1
CO2	3	-	2	-	-	2	-	-	-	-	-	-	3	2	1
CO3	-	1	2	2	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	2	-	-	-	-	-	-	-	-	2	-	3	1
CO5	1	3	3	3	-	-	-	-	-	-	-	2	-	3	1
Avg	2	1	2	1	-	0	-	-	-	-	-	1	1	3	1

Course Code & Name: 16CS3032 Data structures laboratory

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

Semester – IV

Course Code & Name: 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	PSO 3
CO1	2	3	2	1	1	-	-	-	-	-		1	2	2	2
CO2	2	3	2	1	1	-	-	-	-	-		1	2	2	2
CO3	2	2	2	2	1	-	-	-	-	-		1	2	2	2

PO& PSO														
CO4	3	3	3	1	2	2	-	-	-	-	1	2	2	2	2
CO5	3	3	3	2	1	1	-	-	-	-	1	2	2	3	3
Avg	2.4	2.8	2.4	1.4	1.2	2	-	-	-	-	1	1.4	2	2.2	2

Course Code & Name: 16BM4201 Pathology and Microbiology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	2	-	-	-	-	-	-	-	1	1	1	2	2
CO2	1	1	2	3		1	-	-	-	-		1	1	1	1
CO3	1	3	3	-	-	-	-	-	3	1	2	2	3	2	1
CO4	1	1	2	-	-	-	-	-	-	-	-	1	1	1	1
CO5	1	3	3	3		2	-	-	3	1	2	2	3	3	1
Avg	1	2	2	1		1	-	-	1	0	1	1	2	2	1

16BM4202   Linear Integrated Circuits

Course Code & Name:

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

Course Code & Name: 16BM4203 Digital Electronics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	2	2	-	1	-	2	-	2	2	-	2	1
CO2	2	2	2	2	2	-	-	-	-	2	2	2	-	2	2
CO3	2	2	3	2	2	-	2	2	2	-	2	2	-	2	1
CO4	2	2	2	2	2	-	2	2	-	2	2	-	-	2	1
CO5	2	-	2	1	2	-	-	-	-	-	2	1	-	1	2
Avg	2	2	2	2	2	0	1	1	1	1	2	1	0	2	1

Course Code & Name: 16EE4231 Basics of Electrical Engineering

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

Course Code & Name: 16HE4103 Professional Ethics in Engineering

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

Course Code & Name: 16BM4001 Human Physiology Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	3	-	-	2	-	3	1
CO2	2	-	2	-	-	-	-	-	3	-	-	2	-	3	1
CO3	3	-	3	2	-	-	-	-	3	-	-	-	-	3	1
CO4	3	-	-	-	2	-	-	-	3	-	-	-	-	2	1
CO5	3			2		-	-	-	3	-	-	2	3	3	1
Avg	3	0	1	1	0	-	-	-	3	-	-	1	1	3	1

Course Code & Name: 16BM4002 Linear Integrated Circuits Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	3	-	-	2		3	1
CO2	2	-	2	-	-	-	-	-	3	-	-	2		3	1
CO3	3	-	3	2	-	-	-	-	3	-	-	-	-	3	1
CO4	3	-	-	-	2	-	-	-	3	-	-	-	-	2	1
CO5	3	-	-	2	-	-	-	-	3	-	-	2	1	3	1
Avg	3	0	1	1	0	-	-	-	3	-	-	1	0	3	1

Mapping of Course Outcome and Programme Outcome:

Regulation 2019
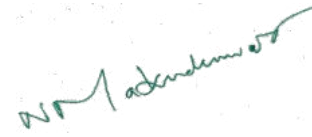
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	I	19HE1101 Technical English	1	1	1	1	1	1	1	1	2	3	1	2	2	2	1
		19MA1103 Calculus and Differential Equations	3	3	3	3	3	-	-	-	-	-	-	2	2	2	1
		19PH1151 Applied Physics	3	2	2	2	2	1	-	-	-	-	-	1	2	2	1
		19CY1151 Chemistry for Engineers	3	2	2	2	2	1	1	-	-	-	-	1	1	1	2
		19CS1151 Python Programming and Practices	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1
		19EE1155 Basics of Electrical Engineering	-	2	1	-	1	-	-	-	-	-	-	-	1	-	1
	II	19HE2101 Business English for Engineers	2	2	1	1	2	2	2	2	2	3	1	3	1	1	1
		19MA2102 Complex Variables And Transform Calculus	3	3	3	3	3	-	-	-	-	-	-	2	2	2	1
		19PH2151 Material Science	3	2	1	2	2	1	2	-	-	-	-	1	2	2	1
		19CY2151 Environmental Studies	2	1	2	-	-	1	2	3	2	-	-	2	-	-	1
		19CS2152 Essentials of C&C++	3	3	2	2	3	-	-	1	1		2	2	2	3	1

		Programming															
		19ME2154 Engineering Graphics	3	3	3	2	2	-	-	-	-	-	-	3	2	2	1

Regulation 2016

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO2
II	III	16MA3111 Fourier Analysis and Z Transforms	3	3	3	3	3	-	-	-	-	-	-	2	2	1	1
		16BM3201 Sensors and Measurement	3	0	-	-	-	-	-	1	1	1		1	1	1	1
		16BM3202 Human Anatomy and Physiology	1	1	1	1	1	-	-	-	-	-	-	2	2	1	1
		16BM3203 Bioelectric Phenomena	1	1	1	1	1							2	2	1	1
		16BM3204 Fundamentals of Biochemistry	2	1	2	1	-	0	-	-	-	-	-	1	1	3	1
		16CS3232 Fundamentals of Data structures in C	3	1	1	-	-	-	-	-	3	-	-	-	-	2	-
		16BM3001 Biochemistry Laboratory	2	1	2	1	-	0	-	-	-	-	-	1	1	3	1
		16CS3032 Data structures laboratory	3	1	1	-	-	-	-	-	3	-	-	-	-	2	-
	IV	16MA4112 Applied Statistics & Numerical Methods	3	3	3	2	2	-	-	-	-	-	-	2	2	2	1
		16BM4201 Pathology and Microbiology	1	2	2	1		1	-	-	1	0	1	1	2	2	1
		16BM4202 Linear Integrated Circuits	3	0	1	1	0	-	-	-	3	-	-	1	0	3	1
		16BM4203	2	2	2	2	2	0	1	1	1	1	2	1	0	2	1

Digital Electronics															
16EE4231 Basics of Electrical Engineering	-	2	1	-	1	-	-	-	-	-	-	-	1	-	1
16HE4103 Professional Ethics in Engineering	2	2	1	1	2	2	2	2	2	3	1	3	1	1	1
16BM4001 Human Physiology Laboratory	3	0	1	1	0	-	-	-	3	-	-	1	1	3	1
16BM4002 Linear Integrated Circuits Laboratory	3	0	1	1	0	-	-	-	3	-	-	1	0	3	1

CHAIRMAN-BOS

DEAN ACADEMICS